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Time Flies When You're Having Approach-Motivated Fun: Effects of Motivational Intensity on Time Perception

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Abstract

Time flies when you're having fun, but what is it about pleasant experiences that makes time seem to go by faster? In the experiments reported here, we tested the proposal that approach motivation causes perceptual shortening of time during pleasant experiences. Relative to a neutral state or a positive state with low approach motivation (Experiment 1), a positive state with high approach motivation shortened perceptions of time. Also, individual differences in approach motivation predicted shorter perceptions of time. In Experiment 2, we manipulated approach motivation independently of the affective state and showed that increasing approach motivation caused time to be perceived as passing more quickly. In Experiment 3, we showed that positive approach motivation, as opposed to arousal, shortens perception of time by comparing a highly arousing positive state with a highly arousing negative state. Shortening of time perception in appetitive states may prolong approach-motivated behavior and increase the likelihood of acquiring appetitive objects or goals.

Keywords

approach motivation, time perception, positive affect, attention, emotion, motivation

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Einstein (1916/2005) observed that much of people's experience of time is subjective, and most research on subjective time perception has attributed this phenomenon to the effects of positive and negative affective states (for a review, see Droit-Volet & Gil, 2009). This research has shown that relative to a negative state, a positive state makes time appear to pass more quickly and causes assessments of elapsed time to be shorter (Angrilli, Cherubini, Pavese, & Manfredini, 1997; Droit-Volet, Brunot, & Niedenthal, 2004; Noulhiane, Mella, Samson, Ragot, & Pouthas, 2007); presumably, this is because affective valence alters temporal processing. However, comparisons between positive and negative affective states do not reveal whether positive states shorten perceptions of time or whether negative states lengthen perceptions of time. More important, these types of comparisons do not test the underlying mechanisms driving the relationship between affect and time perception.

Previous conceptual approaches to the study of affect-cognition interactions have been predicated on models that emphasize major differences between positive and negative affect (Droit-Volet & Gil, 2009; Fredrickson & Cohn, 2008). However, recent conceptual models that emphasize the dimension of motivation inherent in affect (e.g., approach vs. withdrawal) suggest both similarities and dissimilarities between specific positive (and negative) affects (see Gable & Harmon-Jones, 2010c, for a review). These similarities and dissimilarities may facilitate a better understanding of affect-cognition interactions, particularly in the study of positive affect.

Positive affect states vary in motivational intensity. Some are low in approach motivation (e.g., feeling serene or content), and some are high in approach motivation (e.g., feeling desire or excitement). Positive affects high in approach motivation often occur in the pursuit of a goal (pregoal affects), such as reproduction and social attachment, or acquisition of biologically necessary resources, such as food and water. In contrast, positive affects low in approach motivation occur after a goal has been attained (postgoal affects) or when no goal is present (goal-irrelevant affects). In a pregoal state in which approach motivation is high, an organism is appetitively motivated (Gable & Harmon-Jones, 2011; Knutson & Wimmer, 2007). High-approach-motivation positive states activate distinct neurobiological brain areas, such as the prefrontal cortex, nucleus accumbens, and other structures

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associated with motivational processes (Davidson & Irwin, 1999; Gable & Harmon-Jones, 2010c; Harmon-Jones, Harmon-Jones, Fearn, Sigelman, & Johnson, 2008; Knutson & Peterson, 2005; Knutson & Wimmer, 2007).

Although much prior research has investigated the cognitive consequences of positive affects low in approach motivation, only recently have positive affects high in approach motivation been investigated. Research investigating the cognitive effects of positive affects high in approach motivation has found that such states cause narrowing of memory and attention (Gable & Harmon-Jones, 2008a, 2010c; Harmon-Jones & Gable, 2009; Price & Harmon-Jones, 2011), presumably because narrowed processes assist in shutting out irrelevant perceptions and cognitions as organisms approach and attempt to acquire desired objects (Gable & Harmon-Jones, 2010a, 2010b; Harmon-Jones & Gable, 2008). Broadened cognitive processing during a pregoal state might cause distraction or disengagement and hinder acquisition of the desired goal.

Approach Motivation and the Perception of Time

Given the importance of positive approach motivation in the acquisition of outcomes such as reproduction, social attachment, and the attainment of food and water, it seems unlikely that such states would be associated with perceptions of time passing slower (i.e., lengthening of time). Rather, states associated with appetitive acquisition should be associated with the perception of time passing faster (i.e., shortening of time) as organisms shut out irrelevant stimuli, perceptions, and cognitions as they approach and acquire the desired objects. Positive states low in approach motivation should cause a shortened perception of time because these states occur during active engagement of appetitive objects or goals.

Functionally, a perceived shortening in the passing of time due to high-approach-motivation positive states may prolong tenacious goal pursuit. That is, because time passes more quickly than an organism perceives it to, the organism may persist in the approach-motivated behavior for longer amounts of time. In the pursuit of biologically important resources, for example, it would be adaptive for an organism to engage in prolonged pursuit. In contrast, perceptions of time passing more slowly in appetitive states could hinder goal pursuit or cause goals to be evaluated as less desirable. This slowing of time might be maladaptive, as it may lead the organism to disengage from goal pursuit.[1] Sackett, Meyvis, Nelson, Converse, and Sackett (2010) showed that when time engaged in a task ostensibly passed more quickly than had actually occurred, the hedonic value of the task increased, but when time appeared to pass more slowly than had actually occurred, the hedonic value of the task decreased. These results support the idea that shortened time perception may facilitate goal acquisition by increasing the hedonic value of goals or objects; further, they suggest a bidirectional relationship between positive approach motivation and time perception. To more clearly illuminate the influence of positive affect on time perception, we examined the role of approach-motivation intensity in a series of three experiments.

The Present Experiments

In the three experiments reported here, we tested whether positive approach motivation influences time perception. We predicted that viewing high-approach-motivation positive pictures would cause time to be perceived as passing more quickly than would viewing neutral pictures or low-approach-motivation positive pictures (Experiment 1). In Experiment 1, we also predicted that individual differences in approach motivation would relate to faster perceptions of time when subjects viewed appetitive pictures. In Experiment 2, we predicted that increasing approach motivation independently of picture type would result in time passing more quickly. In Experiment 3, we predicted that high-approach-motivation positive affect would cause time to be perceived as passing faster than would high-withdrawal-motivation negative affect.

Experiment 1

To establish that approach motivation as opposed to positive valence shortens the perception of time, we manipulated positive affects in Experiment 1 by varying the intensity of approach motivation. That is, both low-approach-motivation positive affect and high-approach-motivation positive affect were manipulated using affective pictures. We predicted that relative to a low-approach-motivation positive state or a neutral state, a high-approach-motivation positive state would shorten the perception of time. In addition, Experiment 1 examined whether individual differences in approach motivation toward appetitive pictures would influence time perception. We predicted that, relative to individuals who had eaten more recently, individuals who had eaten less recently would show stronger approach-motivated tendencies toward delicious dessert stimuli and thus have shortened perceptions of time when viewing dessert pictures but not when viewing neutral pictures.

Method

One hundred forty (91 female, 49 male) introductory psychology students participated in exchange for partial course credit. After obtaining informed consent from all participants, we assessed individual differences in approach motivation by asking participants to state how long it had been since they had last eaten. Responses were recorded in hours and minutes.

Participants' perception of time was then measured using a temporal bisection task, one of the most widely used measures of time perception, in which participants judge various stimuli as being displayed for a long or short duration (Gil & Droit-Volet, 2009; Gil, Niedenthal, & Droit-Volet, 2007; Gil, Rousset,

& Droit-Volet, 2009; Tipples, 2010). The task consisted of a training phase and a testing phase. In the training phase, participants were shown examples of short (400 ms) and long (1,600 ms) display durations using a neutral image. Then, participants practiced judging short and long durations while viewing an additional four short and four long presentations of the neutral image.

In the testing phase, participants performed the same bisection task while viewing different picture types: neutral pictures (geometric shapes), positive pictures that elicited a low approach motivation (e.g., flowers), and positive pictures that elicited a high approach motivation (delicious desserts).[2] Each picture was displayed for one of seven durations: the two standard durations (400 and 1,600 ms) and five intermediate durations (600, 800, 1,000, 1,200, and 1,400 ms). Participants viewed 189 total trials of neutral, low-approach-motivation positive, and high-approach-motivation positive pictures. For each picture, participants were asked to judge whether the picture was displayed for a short or a long amount of time. Assessment of time perception in this task was based on the proportion of long (as opposed to short) judgments. Thus, higher proportions indicate slower perceptions of time. After all trials were presented, participants were carefully debriefed using a funnel debriefing (Harmon-Jones, Amodio, & Zinner, 2007). None reported any suspicion about the experiment.

Results

A 3 (picture type) × 7 (picture duration) repeated measures analysis of variance (ANOVA) revealed a significant interaction between picture type and duration, $F(12, 1668) = 9.40$, $p < .0001$, $\eta_p^2 = .06$ (see Fig. 1); this finding indicates that time estimation varied as a function of picture type and duration. Results showed a significant main effect for picture type, $F(2, 278) = 4.79$, $p = .01$, $\eta_p^2 = .03$, such that participants judged the high-approach-motivation pictures as being displayed for a shorter time than the low-approach-motivation and neutral pictures (ps < .02; see Fig. 2). The difference between low-approach-motivation pictures and neutral pictures was not significant ($p = .60$). There was also a significant main effect of duration, $F(6, 834) = 1{,}343.4$, $p < .0001$, $\eta_p^2 = .91$, which indicated that participants estimated time accurately: The longer a stimulus was presented, the more likely participants were to judge it as being displayed for a long amount of time.

As in previous research, participants showed the most variance in duration judgments when pictures were displayed for 800 ms (Droit-Volet & Gil, 2009). That is, this display time was the threshold at which longer displays were predominantly judged as long, but shorter displays were predominantly judged as short. Because this display time was most sensitive to perceptual judgments of time, subsequent analyses investigated responses during this duration. A repeated measures ANOVA revealed a significant main effect among the three picture types, $F(2, 278) = 17.12$, $p < .0001$, $\eta_p^2 = .11$. Participants judged the high-approach-motivation pictures ($M = .30$, $SD = .25$) as being displayed for a shorter time than the low-approach-motivation pictures ($M = .40$, $SD = .27$; $p < .0001$) and neutral pictures ($M = .39$, $SD = .25$; $p < .0001$). The difference between low-approach-motivation pictures and neutral pictures was not significant ($p = .66$).

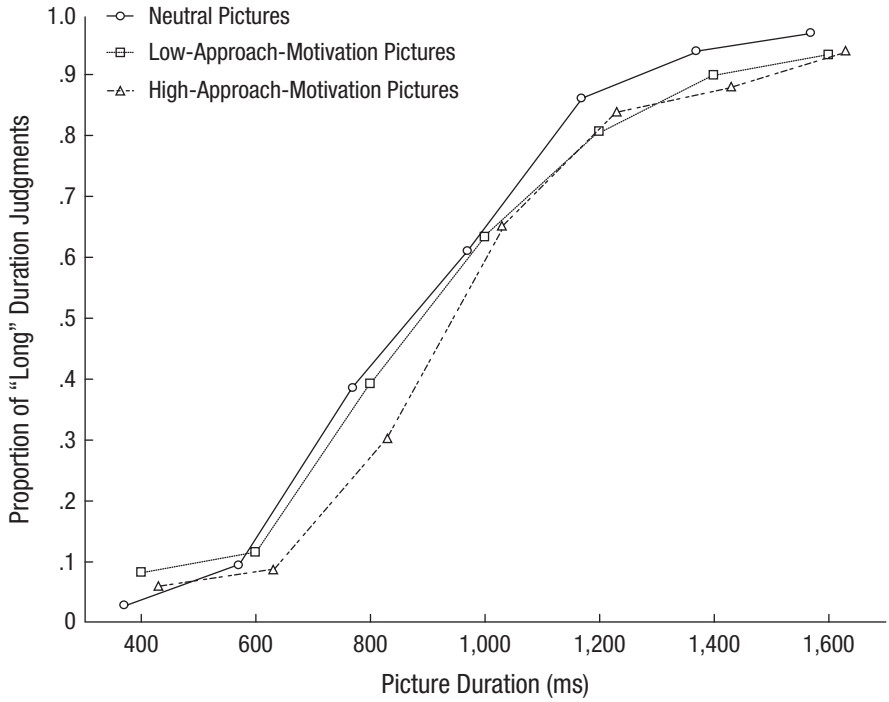

Fig. 1. Results of Experiment 1: mean proportion of display durations that participants rated as "long" as a function of the actual presentation length and the type of picture displayed.

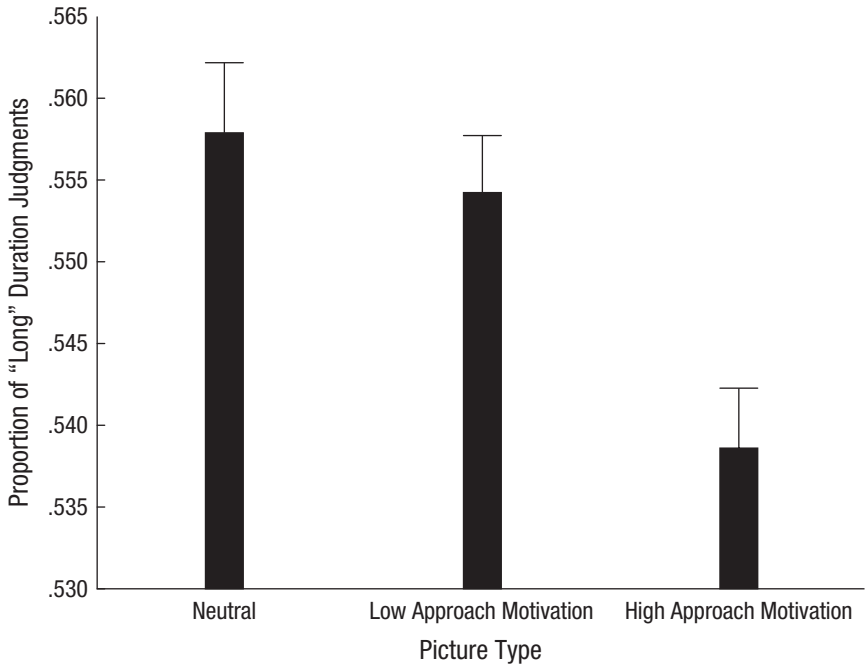

Fig. 2. Results of Experiment 1: mean proportion of display durations that participants rated as "long" as a function of the type of picture displayed. Error bars indicate standard errors of the mean.

To test the prediction that individuals with stronger approach motivation would respond to dessert pictures with shorter time perception, we conducted regression analyses in which picture type and the amount of time since participants had last eaten were used to predict time perception. Because the predicted effect was for high-approach-motivation pictures, we conducted interaction analyses comparing time perception to these pictures with time perception to the other two types of picture.

A significant interaction of picture type and the amount of time since participants had last eaten emerged between the neutral and high-approach-motivation pictures, $F(1, 138) = 4.15$, $p = .04$, $\eta_p^2 = .03$ (see Fig. 3). The amount of time since participants had last eaten did not relate to time perception when viewing neutral pictures, $r = -.002$, $p = .98$. However, an analysis controlling for judgments for neutral pictures revealed that the amount of time since participants had last eaten related to shorter time judgments for high-approach-motivation pictures, partial $r = -.19$, $p = .03$.

A marginal interaction of picture type and amount of time since participants had last eaten emerged between low-approach-motivation pictures and high-approach-motivation pictures, $F(1, 138) = 2.94$, $p = .09$, $\eta_p^2 = .02$. The amount of time since participants had last eaten did not relate to time perception when viewing low-approach-motivation pictures, $r = -.03$, $p = .76$. However, an analysis controlling for judgments to low-approach-motivation pictures revealed that the amount of time since participants had last eaten related to shorter time judgments for high-approach-motivation pictures, partial $r = -.18$, $p = .04$.

Discussion

Experiment 1 revealed that participants perceived time as passing faster in a high-approach-motivation positive state than in a low-approach-motivation positive state or in a neutral state. These results show that positive affects varying in motivational intensity have different effects on time perception. In addition, Experiment 1 revealed that individual differences in approach motivation, as measured by the amount of time since participants had last eaten, relate to shortened time perception to high-approach-motivation pictures but not to neutral or low-approach-motivation pictures.

Experiment 2

To further test whether approach motivation was responsible for the shortened perception of time we observed in Experiment 1, we designed Experiment 2 to manipulate the intensity of approach motivation independently of picture type by experimentally varying the expectancy to act. Past research has suggested that the expectation to act increases motivational intensity (for a review, see Brehm & Self, 1989).

Specifically, we manipulated the expectancy to consume delicious desserts. Previous studies have found that manipulating the expectancy to act increases approach motivation

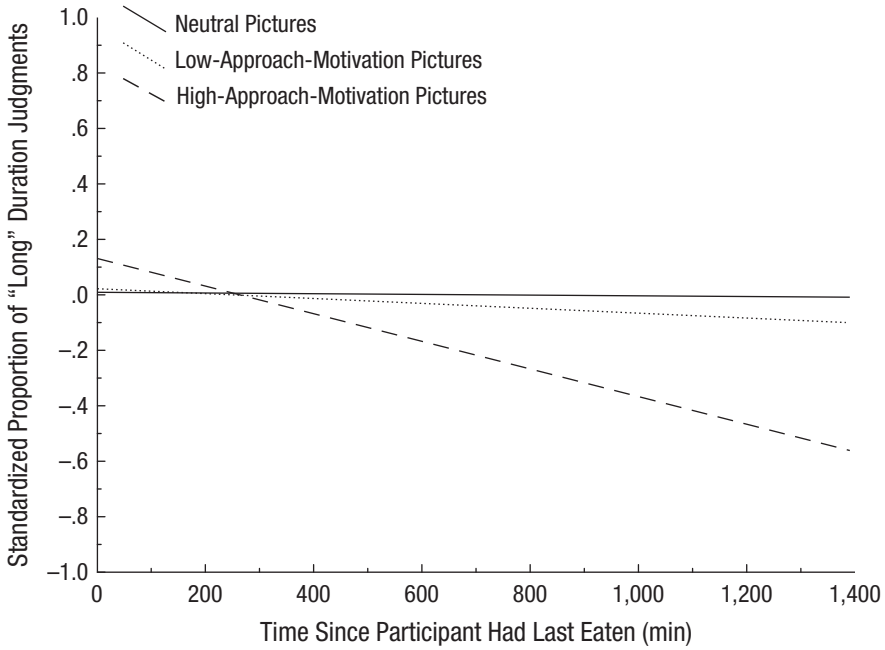

Fig. 3. Results of Experiment 1: mean standardized proportion of display durations that participants rated as "long" as a function of the amount of time since participants had last eaten and the type of picture displayed.

(Gable & Harmon-Jones, 2008a; Harmon-Jones, Lueck, Fearn, & Harmon-Jones, 2006). However, past research has shown that manipulating the expectancy to consume desserts does not influence self-reports of positive affect; that is, the approach manipulation resulted in equal increases in self-reported positive affect (relative to a neutral condition) among participants given low expectation to act and those given high expectation to act. Also, the expectancy to consume dessert items decreased self-reported negative approach motivation (e.g., anger) because of the appetitive engagement of the manipulation (Gable & Harmon-Jones, 2008a). In the present experiment, we predicted that participants who viewed dessert pictures and expected to consume these desserts would perceive time as passing faster than would participants who simply viewed the dessert pictures.

Method

Eighty-four (59 female, 25 male) introductory psychology students participated in exchange for partial course credit. All participants provided informed consent. Six participants' data were excluded from analyses because they did not follow instructions. After viewing six neutral practice pictures, participants were randomly assigned to two conditions. In both conditions, participants viewed 36 dessert pictures, but half of the participants were given the expectation to consume the items pictured by being informed that "at the end of the experiment, you will be presented with a large tray that contains most of the items you will see in the pictures. You will be able to take as many as you want." The other half of the participants were not given any additional information.

Each picture was displayed for 12 s and preceded by a 2-s fixation cross. Intertrial intervals varied between 6 and 8 s. After viewing the pictures, participants responded to the question, "How did time seem to progress while you viewed the pictures?" using a Likert-type scale from 1 (*time dragged*) to 7 (*time flew*; adapted from Sackett et al., 2010). Participants were then carefully debriefed. None reported any suspicion about the experiment. Before being dismissed from the experiment, participants in all conditions were presented with a tray of desserts and allowed to take any they wanted.

Results

A one-way ANOVA revealed a significant difference between conditions, $F(1, 76) = 6.05$, $p = .02$, $\eta_p^2 = .07$. Participants reported time as passing faster when they viewed the dessert pictures with the expectation that they would be able to consume the desserts later ($M = 2.38$, $SD = 1.63$) than when they viewed the dessert pictures without the expectation to consume the desserts later ($M = 1.61$, $SD = 0.90$; $p < .01$).

Discussion

Experiment 2 revealed that directly manipulating approach motivation independently of picture type caused time to be perceived as passing more quickly. These results further demonstrate that approach motivation directly influences time perception.

Experiment 3

In Experiment 3, we sought to extend the findings of Experiments 1 and 2 by testing whether high-approach-motivation positive states shorten the perception of time relative to high-withdrawal-motivation negative states. This comparison allowed us to test whether some characteristics of high-approach-motivation positive states, such as heightened arousal or attentional capture, may have contributed to the observed outcomes on time perception.

Major theories of emotion view motivational intensity as being closely related to the arousal level of affective states; such theories posit that both motivation and arousal are associated with increased activation of the sympathetic nervous system (Bradley & Lang, 2007). However, unlike arousal, motivation always has action implications (e.g., moving toward or moving away from an object or goal). To differentiate the effects of arousal and motivation on time perception, we compared two high arousal states differing in motivational direction (approach vs. withdrawal).

In addition, Experiment 3 was designed to test whether attentional capture caused by high positive approach motivation and by high negative withdrawal motivation shortened time perception (Gable & Harmon-Jones, 2008a, 2010c). That is, perhaps individuals fail to attend to the passing of time when viewing highly emotional stimuli and lose track of time. However, we believe this perceptual shortening of time is caused by approach motivation. We predicted that relative to high negative withdrawal motivation, high positive approach motivation would shorten the perception of time.

Method

One hundred twenty-nine (97 female, 32 male) introductory psychology students participated in exchange for partial course credit. All participants provided informed consent. Participants completed a temporal bisection task similar to that in Experiment 1, except that they viewed 126 trials of high-approach-motivation positive pictures and high-withdrawal-motivation negative pictures.[3] Participants judged whether each picture was displayed for a short or a long amount of time. Assessment of time perception was based on the proportion of long (as opposed to short) judgments, with higher proportions indicating a slower perception of time. Data from 14 participants were not included in analyses because of noncompliance with instructions or computer failure.

Results

A 2 (picture type) × 7 (picture duration) repeated measures ANOVA revealed a significant interaction between picture type and duration, $F(6, 678) = 8.99$, $p < .0001$, $\eta_p^2 = .07$; this finding indicated that time estimation varied as a function of picture type and duration. Results also showed a significant main effect of picture type, $F(1, 113) = 8.36$, $p = .005$, $\eta_p^2 = .07$, such that participants judged the high-approach-motivation positive pictures ($M = .56$, $SD = .12$) as being displayed for a shorter time than the high-withdrawal-motivation negative pictures ($M = .58$, $SD = .13$). There was also a significant main effect of duration, $F(6, 678) = 994.77$, $p < .0001$, $\eta_p^2 = .90$, which indicated that participants estimated time accurately.

As in Experiment 1, we found that pictures displayed for 800 ms elicited the most variation in duration judgments: Participants judged the high-approach-motivation positive pictures as being displayed for a shorter time ($M = .34$, $SD = .27$) than the high-withdrawal-motivation negative pictures ($M = .43$, $SD = .30$), $t(114) = 3.92$, $p = .0001$.

Discussion

Experiment 3 revealed that high positive approach motivation shortens time perception relative to high negative withdrawal motivation. These results suggest that approach motivation, rather than heightened arousal or attentional capture, hastens the perceived passing of time.

General Discussion

In the present experiments, we sought to test whether positive approach motivation causes time to anecdotally "fly when you're having fun" by investigating the effects of positive approach motivation on the perception of time. Across three experiments, results suggest that positive approach motivation causes the perception of time to shorten. In Experiment 1, we demonstrated that high-approach-motivation positive pictures caused time to be perceived as passing faster than low-approach-motivation positive pictures or neutral pictures. Moreover, the approach-motivated individual difference of time since individuals had last eaten interacted with the type of picture displayed to predict shorter judgments of time for pictures of delicious desserts. Experiment 2 further connected approach motivation to time perception by demonstrating that approach motivation manipulated independently of picture type caused subjective time to pass more quickly. Experiment 3 provided additional support that approach motivation, as opposed to arousal or attentional capture, shortens time perception by revealing that high-approach-motivation positive stimuli caused time to be perceived as passing faster than did high-withdrawal-motivation negative stimuli. Taken together, evidence from these experiments supports our hypothesis that positive approach motivation shortens time perception.

High positive approach motivation is evoked by objects and goals that are both highly pleasant and high in approach motivation (Gable & Harmon-Jones, 2010c, 2011; Harmon-Jones, Gable, & Price, 2011). Reduced perceptions of time may assist in abating irrelevant processes that would delay or hinder goal acquisition. This reduced perception of time in an appetitive state may prolong pursuit of appetitive objects or

goals (e.g., food, water, companionship). In conjunction with research by Sackett et al. (2010), the current results indicate that shortened time perception and approach motivation are closely linked and bidirectional, such that approach motivation shortens time perception, and a perceived shortening of time causes stimuli to be perceived as more appetitive.

In summary, these experiments highlight the importance of studying affects varying along dimensions other than valence and arousal. Specifically, these results highlight the importance of incorporating motivational direction into studies on affective valence. Investigating the effects of motivation could provide a better understanding of the impact that affective states have on cognition. A more complete examination of affects and their relationships with time perception and cognitive processes will assist not only in better understanding positive affects and affect-cognition interactions, but also may have important applications for performance.

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Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

Notes

1. Positive approach motivation occurs during active engagement of appetitive objects or goals (Gable & Harmon-Jones, 2010c; Knutson & Wimmer, 2007). If active engagement is disrupted or impeded, then the affective state would no longer be positive. Such states are likely to be negative and unlikely to cause a shortened perception of time.
2. The high-approach-motivation positive pictures used in the current study have been used in a number of previous studies and have been consistently rated as significantly more positive, more arousing, and as evoking more approach motivation than neutral pictures (Gable & Harmon-Jones, 2008a, 2008b, 2010b; Harmon-Jones & Gable, 2009). The low-approach-motivation positive pictures were taken from the International Affective Picture System (Lang, Bradley, & Cuthbert, 2005; Pictures 1419, 1603, 1610, 1812, 1900, 2360, 5001, 5010, 5200, 5201, 5551, 5611, 5781, 5891, and 7545). Normative ratings using the Self-Assessment Manikin (Bradley & Lang, 1994) to assess valence (1 = *very unpleasing*, 9 = *very pleasing*) and arousal (1 = *exciting*, 9 = *calm*) indicated that the high-approach-motivation positive pictures were similar in valence (M = 6.80, SD = 2.22, and M = 7.11, SD = 1.56, respectively) but dissimilar in level of arousal (M = 5.74, SD = 2.57, and M = 3.53, SD = 2.32, respectively). Following major theories of emotion, we view motivational intensity as being closely related to the arousal level of affective states (Bradley & Lang, 2007).
3. Picture stimuli were chosen based on normative ratings using the Self-Assessment Manikin. High-approach-motivation positive pictures and high-withdrawal-motivation negative pictures were matched on how strongly they evoked pleasant or unpleasant feelings (M = 6.80, SD = 2.22; M = 2.64, SD = 1.65, respectively) and on arousal (M = 5.74, SD = 2.57; M = 5.84, SD = 2.19, respectively).

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