

## **Environmental Influences on Hunger and Psychological States: Is Autonomous Self-Regulation Protective?**

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### **ABSTRACT**

*Individuals are regularly exposed to environmental cues that may influence their current internal mental and bodily states. Some messages in the environment may positively affect individuals, such as health promotion messages, while other messages may be detrimental to one's health, such as the thin ideal. Not all individuals are impacted by environmental cues in the same way. One trait, such as dispositional motivational style, may buffer the impact of these environmental cues. Previous research suggests that individuals who are more self-determined or autonomously self-regulated, as outlined by the self-determination theory (SDT; Ryan & Deci, 2000), may not be as greatly affected by sociocultural pressures to be thin (Pelletier, Dion, & Lévesque, 2004). The current experiment sought to examine the effect of subtle environmental messages about body image or health behavior on current bodily and mental states, such as hunger, mood, self-esteem, and body dissatisfaction, while examining the individual level of autonomy as a moderating factor between these cues and resulting changes. Participants were given one of three prompts in the form of surveys: a health behavior prompt, a body image prompt, or control (no survey), then asked to complete a number of other surveys assessing these bodily and mental states. No significant differences between the groups were found on any of the variables measured. Self-determination was not a significant moderator between the cues and the dependent variables, but level of autonomy was significantly related to indicators of greater well-being, such as less negative mood and higher self-esteem.*

### **Introduction**

In the natural environment, humans are bombarded by messages that affect their mental and bodily states. One state that is clearly affected by environmental cues is hunger, which is defined as the cognitive awareness of the internal need to eat. Hunger is not just a sensation, but a “powerful instigator” of eating behavior (Herman, Ostovich, & Polivy, 1999, p. 181). Hunger and eating are not a perfect cause and effect; just because one is hungry does not mean one will eat. There are multiple factors that contribute to the instigation or suppression of eating behavior, such as environmental cues, access to food, or internal self-regulation processes. If not addressed immediately, one may become acclimated to the hunger sensation, and will “forget” to eat. However, because hunger tends to be an aversive state, most people manage the sensation by eating as soon as they possibly can. Although considerable research has examined the impact of external cues (e.g., plate size, availability of food) on eating, there is little research that looks specifically at the relationship between these cues and subsequent hunger (which may then impact eating behavior).

### **Health Enhancing Behavior Promotion**

Although external cues may negatively impact food selection, amount of food consumed, and ultimately one's weight, these cues may also serve to promote positive health behaviors. For example, Reger, Wootan, and Booth-Butterfield (1999) conducted a mass media campaign to increase the sales of low-fat milk instead of whole milk. Their campaign effectively increased low-fat milk sales by 15% and lowered high-fat milk sales by 17%. Another mass media campaign done in New Orleans encouraged walking and the consumption of fruit and vegetables. At follow-up, recall of the fruit and vegetable message was negatively correlated with snack food consumption, and positively correlated with attitudes towards walking (though actual walking behavior did not change; Beaudoin, Fernandez, Wall, & Farley, 2007). Campaigns like these are a commonly used means of affecting positive health behavior change.

While there is a dearth of research examining the direct impact of health behavior promotion campaigns on mood, self-esteem, and body image, research suggests that healthy eating is associated with overall psychological well-being (Pelletier, Dion, Slovinec-D'Angelo, & Reid, 2004). In a weight-loss intervention targeting dietary and physical activity behaviors in adolescents, all boys and girls who lost or maintained their weight improved their body image at the 6- and 12-month follow-ups compared to girls who gained weight; whereas participants who gained weight did not experience improved self-esteem or a reduction in body image (Huang, Norman, Zabinski, Calfas, & Patrick, 2007).

### **Endorsing the Thin Ideal**

Environmental cues may not always have a positive impact on behavior. The portrayal of the ideal female body in the media has become progressively thinner over the past few decades (Johansson, Lundh, & Andersson, 2005) and has been linked to the dramatic rise in body dissatisfaction, dieting behavior, and eating disorders. Numerous studies indicate that stable body dissatisfaction, body comparison tendencies, and internalization of the thin ideal are considered to be some of the best predictors of state body dissatisfaction and state depression (Durkin & Paxton, 2002; van den Berg et al., 2007). Moreover, women who already have body dissatisfaction may be more negatively affected by thin ideal cues (Johansson et al.).

Exposure to the thin ideal may indirectly impact eating behavior by first influencing psychological states. Stice, Nemeroff, and Shaw (1996) found evidence that body dissatisfaction was directly influenced by body mass, perceived pressure to be thin, and ideal-body internalization. According to their model, body dissatisfaction often leads to dietary restraint (i.e., dieting) and/or negative affect, which may then lead to bulimic symptomatology. In order to deal with body dissatisfaction and exposure to thin ideal advertisements, some women may learn to ameliorate the dissonance by developing disordered eating patterns. This theory has been supported in a variety of ways. In a longitudinal study, Stice, Spangler, and Agras (2001) randomly assigned adolescent females to a 15-month subscription of a fashion magazine or no subscription. Although there was no main effect for the subscription on body dissatisfaction, thin-ideal internalization, dieting, negative affect, or bulimic symptoms, girls who were considered "vulnerable" (higher body dissatisfaction and internalization of the thin ideal) prior to the manipulation had greater negative affect at the end of the study. Also, vulnerable girls without adequate social support reported an increase in body dissatisfaction, dieting, and bulimic symptoms. This provides evidence that prior body dissatisfaction may exacerbate the effect of thin ideal advertisements. In addition, Bessenoff (2006) found that participants in a controlled experiment exposed to thin ideal advertisements had greater body dissatisfaction, greater negative mood, and lower appearance and social state self-esteem immediately after the viewing than controls exposed to advertisements without thin women. This suggests that there is an immediate impact on individuals after exposure to thin ideal images, which may be because they are comparing themselves to that other person. Depending on how the individual may cope with the discrepancy between their actual body and the ideal body, some may develop disordered eating patterns after repeated exposure to such images.

Correlational analyses have also shown that body dissatisfaction is associated with negative psychological measures. Pelletier and Dion (2007) found that women who reported greater body dissatisfaction also reported controlled eating behavior and dysfunctional eating behavior styles. Other correlational analyses have indicated that women who report bulimic symptoms also report lesser psychological adjustment (Pelletier & Dion), lower life satisfaction, and higher negative affect (Kitsantas, Gilligan, & Kamata, 2003) than women who report healthy eating styles.

### **The Effect of External Cues on Eating Behavior and Hunger**

Although the impact of hunger on eating behavior is complex, hunger may be an important indicator of how external cues will impact eating behavior. Herman et al. (1999) conducted an experiment in which they asked half of their participants to refrain from eating after 10 p.m. the evening before their appointments (deprived of food for 14-20 hours), while the other half (non-deprived) was allowed to eat whatever they wished. Both the deprived and non-deprived participants reported an

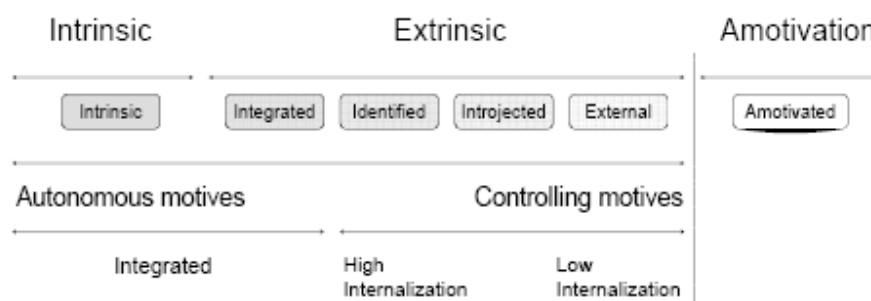
increase in hunger after exposure to a palatable food cue, although deprived participants were arguably hungrier than non-deprived participants. This suggests that regardless of prior fullness or hunger, hunger can be manipulated in a matter of moments.

### **Self-Determination**

Research suggests, however, that not everyone is similarly affected by environmental cues (Johansson et al., 2005; Pelletier, Dion, & Lévesque, 2004). Other variables, such as dispositional motivation style, may protect an individual from the negative effect of external cues on internal states. Ryan and Deci (2000) proposed the self-determination theory (SDT) as a general theory of motivation ranging from amotivation (not motivated at all) to extrinsic motivation (motivated for outside reasons) to intrinsic motivation (highly self-determined). People who are intrinsically motivated engage in activities for their sheer enjoyment, while people who are extrinsically motivated engage in certain behaviors as a way to achieve another desired result (i.e., health benefits, goal achievement; Pelletier & Dion, 2007). The practice of extrinsically motivated activities leads to the question, “Why would someone engage in such a practice if they do not enjoy doing it?” According to SDT, self-regulatory styles associated with extrinsic motivation account for extrinsically motivated behaviors. From the least self-determined to the most self-determined style, there is *external* regulation (behavior satisfies an external demand, such as a reward), *introjected* regulation (participates in behavior to avoid guilt or anxiety or to boost their ego), *identified* regulation (behavior is valued), and *integrated* regulation (behavior is consistent with one’s own values, but is still done for alternative reasons; see Figure 1).

Self-determination has been associated with many measures of overall well being. Intrinsic motivation has been positively associated with self-esteem, self-actualization, and the inverse of depression and anxiety (Ryan & Deci, 2000). While autonomous motivation is associated with well being, controlled or externally regulated behaviors may be associated with poor adjustment. In a sample of college aged women, those with eating disorders had a higher incidence of more controlled self-regulatory strategies (Kitsantas et al. 2003).

Figure 1. SDT Continuum.



In addition to the psychological benefits of autonomous motivation, a person who is more self-determined may be less likely to react to societal pressures about body image. Pelletier et al. (2004) found that women who were more self-determined were less likely to internalize societal pressures about the thin ideal and were therefore less likely to experience bulimic symptoms. This suggests that one’s general level of self-determination and relative autonomy (the extent to which one’s actions are self-directed) may act as a moderating variable between an external prompt and the resulting change in body or mood states. Pelletier et al. found that self-determination negatively predicted bulimic symptomatology as well as perceived sociocultural pressures about body image and endorsement of those beliefs, but an interaction between self-determination and those variables was not significant. They did not examine self-determination as a moderator for other internal psychological states, such as body dissatisfaction, mood, and self-esteem. In another study, Pelletier and Dion (2007) found that self-determination may act

as a buffer between societal pressures about body image and subsequent body dissatisfaction, as women with greater self-determination were more likely to have autonomously regulated eating behaviors, which are associated with healthier eating behavior styles. This suggests that healthy eating behaviors are necessary contributors to overall psychological adjustment (Pelletier & Dion).

The purpose of the current study was to establish the relationship between subtle environmental cues and self-reports of bodily and mental states (i.e., hunger, mood state, self-esteem, and current body dissatisfaction) as well as behavioral outcomes (i.e., food selection), while examining one's general self-determination as a moderating variable between the prompt and the outcome. Specifically, this study investigated whether or not exposure to health behavior or body image cues play a role in subjective hunger ratings as well as these other mental states. The cues, in the present study, were in the form of a survey about health-related behaviors or body image that prompted participants to think about their health behavior or body image. This study also included men, because they are notoriously underrepresented in eating behavior research, and it may be important to understand how these cues impact males.

### **Hypotheses**

There were seven main hypotheses of this study:

1. Participants in the health behavior prompt will have a higher subjective hunger rating, as compared to participants in the control condition.
2. Participants in the body image prompt condition will have a lower subjective hunger rating, as compared to participants in the control condition.
3. Participants in the body image prompt will be more greatly affected by the prompting condition than those in the health behavior prompt.
4. More self-determined (i.e., integrated and intrinsic motivation) self-regulatory styles will act as moderators between the prompts and self-reports of subjective bodily and mental states.
5. Participants exposed to the body image prompt will report lower state self-esteem, higher body-dissatisfaction, and a more negative mood than participants in the health behavior or control conditions.
6. Participants in the health behavior prompt will be more likely to pick nutritious food choices than participants in the body image or control conditions.
7. Participants in the body image prompt will report less desire to eat either the nutritious or unhealthy foods, compared to the health behavior and control conditions.

The results of this study may lead to a better understanding of how environmental cues contribute to disordered eating patterns, and how one's level of self-determination may act as a buffering variable between the two.

### **Method**

#### *Participants*

One hundred thirty-eight participants [68% male, 97% Caucasian, mean age 19.5 years ( $SD = 1.33$ ), mean body mass index (BMI) = 24.52 ( $SD = 4.63$ ), see Table 1] were recruited using a web-based recruiting system that allows students in several psychology classes to register for participation in studies in exchange for a credit in their psychology course. To be eligible to participate in this study, participants needed to be registered students at the University of Minnesota Duluth and at least 18 years of age. One participant was not included in analyses because they did not complete three of the measures. Participants were still included in the analyses if they failed to answer one question per scale. The average of their answers on that scale was filled in for the missing datum. None of the remaining participants missed more than one question per scale.

### Procedures

A between-subjects experimental design was used. Participants were randomly assigned to one of three conditions: a health behavior prompt ( $n = 47$ ), a body image prompt ( $n = 46$ ), or a control prompt ( $n = 46$ ). These prompts were in survey form and were included with the survey packet. For the control condition, the survey prompt was not given. Each survey packet included measures in the following order: basic demographic information (age, sex, ethnicity, etc.), a global self-determination measure, one of the two prompting measures (a general health questionnaire or a body image questionnaire; except in the case of the control condition where no questionnaire was given), a visual analogue scale assessing various internal states (including hunger), a measure of current mood state, a measure of state self-esteem, a measure of body dissatisfaction, and a food choice questionnaire. The participants also provided their height and weight at the end of the survey.

### Measures

**Global Motivation Scale (GMS).** Developed by Sharp, Pelletier, Blanchard, and Lévesque (2003), this 18-item questionnaire measures one's general self-regulatory style towards various behaviors in their life in the context of the SDT framework. Using a 7-point Likert scale that ranges from 1 (*not agree at all*) to 7 (*completely agree*), this measure asks the participant to rate the extent to which the statements correspond generally to the reasons why they do different things ("In general, I do things..."). This measure has six subscales that correspond to the six self-regulatory styles postulated in SDT: amotivation (e.g., ...*even though I do not have a good reason for doing them*), external regulation (e.g., ...*because I do not want to disappoint certain people*), introjected regulation (e.g., ...*because otherwise I would feel guilty for not doing them*), identified regulation (e.g., ...*because I chose them as a way to reach my goals*), integrated regulation (e.g., ...*because they are in line with my main beliefs*), and intrinsic motivation (e.g., ...*for the pleasure of learning something new*). A global score of self-determination was calculated by weighting the autonomous motivated styles positively (intrinsic x 3; integrated x 2; identified x 1) and adding the negatively weighted controlled motivation styles (introjected x -1; external x -2; amotivation x -3). This measure has been shown to be internally consistent (all  $\alpha > .73$ ) and temporally reliable ( $r = .72$ ) over a six-week period.

**Health Behavior Prompt.** To prompt for thoughts about health behavior, participants were asked to rate [on a 7-point Likert scale ranging from 1 (*never*) to 7 (*always*)] 24 statements on the extent to which each applied to them. Of the 24 items, 18 were adapted from Japenga's (1997) "How Healthy is Your Diet?" survey (e.g., "Half the dinners I eat each week contain little or no meat," or "At dinnertime, there is something dark green, bright orange, or deep red on my plate."). Six items were added to encompass additional aspects of a healthy lifestyle (e.g., physical activity, hygiene) other than diet. This questionnaire was created to look similar to the body image survey.

**Body Image Prompt.** To prompt for thoughts about body image, the Objectified Body Consciousness Scale (OBCS; McKinley & Hyde, 1996) was used. This 24-item questionnaire measures one's objectified body consciousness on three subscales: surveillance (viewing the body like an outside observer), body shame (feeling shameful when one's body does not conform), and appearance control beliefs (the extent to which one feels control over what one's body looks like). Participants rated the extent to which they agreed with these statements from 1 (*not agree at all*) to 7 (*completely agree*). Neither the Health Behavior measure nor the OBCS were scored or included in analyses because they were used simply as prompting cues.

**Visual Analogue Scale (VAS).** This 10-item scale asks participants to rate their current bodily/mental states from "not at all" to "extremely" by putting a vertical mark on a 100 mm horizontal line. There is one "hunger" item ("I am hungry") and one "fullness" item ("I am full") embedded among eight other items not related to hunger (e.g., anxious/calm, happy/sad). This was done to disguise the true

hypothesis of the study and to avoid demand effects. Herman et al. (1999) used a similar measure with the same concerns in mind. A higher score on this measure indicates a greater hunger sensation.

**Mood Questionnaire.** This mood questionnaire, developed by Higgins (1987), assesses current negative mood state by asking participants to rate 20 mood-related adjectives on a 4-point Likert scale ranging from 1 (*not at all*) to 4 (*very much*) based on how they feel “at this moment.” Ten questions relate to dejection (e.g., dejected, sad) and ten items relate to agitation (e.g., agitated, frustrated). Four “positive” adjectives were included and reverse scored on each subscale to avoid demand effects. The higher the subscale score, the more the person feels that way at the current moment. The subscales were shown to be internally consistent (Agitation,  $\alpha = .74$ ; Dejection,  $\alpha = .83$ ).

**State Self-Esteem Scale.** Developed by Heatherton and Polivy (1991), this 20-item scale measures self-esteem as a transient state, suggesting that self-esteem is susceptible to momentary changes. The measure has three subscales: appearance self-esteem (e.g., “I feel satisfied with the way my body looks right now”), social self-esteem (e.g., “I feel inferior to others at this moment”), and performance self-esteem (e.g., “I feel like I’m not doing well”). Questions are answered on a 5-point Likert scale ranging from 1 (*not at all*) to 5 (*extremely*). This scale has been shown to have high internal consistency ( $\alpha = .92$  for the total score) and satisfactory internal consistency for the three subscales (Appearance,  $\alpha = .85$ ; Performance,  $\alpha = .82$ ; Social,  $\alpha = .89$ ).

**Body Dissatisfaction (BD) Scale of the Eating Disorder Inventory-3 (EDI-3).** Developed and refined by Garner (2004), the BD scale of the EDI-3 measures a participant’s dissatisfaction with their body. This 9-item measure uses a 6-point Likert scale ranging from 1 (*never*) to 6 (*always*) in response to items asking the participant to rate how they feel about specific body parts (e.g., *I think that my stomach is too big*). Responses were then converted to a 0, 0, 1, 2, 3, or 4 before obtaining the scale score. In a clinical sample (with a tenth item that has been omitted due to unsatisfactory factor analysis), scores ranging from 0-21 are considered low body dissatisfaction, from 22-35 are considered typical body dissatisfaction, and from 36-40 are considered elevated body dissatisfaction. The BD scale has been shown to positively correlate with body weight (Garner). This measure has been shown to have a test-retest reliability of  $r = .95$ .

**Food Choice Questionnaire.** This 10-item questionnaire was developed by the researcher to assess the extent to which the participant would be likely to eat a certain food (from 1, “*I would never eat this*,” to 7, “*I would eat this*”) at the current moment. This questionnaire had 5 items relating to healthy foods and 5 items relating to unhealthy foods (which were reverse-scored). The higher the score on this measure, the more likely the participant had a desire to eat healthier foods.

## **Results**

### *Sex Differences*

Prior to conducting the analyses on the main hypotheses, males and females were compared in order to determine whether sex should be included as a covariate. *T*-tests indicated that males and females were significantly different on measures of BMI,  $t(136) = 2.17, p = .03$ , appearance state self-esteem,  $t(135) = 2.14, p = .03$ , and body dissatisfaction,  $t(136) = -6.23, p < .001$ , and thus sex was used as a covariate in subsequent analyses using these variables. No other significant differences between males and females were found. See Table 1 for a full list of means for the total sample, males, and females.

Table 1. Means and Standard Deviations of Measures for the Total Sample, Males, and Females.

Variable	Total		Male		Female		<i>t</i>	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Age	19.53	1.33	19.58	1.41	19.43	1.17	0.61	
BMI	24.52	4.63	25.09	4.63	23.28	4.42	2.17	*
GMS Intrinsic	15.25	2.93	14.97	2.87	15.86	3.00	-1.68	
GMS Integrated	14.93	3.10	14.84	2.91	15.11	3.51	-0.48	
GMS Identified	16.08	2.66	15.80	2.39	16.68	3.10	-1.80	
GMS Introjected	12.49	3.30	12.15	3.28	13.20	3.26	-1.76	
GMS External	14.23	2.97	13.93	3.08	14.89	2.63	-1.79	
GMS Amotivation	9.61	3.13	9.66	3.34	9.50	2.66	0.28	
GMS Continuum	21.92	17.83	21.40	17.53	23.02	18.59	-0.50	
Hunger	83.35	56.51	86.60	58.30	76.50	52.50	0.98	
Mood	54.17	17.41	52.69	17.28	57.34	17.46	-1.47	
SSES Performance	26.50	4.56	26.83	4.65	25.80	4.33	1.24	
SSES Social	24.59	5.22	24.89	5.26	23.95	5.14	0.98	
SSES Appearance	21.36	4.14	21.87	3.91	20.27	4.44	2.14	*
Food Choice	42.53	6.74	42.20	6.81	43.23	6.59	-0.83	
Body Dissatisfaction	9.84	7.85	7.32	5.95	15.23	8.73	-6.23	**

\*  $P < .05$ \*\*  $p < .001$ 

### Hunger

To compare hunger-ratings between conditions, a one-way ANOVA was conducted. No significant difference was found  $F(2, 134) = 0.24, p = .79$ . That is, participants in the health behavior prompt condition did not rate their hunger significantly higher than participants in the body image prompt condition or the control condition (see Table 2).

### Mood

A one-way ANOVA compared the conditions on the negative mood scores. No significant differences between the groups were found,  $F(2, 135) = 0.56, p = .57$ . Participants in the body image prompt condition did not have a significantly more negative mood than participants in the health behavior prompt condition or the control condition.

Table 2. Means and Standard Deviations for Measures Between Conditions.

Variable	Condition						<i>F</i>
	Control		Health behavior		Body image		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Age	19.74	1.65	19.38	1.23	19.48	1.05	0.89
BMI	24.08	4.59	25.11	4.31	24.36	4.99	0.61
GMS Intrinsic	15.17	3.19	15.02	3.04	15.57	2.57	0.42
GMS Integrated	14.96	3.08	14.59	3.43	15.24	2.80	0.51
GMS Identified	15.85	2.66	15.91	2.94	16.48	2.36	0.78
GMS Introjected	12.00	3.53	12.85	3.07	12.61	3.30	0.81
GMS External	13.89	3.01	14.22	2.91	14.59	3.00	0.63
GMS Amotivation	9.20	3.34	9.83	3.21	9.80	2.85	0.60
GMS Continuum	23.91	19.09	19.39	17.96	22.46	16.41	0.78
Hunger	78.63	53.11	86.15	61.66	85.17	55.30	0.24
Mood	56.17	16.29	54.02	19.53	52.33	16.37	0.56
SSES Performance	25.54	4.67	27.46	4.30	26.49	4.60	2.06
SSES Social	24.37	5.48	24.20	5.23	25.22	4.99	0.50
SSES Appearance	21.04	3.91	20.30	4.50	22.76	3.64	4.40*
Food Choice	41.93	7.03	43.57	6.27	42.09	6.91	0.82
Body Dissatisfaction	9.22	7.31	10.46	8.32	9.85	8.01	0.28

\*  $p < .05$

#### State Self-Esteem

**Appearance.** Because sex was significantly related to appearance self-esteem, it was used as a covariate in the subsequent analysis. Thus, a one-way between-subjects ANCOVA was used to assess the effect of condition on the appearance subscale of the SSES, with sex as a covariate. The main effect for condition was significant,  $F(2, 133) = 5.27, p = .01$ , with participants in the body image prompt condition having significantly higher appearance self-esteem than participants in the health behavior prompt condition, but not significantly higher than participants in the control condition.

**Performance.** To assess the effect of condition on the performance subscale of the SSES, a one-way ANOVA was conducted. No significant differences were found,  $F(3, 134) = 2.06, p = .13$ . Participants in the health behavior prompt condition did not have significantly higher performance self-esteem than participants in the body image prompt condition or the control condition.

**Social.** Using a one-way ANOVA, the conditions were compared on their social self-esteem. No significant differences were found,  $F(2, 134) = 0.50, p = .61$ . Participants in the body image prompt condition did not have significantly higher social self-esteem than participants in the control condition or the health behavior prompt condition.



*Body Dissatisfaction*

A one-way ANCOVA was used to compare the effect of condition on body dissatisfaction, covarying out the effect of sex, as sex was significantly related to body dissatisfaction. No main effect for condition was found,  $F(2, 134) = 0.30, p = .74$ , with participants in the health behavior prompt condition not having higher body dissatisfaction than participants in the control condition or the body image condition after covarying for sex.

*Food Choice*

To assess differences in food choice between groups, a one-way ANOVA was used. No significant differences were found,  $F(2, 135) = 0.82, p = .44$ . Participants in the health behavior prompt condition did not significantly desire healthier foods than participants in the body image condition and the control condition.

*Self-determination*

Pearson's correlations indicated that more self-determined self-regulatory styles were associated with greater well being on a number of measures. The GMS scale score was positively associated with performance,  $r = .37, p < .001$ , and social,  $r = .42, p < .001$ , state self-esteem, but not appearance self-esteem,  $r = .13, p = .13$ . Participants who reported more self-determined self-regulatory styles were more likely to report higher performance and social self-esteem. Also, more self-determined participants reported a less negative mood,  $r = -.40, p < .001$ , (see Table 3).

However, self-determination was not a significant moderator for any of the dependent variables. All moderating effects were assessed using 2 (self-determination) x 3 (condition) between-subjects factorial ANOVAs, in which the upper third and the lower third of the GMS continuum in each of the three conditions were compared on each of the dependent variables. This method was chosen over a median split because the sample presented as a normal curve, and individuals whose scores fell in the middle of the continuum could be more similar to individuals in the other group than to individuals in their own group. For negative mood, the main effect for condition was not significant,  $F(2,89) = 0.81, p = .45$ , but the main effect for self-determination was significant,  $F(1,89) = 10.69, p = .002$ , with the upper third having a significantly lower negative mood score ( $M = 47.70, SD = 2.48$ ) than the lower third ( $M = 59.33, SD = 2.55$ ). This difference is consistent with the correlation reported above. No significant interaction between condition and self-determination was found,  $F(2,89) = 0.28, p = .76$ . Food choice was also compared using a 2 x 3 factorial ANOVA. A main effect for condition was not found,  $F(2,89) = 0.89, p = .41$ ; however, a main effect for self-determination was found,  $F(1,89) = 13.01, p = .001$ , with the participants in the upper third desiring healthier foods ( $M = 44.58, SD = 0.90$ ) than participants in the lower third ( $M = 39.96, SD = 0.92$ ). A significant interaction between self-determination and condition was not found,  $F(2,89) = 0.09, p = .92$ .

Table 3. Intercorrelations Among Measures.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Age	--															
2. BMI	.14	--														
3. GMS Intrinsic	.08	-.01	--													
4. GMS Integrated	-.15	.00	.45**	--												
5. GMS Identified	-.08	.01	.51**	.65**	--											
6. GMS Introjected	-.26**	.07	.21*	.31**	.38**	--										
7. GMS External	-.26**	-.07	.26**	.39**	.44**	.44**	--									
8. GMS Amotivation	-.15	.12	.04	.01	-.07	.33**	.28**	--								
9. GMS Continuum	.19*	-.06	.59**	.48**	.45**	-.24**	-.24**	-.67**	--							
10. Hunger	.01	-.10	.04	-.10	-.02	.07	-.05	-.01	-.01	--						
11. Mood	-.03	-.02	-.30**	-.23**	-.30**	.06	-.03	.12	-.40**	.14	--					
12. SSES Performance	.13	.11	.14	.09	.18*	-.20*	-.16	-.27**	.37**	-.06	-.49**	--				
13. SSES Social	.13	.03	.12	.00	-.01	-.34**	-.38**	-.33**	.42**	-.10	-.44**	.51**	--			
14. SSES Appearance	.04	-.29**	.04	.03	.07	-.16	-.02	-.10	.13	-.06	-.33**	.28**	.39**	--		
15. Body Dissatisfaction	-.03	.35**	.03	-.03	.06	.20*	.14	.08	-.11	.06	.28**	-.16	-.30**	-.65**	--	
16. Food Choice	.19*	-.01	.11	.13	.11	.10	-.06	-.08	.16	.02	-.16	.00	.04	-.04	.09	--

\* p < .05  
 \*\* p < .001

## **Discussion**

This study sought to investigate the impact of subtle environmental cues on internal bodily and mental states. The results indicate that the prompt had little or no effect on participants between conditions on most of the dependent variables. There may be several reasons for these unexpected findings, and these explanations tend to be consistent for most of the hypotheses. The following reasons should be kept in mind for all of the hypotheses. First, it may be that the prompting conditions were not strong enough to elicit a response. There was no manipulation check to ensure that participants paid a considerable amount of attention to the surveys, and a 24-item survey usually does not take much effort to complete. Second, people may be more resilient to subtle environmental cues than previously thought. Subtle changes in environment may not be noticed enough to elicit a differential response. Also, individuals choose the extent to which they attend to environmental stimuli, and many cues may be filtered out as unimportant. Third, based on self-determination scores, the sample is considered quite autonomous, with a mean continuum score of 21.92 ( $SD = 17.83$ ). A score of zero is midway between amotivation and intrinsic motivation. This could be a protective factor, so the high level of autonomy seen in this sample would counteract any impact the cues may have had on those individuals. Although the upper and lower third of the GMS scores were used to assess moderation of responses, many individuals scored near the mean of the continuum and were thus excluded from those analyses. This may have decreased power in the sample. Correlational analyses indicated that individuals reporting greater levels of autonomous regulation also reported higher social and performance self-esteem and lower negative mood, which may indirectly buffer the effect of environmental cues.

The first hypothesis posed that the health behavior prompt would increase subjective hunger, and the second hypothesis assumed that the body image prompt would decrease subjective hunger. Both hypotheses were not supported; participants did not differ in their subjective hunger rating based on condition. This could be because participants were not asked to restrict their intake prior to coming in for the study, and all of the sessions were held around dinnertime (between 5:00 p.m. and 8:00 p.m.). Again, this could also be because the prompting cues were not strong enough to elicit a response. The third hypothesis was also not supported by significant results; the body image prompting condition did not have a greater impact on the dependent measures than the health behavior condition. Both of these prompting conditions may have been of a similar strength, which may not be significantly different from the control condition.

One's general level of self-determination did not act as a moderator between the prompting conditions and the dependent variables. This is consistent with Pelletier et al. (2004), who did not find a significant interaction between self-determination and the endorsement of the societal beliefs about body image. Pelletier et al. did not use prompting conditions in their study, but instead used correlational analyses that suggested that more autonomously regulated individuals would be less inclined to attend to environmental cues about body image. Because their study was purely correlational, an experimental test of this hypothesis was necessary. Although self-determination did not moderate the effects of the conditions, it was found that the more autonomous an individual, the more positive their mood and the greater their social and performance self-esteem. Consistent with previous research (e.g., Brown & Ryan, 2004), this suggests that autonomy may foster well-being, or vice-versa. High self-esteem and a positive mood may buffer individuals from negative life events, which could then adversely affect health. Moreover, individuals who endorsed more autonomous regulatory styles were more likely to desire healthier food choices. This may also indirectly impact well-being, because those individuals would have healthier eating patterns. Instead of a direct buffering pathway, self-determination may lead to better mental and physical health, which would then indirectly influence response to the external environment.

Participants in the body image condition did not report significantly more negative mood, lower performance or social self-esteem, or body dissatisfaction than participants in the health behavior or control conditions, therefore hypothesis five was also not supported. However, participants in the body image prompting condition reported significantly higher appearance self-esteem than participants in the health behavior condition. This was an unexpected finding, considering the hypothesis suggested the

relationship would be in the opposite direction, and is inconsistent with previous research. For example, Bessenoff (2006) found that individuals exposed to the thin ideal images reported greater body dissatisfaction, negative mood, and lower self-esteem. It may be this finding was simply due to error. However, it is plausible that individuals exposed to the body image prompt actually felt better about their bodies after being exposed to the prompting survey, therefore inoculating against another body dissatisfaction questionnaire.

The health behavior prompt did not increase the desire to eat healthier foods, nor did the body image prompt decrease the desire to eat healthier foods. Therefore, the sixth and seventh hypotheses were also not supported; food choice was not significantly different in any of the three conditions. This may be because the food choice measure was created by the researcher for the purpose of this study as a way to assess whether individuals would choose healthier foods after exposure to a health cue, and it may not accurately measure this choice. Individuals must first be educated on what is healthy and what is not healthy before being able to make a decision about choice, and the choices were not labeled as healthy or not healthy as a means of reducing demand effects within the experiment. Another measure that has been used is a snack tray that provides the individual with high-fat or low-fat choices (e.g., Epel, Lapidus, McEwen, & Brownell, 2001). This type of measure is beneficial because it measures actual eating behavior, instead of self-reported hunger or desire to eat a certain food. However, this measure is subject to demand effects from the experimental situation, and may be affected by the individual's food preferences because they may not like the foods provided in the experiment. Diet analyses 24 hours following an environmental prompt could also be used to measure food choice, but are subject to human error or changes in eating behavior just because the individual is writing down what he or she is eating. Overall, measuring human eating behavior is a complicated task that must be carefully considered when designing an experiment.

Traditionally, eating behavior research has focused on the impact of environmental cues on females. This study included both males and females to expand upon our understanding of this topic. Secondary analyses indicated that although women reported higher body dissatisfaction and lower appearance self-esteem than males, environmental cues were not found to differentially impact the sexes. This may be due to the chronic pressure from the media for women to obtain the thin, ideal body.

The strengths of this study lie in its design. Participants were randomly assigned to each condition, making it unlikely that the groups were significantly different before the prompting manipulation. Many participants could be surveyed at once because the instructions for each group were the same. This study also had an easily administered protocol and was cost-effective.

The limitations of this study may explain the null findings. First, the dependent variables were entirely self-report. Participants may not have a great deal of insight into their actual body dissatisfaction, mood, self-esteem, and hunger, or they may desire to present themselves in a positive light. Unfortunately, self-report may be one of the only methods to measure internal psychological processes. Secondly, there was no manipulation check to ensure the participants thought about the prompting surveys enough to affect their current internal states, so there is no way to know the extent to which the participants paid considerable attention to the prompts. All of the surveys were completed during the second half of the semester, which could have impacted the participants' investment in completing the surveys accurately. Many participants seem rushed and completed all of the surveys in approximately 10 minutes, which may not be enough time to process the survey and think about the relevance to them. A time lapse between the prompting survey and the subsequent psychological measures may be beneficial. Finally, there were twice as many males as females in this sample. The female sub-sample was small and may have limited significant findings, if the prompts affect males and females differently.

Further research is needed to expand the knowledge in this area. This protocol could be repeated, but done earlier in the semester so students do not feel rushed to complete their study credits. This research should also be expanded to use more invasive prompting cues, such as media images seen in magazines. This will determine the level of exposure needed to see a response. Providing a snack or small meal following the prompting cues may also assess a link between hunger and eating behavior. Also, systematically varying the time of day in which the experiment is conducted may impact the

findings, because participants may be more susceptible to hunger cues at different times. By determining this cause-effect relationship without environmental restrictions (i.e., time restraints, lack of availability of food), one may be able to determine how hunger will impact eating behavior.

As conducted (with the use of surveys to prompt individuals to think about their health behavior or body image), this study demonstrated that individuals are more resilient to subtle environmental cues than previously thought. This study also provided further support that highly self-determined individuals are more likely to report higher well-being indicators, such as positive mood, high self-esteem, and healthier food choices.

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