Motiv Emot
DOI 10.1007/s11031-009-9140-6

ORIGINAL PAPER

Feeling happy and sad, but only seeing the positive: Poignancy and the positivity effect in attention

Hal Ersner-Hershfield · David S. Carvel · Derek M. Isaacowitz

Abstract Poignancy is a mixed emotional experience that occurs in the face of meaningful endings (Ersner-Hershfield et al. J Pers Soc Psychol 94(1):158–167, 2008). Despite documentation of the phenomenological component of poignancy, no study to date has examined the relationship between such a state and information processing. We therefore examined the link between poignancy and attentional patterns using an eyetracking paradigm. To induce poignancy, experimental condition participants imagined being in a personally chosen meaningful location for a final time; control participants also imagined being in a meaningful location but with no ending. After, both groups were shown emotional images. Experimental condition participants looked more at positive images relative to negative images, whereas participants in the control condition did not display such a preference. Findings suggest that despite being a mixed emotional experience, poignancy may produce a subsequent positivity effect in information processing.

H. Ersner-Hershfield
Stanford University, Stanford, CA, USA

D. S. Carvel · D. M. Isaacowitz
Brandeis University, MS 062, PO Box 549110, Waltham, MA 549110, USA

D. S. Carvel
e-mail: dcarvel@gmail.com

D. M. Isaacowitz
e-mail: dmi@brandeis.edu

Present Address:
H. Ersner-Hershfield (✉)
Department of Management and Organizations, Kellogg School of Management, Northwestern University, 2001 Sheridan Road, Evanston, IL 60208, USA
e-mail: h-ersnerhershfield@kellogg.northwestern.edu

Keywords Mixed emotions · Information processing · Socioemotional selectivity theory · Poignancy

Introduction

Upon selling his world-famous winery, Stag's Leap Wine Cellars, owner Warren Winiarski remarked, "There's sadness and great joy. The two things can't be separated in a situation like this" (Bonne 2007). Indeed, recent research has shown that sensing an ending in the face of meaningful experience can give rise to a mixture of happiness and sadness, a feeling that has been termed "poignancy" (Carstensen et al. 2000; Ersner-Hershfield et al. 2008). Despite a growing body of research about these mixed emotional states, little is known about the effect that mixed emotions have on information processing. In what ways, for example, would the experience of poignancy influence one's attention? The present study offers evidence that feeling poignant can actually lead to a focus on positive material relative to negative material.

Poignancy

Poignancy is a mixed emotional experience that occurs in the face of meaningful endings. As Ersner-Hershfield et al. (2008) note, mixed emotions can take on many different forms, be it a combination of anger and joy, disgust and amusement, or embarrassment and sadness. Unlike these other cases of mixed emotions, however, poignancy seems to be particular to the experience of endings, of no longer having something that one once had. And, whereas the anticipation of an ending is not a necessary component of other mixed emotion states, it is integral to the experience of poignancy. This view is consistent with that of

Published online: 11 September 2009

philosopher Karl Duncker who argued that poignancy results from recognizing that something once possessed is or will no longer be present: "A feeling of not having takes on a greater poignancy if it is a no-longer-having, a loss (whether of something actually or almost possessed)" (Duncker 1941, p. 418). In Duncker's framework, poignancy is the result of the awareness or anticipation of not having something that one once had. Duncker's theorizing speaks directly to the intimate relationship between poignancy and endings in life that mark the passage of time. The heightened sense of mortality that occurs naturally as individuals progress through life gives rise to both an appreciation of life's fragility and an awareness that the most cherished aspects of life are fleeting. Lazarus's (1991) appraisal theory suggests that such a sense of loss is often associated with sadness. However, because feelings of poignancy also involve the knowledge that one is positively progressing through life, a sense of happiness is evoked as well. Accordingly, poignancy is comprised of a mixture of happiness and sadness that occurs when one faces meaningful endings.

In a direct test of the bi-valenced nature of endings, Ersner-Hershfield et al. (2008) had a group of younger and older adults repeatedly imagine being in a personally meaningful location. Participants in the experimental condition were asked to imagine being in the meaningful location for a final time. Interestingly, results indicated that only participants who imagined endings or "last times" at meaningful locations experienced more mixed emotions, or poignancy. Thus, the phenomenological component of poignancy—a mixture of happiness and sadness—has been documented. What effect such a mixed emotional state has on cognitive processing and attention, however, has not. Carstensen's Socioemotional Selectivity Theory (SST; Carstensen 2006), discussed next, speaks to the possible effects that feelings of poignancy may have on information processing.

Socioemotional selectivity theory and the positivity effect

Socioemotional Selectivity Theory (Carstensen 2006; Carstensen et al. 1999) is a life-span theory of motivation that maintains that, as time passes and people approach endings, activities that are devoid of meaning in the present become less interesting and desirable. As a person approaches an ending, his or her interest in novel information declines, because this information is closely linked to future needs. The increasing awareness of time constraints focuses attention on the present, and this temporal shift increases the value that people place on the most important aspects of life. As such, SST maintains that when the future is seen as expansive and endings are not acutely anticipated, greater focus is placed on knowledge-related goals and information seeking. Conversely, when individuals approach endings, they are motivated to pursue emotionally meaningful goals and focus more on the present (Carstensen 1995, 2006). Because chronological age is strongly linked to perceived time left in life, SST predicts that older adults, relative to younger adults, see the world through the lens of limited time and pursue more emotionally meaningful goals in the here and now. Such a focus leads to an intensified desire for and ultimate experience of more positive emotion and less negative emotion over time, as is observed with older adults (Carstensen et al. 2000).

Time perspective does not simply influence the goals that people pursue; it also affects attention. Specifically, SST maintains that an open-ended time perspective tends to focus an individual on knowledge-related information while a limited-time perspective focuses an individual's attention on emotionally meaningful material. To test this proposition, Mather and Carstensen (2003) ran a *dot-probe* experiment. In the study, young and old participants first saw a pair of photographs on a computer screen. Both photographs in the pair depicted the same person, but in one photograph the person displayed a neutral facial expression and in the other the person displayed a positive or negative expression. That is, sometimes the neutral face was paired with a positive face and sometimes the neutral face was paired with the negative face. The photograph pairs were presented for 1 s and then disappeared. A dot appeared behind the location of one of the faces, and the participant was required to press a computer key indicating the location of the dot. Although virtually all participants responded correctly on all of these trials, where they differed was in the time it took them to respond. In this paradigm, responses are faster if participants are already looking at the photograph where the dot will appear. Results indicated that younger participants were equally fast whether the dot was behind a positive or negative face. Older people, however, showed a different pattern: response times were faster when the dot appeared behind a positive face but slower when the dot appeared behind a negative face.

In another study, Mather et al. (2004) used functional magnetic resonance imaging (fMRI) to examine neural activation patterns while older and younger adults viewed positive and negative emotional images. For younger adults, the amygdala—a neuroanatomical area associated with emotional processing—showed greater activation for all emotional pictures, regardless of valence, as compared to neutral pictures. For older adults, however, positive pictures led to greater amygdala activation than negative pictures. Strikingly, it appears that older adults show diminished encoding of negative information, even in the

early neural stages of processing emotionally valenced material.

Furthermore, in two different studies, Isaacowitz et al. (2006a, b) used an eyetracking paradigm to track the natural gaze of younger and older adults as they viewed faces making emotional and nonemotional expressions. Previous research has demonstrated that gaze is nearly identical to visual attention (Parkhurst et al. 2002), and moreover that motivational factors influence gaze patterns (Isaacowitz 2006). Tellingly, in both studies, older adults showed a gaze pattern preference toward happy and away from negative faces (i.e., faces making angry or sad expressions). To the contrary, younger adults showed mostly evenhanded looking, with some preferences toward negative faces (Isaacowitz et al. 2006a, b).

Theoretically, it is possible that these positivity effects in attention serve an emotion regulation purpose. To elaborate, if a limited time perspective can lead to a mix of happiness and sadness, then to alleviate these feelings of sadness, an individual might be more motivated to focus on positive information in the surrounding environment. In other words, experiencing happiness when in an ending state might better allow individuals to search for the positive material in their environments and thus, regulate their concurrent feelings of sadness. This form of subsequent emotion regulation, though, is not typical for young adults, as previous research has demonstrated that younger adults tend to gravitate toward mood-congruent material in the environment. In a recent study, for example, Isaacowitz et al. (2008) demonstrated that when in a positive mood, younger adults look more at positive faces and when in a negative mood, younger adults look more at negative faces. Thus, it is possible that feeling poignant, because it involves the dominant negative emotion of sadness, could lead younger adults to focus on mood-congruent material (i.e., negative material).

However, the same Isaacowitz et al. (2008) study found that older adults showed mood-*incongruent* gaze and looked more toward positive and away from negative faces when in a bad mood. Such results suggest that older adults, compared to younger adults, use gaze to regulate mood, rather than to reflect it. As predicted by SST, it is also possible that when younger adults view the world through the lens of limited time (like older adults do), and are thus feeling poignant, they too should attempt to regulate their emotions and demonstrate a positivity effect in attention.

Testing the link between poignancy and attention: Overview of current research

Experientially, poignancy entails a mixture of happiness and sadness. But, paradoxically, because poignancy arises from a limited time perspective, SST would predict that feeling poignant, due to the sensation of an imminent ending, should give rise to a positivity effect in attention. To test the link between poignancy and attentional patterns, following the procedure of Ersner-Hershfield et al. (2008), participants in two between-subjects conditions were asked to imagine that they were in a personally meaningful location. Limited time was manipulated by instructing participants in the experimental condition to imagine that they were visiting their personally chosen location for the final time. Participants in the control condition, however, were simply asked to imagine being at their meaningful location under no time constraints. Participants in both conditions were then asked to report their emotional experiences.

All participants then viewed emotional images and had their gaze patterns tracked using an eye-tracking device. Because poignancy is associated with a sense of limited time, we hypothesized that such a perspective would focus individuals on emotionally meaningful goals and cause them to subsequently want to maximize positive emotion and minimize negative emotion (Charles et al. 2003). Thus, based on SST, we hypothesized that poignancy would produce a positivity effect in attention such that participants would look more toward positive, relative to negative, images in order to regulate their affective state. On the contrary, we expected that control participants—for whom no sense of poignancy was induced—would show no preference toward positive or negative images.

Method

Participants

Fifty-three younger adults (16 males, 37 females; $M = 19.79$ years; 67.9% Caucasian, 32.1% other) took part in the study. Participants were randomly assigned to one of two conditions: 25 were in the experimental condition and 28 were in the control condition. Two participants in the experimental condition and four participants in the control condition were unable to be tracked, and one participant in the experimental condition and one participant in the control condition were outliers on negative baseline affect (as measured by the PANAS; Watson et al. 1988). Thus, these individuals were excluded from data analysis and our final sample included 45 individuals (85%). Participants were recruited from the Introduction to Psychology class at Brandeis University (and received course credit for participation), or were recruited by word of mouth.

Stimuli

Stimuli consisted of 30 images taken from the International Affective Picture System (Lang et al. 2001). The IAPS

manual provides ratings of each image on a Likert scale from 1 (the most negative) to 9 (the most positive) in two categories: valence and arousal. The valence of the IAPS images used in the present study was as follows: ten were of negative valence (defined as an IAPS rating from 1 to 4; $M = 2.73$, $SD = 0.61$), ten were of neutral valence (defined as an IAPS rating from 4 to 6; $M = 5.26$, $SD = 0.39$), and ten were of positive valence (defined as an IAPS rating from 6 to 9; $M = 7.41$, $SD = 0.42$). This rating scheme was consistent with past studies (Charles et al. 2003; Xing and Isaacowitz 2006). The arousal values for the negative stimuli ($M = 5.04$, $SD = 0.56$), neutral stimuli ($M = 3.79$, $SD = 0.73$), and positive stimuli ($M = 5.33$, $SD = 1.02$) used in the present experiment were controlled such that the IAPS arousal levels for the positive and negative stimuli were not significantly different $t(18) = 0.78$, $p = .57$. However, differences in arousal existed between the positive and neutral stimuli $t(18) = 3.87$, $p < .01$, and between the negative and neutral stimuli $t(18) = -4.26$, $p < .01$.

Apparatus

An ASL Eye tracker Model 504 with Magnetic Head Transmitter was used to record the gaze of participants' left eyes. The eye tracker specifically recorded the duration and location of the participants' left eye 60 times per second. The eye tracker defined visual fixations as a period in which a participant focused their gaze within one degree of visual angle on a location for 100 m or more within predesignated Area of Interest (AOI) locations. The use of these AOIs allowed experimenters to calculate the total viewing time and percent fixation time within specific aspects of each slide. The main AOI for this experiment was the whole IAPS image centered on the background. This AOI was drawn around the center image, enabling gaze pattern analysis of when a subject looked at the image versus when they looked at the background. As assessed by the Rosenbaum Near-Vision Test, the Snellen 20-20 E-Chart, and the Pelli-Robson test of contrast sensitivity (Pelli et al. 1988), all participants had acceptable acuity and contrast sensitivity.

Procedure

All participants first completed an informed consent and a basic demographic form. Following the completion of these surveys, the experimenter administered three eye exams to participants: the Rosenbaum Near-Vision Test, the Snellen 20-20 E-Chart for acuity, and the Pelli-Robson Chart (Pelli et al. 1988) for contrast sensitivity.

After completing the eye exams, participants moved into the eye tracking room where they were randomly assigned to one of the two conditions: experimental or control. The instructions for each condition were recorded using Microsoft Sound Recorder technology and were played for all participants through computer speakers.

The manipulation for the present study was based on recent work (Ersner-Hershfield et al. 2008) which used a three-part guided imagery instruction to induce the mixed emotional experience of poignancy in participants. Ersner-Hershfield et al. (2008) found that the impending end of an emotionally-meaningful activity elicited poignant feelings. That study operationalized poignant feelings based on participant self-reported responses to a 19-question Emotion Questionnaire. In the present study, we used both the three-part instruction set and the Emotion Questionnaire from Ersner-Hershfield et al.'s (2008) study, but combined the data with eye tracking in order to study participants' visual attention.

Participants in both the experimental and control conditions were first asked to do the following: "Think of a place that has personal significance to you. Please think of a specific, meaningful location that you go to with people whom you care about." After the participant had selected a meaningful location, the experimenter recorded the location. The three-part guided imagery induction followed this response.

The first instruction had participants recall the meaningful location:

> Please close your eyes. Now please take a moment to imagine being at the location that you just described. As best as you can, place yourself in the location. Notice your surroundings. Notice any people whom you are with, their faces and voices. Take in everything that you see. Listen carefully to the sounds of your surroundings. Take a deep breath and notice the smells. Notice the air on your skin. Now take whatever time you need to fully experience the sights, sounds, and smells of the environment and the overall experience of the location. When you are ready, please open your eyes.

Upon completing this induction, participants completed an emotion questionnaire in which they rated the degree to which they were experiencing each of 19 different emotions (Positive: accomplishment, amusement, contentment, excitement, happiness, interest, joy, and pride; Negative: anger, anxiety, boredom, disgust, embarrassment, fear, frustration, guilt, irritation, sadness, and shame) on a 7-point scale (From 1 = "Not at all" to 7 = "Very Intensely"). The second guided imagery induction trial immediately followed this emotion questionnaire and was identical to the first instruction in all but one respect: in this trial, participants in both conditions were asked to imagine

the experience of being at their meaningful location as if they were to visit the location in 2 months' time:

> Please close your eyes. It is now two months later and you are back at the meaningful location that you chose. Now please take a moment to imagine being at the location that you just described. As best as you can, place yourself in the location. Notice your surroundings. Notice any people whom you are with, their faces and voices. Take in everything that you see. Listen carefully to the sounds of your surroundings. Take a deep breath and notice the smells. Notice the air on your skin. Now take whatever time you need to fully experience the sights, sounds, and smells of the environment and the overall experience of the location. When you are ready, please open your eyes.

After this guided imagery induction, participants then completed the same emotion questionnaire again, which was followed by the third and final guided imagery induction. Here, participants in the control condition were asked to imagine the experience of being at their favorite location as if they were there in 4 months' time:

> Please close your eyes. It is now four months later and you are back at the meaningful location that you chose. Now please take a moment to imagine being at the location that you just described. As best as you can, place yourself in the location. Notice your surroundings. Notice any people whom you are with, their faces and voices. Take in everything that you see. Listen carefully to the sounds of your surroundings. Take a deep breath and notice the smells. Notice the air on your skin. Now take whatever time you need to fully experience the sights, sounds, and smells of the environment and the overall experience of the location. When you are ready, please open your eyes.

Participants in the experimental condition, however, were asked to imagine being at their personally chosen location as though this would be the *final* time that they would be able to visit the meaningful location:

> Please close your eyes. It is now four months later and this is the last time you will be able to visit the meaningful location that you chose. Now please take a moment to imagine being at the location that you just described. As best you can, place yourself in the location. Notice your surroundings. Notice any people whom you are with, their faces and voices. Take in everything that you see. Listen carefully to the sounds of your surroundings. Take a deep breath and notice the smells. Notice the air on your skin. Now take whatever time you need to fully experience the sights, sounds, and smells of the environment and the overall experience of the location, keeping in mind that this is the last time you will be able to visit the meaningful location. When you are ready, please open your eyes.

After finishing the third trial, all participants completed the emotion questionnaire for the final time.

Presentation of images

Upon completing the final emotion questionnaire, participants in both the experimental and control conditions were presented with the IAPS images. An eye tracker was used to record participant gaze patterns and fixation times. Once seated in front of the eye tracker, participants' left eyes were calibrated using standard eye tracking calibration procedures (Xing and Isaacowitz 2006).

Before beginning the visual presentation, the experimenter did a quick recalibration of the participant's left-eye to ensure accuracy of tracking before beginning the visual presentation. Participants were then presented with the 30 IAPS images, during which time the eye-tracker recorded their gaze patterns. Prior to the first image appearing on the screen, all participants saw an instruction slide. The instruction slide for the control condition read "The presentation is about to begin. Please look at the slides naturally, as if you were at home watching television." The instruction slide for the experimental condition read, "The presentation is about to begin, please continue to think about the meaningful location that you generated earlier." A reminder slide was inserted between images 15 and 16; for both the control and experimental conditions, the phrase "The presentation is about to begin," was replaced with, "There are 15 slides remaining."

To counter-balance the presentation of images, two random-order presentations were created. Each presentation contained all 30 IAPS images plus the 2 instruction-reminder slides. The only difference between presentations was the order in which each image appeared: one half of participants saw the images in one order (e.g., slide 1 to slide 32) while the other half of participants saw the same images in the reverse order (e.g., slide 32 to slide 1). During the presentation, each IAPS image was presented alone, centered on a randomly assigned background. All backgrounds were taken from the "stock" supply of backgrounds that comes standard with Microsoft PowerPoint. Nine different backgrounds served to distract participants' attention from the image in the center of the slide. Though two presentation orders were used, the image-background pairings were consistent across the two slide orders (e.g., slide 8 appeared on the same background regardless of the presentation).

The presentations were created using Microsoft PowerPoint but were automated using GazeTracker software. GazeTracker software was also used to record participant gaze patterns. The 32 slides appeared on the monitor in a slide-show manner, and each image appeared on the screen for 10 s. There was 1 s of blank gray screen in between each image. During the presentations, participants sat approximately 24 inches in front of a 15-inch computer monitor. When the presentation finished, participants were debriefed and the experiment was concluded.

Results

Operationalizing poignancy

As in Ersner-Hershfield et al. (2008), poignancy was operationalized using a modified version of Kaplan's (1972) attitudinal ambivalence metric. In Kaplan's (1972) formula, mixed emotions were defined as

$$ME = PA + NA - |PA - NA|$$

In this equation, ME refers to mixed emotions, PA to average positive affect, and NA to average negative affect. However, as noted by Priester and Petty (1996), Kaplan's (1972) formula can be reduced to simply two times the minimum amount of PA and NA. Thus, it is easier to conceptualize mixed emotions as the minimum of PA and NA. Such an approach has been taken by both Schimmack (2001) and Larsen et al. (2004).

However, because our conceptualization of poignancy involves the positive emotion of happiness and the negative emotion of sadness, the mixed emotions measure that we employ here is defined as

$$ME = MIN\ [Happiness, Sadness]$$

where ME refers to mixed emotions and MIN refers to minimum. Thus, our measure simply took the minimum amount of whichever emotion—happiness or sadness—was rated the lowest.

Attention assessment

To assess attention and determine location and duration of participant fixations at the slides, a Gazetracker output variable—Percentage of Total Fixations (PTF)—was collected and analyzed. Percentage of Total Fixations was a computed ratio of the duration of fixations made within the center of the AOI to the total duration of fixations made anywhere on the slide. Put another way, the PTF represents the proportion of how long a subject fixated in an AOI (i.e., the positive, negative, or neutral picture) divided by the total amount of time they fixated anywhere on the slide (i.e., the picture plus the stock PowerPoint background). This ratio thus analyzed what percentage of all the fixations made during a given slide were made within the AOI, and is comparable to the gaze measure used in previous studies (e.g., Xing and Isaacowitz 2006).

Poignancy manipulation check

A manipulation check was conducted to verify that participants in the experimental condition were in fact experiencing poignancy following the limited time manipulation. To test whether participants in the experimental condition experienced changes in happiness and sadness, a repeated-measures ANOVA with two within-participant factors (Time: first imagery induction time trial, second imagery induction time trial, third imagery induction time trial; Valence: happiness, sadness) and one between subjects factor (Condition: control, experimental) was conducted.

Results indicated that there was a main effect of Valence ($F(1,43) = 281.41$, $p < .001$) such that all participants experienced more happiness than sadness across the three guided imagery inductions. Further, there was a significant Time × Emotion × Condition interaction ($F(2,42) = 14.70$, $p < .001$). To examine the nature of this three-way interaction, we ran separate repeated measures ANOVAs with one within subjects factor (Time: first imagery induction time trial, second imagery induction time trial, third imagery induction time trial) for happiness and sadness for each condition. Results indicated that experimental condition participants experienced a decrease in happiness over time ($F(2,20) = 10.38$, $p < .001$). As in Ersner-Hershfield et al. (2008), planned contrasts revealed that for experimental condition participants, there was a trend toward a decrease in happiness from Time 1 to Time 2 ($F(1,21) = 3.20$, $p = .09$), most likely due to habituation (Frijda 1988). Importantly, as a result of the ending manipulation, there was a significant decrease in happiness from Time 2 to Time 3, ($F(1, 21) = 16.14$, $p < .001$). Experimental condition participants also showed a change in sadness over time ($F(2,20) = 28.04$, $p < .001$). Planned contrasts revealed a slight increase in sadness from Time 1 to Time 2 ($F(1,21) = 4.50$, $p < .05$), and a strong increase in sadness from Time 2 to Time 3, as a result of the limited time manipulation ($F(1,21) = 16.21$, $p < .001$). As expected, control condition participants did not show such changes. While they showed a change in happiness over time ($F(2,21) = 3.60$, $p < .05$), with planned contrasts revealing a trend toward a decrease in happiness from Time 1 to Time 2 ($F(1,22) = 3.98$, $p = .06$), they showed no difference in happiness levels between Time 2 and Time 3 ($F(1,22) = 1.34$, $p = .26$). Further, control

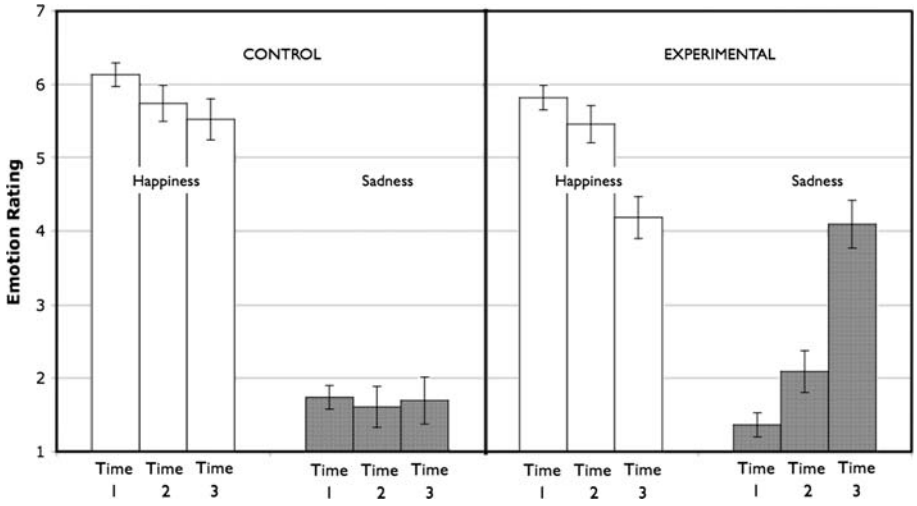

Fig. 1 Mean happiness and sadness ratings by condition, for all three guided imagery induction trials. *Error bars* indicate standard error of the mean

condition participants showed no changes in sadness over time ($F(2,21) = .15$, $p = .86$). Figure 1 depicts the happiness and sadness means for all three guided imagery induction time trials for both conditions.

The decrease in happiness and increase in sadness suggests a more mixed emotional experience as a function of the limited time manipulation for experimental condition participants. But because these changes in emotional experience correspond to mean-level changes across participants, they do not speak to changes in emotional experience within individuals. To examine changes in emotional experience within individuals, we calculated mixed emotion scores for each participant as described above using the MIN measure. We then ran a repeated-measures ANOVA on these scores with one within-subjects factor (Time: first imagery induction time trial, second imagery induction time trial, third imagery induction time trial) and one between-subjects factor (Condition: control, experimental). Results indicated that a main effect of Time ($F(2,42) = 12.56$, $p < .001$), was qualified by a significant Time × Condition interaction ($F(2,42) = 16.14$, $p < .001$). To further examine this Time × Condition interaction, we conducted separate repeated measures ANOVAs with one within-subjects factor (Time: first imagery induction time trial, second imagery induction time trial, third imagery induction time trial) on mixed emotions scores for both conditions. Results indicated that experimental condition participants experienced a change in mixed emotions over time ($F(2,20) = 24.15$, $p < .001$). Planned contrasts showed a trend toward an increase in mixed emotions from Time 1 to Time 2 ($F(1,21) = 4.10$, $p = .06$), and a significant increase from Time 2 to Time 3, as a function of the limited time manipulation, ($F(1,21) = 6.41$, $p < .05$). Control participants, by contrast, showed no such changes in mixed emotions over the three guided imagery inductions ($F(2,21) = .57$, $p = .57$). Figure 2 depicts the mixed emotion mean scores for all three guided imagery inductions for both conditions.

Eye-tracking analyses

To test our hypothesis that participants in the experimental group would demonstrate different attention patterns than participants in the control condition, we conducted a repeated-measures ANCOVA with one within-subjects factor (Valence: positive, negative) and one between-subjects factor (Condition: control, experimental) on the Percentage of Total Fixations (PTF). We controlled for differences between individuals in absolute levels of looking time by treating Percentage of Total Fixations toward neutral stimuli as a covariate. Although there was no main effect of Valence ($F(1,42) = 2.18$, $p = .18$), there was a significant Valence × Condition interaction ($F(1,42) = 4.92$, $p < .05$). To examine the nature of this Valence by Condition interaction, we used paired-samples t tests to compare percentage of total fixations for positive and negative stimuli within each condition. Participants in the control condition showed no attentional bias toward either positive or negative stimuli, in that they looked at positive and negative images for an equal amount of time ($t(22) = 1.32$, $p = .20$). Participants in the experimental condition, however, demonstrated a different attentional pattern. Namely, they looked at positive images longer than they looked at negative images ($t(21) = 3.74$, $p < .001$). Figure 3 depicts the percentage of total fixation for positive and negative stimuli for both conditions. Examination of the means suggests that the difference is primarily due to participants in the experimental condition looking more at positive images.

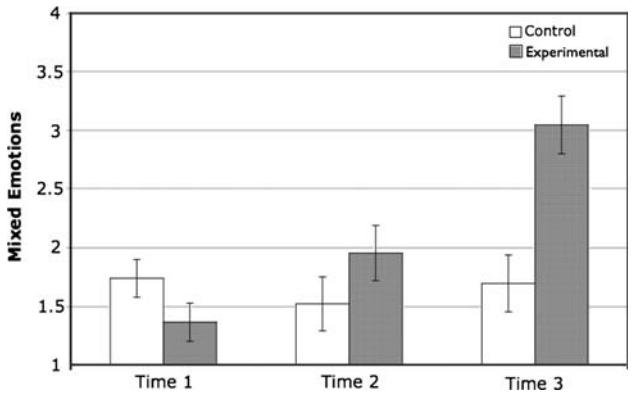

Fig. 2 Mixed emotion scores by condition, for all three guided imagery inductions. *Error bars* indicate standard error of the mean

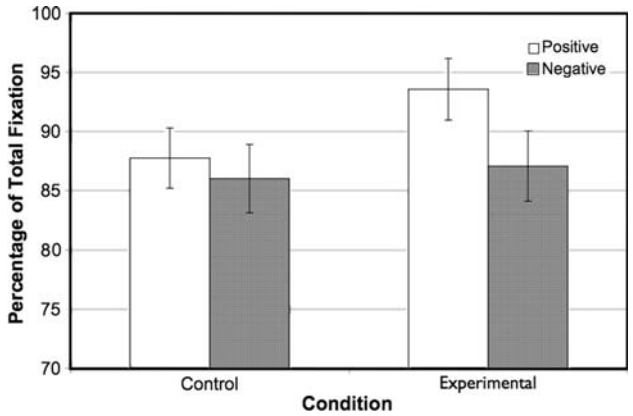

Fig. 3 Percentage of total fixations for positive and negative stimuli for both conditions (unadjusted means)

Discussion

Based on SST, we hypothesized that poignancy, despite being composed of happiness and sadness, would actually direct visual attention toward positive and away from negative material. To test the relationship between poignancy and information processing, we measured participants' gaze patterns toward emotional material, after inducing participants to imagine a final visit to a personally-meaningful location. As in Ersner-Hershfield et al. (2008), results from the emotion questionnaire indicated that the limited time manipulation gave rise to a significant decrease in the experience of happiness and a significant increase in the experience of sadness. Moreover, mixed emotions scores indicated that a sense of limited time did indeed produce a mixed emotional experience among participants in the experimental condition. This mixed emotional experience was not unidirectionally negative in nature, but rather, remained positive as well. Most importantly, despite feeling mixed emotions, participants in the experimental condition looked more toward positive emotional images rather than negative emotional images, whereas control participants did not display such a preference. As such, we provide evidence that the experience of poignancy produces a positivity effect in attention.

Our hypothesis that poignancy would give rise to a positivity effect in information processing arose out of the observation that the sense of limited time that is associated with poignancy causes individuals to focus on emotionally meaningful goals. And, such a focus on emotionally meaningful goals tends to cause individuals to want to maximize positive emotion and minimize negative emotion (Charles et al. 2003). Previous research has demonstrated that experientially, poignancy entails a mixture of happiness and sadness (Ersner-Hershfield et al. 2008), but the extent to which this emotional experience affects subsequent attention had not yet been explored. Importantly, we demonstrated that the experience of poignancy affects attention by producing a positivity effect, such that participants in the experimental condition showed preferential processing of positive over negative stimuli.

Our findings lend support to SST's (Carstensen 2006) prediction that a sense of limited time causes people to want to optimize positive affect, and minimize negative affect. Furthermore, because previous eyetracking research has demonstrated that gaze patterns reflect motivation (Light and Isaacowitz 2006), we conclude that the information processing patterns associated with poignancy reflect an actual motivational state oriented toward maximizing subsequent positive feelings. As such the positivity effect that we found may have been the result of individuals in a poignant state attempting to regulate their moods in a positive direction. Interestingly, previous research on mood and attention patterns have demonstrated that younger adults show mood-congruent gaze, and look more at positive faces when in a good mood and at negative faces when in a bad mood (Isaacowitz et al. 2008). Thus, in contrast to normal mood-congruent looking patterns, it appears that feeling poignant can lead individuals to search for the positive and regulate their moods. Nonetheless, the current study did not examine whether mood changed after the use of gaze as a form of emotion regulation. Thus, future research should attempt to explore the specific relationship among poignancy, information processing, and subsequent mood.

Furthermore, beyond age differences in the propensity to experience poignancy, recent research has demonstrated that the extent to which individuals regularly experience mixed emotions can differ as a function of personality (Rafaeli et al. 2007) and culture (Bagozzi et al. 1999; Schimmack, in press; Schimmack et al. 2002). It would be interesting, then, to examine whether individuals from these various groups also show attentional differences when processing emotional material.

Despite poignancy being composed of happiness and sadness, we found that participants who were feeling poignant looked more toward positive images and less toward negative images. The positive images used, however, represented an amalgamation of many positive emotions and likewise for the negative images. It is possible that if only happy and sad images were used, we would have obtained different results. To clarify, because poignancy comprises both happiness and sadness, it is possible, though unlikely, that participants might look more at both happy *and* sad images so as to maintain their emotional state (e.g., Wegener and Petty 1994). Accordingly, future research might attempt to test the link between poignancy and information processing using images that represent the discrete positive emotion of happiness and the discrete negative emotion of sadness.

To the best of our knowledge, this study is the first examination of mixed emotions and subsequent behavior. The finding that poignancy, despite being composed of mixed emotions, actually leads to a positivity effect in attention, has important implications for coping behavior. That is, being able to simultaneously feel both ends of the emotional spectrum—happiness *and* sadness—may help individuals in difficult life endings to still focus on the positive aspects of life and to feel good. Positive gaze preferences may thus be a critical component that keeps poignant feeling states from descending into depressive ones.

Acknowledgements This research was supported in part by NIA Grant R01AG26323 to the last author. The authors wish to thank Ewart Thomas for helpful discussions of statistical issues and Jesse Hershman for help with data collection.

References

Bagozzi, R. P., Wong, N., & Yi, Y. J. (1999). The role of culture and gender in the relationship between positive and negative affect. *Cognition and Emotion, 13*(6), 641–672.

Bonne, J. (2007, August 1). Napa Valley Stunner—Famed Winery Sold. *San Francisco Chronicle*, p. A1.

Carstensen, L. L. (1995). Evidence for a life-span theory of socioemotional selectivity. *Current Directions in Psychological Science, 4*, 151–156.

Carstensen, L. L. (2006). The influence of a sense of time on human development. *Science, 312*(5782), 1913–1915.

Carstensen, L. L., Isaacowitz, D. M., & Charles, S. T. (1999). Taking time seriously: A theory of socioemotional selectivity. *American Psychologist, 54*, 165–181.

Carstensen, L. L., Pasupathi, M., Mayr, U., & Nesselroade, J. (2000). Emotional experience in everyday life across the adult life span. *Journal of Personality and Social Psychology, 79*, 644–655.

Charles, S. T., Mather, M., & Carstensen, L. L. (2003). Aging and emotional memory: The forgettable nature of negative images for older adults. *Journal of Experimental Psychology-General, 132*(2), 310–324.

Duncker, K. (1941). On pleasure, emotion, and striving. *Philosophy and Phenomenological Research, 1*, 391–430.

Ersner-Hershfield, H., Mikels, J. A., Sullivan, S. J., & Carstensen, L. L. (2008). Poignancy: Mixed emotional experience in the face of meaningful endings. *Journal of Personality and Social Psychology, 94*(1), 158–167.

Frijda, N. H. (1988). The laws of emotion. *American Psychologist, 43*, 349–358.

Isaacowitz, D. M. (2006). Motivated gaze: The view from the gazer. *Current Directions in Psychological Science, 15*(2), 68–71.

Isaacowitz, D. M., Toner, K., Goren, D., & Wilson, H. R. (2008). Looking while unhappy: Mood-congruent gaze in young adults, positive gaze in older adults. *Psychological Science, 19*(9), 848–853.

Isaacowitz, D. M., Wadlinger, H. A., Goren, D., & Wilson, H. R. (2006a). Is there an age-related positivity effect in visual attention? A comparison of two methodologies. *Emotion, 6*(3), 511–516.

Isaacowitz, D. M., Wadlinger, H. A., Goren, D., & Wilson, H. R. (2006b). Selective preference in visual fixation away from negative images in old age? An eye-tracking study. *Psychology & Aging, 21*(1), 40–48.

Kaplan, K. J. (1972). On the ambivalence-indifference problem in attitude theory and measurement: A suggested modification of the semantic differential technique. *Psychological Bulletin, 77*(5), 361–372.

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (2001). *International affective picture system (IAPS): Instructional manual and affective ratings*. Gainesville, FL: The Center for Research in Psychophysiology, University of Florida.

Larsen, J. T., McGraw, A. P., Mellers, B. A., & Cacioppo, J. T. (2004). The agony of victory and thrill of defeat: Mixed emotional reactions to disappointing wins and relieving losses. *Psychological Science, 15*(5), 325–330.

Lazarus, R. S. (1991). *Emotion and adaptation*. New York, NY: Oxford University Press, Inc.

Light, J., & Isaacowitz, D. M. (2006). The effect of developmental regulation on visual attention: The example of the "Biological Clock". *Cognition and Emotion, 20*, 623–645.

Mather, M., Canli, T., English, T., Whitfield, S., Wais, P., Ochsner, K., et al. (2004). Amygdala responses to emotionally valenced stimuli in older and younger adults. *Psychological Science, 15*, 259–263.

Mather, M., & Carstensen, L. L. (2003). Aging and attentional biases for emotional faces. *Psychological Science, 14*, 409–415.

Parkhurst, D., Law, K., & Niebur, E. (2002). Modeling the role of salience in the allocation of overt visual attention. *Vision Research, 42*, 107–123.

Pelli, D. G., Robson, J. G., & Wilkins, A. J. (1988). The design of a new letter chart for measuring contrast sensitivity. *Clinical Vision Science, 2*, 187–199.

Priester, J. R., & Petty, R. E. (1996). The gradual threshold model of ambivalence: Relating the positive and negative bases of attitudes to subjective ambivalence. *Journal of Personality and Social Psychology, 71*(3), 431–449.

Rafaeli, E., Rogers, G. M., & Revelle, W. (2007). Affective synchrony: Individual differences in mixed emotions. *Personality and Social Psychology Bulletin, 33*(7), 915–932.

Schimmack, U. (2001). Pleasure, displeasure, and mixed feelings? Are semantic opposites mutually exclusive? *Cognition and Emotion, 15*, 81–97.

Schimmack, U. (in press). Culture, gender, and the bipolarity of momentary affect: A critical reexamination. *Cognition and Emotion.*

Schimmack, U., Oishi, S., & Diener, E. (2002). Cultural influences on the relation between pleasant emotions and unpleasant emotions:

Asian dialectic philosophies or individualism-collectivism? *Cognition and Emotion, 16*(6), 705–719.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54*, 1063–1070.

Wegener, D. T., & Petty, R. E. (1994). Mood management across affective states: The hedonic contingency hypothesis. *Journal of Personality and Social Psychology, 66*(6), 1034–1048.

Xing, C., & Isaacowitz, D. M. (2006). Aiming at happiness: How motivation affects attention to and memory for emotional images. *Motivation and Emotion, 30*, 249–256.