The Gaze of the Optimist

Derek M. Isaacowitz

Pers Soc Psychol Bull 2005 31: 407
DOI: 10.1177/0146167204271599

The Gaze of the Optimist

Derek M. Isaacowitz
Brandeis University

Two studies used eye tracking to investigate the attentional preferences of optimists and pessimists to negative emotional stimuli. In both studies, optimistic and pessimistic college students viewed three types of visual stimuli while having their eye movements tracked: skin cancer (melanoma) images, matched schematic line drawings, and neutral faces. In the first study, participants were asked to view the images naturally, whereas in the second study, some participants received a relevance manipulation. Percentage of fixation time to the different images was measured. Optimists showed selective inattention to the skin cancer images, even after controlling for attention to matched schematic line drawings. This relationship remained significant in both studies after controlling for the effects of neuroticism, affect, anxiety, relevance, and perceptual variables. These data suggest that optimists may indeed wear "rose-colored glasses" in their processing of information from the world.

Keywords: *optimism; attention*

Optimistic individuals are happier, less likely to become depressed, cope better with stressful situations, and recover more quickly from physical stresses such as coronary bypass surgery than their pessimistic peers (Scheier & Carver, 1993). Individuals with a positive outlook may also live longer (Levy, Slade, Kunkel, & Kasl, 2002). These findings beg the question: What do optimists have or do that allows them to be so much more psychologically and physically resilient? Despite the classic lay view that optimists wear "rose-colored glasses," psychologists have looked elsewhere for the active ingredients in optimism. For example, optimists and pessimists show differences in appraisal and coping (Chang, 1998). That is, optimists may be so successful in their affective lives by being master "spin doctors." Rather than wearing rose-colored glasses, optimists might instead have rose-colored interpretations.

The spin doctor perspective implies that optimists and pessimists cognitively experience their environment (e.g., see, hear) in the same way and differences between them emerge only in how they interpret what they see and hear. However, the attentional mechanisms underlying what we see and hear appear to be quite selective, for the purpose of weaning down the multitude of possible stimuli to the few that will actually be processed cognitively (Parkhurst, Law, & Niebur, 2002). It might be that optimism affects not just how individuals interpret what they see but also actually affects what from the environment they attend to in the first place. If this were the case, it would help explain the large behavioral differences between optimists and pessimists.

Aspinwall and colleagues (Aspinwall, Richter, & Hoffman, 2001) suggest that attentional mechanisms should play a role in optimists' affective success. In one study (Aspinwall & Brunhart, 1996), young optimists spent more time looking at risk information on a Web page and remembered more of the risk-related information in a memory task than did their pessimistic peers, but only when the risk information was relevant to them. However, this effect was found only for vitamin risk and not for ultraviolet exposure risk. Based on these findings, they argue that optimists selectively and strategically attend to negative stimuli only when it is self-relevant. This allows optimists to ignore irrelevant negative stimuli and to focus their coping and problem-solving efforts on relevant ones.

More direct measures of attention may tell a different story. Recently, Segerstrom (2001) found that optimists show an attentional preference for positive information in an Emotional Stroop paradigm. Specifically, optimists take relatively longer than pessimists to name the color

Author's Note: This research was supported by National Institute of Health Grant R03 AG22168-01. I wish to thank Erica Goldman, Aurora Sherman, and Art Wingfield for their helpful comments on earlier drafts of this article. I also wish to thank Heather Wadlinger and David Block for their assistance with data collection and Art Huntley for his permission to use the skin cancer images. Correspondence concerning this article should be addressed to Derek Isaacowitz, Department of Psychology, Brandeis University, MS 062, Waltham, MA 02454-9110; e-mail: dmi@brandeis.edu.

PSPB, Vol. 31 No. 3, March 2005 407-415
DOI: 10.1177/0146167204271599

in which positive words are written, and vice versa for pessimists and negative words. The interpretation is that optimists' attention is more directed toward positive stimuli, lengthening the time it takes them to shift attention to completing the color-naming task. Differences between optimists and pessimists may thus be more automatic and early in information processing, and optimists' early attentional orienting may favor positive rather than negative information.

The current two studies bring the investigation of the relationship between optimism and attention to emotional stimuli to a new methodological level by using eye tracking—a technology that allows for the recording of eye movements in nearly real time. Eye tracking has been used to study individual differences, primarily to identify attentional biases among individuals with anxiety disorders (e.g., Mogg, Millar, & Bradley, 2000). Whereas the Emotional Stroop used in the Segerstrom (2001) study described above is a standard measure of attention, the eye tracker provides a better measure of early attentional preferences than does the Stroop. In particular, it is free from the Stroop task's inability to distinguish whether information receives preferential treatment at input/attention or output/color naming (see Mogg et al., 2000). In contrast, although it is possible under some circumstances to dissociate eye movements from visual attention, there is good evidence that eye movements and visual attention are associated under normal viewing (Parkhurst et al., 2002). Thus, tracking eye movements is an effective tool for studying individual differences in attentional preferences and biases (see also Calvo & Avero, 2002).

STUDY 1: NATURAL PATTERNS

The first study aimed to evaluate the attentional patterns of optimistic and pessimistic individuals to negative images using eye tracking under natural conditions. This appears to be the first study using an eye tracker to link optimism with attention to emotional stimuli. The hypothesis of the study is simple: If optimism is actually associated with early attentional focus, then when an eye tracker is used to record naturalistic eye movements among optimistic and pessimistic individuals, optimists will show selective inattention to negative stimuli.

Method

Equipment, stimuli, and procedure. Images of skin cancer served as the negative stimuli that individuals could either look at or not. Skin cancer images are suitable test stimuli because they are negative and potentially self-relevant. The experimental setup mirrors real-world visual information processing insofar as individuals can look at potentially negative, troubling information, or not look at it. Stimuli were presented in five trials, each containing three images: skin cancers (melanoma), schematic line drawings matched to each skin cancer image, and neutral faces. Skin cancer images were selected from pictures available publicly and were composed of melanoma and some surrounding skin. Members of the laboratory then created matched schematic line drawings for each of the five skin cancer images by making each skin cancer image black and white and deleting everything but the contours of the melanoma. This served as a control for the contours of the cancer images. Finally, faces that had been unanimously rated by at least three raters as neutral/nonemotional were selected from a face database maintained in the lab. These were originally intended to serve as a comparison to evaluate whether optimists and pessimists differed in their attentional patterns to nonemotional, real-world stimuli but were ultimately not included in the full analyses because the matched drawings provided the strongest controls.[1] Examples of the noncancer stimuli are shown in Figure 1. Positive stimuli were not included because of recent evidence on the asymmetry of positive and negative information (e.g., Rozin & Royzman, 2001).

Each image was presented in the center of a 15-in. computer monitor surrounded by gray screen for 15 s, with 5 s of gray screen in between. Test images were presented in the following order: face, lines, cancer. Order of presentation was not randomized so cancer images would not bias attention to lines of the same shape. Within each set of three images, lines did not correspond to their matched cancer to reduce the risk of bias. In other words, the first skin cancer image was matched with the schematic line from another skin cancer image in any particular trial. This design did not allow for any counterbalancing to keep matched images separate from their counterparts.

The apparatus chosen for this study was an ASL Eye Tracker 504 with Magnetic Head Transmitter. Stimuli were presented on a computer monitor; the tracker then recorded the gaze of the participants' left eye 60 times per second. A fixation was defined as a gaze within an area of 1 degree visual angle for at least 100 msec. Each image had a designated Area of Interest (AOI)—the melanoma on the skin cancer images and the equivalent area on the schematic drawings. Attention to these areas of interest was measured by percentage of fixation time within that area.

When participants arrived at the lab, they first completed self-report measures and then were brought to the eye tracker chamber. There, they were seated in front of the eye tracker and their seating was adjusted so their eyes were level with the middle of the 15-in. computer monitor on which images were presented. After the eye tracker was adjusted to best capture each partici-

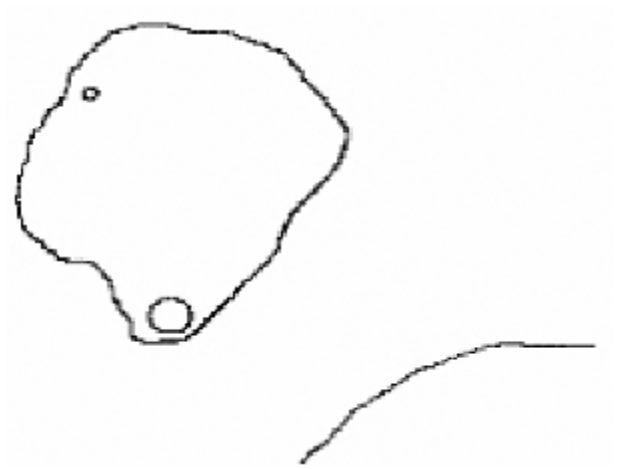

Figure 1 Example of noncancer stimuli used in this study.
NOTE: This is a schematic line drawing matched to the contours of one of the skin cancer images.

pant's left pupil, he or she completed a 9-point calibration procedure. The calibration was then checked by having the participant look at each of the nine points and ensuring that the tracker recording was within 1 degree visual angle of the appropriate point. Any necessary adjustments were made at that point and participants were recalibrated to the correct level of accuracy. Finally, participants were informed that some of what they would be viewing would involve skin cancer images and they were instructed to look "naturally" at the actual images in the five trials, "as though [they were] at home watching television."

Participants. Participants were 51 young adults age 18 to 21, 18 men and 33 women; none wore hard contact lenses. Data were lost for several trials from 6 participants due to difficulties tracking with their soft contact lenses and shiny metal eyeglass frames; for these participants, an average of the trackable trials was used.

Optimism. Level of optimism was assessed using the Life Orientation Test (LOT; Scheier & Carver, 1985). Coefficient alpha for the LOT in this sample was .69 for the optimism items and .77 for the pessimism items. Consistent with past research using the LOT (e.g., Aspinwall & Brunhart, 1996), the four optimism and four pessimism items were summed and then the pessimism score was subtracted from the optimism score, yielding total scores on which higher values indicated more optimism. Continuous optimism scores were used in all analyses.

Covariates. To test whether any relationship found between optimism and attention to negative stimuli is unique to optimism, several measures were included that are theoretically related to optimism and might account for any observed relationship (following the argument of Smith, Pope, Rhodewalt, & Poulton, 1989). These measures were neuroticism, positive and negative affect, and depressive symptoms. Neuroticism was measured with an 11-item scale described in Bolger and Schilling (1991), positive and negative affect was measured with the Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988), and depressive symptoms were measured with the Center for Epidemological Studies–Depression Scale (CES-D; Radloff, 1977).

Self-relevance of skin cancer. To determine whether any observed relationship between optimism and attention to negative stimuli was a function of perceived self-relevance of skin cancer, following Aspinwall et al.'s (2001) assertion that optimists attend only to self-relevant negative information, two different relevance measures were included in this study. One was a simple self-report of family history of skin cancer, coded as 0 = no family history, 1 = family history. This measure was included because risk of skin cancer is known to run in families (Greene, 1997). Second, a composite score was computed based on a series of three questions asking participants how much they worried about and believed skin cancer was relevant to their current life. This scale was computed as the average of the three items and was meant to reflect perceived rather than statistical relevance of skin cancer to participants (coefficient alpha = .80).

Results

To analyze differences between gaze patterns to the skin cancer and to their matched nonemotional schematic drawings, residual scores were computed for each pair after cancer images were regressed on their matched line drawings. These scores were then summed to form a composite score, centered at zero, in which positive scores indicated a relative gaze preference for the cancer images after controlling for gaze to the matched schematic images and negative values indicated less attention to the cancers than would be expected from the matched drawings. This provides a direct comparison of how much participants gazed at the cancer as compared to the nonthreatening matched line drawings.

Once this composite residual score had been computed, a hierarchical regression was conducted to test for unique effects of the continuous optimism variable on relative fixation to the skin cancer. This conservative approach was intended to isolate unique effects of optimism separate from those of related affective, personality and demographic factors. In the first step, demographic and affective variables were entered that might covary with attention or optimism, including sex, positive and negative affect, depressive symptoms, neuroticism, self-rated health, and two measures of relevance, an index of perceived relevance and a self-report of fam-

TABLE 1: Predictors of Percentage of Fixation Time to Skin Cancer Images After Controlling for Effects of Fixation to Matched Drawings (Study 1)

Predictor	*Standardized* β	t
Sex	–.37	–2.34, $p < .05$
Self-rated health	.21	1.32
Family history	–.19	–1.05
Perceived relevance	.17	.96
Depression	–.27	–1.34
Positive affect	–.17	–1.04
Negative affect	.06	.35
Neuroticism	–.07	–.39
Optimism	–.39	–2.11, $p < .05$

ily history of skin cancer. In the second step, the continuous optimism variable was entered to determine whether it made any unique contribution to the prediction of fixation preferences. Results of the full model hierarchical regression are shown in Table 1. Optimism did emerge as a significant predictor of fixation patterns, with more optimistic individuals looking relatively less at the skin cancer images, $\beta = -.39$, $p < .05$. Figure 2 provides a particularly dramatic demonstration of the effect, with the fixation pattern for a single more optimistic participant (top) and a more pessimistic one (bottom) to the same melanoma image.

The only other significant predictor of fixation was sex: $\beta = -.37$, $p < .05$. Female participants showed less relative fixation to the cancer images than did men.

Optimism and relevance of the stressor. To test whether optimism interacted with relevance, optimism, perceived relevance and family history, and the interaction between optimism and the two types of relevance were entered into a regression model predicting the residualized fixation percentages described above. Neither of the Optimism × Relevance interactions was significant.

Discussion

In this study, optimists and pessimists had their eye movements recorded as they looked naturally at negative stimuli—graphic images of melanoma surrounded by skin. They also looked at matched schematic line drawings featuring all of the contours of the cancer images without the actual cancer as well as faces rated as neutral by separate raters. The proportion of the 15 possible seconds during which participants were fixating to the actual cancer in the melanoma images, the matched area of the schematic line drawings, and the neutral faces was measured. Optimists fixated less frequently to skin cancer images than did pessimists, even after covarying attentional patterns to the matched schematic drawings.

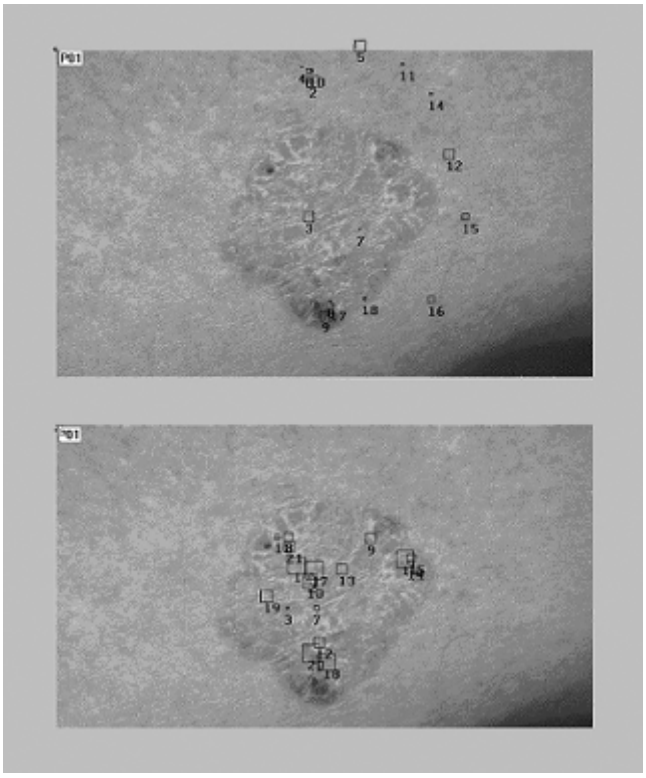

Figure 2 Fixation patterns of a more optimistic (top) and a more pessimistic (bottom) individual to the same skin cancer image from Study 1.

NOTE: Numbers signify order of fixation (1 = first fixation) and box size is an index of fixation length, with larger boxes indicating a longer fixation at that location. Percentage of fixation within the Area of Interest (AOI) was 37.57% for the participant in the top panel and 85.58% for the bottom panel.

The significant difference between optimists and pessimists in attention patterns to the cancer images remained even after controlling for neuroticism, positive and negative affect, and depressive symptoms. Selective inattention to negative stimuli was therefore directly linked to optimism, not mood or affective tendencies.

STUDY 2: INCREASED RELEVANCE

Although Study 1 provided evidence that optimistic young people naturally fixate less toward negative information than do their pessimistic peers, it may be argued that the skin cancer images were not particularly relevant to the college-age participants. Despite attempting to statistically control for individual differences in perceived relevance of skin cancer in Study 1, it appeared important to also try to experimentally manipulate relevance of the stimuli. The important theoretical issue raised is whether the link between optimism and attention is a general mechanism or whether it is context dependent. Therefore, in Study 2, the procedure from Study 1 was replicated in a new sample of undergraduate

students with one major modification: half of the participants were given instructions aimed at making the skin cancer images more relevant to them. In addition, a memory task was added to try to further discern where optimism might operate in information processing. Further additions to the second study included a measure of anxiety because a sizable body of research has demonstrated attentional biases toward threatening or generally negative stimuli among anxious individuals (for a review, see Williams, Watts, MacLeod, & Mathews, 1997). Finally, a battery of vision tests was included to ensure comparable vision between groups.

Method

Participants. Participants for Study 2 included 93 young adults between the ages of 18 and 25. The sample included 35 men and 58 women. Six of the 93 participants were not trackable, leaving 87 participants (93.5% of the sample) for the full analyses. As in Study 1, individual means for the trackable trials were used for several participants who were generally trackable but had missing data for individual trials.

Procedure, measures, and materials. The procedure for Study 2 was similar to Study 1 with several modifications. First, all participants had their vision tested using two standard measures: a Snellen test of visual acuity and a Pelli-Robson test of contrast sensitivity (Pelli, Robson, & Wilkins, 1988). The ensuing self-report packet was identical to that in Study 1, with the addition of the Spielberger State/Trait Anxiety Inventory (STAI; Spielberger, Gorusch, Lushene, Vagg, & Jacobs, 1983), a standard self-report anxiety measure. Then, before having their eye movements tracked, half of the participants were randomly assigned to the control condition and were instructed to view the images naturally, just as in Study 1. The other participants were assigned to the increased relevance condition, and rather than being told to view the stimuli naturally, they were told that

> these images may be useful to you in the future in helping you identify problems on the skin in yourselves and others. So, try to look at the images as you would approach any information that may prove useful to you in the future.

This manipulation aimed to make the cancer stimuli more relevant to participants by suggesting that they could serve a function in their future lives outside the experiment. In both conditions, participants knew before the stimulus presentation started that some of the images would be of skin cancer.

Finally, after having their eyes tracked, all participants completed a recognition memory task for the faces and cancer images. Twenty-five skin cancer images and 25 female faces (each including the 5 correct "hits") were presented to participants for 1 s each, after which they had to determine whether they had previously seen each image during the eye tracking session. Correct identifications and error patterns were derived from responses to this recognition memory task.

Results

The analytic strategy from Study 1 was generally repeated for Study 2. However, because of the additional between-subjects factor of study condition, main effects of optimism and manipulated relevance were added to demographics and self-reported affect measures in Step 1, and the interaction of optimism and manipulated relevance became the effect added in Step 2 of the regression. In addition, because vision tests and self-reported anxiety were added to the protocol in this study, these effects were added to the first regression step. Results of this regression analysis are shown in Table 2. In the final model, there was a significant main effect of optimism but not of manipulated relevance. The Optimism × Manipulated Relevance interaction was not significant. Furthermore, no main effect of sex emerged in Study 2.

Of interest, a main effect of family history did emerge, $\beta = -.24$, $p = .05$; however, the direction of this effect was that individuals who reported a positive family history of skin cancer actually showed lower residual scores than those without such history. Interactions of different types of relevance and optimism were therefore tested, although none was significant in the prediction of residual scores.

The above analysis was rerun with memory accuracy as the dependent variable; neither optimism, manipulated relevance, the Optimism × Manipulated Relevance interaction, nor any of the other predictors significantly predicted memory accuracy. This may have been due to a ceiling effect, however, because overall accuracy in the sample was 23.59 correct out of 25 (or 94% accuracy).

Robustness of relationship across studies. The simple correlation of optimism and residual fixation scores was compared across the two studies as a check of the robustness of the findings. Although this simple correlation was significant in Study 2 but not Study 1, the magnitude of the correlation is nearly identical in both samples: Study 1, $r(48) = -.21$, *ns*; Study 2, $r(86) = -.22$, $p < .05$. This suggests that the small sample size of Study 1 obscured what were actually fairly robust effects across the studies.

Discussion

In Study 2, a manipulation designed to increase the relevance of the melanoma images failed to produce changes in attentional patterns, but optimistic young adults continued to show an attentional preference away

from the negative emotional images as compared to their pessimistic peers. State and trait anxiety did not predict these attentional patterns, and neither did perceptual variables such as visual acuity and contrast sensitivity. Family history of skin cancer predicted less relative attention to cancer images. However, in a regression model, optimism predicted less fixation to skin cancer images even after controlling for these other possible predictors. These results replicate the finding from Study 1 linking optimism with an attentional preference away from negative emotional stimuli and provide evidence that this preference is not due to anxiety or sensory processes. The failure of the relevance manipulation to affect the findings suggests that optimists' attentional preference is not context dependent. However, a limitation of the study is that it lacked a manipulation check for relevance, leaving open the possibility that the relevance manipulation was simply not powerful enough to actually increase relevance among the participants.

GENERAL DISCUSSION

In two studies, college students had their eyes tracked as they viewed stimuli varying in emotional valence: negative emotional images of melanoma (skin cancer) as well as matched, nonthreatening schematic line drawings. Those who were more optimistic according to a standard paper-and-pencil measure showed a specific attentional preference to look less at the melanoma images than their more pessimistic peers, even in a conservative test in which attentional patterns to the matched schematic drawings were controlled. In other words, more optimistic individuals looked less at the skin cancer images than what would be expected based on their fixation to matched drawings, whereas more pessimistic ones looked more than their attention to the matched drawings would predict. These attentional patterns related to optimism did not seem to be a function of affect, anxiety, demographics, personality, and perceptual variables. In Study 1 but not Study 2, female participants showed an attentional preference away from the cancer images. In Study 2 but not Study 1, individuals with a family history of skin cancer also showed less fixation to the cancer images.

The tendency on the part of optimists to fixate less on negative stimuli is generally consistent with previous research. Segerstrom (2001) found that when optimism was evaluated as a continuous variable, optimism was related positively to attentional interference on positive words but negatively to interference on negative ones, suggesting their attention was more directed toward positive stimuli. Together with the findings of the current study, this line of research suggests "fast" mechanisms that may direct information processing more toward more positive information among optimistic individuals and toward more negative information among pessimistic ones. This would be broadly compatible with theory and research on the hedonic contingency model (Handley, Lassiter, Nickell, & Herchenroeder, 2004; Wegener & Petty, 1994).

The Relevance-Optimism Relationship

Although the current studies are consistent with some past work, they also have yielded some results inconsistent with previous research. Unlike the findings of Aspinwall and Brunhart (1996), the current studies did not reveal an interaction between optimism and relevance such that optimists displayed increased attention when stimuli were relevant. In that study, optimistic vitamin users spent more time looking at information on the risks of vitamin use, but the effect did not reach significance for tanners and the risks of sun exposure. Assuming that the differences between the vitamin and skin cancer findings are not meaningful and that the results of that study can be interpreted as demonstrating that optimists look more at self-relevant negative information, how can the discrepancy between these findings and those of the current study be explained?

One technical difference between the studies is that the Optimism × Relevance effects in the Aspinwall and Brunhart study were found only using a health-specific optimism scale and not with the dispositional optimism scale. In the current study, only the dispositional optimism scale was used. Although it is conceivable that this difference could account for the discrepant findings, this seems unlikely. The dispositional and health-specific optimism scales have been highly correlated in past research, $r = .59$ (Aspinwall & Brunhart, 1996), and the dispositional scale has been the most standard measure used in past work linking optimism to important psychological and physical outcomes. A second possible explanation for the discrepant results is that the provocative interaction between optimism and relevance is simply not very robust. Not only did we fail to replicate the interaction in the present research but Aspinwall and Brunhart found the interaction only for vitamin use and not for ultraviolet exposure information. In light of this, it may not be surprising that the finding was not replicated in the current study.

Nonetheless, there may be substantive reasons for the different findings as well as the foregoing methodological ones. For example, there may be differences in the attentional ramifications of relevance depending on whether the stimuli in question are in some way psychologically relevant to the individual (i.e., interesting or related to the task in question) or statistically relevant (i.e., some factor actually makes the stimuli in question more likely to happen to them or affect them than it

TABLE 2: Predictors of Percentage of Fixation Time to Skin Cancer Images After Controlling for Effects of Fixation to Matched Drawings (Study 2)

Predictor	*Step 1* *Standardized* β	t	*Step 2* *Standardized* β	t
Visual acuity	.22	1.81	.21	1.79
Contrast sensitivity	–.20	–1.65	–.20	–1.72
Sex	.07	.57	.04	.32
Self-rated health	.19	1.38	.16	1.16
Family history	–.24	–1.94	–.24	–1.97, $p = .05$
Perceived relevance	.07	.58	.08	.62
Depression	–.19	–1.13	–.21	–1.24
Positive affect	.01	.08	0	–.02
Negative affect	–.23	–1.21	–.21	–1.13
State anxiety	–.10	–.47	–.09	–.42
Trait anxiety	.36	1.43	.37	1.58
Neuroticism	.04	.24	.05	.32
Optimism	–.30	–1.97, $p = .05$	–.42	–2.47, $p = .05$
Manipulated relevance	–.10	–.86	–.20	–1.56
Manipulated Relevance × Optimism			.25	1.57

would for some other individuals without those factors). It is possible that optimists attend more to negative information only when it is statistically relevant to them, as it was in the Aspinwall and Brunhart (1996) design, but not when it is merely made pertinent to the current task and thereby psychologically relevant, as it was in the current Study 2. However, it was the case in Study 2 that individuals for whom skin cancer is more statistically relevant, given their positive family history, actually show the same attentional pattern as do optimists, rather than a more engaged attentional pattern. Thus, even with a statistically relevant measure more closely related to that of Aspinwall and Brunhart's (1996) study, the Optimism × Relevance interaction is not replicated. It is certainly possible that our attempt to test this statistical relevance in the current studies using family history as an index may have been too indirect; therefore, several studies are currently in progress in our lab to pursue this possibility more directly (e.g., by comparing actual tanners to nontanners).

Two factors suggest that the discrepant findings are not simply attributable to a statistical power issue. The first is that to the extent that relevance did relate to attention in this data set, the effect was in the opposite direction. Individuals with a family history of skin cancer looked less at the cancer images in Study 2. One possible interpretation of this finding is that their previous personal experience allows them to more efficiently take in information from the scene, which would be consistent with cognitive psychology research on the effects of experience on attention (Polk & Farah, 1995). Second, although it is impossible to compare power between these studies and Aspinwall and Brunhart (1996) because the standard deviations for the reading time measure are not provided in that study, some guesses can be made on comparative power. Given the comparable sample size in Study 1 and larger sample in Study 2 as compared to the past work, the current studies should have had comparable power to detect effects.

There are clearly a number of possible reasons why the results of the current work differ from that of Aspinwall and Brunhart (1996); these reasons range from subtle methodological differences between the studies to the more substantive possibility that measures of visual attention less affected by volitional control do not show the Optimism × Relevance interaction found when attention was measured by time before clicking off a Web page. Derryberry and Reed (2002) have recently raised the possibility that attentional preferences unfold over time. This suggests one possible way to resolve the potentially conflicting results of current and previous work. It is at least plausible that optimists show attentional biases away from negative information, even potentially relevant information, but that they may then volitionally try to focus on that information once they decide it is important and should not be avoided. The original tendency, though, may be to avoid rather than approach the negative information.

Attention, Expectation, and Appraisal

Another lingering possibility given the experimental design is that attentional differences between optimists and pessimists emerged not on early trials but rather as participants came to expect to see a cancer image on the later trials. If optimists only attended less to cancer images on later trials, this would implicate a more strategic and volitional attempt to avert gaze from unpleasant images once they knew when to expect them to appear on the screen. However, if the difference emerged immediately, this would support a less volitional and more

rose-colored glasses interpretation. Although the small number of stimuli does not permit a full analysis of this issue, inspection of the data by trial from both studies shows that optimists looked less at the cancer images starting with the very first trial. For example, in Study 2, the effect sizes were similar for the first and last skin cancer image. Although this suggests that the observed effects, while modest, are likely not simply the result of strategic and volitional deployment of attention once optimists have come to accurately predict when they will see an unpleasant image, it is certainly possible that volitional processes did contribute during the time each image was presented.

Similarly, differences in fixation patterns between optimists and pessimists could result from differential appraisals leading to differential attention. For example, pessimists may have appraised the stimuli as more threatening and therefore were motivated to spend more time looking at them. Unfortunately, these data simply cannot discern specifically which patterns were and which were not the result of appraisal processes. This relates to a final open issue: whether it is optimists or pessimists who are "biased" in their attention. If memory tasks free from the ceiling effects in the current work continue to find that optimists look less at negative information but show no memory decrement, it may turn out that optimists are the ones showing the most adaptive pattern of visual attention. Findings from Segerstom's (2001) work suggest that this may be the case. In that study, moderate optimists showed the least bias in their attention and high optimists actually showed smaller overall biases than individuals classified as pessimists. Future directions are therefore many: for example, using faster time intervals may better tease out volitional and nonvolitional aspects of these gaze patterns and measuring actual threat appraisals can clarify whether gaze is deployed in the service of appraisals after a certain time delay.

Conclusions

The specific case of optimists' gaze toward (and away from) negative stimuli may be an instance of the more general process by which top-down (goal-driven) and bottom-up (stimulus-driven) influences on attention interact to produce attentional preferences for some individuals facing some stimuli under some situations (see, e.g., Egeth & Yantis, 1997). Whereas attentional preferences and biases in emotional disorders have been documented and are now understood to play a role in the maintenance of psychopathological states (see Williams et al., 1997), the current study demonstrates that normal range of affective responses also may have attentional underpinnings. However, what remains unclear is whether the observed attentional preferences associated with optimism are the product of automatic or volitional processes, although certainly the stimulus presentation was lengthy enough for volitional processes to play a significant role. Future research will need to use varying intervals of stimulus presentation to better discern the contribution of automatic and volitional processes to these attentional preferences, but it may be the case that both play a role, with architectural as well as knowledge-based features promoting biases (see Mathews & Wells, 1999). Additional work is also needed to discern how these attentional preferences relate to later stages of information processing. Although no effects of optimism on memory were found in the current work, it will still be important to frame attentional preferences within the larger context of information processing more generally. However, this study nonetheless demonstrates a powerful new technique for investigating the attentional underpinnings of individual differences relevant to emotion regulation and well-being.

These data suggest that Dickens (1857/1979) was right about the nature of optimism when one character in *Little Dorrit* commented to another, "I don't like to dispel your generous visions, and I would give any money . . . to live in such a rose-coloured mist" (p. 338). It remains to be determined whether this strategy is completely adaptive or whether it leads optimists to ignore some potentially important information from their environment. Perhaps it is the mixed gift of optimists that they attend to what is best in their environment and screen out what is worst.

NOTE

1. Although the faces were originally included in the study as a nonemotional control stimuli, it appeared that they did not contribute to the direct test of the hypothesis concerning fixation to negative rather than neutral stimuli; rather, the matched schematic drawings served the role of control stimuli by being similar in shape to the cancer images but without the negative emotional aspects. Indeed, overall fixation to faces was significantly different than gaze to skin cancer, $t(44) = 2.24$, $p < .05$, but fixation to cancer and the matched images did not differ, $t(20) = .31$, *ns*. Therefore, face stimuli were not included in the remaining analyses to isolate different fixation patterns to stimuli very similar except in emotional content. However, to further demonstrate that patterns of fixation to skin cancer were unique to these emotional stimuli, analyses were run on face stimuli that mimicked those conducted on the primary dependent variables. In a regression analysis, no significant effects of any demographic, affective, or personality variables (including optimism) predicted fixation pattern to the neutral face stimuli.

REFERENCES

Aspinwall, L. G., & Brunhart, S. M. (1996). Distinguishing optimism from denial: Optimistic beliefs predict attention to health threats. *Personality and Social Psychology Bulletin, 22*, 993-1003.

Aspinwall, L. G., Richter, L., & Hoffman, R. R. (2001). Understanding how optimism "works": An examination of optimists' adaptive moderation of belief and behavior. In E. C. Chang (Ed.), *Optimism and pessimism: Theory, research, and practice* (pp. 217-238). Washington, DC: American Psychological Association.

Bolger, N., & Schilling, E. (1991). Personality and the problems of everyday life: The role of neuroticism in exposure and reactivity to daily stressors. *Journal of Personality*, *59*, 355-386.
Calvo, M. G., & Avero, P. (2002). Eye movement assessment of emotional processing in anxiety. *Emotion*, *2*, 105-117.
Chang, E. (1998). Dispositional optimism and primary and secondary appraisal of a stressor: Controlling for confounding influences and relations to coping and psychological and physical adjustment. *Journal of Personality and Social Psychology*, *74*, 1109-1120.
Derryberry, D., & Reed, M. A. (2002). Anxiety-related attentional biases and their regulation by attentional control. *Journal of Abnormal Psychology*, *111*, 225-236.
Dickens, C. (1979). *Little Dorrit*. Oxford, UK: Oxford University Press. (Original work published 1857)
Egeth, H. E., & Yantis, S. (1997). Visual attention: Control, representation, and time course. *Annual Review of Psychology*, *48*, 269-297.
Greene, M. H. (1997). Genetics of cutaneous melanoma and nevi. *Mayo Clinic Proceedings*, *72*, 462-474.
Handley, I. M., Lassiter, G. D., Nickell, E. F., & Herchenroeder, L. M. (2004). Affect and automatic mood maintenance. *Journal of Experimental Social Psychology*, *40*, 106-112.
Levy, B. R., Slade, M. D., Kunkel, S. R., & Kasl, S. V. (2002). Longevity increased by positive self-perceptions of aging. *Journal of Personality and Social Psychology*, *83*, 261-270.
Mathews, G., & Wells, A. (1999). The cognitive science of attention and emotion. In T. Dalgleish & M. Power (Eds.), *Handbook of cognition and emotion* (pp. 171-192). New York: John Wiley.
Mogg, K., Millar, N., & Bradley, B. P. (2000). Biases in eye movements to threatening facial expressions in generalized anxiety disorder and depressive disorder. *Journal of Abnormal Psychology*, *109*, 695-704.
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 measuring contrast sensitivity. *Clinical Vision Science*, *2*, 187-199.
Polk, T. A., & Farah, M. J. (1995). Late experience alters vision. *Nature*, *376*, 648-649.
Radloff, L. S. (1977). The CES-D Scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, *1*, 385-401.
Rozin, P., & Royzman, E. B. (2001). Negativity bias, negativity dominance, and contagion. *Personality and Social Psychology Review*, *5*, 296-320.
Scheier, M. F., & Carver, C. S. (1985). Optimism, coping, and health: Assessment and implications of generalized coping expectancies. *Health Psychology*, *4*, 219-247.
Scheier, M. F., & Carver, C. S. (1993). On the power of positive thinking: The benefits of being optimistic. *Current Directions in Psychological Science*, *2*, 26-30.
Segerstrom, S. C. (2001). Optimism and attentional bias for negative and positive information. *Personality and Social Psychology Bulletin*, *2*, 1334-1343.
Smith, T. W., Pope, M. K., Rhodewalt, F., & Poulton, J. L. (1989). Optimism, neuroticism, coping, and symptom reports: An alternative interpretation of the Life Orientation Test. *Journal of Personality and Social Psychology*, *56*, 640-648.
Spielberger, C. D., Gorusch, R. L., Lushene, R., Vagg, P. R., & Jacobs, G. A. (1983). *Manual for the state-trait anxiety inventory*. Palo Alto, CA: Consulting Psychologists Press.
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 model. *Journal of Personality and Social Psychology*, *66*, 1034-1048.
Williams, J. M. G., Watts, F. N., MacLeod, C., & Mathews, A. (1997). *Cognitive psychology and emotional disorders* (2nd ed.). New York: John Wiley.

Received January 23, 2004
Revision accepted June 16, 2004