Sadness Speeds and Disgust Drags:

Influence of Motivational Direction on Time Perception in Negative Affect

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Abstract

Time flies when you're having fun, but how does time pass in negative states? Past research has examined how time passes in positive states varying in motivation, but has not examined differing motivational tendencies within negative states. The current experiments investigate the impact of sadness, disgust, and anger on time perception. Based on the motivational direction model of time perception, we propose that sadness and anger, hypothesized approach-motivated negative states, will cause time to shorten, but disgust, a withdrawal-motivated negative state will cause time to lengthen. Experiments 1 demonstrated that sadness caused the perception of time to "fly" as compared to a neutral state. Experiment 2 found that sad states caused time to shorten relative to a neutral state as measured by a temporal bisection task. In contrast, Experiment 3 demonstrated that disgust caused the perception of time to lengthen relative to a neutral state. Experiments 4 and 5 manipulated approach motivation within sad and anger states. High approach motivated sad and anger states caused time to pass more quickly than low approach motivation in the same negative state. These experiments demonstrate that negative affects vary in their effects on time perception. Motivational direction appears to influence the perception of time passing.

Keywords: time perception, sadness, motivation, anger

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When descending the first hill of a rollercoaster, or being in a car careening out of control, time may seem to slow. Studies examining the influence of negative affects on time perception have shown that negative states cause time to lengthen compare to neutral states (Droit-Volet & Gil, 2009; Grommet et al., 2011; Stetson, Fiesta, & Eagleman, 2007). However, this past research on negative states has focused on withdrawal-motivated states (e.g. fear and disgust). But, is this the whole story? Do *all* negative affective states slow the perception of time? The current experiments sought to answer this question and investigate the influence of motivation on the perception of time in negative states.

Previous approaches to studying the interaction between affect and time perception have been predicated on models that focus on differences between pleasant or unpleasant emotions that are high and low in arousal (Angrilli et al., 1997; Noulhiane et al., 2007) or differences between discrete emotions (Droit-Volet & Gil, 2009; Droit-Volet & Meck, 2007; Grommet et al., 2011). However, to date the influence of motivational direction on time perception within negative affects has been unexplored. Affective states are the subjective feelings associated with the current emotional state. Recent models have investigated the role of motivation in affective states and its effect on temporal perception (Gable & Poole, 2012). Based on the motivational dimensional model of affect, affects differ in motivational direction. That is, some affects are approach motivating and give the impetus to move towards an object, while some affects are withdrawal motivating and give the impetus to move away from an object (Harmon-Jones, Harmon-Jones, & Price, 2013; Lang, 1995). In addition, approach and withdrawal motivations can vary in the strength of the motivational drive. Some affects have strong motivational drive,

while others have weak motivational drive. Motivational drive can vary within affective states of the same valence (Gable & Harmon-Jones, 2008, 2010; Harmon-Jones, Price, & Gable, 2012).

Motivational Direction in Negative Affect

Predominantly, negative affect has been associated with withdrawal motivation (Balconi, Falbo, & Conte, 2012). That is, some of the most widely studied negative affects (e.g., fear, disgust) cause an individual to move away from an object. Prominent models of emotion posit that negative affects in general are related to avoidance motivation (Davidson, 1992; Lang, Bradley, & Cuthbert, 1998; Watson, 2009; Watson, Clark, & Tellegen, 1988). The idea that certain negative affects are associated with withdrawal motivation is well-established.

However, not all negative affective states fit within a negative-withdrawal framework. Negative affects vary in motivational direction (Harmon-Jones, Harmon-Jones, Amodio, & Gable, 2011). For example, some models suggest that anger relates to the functioning of an approach system (Carver & Harmon-Jones, 2009). Anger arises in situations where approach toward a goal is interrupted or an anticipated reward is blocked (Berkowitz, 1993; Carver & Scheier, 1998, 2008; Rolls, 1999). Functionally, anger is thought to facilitate attempts to remove whatever is impeding goal pursuit (Fischer & Roseman, 2007; Frijda, 1986; Gable, Poole, & Harmon-Jones, 2015). Protracted attempts to remove goal impediments may further facilitate goal pursuit. Moreover, neural regions associated with approach are activated during situational anger (see Harmon-Jones, Gable, & Peterson, 2010; Poole & Gable, 2014, for reviews).

Along these lines, some prominent theories of emotion suggest sadness may be associated with approach motivation (Carver, 2004; Henriques & Davidson, 2000; Higgins, Shah, & Friedman, 1997). For example, sadness occurs following a loss or failure when individuals are already in an approach-motivated state (Carver, 2004; Carver & Scheier, 1998,

2008; Leventhal, 2008; Rolls, 2005). Situations evoking approach-motivated sadness can result in promoting social behaviors like strengthening or creating social bonds (Gray, Ishii, & Ambady, 2011; Keller & Nesse, 2006). Approach motivation in a sad state may be adaptive because it facilitates engagement with a new goal after encountering a terminally blocked goal (Klinger, 1975). The process of disengagement of old goals and engagement in new goals could be lengthy. Extended searches for new goals could facilitate engagement. Approach behaviors occurring during sadness are thought to be more adaptive than avoidance behaviors and may mitigate the onset of depression (Leventhal, 2008).

Not all occurrences of sadness may be characterized by approach motivation. Some types of sadness may signal in-action, rather than approach, in order to reassess or reintegrate goal pursuit (Frijda, 1986; Lazarus, 1991). Gray et al. (2011) found that sadness caused approach or inaction depending on the particular sources of sadness. Specifically, sadness caused by social loss led to an increased desire to engage in social situations (approach), while sadness due to failure led on a major goal led to inaction. The motivation to approach when sad may depend on the situation evoking sadness. When approach motivation is adaptive to goal attainment, such as seeking social support, sadness may evoke approach motivation. In contrast, when goal attainment is irrevocably lost, sadness may signal the organism to inaction. As such, motivation associated with sad states may not be strongly associated with a specific object or goal (Harmon-Jones, Gable, & Price, 2013).[1] There may be different types of sadness depending on the motivational need created by the situation.

Motivational Dimensional Model of Time Perception

Looking at the motivational dimension of affect reveals that affects of the same valence can vary in strength of motivation. A growing body of literature has shown that positive and

negative affective states varying in the strength of motivational direction have diverse consequences on perceptual processes (see Gable & Harmon-Jones, 2010; Harmon-Jones, Gable, & Price, 2013 for review). Gable and Poole (2012) sought to investigate whether positive affective states varying in motivational strength would also have diverse consequences on perceptions of time. In one experiment, participants completed a temporal bisection task in which they judged whether low-approach positive pictures or high approach-positive pictures were displayed for either a long or short amount of time. Results demonstrated that participants were more likely to judge high approach-motivated positive pictures as being displayed for a shorter amount of time than low approach-motivated positive pictures or neutral pictures. In another study, manipulations of approach motivation - independent of pleasantness - caused time to be perceived as passing more quickly. These results suggest that approach motivation within positive affects cause time to pass more quickly. While this past work examined the influence of motivational direction on time perception in different positive affective states, as well as motivational direction between positive and negative affects, no previous work has looked at the effects of different motivational directions within negative affect states.

Motivation is likely to influence time perception in negative affect states. Most past research examining the influence of negative affects on time perception have examined withdrawal-motivated negative states (e.g., fear and disgust), and found that these states cause time to lengthen compare to neutral states (Droit-Volet & Gil, 2009; Grommet et al., 2011; Stetson, Fiesta, & Eagleman, 2007). In contrast, sadness appears to be a negative affect state that shortens time perception. Gil and Droit-Volet (2009) had depressed and non-depressed participants complete a temporal bisection task. Results revealed that state sadness in depressed individuals predicted a hastened perception of time. This finding is consistent with other research

relating greater experiences of sadness with time passing more quickly in depressed individuals (Grinker, Glucksman, Hirsch, & Viseltear, 1973; Tysk, 1984).

Sadness may cause time to pass more quickly because it is associated with approach motivation. However, past evidence of the influence of sadness on time-perception is mixed. Gil and Droit-Volet (2012) found an overall lengthening of time perception in sad states. Additionally, Droit-Volet, Fayolle, and Gil (2011) found that sadness did not influence the length of time of neutral events. In sum, sadness has been found to shorten time perception, lengthen time perception, or have no effect[2]. However, no past work has directly tested whether sad states cause time to pass more quickly or whether approach motivation is related to time perception in sad states.

The Current Experiments

The motivational dimensional model predicts that motivational direction of negative states will alter the perception of time. That is, affective states of the same valence differing in motivational direction should have differing effects on time perception. Experiments 1 and 2 focused on sadness, a negative state hypothesized to be related to approach motivation. We predicted that sadness would cause time to be perceived as shortening compared to a neutral state and that approach motivation in sad states would relate to time perception. Experiment 3 experimentally manipulated high and low disgust, a withdrawal-motivated negative state, in order to test whether varying levels of withdrawal motivation lengthen time in negative affects. We predicted that a high disgust state would cause time to be overestimated compared to a low disgust state or a neutral state. Experiments 4 and 5 manipulated approach motivational strength within the same negative affect to investigate whether manipulations of approach motivation in the same affect would influence time perception. We predicted that time perception would be

shorter in high approach-motivated negative states than low approach-motivated negative states. Predictions were directional, derived from theory, and specified a priori. Therefore, they were evaluated using a one-tailed criterion of significance (Rosenthal, Rosnow, & Rubin, 2000).

Past research has differentiated between retrospective and prospective temporal judgment paradigms (Block & Zakay, 1997). According to this past work, retrospective time estimation tasks are those in which participants are unaware they will be asked to judge a time interval until after it has passed. In contrast, prospective time estimation tasks are those in which participants are aware they will be judging a time interval before the interval begins. These tasks may rely differently on memory processes (Grondin, 2010). However, past work has demonstrated that motivation influences time perception on both prospective and retrospective tasks (Gable & Poole, 2012). The influence of motivation on time perception does not appear to be limited to one type of time perception measure. The current research utilized both prospective (Experiments 2 & 3) and retrospective tasks (Experiments 1, 4 & 5) to examine how motivation influences time perception.

Experiment 1

Experiment 1 was conducted to examine approach motivation in sad states. This study used a retrospective judgment of time passing during films evoking a sad and neutral state in a within-subjects design. Specifically, we measured the perception of time passing by asking participants to report whether time "flew" or "dragged" during the films. Time "flying" would indicate that the participants underestimated the passing of time. In addition, we sought to assess whether approach (vs. withdrawal) motivation related to time passing more quickly in a sad state. Therefore, we used a self-report measure of motivation that assessed participants' perceived

motivational direction (move toward vs. move away). We hypothesized that greater approach motivation in a sad (vs. neutral) state would relate to time passing more quickly.

Method

Seventy-three (59 female) introductory psychology students participated in exchange for partial course credit. Participants viewed two films designed to evoke a sad state or a neutral state. The sad film depicted two children describing the death of a younger sibling from sudden infant death syndrome and the neutral film depicted the exteriors of houses (Gable & Harmon-Jones, 2008). Both films were found on the Internet and were edited to last exactly 1 minute and 34 seconds. Films were presented in a counterbalanced order between participants. After viewing each film, participants indicated their response to the time perception question "How did time seem to progress while you viewed the film?" using a scale from 1 (*time dragged*) to 7 (*time flew*).

Finally, participants reported emotive reactions to the films, indicating valence (1 = *positive*; 9 = *negative*) and motivational direction (1 = *move toward*; 9 = *move away*; Gable, Poole, & Harmon-Jones, 2015). Eight participants did not report motivational direction to the sad film and ten participants did not report motivational direction to the neutral film. All participants were then carefully debriefed. None reported any suspicion with the experiment.

Results

Participants rated the sad film as more negative than the neutral film, $t(68) = 7.21$, $p < .0001$ one-tailed, $d = 1.04$. Participants reported values closer to approach motivation on the motivational direction scale during the sad film than the neutral film, $t(54) = 2.57$, $p < .01$ one-tailed, $d = .44$. The neutral film motivation rating was significantly greater than the midpoint, $t(61) = 4.33$, $p < .001$. The sad film motivation rating did not differ from the midpoint, $t(65) =$

0.46, $p = .64$. Participants reported greater time "flying" during the sad film than the neutral film, $t(71) = 7.16$, $p < .0001$ one-tailed, $d = 1.11$ (see Table 1 for all comparisons).

[Insert Table 1 Here]

To test the prediction that approach motivation to the sad and neutral films would relate to a hastened perception of time, we conducted general linear model analyses in which film type and strength of self-reported motivation predicted time perception. Based on past work using difference scores to control for individual differences in motivation and to examine the relative difference between two motivational conditions (Gable & Harmon-Jones, 2008; Hicks, Fields, David, & Gable, 2015; Hicks, Friedman, Gable, & David, 2012; Poole & Gable, 2014), we created a difference score by subtracting self-reported motivation to the neutral film from self-reported motivation to the sad film.

There was no main effect of motivation on time perception, $F(1, 52) = .06$, $p = .81$. There was a significant main effect of film type on time perception, $F(1, 52) = 74.8$, $p < .001$, $\eta_p^2 = .59$, such that participants judged time as "flying" more during the sad film ($M = 2.77$, $SD = 1.53$) than the neutral film ($M = 4.73$, $SD = 1.52$). The main effects were qualified by a significant interaction of film type and approach motivation emerged to predict time "flying" during the sad film, $F(1, 52) = 6.79$, $p < .01$, $\eta_p^2 = .11$ (see Figure 1). Consistent with predictions, approach motivation to the sad film predicted time passing more quickly during the sad film, $r = -.25$, $p < .03$, one-tailed. Approach motivation to the neutral film did not relate to the perception of time during the neutral film, $r = .19$, $p = .15$.

[Insert Figure 1 Here]

In order to test whether valence, rather than motivation, was responsible for the effect of sadness on time perception, we conducted the same regression analyses in which film type and valence predicted time perception. We created a difference score subtracting valence ratings to the neutral film from valence ratings to the sad film. There was no significant interaction of film type and valence, $F(1, 65) = 1.64$, $p = .20$. Valence ratings to the sad film did not relate to time perception during the sad film, $r = -.09$, $p = .46$. Valence ratings to the neutral film did not predict time perception during the neutral film, $r = -.04$, $p = .75$. Thus, it appears that the motivational direction, rather than negativity, of the sad film was responsible for the effects on time perception.

Discussion

Results of Experiment 1 suggest that sad states evoked by films hasten the perception of time as compared to a neutral state. In addition, the sad films evoked values on the approach-withdrawal scale closer to approach motivation than the neutral film. Greater self-reported approach motivational direction in the sad film predicted an underestimation of time during the sad film. Self-reported motivation of the sad video was near the midpoint and the neutral video was relatively closer to the "move away" anchor. However, the relative difference between these two conditions is the variable of interest in this scale. Participants may consider numbers higher than the midpoint as more withdrawal motivating or less approach motivating.

Participants rated the neutral film as more pleasant than the sad film. Participants likely associate verbal associations of approach motivation with pleasant experiences and verbal associations of withdrawal motivation with negative affect. As such, it may be difficult for

participants to self-report being approach motivated to negative states like sadness. This may explain why the self-report of approach motivation is not more on the approach side of the scale. These results also suggest that participants may have difficulty self-reporting approach motivation in sad states.

Results of Experiment 1 suggest that sadness – a negative state – shortens the perceived passing of time. Consistent with past research demonstrating that approach-motivated states shorten time perception, it could be that approach motivation in sad states is shortening the passing of time. However, results of Experiment 1 are suggestive and leave some ambiguity as to whether sadness shortens time perception. The self-reported motivation provides evidence that sadness may have been more approach motivated than a neutral state, but did not provide conclusive support that individuals self-reported greater approach motivation. Because the findings that approach-motivated negative states hasten time perception are new and inconclusive, we sought to conceptually replicate the effect of sadness on time perception using a different affective manipulation and measure of time perception.

Experiment 2

In Experiment 2, we used a temporal bisection task, one of the most widely used measures of prospective time perception (Gil & Droit-Volet, 2009; Gil, Rousset, & Droit-Volet, 2009; Tipples, 2010). Experiment 2 employed a within-subjects manipulation of sadness and neutral affect. In order to ensure that the effects of Experiment 1 were not due to differences in videos (e.g., differences in content, boredom, or text), we used sad and neutral pictures rather than videos. We hypothesized that sad pictures would be perceived as being displayed for a shorter amount of time than neutral pictures.

Method

One hundred and nine (55 female) introductory psychology students participated in exchange for partial course credit. The temporal bisection task consisted of a training phase and a testing phase where participants judge whether stimuli are displayed for a long or short duration. In the training phase, participants were shown examples of short (400 ms) and long (1600 ms) display durations using a neutral image. Then, participants practiced judging short and long durations in four short and four long presentations of the neutral image.

In the testing phase, participants performed 126 trials of the same bisection task while viewing sad (e.g., gravesites, people crying) and neutral (geometric shapes) pictures.[3] These pictures have been used in past studies and were found to reliably evoke sadness or a neutral state (Gable & Harmon-Jones, 2010; Gable & Poole, 2012). Each picture was displayed for one of seven durations: the two standard durations (400 and 1600 ms) and five intermediate durations (600, 800, 1000, 1200, and 1400 ms). Participants judged whether each picture was displayed for a short or long amount of time. Assessment of time perception in this task was based on the frequency with which long (vs. short) judgments were chosen, with higher scores indicating an overestimation of time.

Following the bisection task, participants reported emotive reactions to a subset (N = 10) of the pictures, indicating picture valence (1 = *positive*; 9 = *negative*) and how sad they felt when they viewed each picture (1 = *no emotion*; 9 = *strongest feeling*). Finally, all participants were carefully debriefed. None reported any suspicion with the experiment.

Results

Participants rated the sad pictures as being more negative and saddening than the neutral pictures, ts > 11.99, ps < .0001 one-tailed (see Table 2).

[Insert Table 2 Here]

A 2 (picture type) × 7 (picture duration) repeated-measures ANOVA of temporal judgments revealed a significant main effect for picture type, $F(1, 108) = 15.35$, $p < .001$, $\eta_p^2 = .12$, such that participants underestimated the duration of sad pictures ($M = 0.52$, $SD = 0.11$) compared to neutral pictures ($M = 0.55$, $SD = 0.10$). There was also a significant main effect for duration, $F(6, 648) = 1093.20$, $p < .0001$, $\eta_p^2 = .91$, indicating that participants estimated time accurately: the longer a picture was presented, the more likely participants judged it as being displayed for a "long" amount of time. These main effects were qualified by a significant interaction between picture type and duration $F(6, 648) = 8.14$, $p < .0001$, $\eta_p^2 = .07$, indicating that time estimation varied as a function of picture type and duration (see Figure 2).

[Insert Figure 2 Here]

Consistent with previous research, participants showed the most variance in duration judgments when pictures were displayed for 800 ms (Droit-Volet & Gil, 2009; Gable & Poole, 2012). That is, the threshold where longer displays were predominantly judged as long, but shorter displays were predominantly judged as short occurred at this display time. A dependent-samples *t*-test for judgments at this display time revealed that participants judged the sad pictures ($M = 0.26$, $SD = 0.24$) as being displayed for a shorter time than the neutral pictures ($M = 0.38$, $SD = 0.27$), $t(108) = 5.61$, $p < .0001$ one-tailed, $d = .47$. At the other display lengths, time

estimations between sad and neutral pictures did not differ (400 ms, $t(108) = 1.55$, $p = .12$; 600 ms, $t(108) = 0.72$, $p = .47$; 1000 ms, $t(108) = 1.60$, $p = .11$; 1400 ms, $t(108) = 1.63$, $p = .10$; 1600 ms, $t(108) = 0.26$, $p = .79$). Time estimations between sad and neutral pictures were significantly different at 1200 ms, $t(108) = 2.12$, $p = .03$.

The bisection point reflects the estimate of the presentation length at which participants responded "short" or "long" with equal frequency. The bisection point for each participant was calculated using the regression method (Maricq, Roberts, & Church, 1981; Wearden & Ferrara, 1996) by calculating the individual regression slope for each participant for the steepest part of the psychometric function. The bisection point was shifted to the right for sad stimuli (M = 969.35, SD = 301.36) compared to neutral stimuli (M = 887.49, SD = 220.43), $t(105) = 2.71$, $p < .007$.

Discussion

Results of Experiment 2 revealed that participants judged the sad pictures as being on the screen for shorter time intervals than the neutral pictures. Sad pictures hastened the perception of time as compared to neutral pictures using a temporal bisection task. This study conceptually replicated and extended results of Experiment 1 using a prominent measure of time perception. These results further support that sadness can speed the perception of time. Because Experiments 1 and 2 only examined negative affect states of sadness, we sought to demonstrate whether the perception of time could be lengthened in negative affect states of disgust associated with withdrawal motivation.

Experiment 3

In Experiment 3, we examined the influence of withdrawal-motivated negative affective states on prospective time perception in a within-subjects experiment. Based on our model, we predicted that disgust, a withdrawal-motivated negative affect would lengthen the perception of time.[4] Such a result would support our analysis by showing that highly withdrawal-motivated negative states in general lengthen the perception of time. Also, because past work suggests that withdrawal motivation slows the perception of time, we predicted that negative states high in disgust would lengthen time relative to negative states low in disgust. That is, withdrawal motivation, as opposed to negative valence, should influence time perception between disgust conditions.

Method

Sixty-two (47 female) introductory psychology students participated in exchange for partial course credit. Participants completed a temporal bisection task similar to that in Experiment 2, except that participants viewed 189 trials of neutral pictures (geometric shapes), low withdrawal negative pictures (e.g., prisoners), and high withdrawal negative pictures (e.g., mutilated bodies). Negative pictures were taken from the Internet and have been used in past studies to reliably evoke withdrawal-motivated affect (Gable & Harmon-Jones, 2010).

Following the bisection task, participants reported emotive reactions to a subset (N = 10) of the pictures, indicating picture valence (1 = *positive*; 9 = *negative*) and motivational strength (1 = *move toward*; 9 = *move away*). Participants also indicated how much disgust they felt when they viewed each picture (1 = *no emotion*; 9 = *strongest feeling*). Six participants did not complete ratings of neutral pictures. Finally, all participants were carefully debriefed. None reported any suspicion with the experiment.

Results

Paired samples *t*-tests were run to compare picture ratings between picture type. Participants rated the high withdrawal pictures as more negative than the low withdrawal pictures, $t(61) = 1.39$, $p < .0001$ one-tailed, $d = .17$. Low withdrawal pictures were more negative than neutral pictures, $t(56) = 10.06$, $p < .0001$ one-tailed, $d = 1.71$. Low withdrawal pictures were rated as less withdrawal motivated than high withdrawal pictures, $t(62) = 2.32$, $p < .0001$ one-tailed, $d = .39$. The high withdrawal pictures were rated as more withdrawal-motivated than the midpoint, $t(62) = 10.41$, $p < .001$. The low withdrawal pictures were not rated as significantly different from the midpoint on motivation, $t(62) = .03$, $p = .97$. The neutral pictures were not rated as significantly different from the midpoint, $t(52) = 1.41$, $p = .17$. High withdrawal pictures evoked more disgust than the low withdrawal pictures, $t(62) = 4.84$, $p < .0001$ one-tailed, $d = .64$; see Table 3 for all comparisons.

[Insert Table 3 Here]

A 3 (picture type) × 7 (picture duration) repeated-measures ANOVA of temporal judgments revealed a main effect for picture type, $F(2, 122) = 4.43$, $p < .005$, $\eta_p^2 = .07$, such that participants overestimated the duration of the high withdrawal negative pictures ($M = .56$, $SD = .13$) compared to the low withdrawal ($M = .53$, $SD = .12$) and neutral pictures ($M = .53$, $SD = .10$), ps $< .01$. Duration judgments between low withdrawal and neutral pictures were similar, $p = .93$. There was also a significant main effect for duration, $F(6, 366) = 766.18$, $p < .0001$, $\eta_p^2 = .93$, indicating that participants estimated time accurately. The main effects were qualified by a significant interaction between picture type and duration, $F(12, 732) = 2.60$, $p < .005$, $\eta_p^2 = .04$, indicating that time estimation varied as a function of both picture type and duration.

Participants showed the most variance in duration judgments when pictures were displayed at 800 ms. A repeated-measures ANOVA revealed a significant main effect of picture type, $F(2, 122) = 4.44$, $p < .01$, $\eta_p^2 = .07$. Participants judged the high withdrawal pictures (M = 0.38, SD = 0.29) as being displayed for a longer time than the low withdrawal pictures (M = 0.31, SD = 0.26) and the neutral pictures (M = 0.30, SD = 0.22), ps < .01. Duration judgments between low withdrawal and neutral pictures were similar, $p = .84$.

At the other display lengths, time estimations between affective and neutral pictures revealed significant differences at 400 ms ($F(2, 122) = 5.07$, $p < .007$), 600 ms ($F(2, 122) = 6.65$, $p < .001$), and 1200 ms ($F(2, 122) = 3.46$, $p < .03$). At other display lengths, time estimation did not differ (1000 ms, $F(2, 122) = 1.44$, $p = .24$; 1400 ms, $F(2, 122) = .03$, $p = .97$; 1600 ms, $F(2, 122) = 0.35$, $p = .71$).

As in Experiment 2, a bisection point was calculated for each participant for each picture type. The bisection point for the high withdrawal pictures (M = 926.77, SD = 210.16) was shifted to the right of the bisection point for the low withdrawal (M = 966.22, SD = 254.51) and neutral pictures (M = 975.88, SD = 230.52). The bisection points did not significantly differ from one another, $F(2, 122) = 1.44$, $p = .24$.

Discussion

Experiment 3 revealed that a disgust pictures high in withdrawal motivation lengthened perceptions of time relative to disgust pictures low in withdrawal motivation or neutral pictures. These results are in contrast to those of Experiments 1 and 2 demonstrating that sadness sped the perception of time relative to a neutral state. Results of Experiment 3 also reveal that high withdrawal-motivated negative states lengthen time relative to a neutral state, but low withdrawal-motivated negative states do not. These results further support the motivational

dimensional model of time perception that withdrawal motivation lengthens the perception of time.

Although the highly disgusting pictures were rated as more withdrawal motivated, they also could have been more arousing than the low disgust pictures. Thus, this study could not rule out the possibility that arousal may be responsible for the observed effects. Therefore, we conducted two studies manipulating levels of approach motivation within the same affective states. These states should evoke equal levels of arousal, but differing levels of approach motivation, which would more clearly point to motivation as a potential mechanism influencing time perception.

Experiment 4

Based on results of Experiments 1 - 3, sad states shorten the perception of time, but withdrawal-motivated disgust states lengthen the perception of time. Experiments 4 and 5 were designed to directly test whether manipulating approach motivation within negative states would shorten the perception of time by directly manipulating approach motivation within the same affective state. If manipulating approach motivational strength within negative states influences the perception of time, we can conclude that motivation is influencing time perception.

In Experiment 4, we sought to manipulate sad states that were either high in approach motivation, or low in approach motivation by having participants write about times when they experienced such states. Participants wrote about a past event when they were in a sad state and were highly approach motivated, or when they were in a sad state and were less approach motivated or inactive. We predicted that participants who wrote about a sad event associated with approach motivation would perceive time as shortening during a subsequent retrospective

temporal judgment task compared to participants who wrote about a sad event accompanied with inaction.

Method

One hundred and thirty-seven (78 female) introductory psychology students provided informed consent and participated in exchange for partial course credit. Participants were randomly assigned to one of two writing conditions. In one condition, approach motivation was enhanced by having participants write about a sad experience where they felt approach-motivated. In the other condition, approach motivation was reduced by having participants write about a sad experiences where they felt low or no approach motivation (i.e., inactive). Participants were given the following writing prompt adapted from previous research (Kahn, Tobin, Massey, & Anderson, 2007; Maslow, 1971). Only the underlined wording differed between conditions (inactive condition in parenthesis).

> "Think of one of the most saddening experience or experiences in your life when you felt sad and wanted <u>to seek out other people or you had a strong desire to do something (to withdraw from other people or you did not have a strong desire to do anything)</u>. You may write about any time in your life or any event, but it is important that you write about a time when you felt sad and wanted <u>to engage in something or approach others (to withdraw or not do anything)</u>. Try to imagine yourself at that moment, including all the feelings and actions associated with the experience. Now write about the experience in as much detail as possible, trying to include the emotions, thoughts, and motivations that were present at the time."

Participants were asked to continue writing until they had filled the space provided (approximately one page). Participants in the enhanced approach-motivated sad condition typically wrote essays about wanting to seek comfort from others after the death of a close family member or friend. Conversely, participants in the inactive sad condition typically wrote essays about wanting to be alone after the death of a close family member or friend.

After writing the essay, all participants viewed the sad film used in Experiment 1. We used a sad film in order to maintain the sad state created from the writing task. Participants would continue to be exposed to stimuli eliciting the sad emotion already evoked, yet should have different time perceptions during the film based on the approach motivation evoked by the writing prompt. Participants indicated their response to the question "How did time seem to progress while you viewed the film?" using a scale from 1 (*time dragged*) to 7 (*time flew*). Finally, participants reported emotive reactions to the film, indicating valence (1 = *positive*; 9 = *negative*), sadness (1 = *no emotion*; 9 = *strongest feeling*), and motivational strength (1 = *move toward*; 9 = *move away*). All participants were then carefully debriefed. None reported any suspicion with the experiment. Data from 20 participants (9 in the approach-sad condition, 11 in the withdrawal-sad condition) were excluded because they did not experience sadness during the film.

Two independent coders who were blind to condition rated each essay on dimensions of sadness, approach motivation, and length using a scale of 1 (*very slightly* / *not at all*) to 7 (*extremely*). Ratings between coders were highly reliable for all dimensions: sadness (Cronbach's $\alpha = .84$), approach motivation (Cronbach's $\alpha = .89$), and length (Cronbach's $\alpha = .97$).

Results

Coder Essay Ratings. Essays in the approach-sad condition (M = 4.38, SD = 1.31) were rated as more approach-motivated than essays in the inactive-sad condition (M = 2.07, SD = 1.06), $t(113) = 10.37$, $p < .0001$ one-tailed, $d = 1.95$. Essays were similar in sadness in the approach-sad condition (M = 3.35, SD = 1.49) and inactive-sad condition (M = 3.26, SD = 1.51), $t(113) = 0.30$, $p = .76$. In addition, length of essay did not differ between the approach-sad condition (M = 5.13, SD = 1.84) and the inactive-sad condition (M = 5.16, SD = 1.88), $t(113) = 0.09$, $p = .93$.

Film Ratings. Participants rated the film as being similarly unpleasant in the approach-sad condition (M = 7.83, SD = 1.32) and inactive-sad condition (M = 8.00, SD = 1.61), $t(112) = -0.61$, $p = .55$. In addition, participants rated the film as equally sad in the approach-sad condition (M = 7.73, SD = 1.40) and inactive-sad condition (M = 8.07, SD = 1.21), $t(112) = -1.40$, $p = .17$. Participants did not differ in self-reported approach motivation toward the film in the approach-sad condition (M = 5.79, SD = 2.58) as compared to the inactive-sad condition (M = 4.94, SD = 2.63), $t(110) = 1.72$, $p = .09$.

Time Perception. Participants who wrote the approach-sad essay reported time "flying" (M = 3.32, SD = 1.57) during the sad film more than participants who wrote the inactive-sad essay (M = 2.79, SD = 1.56), $t(114) = 1.82$, $p = .035$ one-tailed, $d = .34$. To investigate whether approach motivation was responsible for this relationship, we ran a correlation with self-reported approach motivation and time perception. Greater self-reported approach motivation related to time "flying", $r = -.48$, $p < .001$ one-tailed.

Discussion

Results of Experiment 4 revealed that enhancing approach motivation in sad states caused time to speed up. This suggests that approach motivation may be causing time to speed within

sad states. Participants self-reported sadness and approach motivation did not differ between conditions. Consistent with the motivation self-report from Study 1, it may be that individuals have difficulty self-reporting approach motivation in sad states because the experience is strongly negative. Time may be perceived differently within sad states depending on the strength of the approach motivation. These results suggest that approach motivational strength in negative states causes time to pass more quickly.

Experiment 5

Past research has demonstrated that anger can be an approach-motivated affective state (Carver & Harmon-Jones, 2009). In Experiment 5, we sought to compare the effects of time perception in anger states varying in approach motivation. Although anger is usually associated with strong approach tendencies (Carver & Harmon-Jones, 2009), anger may sometimes be associated with low, or no approach motivation. This may occur when the source of the anger is not able to be approached (e.g., when it is socially unacceptable to do so; Zinner, Brodish, Devine, & Harmon-Jones, 2008). Using methods similar to those from Experiment 4, we manipulated anger states that were either highly approach motivated or anger states low in approach motivation by having participants write about times when they experienced such states. Manipulating the strength of approach motivation within anger states allows us to examine whether approach motivation is causing differences in time perception within anger states. We predicted that participants who wrote about an approach-motivated anger state would perceive time as shortening during a subsequent retrospective time perception task compared to participants who wrote about an inactive anger state. Consistent with Experiment 4, we used an angering film in order to maintain the anger state the participants were already experiencing from the writing prompt. The anger film depicted people burning American flags. The neutral film

was the same use in Experiments 1 and 4, and depicted the exteriors of houses. Both films were found on the Internet and lasted exactly 1 minute and 34 seconds and were presented in a counterbalanced order between participants.

Method

Ninety-three (69 female) introductory psychology students provided informed consent and participated in exchange for partial course credit. Methods were similar to those used in Experiment 4, except that participants were asked to write about an angering experience. Participants in the approach-motivated anger condition typically wrote essays about a time that they experienced a perceived injustice, and they felt that they could do something about it. Conversely, participants in the inactive anger condition typically wrote essays about a perceived injustice, but could not act on their anger (e.g., out of their control).

After writing the essay, all participants viewed an anger film of anti-American activists such as people defacing and burning American flags. Then, participants indicated their response to the question "How did time seem to progress while you viewed the film?" using a scale from 1 (*time dragged*) to 7 (*time flew*). Finally, participants reported emotive reactions to the film, indicating valence (1 = *positive*; 9 = *negative*), anger (1 = *no emotion*; 9 = *strongest feeling*), and motivational strength (1 = *move toward*; 9 = *move away*). All participants were then carefully debriefed. None reported any suspicion with the experiment. Data from 10 participants (2 in the approach-anger condition, 8 in the withdrawal-anger condition) were excluded because they did not rate the film as being angering. Data from one participant were excluded for not following instructions, and data from another participant were excluded due to a noise interruption during the experiment.

Two independent coders who were blind to condition rated each essay on dimensions of anger, approach motivation, and length using a scale of 1 (*very slightly* / *not at all*) to 7 (*extremely*). Ratings between coders were reliable for the following dimensions: approach motivation (Cronbach's $\alpha = .80$), length (Cronbach's $\alpha = .91$), and anger (Cronbach's $\alpha = .57$).[5]

Results

Essay Ratings. Essays in the approach-anger condition ($M = 3.89$, $SD = 1.49$) were rated as more approach motivated than essays in the inactive-anger condition ($M = 2.03$, $SD = 1.26$), $t(76) = 5.75$, $p < .0001$ one-tailed, $d = 1.32$. Essays were similar in anger in the approach-anger condition ($M = 4.62$, $SD = 0.93$) and inactive-anger condition ($M = 4.24$, $SD = 1.27$), $t(76) = 1.51$, $p = .14$. In addition, length of essay did not differ between the approach-anger condition ($M = 6.16$, $SD = 0.90$) and the inactive-anger condition ($M = 6.11$, $SD = 1.09$), $t(76) = 0.21$, $p = .84$.

Film Ratings. Participants rated the anger film as being similarly unpleasant in the approach-anger condition ($M = 7.76$, $SD = 1.37$) and inactive-anger condition ($M = 7.97$, $SD = 1.64$), $t(73) = 0.58$, $p = .56$. In addition, participants rated the film as similarly angering in the approach-anger condition ($M = 6.96$, $SD = 1.49$) and inactive-anger condition ($M = 7.32$, $SD = 1.42$), $t(71) = -1.04$, $p = .30$. Participants reported no difference in approach motivation toward the film in the approach-anger condition ($M = 6.82$, $SD = 2.30$) than in the inactive-anger condition ($M = 7.05$, $SD = 2.36$), $t(61) = 0.35$, $p = .73$.

Time Perception. Participants who wrote the approach-anger essay reported greater time "flying" ($M = 4.40$, $SD = 1.36$) during the anger film than participants who wrote the withdrawal-anger essay ($M = 3.68$, $SD = 1.78$), $t(77) = 2.03$, $p = .024$ one-tailed, $d = 0.46$. To investigate whether approach motivation was responsible for this relationship, we ran a

correlation with self-reported approach motivation and time perception. Greater self-reported approach motivation did not significantly relate to time "flying", r = -.13, p = .32.

Discussion

Results of Experiment 5 revealed that anger states associated with approach motivation cause time to speed up relative to anger states associated with inaction. The current results confirm hypotheses that anger can be associated with different levels of approach motivation, and perceptions of time would differ between such states. Consistent with Study 4, participants self-reported approach motivation to the anger film did not differ between conditions. It seems evident that individuals have difficulty self-reporting approach motivation in negative states. Nevertheless, results revealed that enhancing approach motivation in anger states caused time to speed up, suggesting that approach motivation may be causing time to speed within negative states.

General Discussion

The current experiments found that sadness and anger cause time to be perceived as shortened, but disgust causes time to be perceived as lengthened. Based on the current experiments, greater motivational direction in sad and anger states appear to cause time to be underestimated, whereas withdrawal-motivated negative affect states appear to cause time to be overestimated. These results reveal that not all negative affective states lengthen the perception of time, and varying levels of approach and withdrawal motivation influence time perception in negative affect states.

The relationship between negative affect and time perception seems to be related to motivational direction. In Experiment 1, we used films and self-reported perceptions of time

passing to demonstrate that a sad state caused time to pass more quickly than a neutral state. In addition, Experiment 1 revealed that individual differences in self-reported motivation in the sad state predicted hastened perceptions of time. Experiment 2 conceptually replicated the effects observed in Experiment 1 using affective pictures and the temporal bisection task. In line with past evidence, Experiment 3 demonstrated that highly disgusting images which created a high withdrawal-motivated negative affect state caused a lengthening of time perception compared with low disgust images which created a low withdrawal-motivated negative affect state or neutral images. Experiment 4 manipulated approach motivation within sad states. Sad states high in approach motivation caused time to pass more quickly than sad states low in approach motivation. Similarly, Experiment 5 manipulated approach motivation within anger states. Anger states high in approach motivation caused time to pass more quickly than anger states low in approach motivation. Even within the same affective valence (Study 4 and 5), greater approach motivation caused time to shorten. These results suggest that approach motivation may be causing time to pass more quickly in sad and anger states. In sum, results of the current experiments reveal that the relationship between negative affect states and time perception may be influenced by motivational direction.

These findings are consistent with past work demonstrating that withdrawal-motivated negative affective states (e.g., fear) lengthen the perception of time (Grommet et al., 2011; Stetson et al., 2007), but approach-motivated positive affective states shorten the perception of time (Gable & Poole, 2012). However, the current findings provide crucial evidence that motivation relates to time perception in negative affect states. All positive affects examined in Gable and Poole (2012) were associated with varying degrees of approach motivation. In contrast, this manuscript examines a novel hypothesis by investigating time perception in

negative affects associated with approach motivation, negative affects associated with withdrawal motivation, and the same negative affect varying in motivational direction. In support of the motivational dimensional model of affect, approach motivation in negative or positive affective states related to the perception of time shortening, but withdrawal motivation related to the perception of time lengthening. These results reveal that changes in the perception of time are not exclusively linked to affective valence or arousal. Instead, the perception of time is influenced by motivational direction (Gable & Poole, 2012). Prior to the current studies, no previous research has found that negative affects hasten time perception. This is the first evidence to examine motivational direction within negative states relating to the shortening or lengthening of time perception.

The effect of motivation on time perception may serve an adaptive function. Functionally, a perceived hastening in the passing of time in approach-motivated negative states may help an individual persist longer in finding new goals or overcoming goal-related obstacles As time passes more quickly than what an individual perceives, an individual may engage in approach-motivated behavior (e.g., goal seeking or removing obstacles) for longer amounts of time. In the pursuit of interrupted goals or seeking new goals, it would be adaptive for an individual to engage in prolonged pursuit. Past work has found that sadness broadens attentional processing, presumably because such states may assist with disengagement from terminally blocked goals and create openness to new and previously irrelevant possibilities (Carver, 2004; Carver & Scheier, 1998; Gable & Harmon-Jones, 2010; Henriques & Davidson, 2000; Higgins, Shah, & Friedman, 1997; Klinger, 1975; Rolls, 2005). Approach-motivated sad states hastening the perception of time may facilitate seeking new goals by prolonging goal-seeking and pursuit.

In contrast, withdrawal-motivated negative states do not cause an underestimation of time, because such perceptions could cause the individual to linger in harmful situations. The perception that time is dragging when one is in a negative withdrawal-motivated state may motivate an individual to more actively avoid and withdraw from the potentially harmful object or situation. Negative states that strongly motivate an individual to withdraw cause time perception to lengthen because such states occur in noxious situations.

The effect of time perception and motivation may be bidirectional. Sackett et al. (2010) demonstrated that an ostensible hastening of time causes stimuli to be perceived as more appetitive, while an ostensible lengthening of time causes stimuli to be perceived as more aversive. These results support the idea that hastening perceptions of time may facilitate approach, but lengthened perceptions of time may facilitate withdrawal. In light of the motivational dimensional model of time perception, the results of Sackett et al. (2010) suggest that as time perception is manipulated, approach or withdrawal motivation is enhanced. That is, motivation influences time perception, and time perception influences motivation.

Influence of Cognitive Processing and Arousal on Time Perception

Past research has argued that arousal may be influencing time perception (Droit-Volet & Meck, 2007). However, it is not clear what type of arousal (e.g., subjective, physiological, sexual) should be driving time perception. The concept of arousal is so broad that some have argued, “the construct is too broad to predict behavior, or indeed to convey meaning” (p.101, Neiss, 1990). In line with this argument, the broad concept of arousal is inherently confounded with the concept of motivational strength, such that physiological and subjective arousal are used as a rough index of the amount of motivational drive inherent in an affective state (Bradley & Lang, 2007). However, arousal and motivational strength are not identical (Gable & Harmon-

Jones, 2013; Harmon-Jones, Harmon-Jones, & Price, 2013). For example, highly arousing positive states such as desire and highly arousing negative states such as fear are both high in arousal, but are opposite in motivational direction.

The current and past studies demonstrating that motivation influences time perception are unlikely due to arousal. Gable and Poole (2012; Experiment 3) and Angrilli (1997) compared time perception in high approach-motivated positive states and high withdrawal-motivated negative states. Although both affective states were high in arousal, results showed that high approach-motivated positive states caused time to pass more quickly than high withdrawal-motivated negative states. Affective states high in arousal but differing in motivational direction had opposite effects on time perception. In addition, Experiments 4 and 5 in the current article further establish that the observed effects are unrelated to differences in arousal. Presumably, similar affective states should evoke similar levels of engagement and arousal. However, Experiments 4 and 5 manipulated approach motivation within the same affective state. As opposed to the null effect predicted between two similar affective states, enhanced approach motivation in negative states caused time to pass more quickly.

The current evidence suggests that motivational direction is influencing time perception. However, the current studies do not directly measure or manipulate specific categories of arousal (e.g., physiological), thus arousal cannot be directly tested. Although it is unlikely that arousal is driving the observed effects, due to the inherent confound between arousal and motivational strength, arousal cannot be dismissed as an explanation for the current results. As such, future studies on time perception should more closely investigate whether emotional motivation, but not arousal, per se, drives the influence of affect on time perception. In the words of Neiss

(1990), “Left out of theories in the past by use of the arousal construct, emotion is too central to human experience to be further ignored.” (p.104).

Negative Affect and Approach Motivation

Critically, these are the first experimental results suggesting sadness can be associated with approach motivation. Results of Experiment 1 revealed that a sad state was more closely associated with approach motivation than a neutral state on a self-reported approach-withdrawal scale. Individual differences to self-reported greater approach motivation (less withdrawal motivation) in a sad state related to time passing more quickly in a video. Experiment 2 extended these findings, revealing that sad states speed the perception of time using a temporal bisection task. It should be noted that the current data are imperfect with regard to showing sadness enhances self-reported approach motivation. However, manipulations of greater approach motivation in Experiments 4 and 5 shortened the perception of time. Experiment 4 revealed that individuals experience approach-motivated sad states, because participants were able to recall experiences when sadness was associated with high approach motivation. Most participants recalled experiences of high approach-motivated sadness related to loss. Approach-motivated sadness may facilitate coping and better emotion-regulation strategies than avoidance behaviors in sad states (Leventhal, 2008). Different experiences seem to evoke sadness low in approach motivation. Future research should examine what conditions evoke high or low approach-motivated sadness.

The idea that some approach-motivated negative states are associated with low approach motivation and prototypical negative states are associated with withdrawal may serve to help explain why negative states are generally associated with withdrawal motivation. Sadness may at times evoke the tendency to retreat or be inactive. Likewise, outward expressions of approach-

motivated anger may be inhibited or directed inward (Stewart et al., 2010). It should be noted that in Experiments 4 and 5, participants recalled situations when they experienced sad and anger states with varying levels of approach motivation, suggesting individuals experience approach-motivated sad and anger states. However, in the absence of directed recall, anger and sadness may evoke withdrawal motivation. Situational variables or individual differences may influence whether negative states are associated with approach or withdrawal motivation. For example, in Experiment 4, sad essays in both conditions were typically written about terminally blocked goals, such as the loss of a social connection through the death of a loved one. Some participants experienced such situations as strongly approach motivating (e.g., seeking comfort from others), but others experienced such situations without strong motivational tendencies (e.g., being alone and not seeking others).

One limitation of the current findings is that the affective pictures and videos used in the current studies were only tested to evoke affective states in an undergraduate population. It seems possible that these stimuli might evoke weaker or stronger emotional reactions in non-undergraduate samples. While the affective picture and videos used in the current studies are prone to this limitation, Experiments 4 and 5 used idiosyncratic reports of sadness and anger. Individuals across any adult population are likely to respond similarly to these individualized manipulations.

The current results demonstrate that negative affective states varying in motivational direction have diverse effects on time perception. Sad and anger states shorten the perception of time, but disgust states lengthen the perception of time. Together with past findings, these results support that motivational direction, rather than affective valence, influences time perception,

such that withdrawal-motivated affective states lengthen the perception of time, but approach-motivated affective states shorten the perception of time (Gable & Poole, 2012).

Footnotes

1. Despite the evidence linking negative states such as anger and sadness with approach motivation, many prominent theories continue to associate all negative states with withdrawal motivation. Most prominent models of emotion tend to link anger and sadness with withdrawal motivation simply because they are experienced as negative states (Christie & Friedman, 2004; Russell, 2003). Others note that anger and sad states (e.g., depression, anhedonia) may be associated with withdrawal motivation, particularly when the emotion (e.g., anger) is socially unacceptable, or when approach would be impossible (Zinner, Brodish, Devine, & Harmon-Jones, 2008).

2. Other research has examined time perception while viewing approach-motivated emotional faces, including happiness, anger, and sadness (Droit-Volet, Brunot, & Niedenthal, 2004). The duration of emotional faces were overestimated compared to neutral faces. However, the viewing of faces expressing a certain emotion may not evoke the emotion of the expression. For example, fearful facial expressions communicate subordination and appeasement, which likely do not evoke fear in the observer (Marsh, Adams, & Kleck, 2005). Additionally, anger faces have been found to evoke either approach or avoidance in participants, depending on context (Kreiglmeyer & Deutsch, 2013). Therefore, the use of emotional faces as stimuli may not evoke the approach or avoidance tendencies typically associated with those emotions, and may not reflect how these emotions affect time perception during an emotional event. Therefore, the current studies sought to examine how negative affective states differing in motivational tendencies evoked through emotional images affects the timing of emotional events.

3. Sad pictures taken from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2005). IAPS picture numbers: 2205, 2455, 2490, 2590, 2700, 2795, 3300, 9001, 9190, 9220, 9331, 9341, 9390, 9471, 9912. Neutral pictures were comprised of geometric shapes.

4. We did not combine both sadness and disgust within the same experiment because we were concerned that the motivational direction/strength from one might spill over into the other and lead to a mixed state (Gable & Harmon-Jones, 2009, 2010).

5. Essay coders found it somewhat more difficult to agree on essay ratings of anger. This low reliability in ratings of anger may be due to the idiographic nature of angering situations (Vansteelandt & Van Mechelen, 2006). An essay about an experience that evoked intense anger in the individual may not reliably convey the same anger to an objective reader.

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Table 1. Film ratings in Experiment 1.

Rating	Picture type	
	Sad	Neutral
Valence	7.60 (1.74)[a]	5.13 (1.74)[b]
Motivational Direction	5.02 (2.80)$_a$	6.33 (2.16)$_b$
Time Perception	4.73 (1.52)$_a$	2.77 (1.53)$_b$

Note. Between-column differences for each row are indicated by different subscripts (p <.05; n = 73 for each cell). Subscripts with a matching letter denote non-significant comparisons. Smaller scores in motivational direction indicate more approach motivation (less withdrawal motivation).

Fig. 1.

Results of Experiment 1: Motivational Direction predicting perception of time to the sad and neutral films. Dashed lines represent confidence intervals around the regression lines. Smaller scores in the motivational direction difference score indicate more approach motivation (less withdrawal motivation).

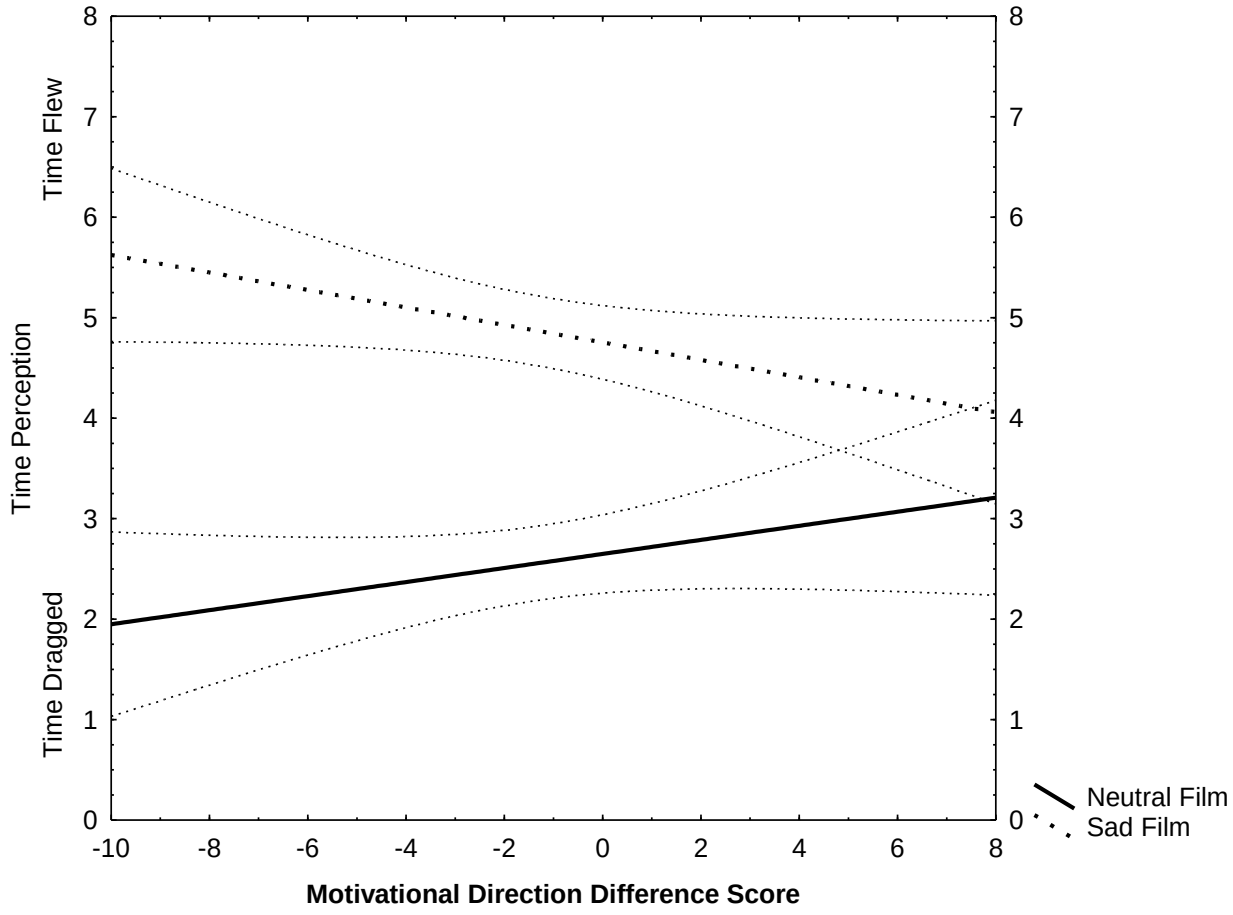

Table 2. Picture ratings in Experiment 2.

Rating	Picture type	
	Sad	Neutral
Valence	6.69 (1.22)[a]	4.70 (1.63)[b]
Sadness	5.61 (1.96)$_a$	2.09 (1.75)$_b$

Note. Between-column differences for each row are indicated by different subscripts (p <.05; n = 109 for each cell). Subscripts with a matching letter denote non-significant comparisons.

Fig. 2.

Results of Experiment 2: Mean proportion of display durations that participants rated as “long” as a function of presentation length and picture type. Error bars reflect within-subjects confidence intervals.

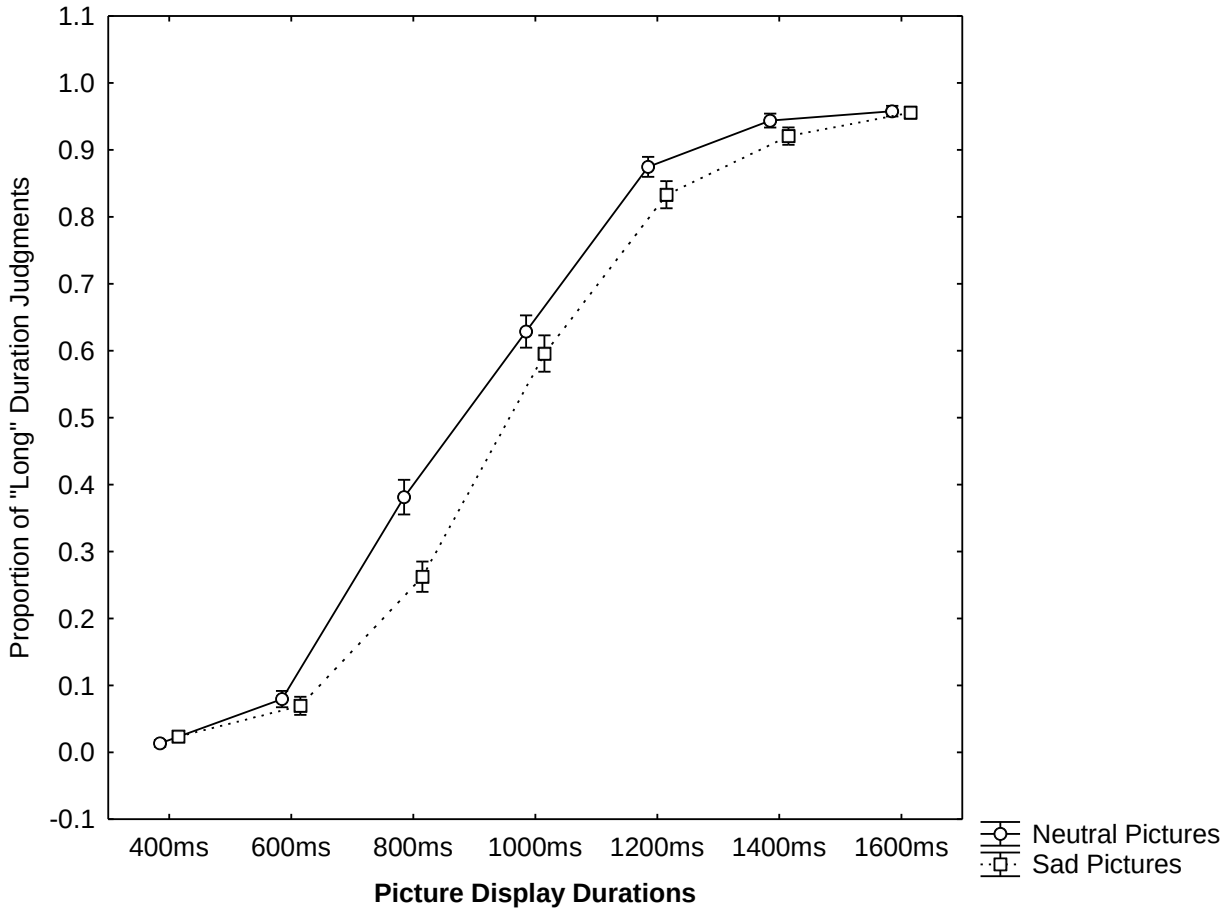

Table 3. Picture ratings in Experiment 3.

Rating	Picture type		
	High Withdrawal Negative	Low Withdrawal Negative	Neutral
Valence	7.97 (1.48)$_a$	6.82 (1.05)$_b$	4.25 (1.80)$_c$
Motivational Direction	7.51 (1.55)$_a$	4.99 (1.51)$_b$	5.38 (1.97)$_b$
Disgust	7.09 (2.27)$_a$	2.25 (1.52)$_b$	2.03 (2.02)$_b$

Note. Between-column differences for each row are indicated by different subscripts (p <.05; n = 62 for each cell). Subscripts with a matching letter denote non-significant comparisons. Larger scores in motivational direction indicate more withdrawal motivation (less approach motivation).