HHS Public Access

Author manuscript

Psychol Aging. Author manuscript; available in PMC 2015 June 15.

Published in final edited form as:

Psychol Aging. 2014 June ; 29(2): 342–350. doi:10.1037/a0036399.

Middle-Aged Adults Facing Skin Cancer Information: Fixation, Mood and Behavior

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Abstract

Older adults fixate less on negative parts of skin cancer videos than younger adults, leading them to feel better (Isaacowitz & Choi, 2012). We extended this paradigm to middle-aged adults (ages 35–59, *n*=63), whose fixation patterns were measured as they viewed skin cancer videos; mood and behavior were also assessed. Middle-aged adults looked even *less* at the videos than the other age groups, especially at the negative clips. They also reported the best moods, but relatively low levels of learning and positive skin cancer behavior. In some cases, middle-aged adults may show larger "age-related positivity effects" than older adults.

Keywords

Middle-aged adults; positivity effects; mood; health messages; attention

Introduction

Recently, we reported findings from a study comparing the responses of younger and older adults to emotionally evocative videos about skin cancer (Isaacowitz & Choi, 2012). In that study, older adults fixated less toward the negative emotional content in the videos and regulated their mood responses to the videos more rapidly than did younger adults. These findings were viewed as consistent with the idea that older adults may show "age-related positivity effects" in their information processing, as a way of accomplishing goals involved in regulating how they feel (Carstensen, 2006; Isaacowitz & Blanchard-Fields, 2012). While older adults' fixation patterns seemed to support their mood regulation, the behavioral results were surprising: despite looking less at the videos, older adults engaged in as many preventative skin cancer-related behaviors as their younger counterparts, even out-performing them in some cases.

Although the comparisons of younger and older adults are intriguing, it is clear that middle-aged individuals constitute a critical demographic in the context of skin cancer. According to the National Cancer Institute (see cancer.gov), the median age of diagnosis for cancers of the skin is 61 (64 for men, 57 for women). Thus, midlife may be a time of great potential

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exposure and possible pathogenesis of the cancer. It is this particular relevance of skin cancer information to middle-aged individuals that makes it of conceptual interest to investigate their attention, mood, and behavioral responses to such relevant yet negative stimuli. The performance of these "at-risk" midlife individuals can help further discern and refine our understanding of possible age-related positivity effects in attention, their constraints, and the extent to which they predict mood outcomes (see Isaacowitz & Blanchard-Fields, 2012; Kunzmann & Grühn, 2005).

Investigating middle-aged individuals can help determine whether positivity effects emerge continuously throughout the adult lifespan (e.g., Kisley, Wood, & Burrows, 2007) or become evident only in late life. The former pattern would be more consistent with a linear developmental account, where processing becomes more positive gradually with advancing age. In contrast, the latter would suggest a more qualitative difference in positivity between older individuals and all younger ones. However, either pattern would be at least broadly consistent with socioemotional selectivity theory's propositions that positivity effects result from time-perspective-driven goal prioritization (Carstensen, 2006).

Alternatively, it is also possible that middle-aged adults may be unique in conceptually interesting ways and this would lead them to show a different pattern of fixation and mood links than what would be expected purely from SST. For example, it is possible that the high relevance of skin cancer information for middle-aged individuals could lead to different attentional patterns for this particular age group: on the one hand, middle-aged individuals could be motivated by the high relevance of the information, despite its negative content, to attend to the skin cancer material even more than their younger counterparts. On the other hand, to the extent that highly relevant negative stimuli have the potential to lead to strong negative emotional reactions, middle-aged individuals may be motivated to regulate their attention away from them to avoid or down-regulate a negative mood response. This might then lead middle-aged individuals to show similar or even greater positivity effects in their attention than their older counterparts. Both of these possibilities are intriguing because previous studies on potential linear age differences in positivity effects have focused on non-personally relevant emotional stimuli such as IAPS images. Either pattern would suggest a key constraint on the nature of age-related positivity effects, and would be generally consistent with findings showing that overall age differences in emotion reactivity are moderated by the age-relevance of the stimuli (Kunzmann & Grühn, 2005).

Determining whether middle-aged individuals display positivity effects when faced with age-relevant negative skin cancer information can thus test boundaries about when age-related positivity effects may or may not emerge. Moreover, by investigating mood effects in addition to attentional ones, we can also answer questions about potential age differences (and similarities) in the relationship between looking and mood regulation in a way that has not previously been done in midlife (Isaacowitz, 2012).

Thus, in the current study we extended our skin cancer video paradigm to a sample of middle-aged individuals recruited from the local community in order to compare their performance to the previously reported results from younger and older adults. Various possible patterns of results would be conceptually interesting as described above. On one

hand, based on limited evidence suggesting that age-related positivity effects increase linearly across adult age groups (Kisley et al., 2007) and self-report findings that middle-aged adults report better affective states than younger adults but worse than older adults (Mroczek & Kolarz, 1998), we would expect middle-aged individuals to show more positive looking patterns and more positive mood responses than young adults, but less positive than older adults. As in the original study comparing only younger vs. older adults, we would expect these differences to be most pronounced among those participants instructed to regulate their emotions during the task, given past work finding that age differences may be magnified when participants were explicitly told to regulate their mood (see, for example, Mikels et al. 2010; Noh et al., 2011). We would predict similarly that middle-aged individuals would show intermediate behavioral performance on the health behavior tasks compared to the other age groups. However, if on the other hand age-relevance trumps linear age-related positivity effects, a different pattern would be expected to emerge, with middle-aged adults diverging from the predicted linear age differences in the key outcome variables.

Method

Participants

Participants (*N*=83) ranged in age from 35 to 59 and were recruited from the Boston area through online ads. Data from 18 participants were excluded from all analyses due to trackability issues (e.g. occluded pupils, lighting problems) and 2 participants withdrew from the study. The final sample consisted of 63 middle-aged adults (M_{age} = 46.1, age range: 35–58; 50.8% female; 63.5% Caucasian, 3.2% Asian American, 20.6% African American, 3.2% Hispanic, and 1.6% East Asian; 6.3% chose Other); 22 were in the control group, 21 were in the emotion-focused group, and 20 were in the information-focused group. Participants were screened over the phone for any chronic or mental illness and were paid $20 for their participation. For age-comparative analyses, data from these 63 middle-aged participants were compared to the younger (M_{age} = 19.5; age range 18–25; 64.1% female; 60.3% Caucasian, 17.9% Asian American, 3.8% African American, 1.3% Hispanic, and 10.3% East Asian; 6.4% chose Other) and older (M_{age} = 71.6; age range 60–92; 81.8% female; 100% Caucasian) adults from the Isaacowitz & Choi (2012) study. Before the experiment, 7.9% of middle-aged adults reported doing thorough skin self-exams, (vs. less than 3% of younger and older adults). Below, we provide a brief overview of the methods and measures; more details can be found in Isaacowitz & Choi (2012).

Measures & Stimuli

Eye-movements were assessed via fixations recorded during two skin cancer-related videos at a rate of 60 Hz with an ASL (Applied Science Laboratories, Bedford, MA) Eye-Trac 6 Desktop Video Head Tracking eye-tracker and GazeTracker software (EyeTellect, LLC, Charlottesville, VA). The first video (*60 Minutes Australia*: “Sunburnt Country”) was 13.5 minutes long and was intended to increase awareness about melanoma risk. This video was the more emotionally negative of the two videos chosen for this study, containing emotional scenes (e.g., a father receiving news of terminal melanoma and having to spend his last few months alive with wife and young son) (Taylor & Brown, 2005). The second video (“Check

it Out: Why and How to do Skin Self-Exam") was 14 minutes long and was intended primarily to inform participants about how to reduce skin cancer risk (e.g., containing scenes with step-by-step instructions about how to conduct a thorough skin self-examination) (Weinstock et al., 2007). In each video LookZones (LZs) were created around the extremely negative, less negative, and informative areas, which were rated by 16 independent raters. Extremely negative LookZones contained graphic scenes with images of surgical procedures (e.g. operating room), gory scars, and melanoma moles; less negative LookZones contained scenes with similar images, but of much less graphic content (e.g. mild melanoma moles, scars); and informative LookZones contained scenes of doctors speaking with family members, step-by-step instructions about how to conduct skin self-exams, and other informative text (see Isaacowitz & Choi, 2012 for details). Though the first video was more negative overall than the second, the full range of LookZone content was represented in both videos, as each contained melanoma images, scars, and surgical procedures.

Mood was self-reported throughout the study via a color-guided response dial; participants were instructed to turn the dial based on how they were feeling, on a scale from 0 to 100 (0=negative mood, 100=positive mood).

Knowledge of skin cancer was measured using a pre-and post-knowledge questionnaire, which contained 20 items related directly to information that was provided in the two videos about skin cancer. Additionally, the Brief Skin Cancer Risk Assessment Tool (BRAT; Glanz et al., 2003) measured **risk** of developing skin cancer.

Behavior was measured by having participants choose from a selection of items that were skin cancer related or not (i.e., they could select SPF 50 suntan lotion vs. hand lotion; they could take related give-away items or not take them) after watching the videos. In addition, participants received a body mole map and were instructed to complete it at home and mail it back to the lab within one week.

Instructions

Before they watched the two skin cancer videos, participants were randomly assigned to one of three instruction groups. Participants in the control group were told to "view the videos naturally, as if you were watching TV at home." Participants in the emotion-focused group were told to "view the videos with the goal of managing your emotions, and avoid feeling bad as much as you can." Participants in the information-focused group were told to "view the videos with the goal of getting as much information as possible and be as thorough as you can in collecting the information so you can act later based on what you have learned."

Procedure

Following Isaacowitz & Choi (2012) participants completed questionnaires and vision tests, were calibrated with the eye-tracker, and then watched the two skin cancer videos in a fixed order. As in the original study, the first video was intended to affectively connect with the viewer (primarily through fear), as is common in public health communication (see Leventhal, 1970), and the second video was intended to provide information on how to reduce risk (and thus potentially modulate the affective response). Participants reported their

moods before and after each video; we expected the first video to lead to negative mood change, and the second video to cause some mood improvement as participants learned what they could do to reduce risk. We also collected additional mood reports later in the experimental session to ascertain mood regulation over time.[1] Participants completed a post-knowledge questionnaire to assess how much they learned in the videos. Before participants left the lab, they selected items from a "give-away" table that contained sunscreen, informational pamphlets, and skin self-exam mirrors. Finally, participants were given a body mole map and a self-addressed envelope and were asked to complete the map and mail it back to the lab within one week.

Results

Below, we first present analyses for each type of dependent variable within the middle-aged sample alone. We then present comparisons to the other age groups (see also Figure 1). Descriptive statistics and correlations among main study variables are presented in Table 1.

Fixation

Middle-aged data: To test for a difference in gaze pattern based on instruction group and fixation type within the sample of middle-aged adults, a 3×3 mixed ANOVA was performed with instruction group (control, emotion-focused, information-focused) as the between-subjects variable and fixation type (extremely negative, less negative, informative LookZone) as the within-subjects variable. There was a main effect of fixation type, $F(2, 116)=88.05$, $p < .001$, $\eta_p^2 = .60$, in that middle-aged adults looked more at the less negative areas and least at the informative areas, with the extremely negative areas falling in the middle (*ps* < .001). There was no main effect of instruction group *(p* = .99) or interaction (*p* = .74).

Comparison to other age groups: As shown in Table 2, there was a main effect of fixation type, with more fixations towards the less negative areas than the extremely negative and informative areas (*ps* < .001). There was a main effect of age, where younger adults fixated the most, middle aged adults fixated the least, and older adults fell between the younger and middle aged groups (*ps* < .05). There was a significant Age x Fixation Type interaction and a Fixation Type x Age x Instruction Group interaction. To break down this 3-way interaction, we next consider the Age x Fixation Type interactions separately by instruction group:

When instructed to view naturally as if watching TV at home, there were more fixations to the less negative areas compared to the extremely negative and informative areas (*ps* < .001). Younger adults fixated the most, middle-aged adults fixated the least, and older adults fell in the middle (*ps* < .05). There was a Fixation Type x Age Group interaction; younger adults looked more than the middle-aged adults at the less negative and extremely negative areas (*ps* < .05). For the informative areas, younger adults looked more than middle-aged and older adults (*ps* < .05), and older adults looked more than middle aged adults (*p* = .003).

[1]For brevity, and given the lack of interesting effects, we do not further discuss other components of the experimental protocol, including the mole rating task or the web browsing task.

When instructed to focus on managing emotions, there were more fixations to the less negative areas compared to the extremely negative and informative areas (*ps* < .001). Younger adults fixated more compared to middle-aged and older adults (*ps* < .001), but there was no difference between middle-aged and older adults (*p* = .37). There was a Fixation Type x Age Group interaction: younger adults looked more at the extremely negative areas and less negative areas compared to the middle aged and older adults, (*ps* > .001). For the informative areas, younger adults looked more than middle-aged adults and older adults looked more than middle-aged adults (*ps* < .05), but there was no age difference between younger and older adults, (*p* = .36).

When instructed to gather as much information as possible from the videos, there were more fixations to the less negative areas compared to the extremely negative and informative areas (*ps* < .001). Younger adults looked more than middle-aged and older adults (*p* < .001), but there was no difference between middle-aged and older adults (*p* = .09). There was a Fixation Type x Age Group interaction: younger adults looked more at the extremely negative, less negative, and informative areas compared to the middle aged and older adults (*ps* < .05), and older adults looked more at the less negative areas than the middle-aged adults (*p* = .03).

Mood

Middle-aged data: To test for a difference in mood based on instruction group within the sample of middle-aged adults, a 7×3 mixed ANOVA was performed with time of mood rating (assessed at 7 different times throughout the experiment) as the within-subjects variable and instruction group (control, emotion-focused, information-focused) as the between-subjects variable. There was a main effect of time of mood rating $F(6, 318)=36.66$, $p < .001$, $\eta_p^2 = .41$. Mood significantly dropped during the negative video (start to end, $p < .001$) and significantly increased during the informational video (start to end, $p < .001$). There were no other significant increases or decreases in mood throughout the experiment (*ps* > .33). There was no main effect of instruction group, and no interaction (*ps* > .50).

Comparison to other age groups: As shown in Figure 2 and Table 2, participants' moods dropped after the negative video, but then recovered throughout the experiment. Results remained consistent even after controlling for the age differences in baseline mood (time 1 mood rating). Middle-aged adults reported being in the best moods, younger adults reported being in the worst moods, and older adults fell in the middle (*ps* < .05). There was a Mood x Age Group interaction, but not a Mood x Instruction Group interaction (*p* >.12) or Mood x Age Group x Instruction Group interaction (*p* = .85). When we looked specifically at the mood change from the start to the end of each video, we did not find any interactions between time and age group (*p* = .14 for video 1, *p* = .58 for video 2). As shown in Figure 2, at the end of the first video, middle-aged individuals reported more positive moods than both other age groups, but by the end of the second video, middle-aged individuals were only significantly higher than younger adults in mood.

Given the age differences in mood change, we re-ran the main fixation analyses controlling for mood, but the age differences in fixation were unchanged.

Behavioral Outcomes

Give-away items

Middle-aged data: To evaluate item choice in middle-aged adults, a 6×3 mixed analysis of covariance was performed with item choice (selection of a mirror, magnet, pamphlet, extra body map, checklist, sunscreen) as the within-subjects variable, instruction group (control, emotion-focused, information-focused) as the between-subjects variable, and gender as a covariate.[2] Gender was not significant as a covariate in the middle-aged sample (p = .35). There was a main effect of item choice, $F(5, 275)=3.86$, p = .002, η_p^2= .07 (i.e., middle-aged adults chose sunscreen and mirrors more than magnets). There was no main effect of instruction group or interaction (ps > .61).

Comparison to other age groups: As shown in Table 2, older adults took approximately 1 more give-away item (M = 3) than younger (M = 2) and middle-aged adults, (M = 2) (ps < .01), who did not differ from each other. There was no main effect of instructions or interaction (ps > .37). There were also no differences in type of sunscreen choice between younger and middle-aged, and middle-aged and older adults (ps > .50).

Likelihood of returning skin self-exam materials—Middle-aged adults (25 out of 63 returned, 40%) were less likely than older adults (50 out of 77 returned, 65%) to return the skin self-exam materials, $X^2(1, N=140)=4.39$, p = .04. There was not a significant difference between middle-aged and younger adults in the number of skin self-exams returned (p = .45). Additionally, there were no differences $X^2(1, N=218)=.963$, p=1.00, in the number of males vs. females who returned the skin self-exam materials.

Change in knowledge of skin cancer

Middle-aged data: To examine how much the middle-aged sample learned about skin cancer information a 2×3 mixed ANOVA with test time (pre, post) as the within-subjects variable and instruction group (control, emotion-focused, information-focused) as the between-subjects variable was performed. There was a main effect of test time, $F(1, 59)=221.43$, p < .001, η_p^2= .79; middle-aged adults scored significantly better on the post-knowledge questionnaire (M=15.81, SD=3.33) compared to the pre-knowledge questionnaire (M=9.35, SD=3.96). There was no main effect of instruction group or interaction (ps > .35).

Comparison to other age groups: All age groups performed significantly better on the post-knowledge (M=16.78, SD=2.55) questionnaire compared to the pre-knowledge questionnaire (M=10.71, SD=3.71). Older adults knew the most before the experiment (M=12.09, SD=3.50) and middle-aged adults knew the least (M=9.35, SD=3.96), with younger adults in the middle (M=10.47, SD=3.26). By the end, younger adults knew the most (M=17.62, SD=1.67) and middle-aged adults still knew the least (M=15.81, SD=3.33), with older adults in between (M=16.71, SD=2.27). Analyses concerning changes in knowledge scores are shown in Table 2.

[2]As discussed in Isaacowitz & Choi (2012), gender differences in selecting sunscreen of a particular SPF have been previously found (e.g., Branstrom et al., 2004; Geller et al., 2002).

Relationship Between Risk and Behavior in Middle-aged Adults

Brief risk-assessment tool (BRAT): To examine the relationship between skin cancer risk and behavior, BRAT scores were correlated with a number of measures. Participants with higher BRAT scores chose a sunscreen with a higher SPF, $r(52)=.433$, $p=.001$, looked more at the less negative areas $r(63)=.287$, $p= .04$, and reported being in worse moods after the informational videos $r(63)= -.290$, $p= .03$.

Discussion

Previously we reported that older adults fixated less on skin cancer videos than did younger adults, and correspondingly felt better, with relatively few costs to their skin cancer-related behavior (Isaacowitz & Choi, 2012). In the current study, we repeated the same paradigm with a sample of middle-aged adults. We did this both because skin cancer is prevalent within this age group, and because research on links between fixation, mood, and behavior has thus far focused on comparisons of younger vs. older adults. When older adults are found to look less at negative stimuli and to feel better than younger adults, this is generally interpreted as reflecting "age-related positivity effects" (Carstensen & Mikels, 2005) – a tendency for older adults to prioritize positive over negative stimuli in their attention and memory, as a function of their emotion regulation goals. In other words, older adults are thought to look in a more positive manner because they have the goal to feel good (though see Isaacowitz & Blanchard-Fields, 2012), and that pattern would seem to match the findings of the original study.

We conducted the same paradigm with middle-aged adults to try to gain further insight into the nature and potential mechanisms underlying age-related positivity effects. Interestingly, the sample of middle-aged individuals did not show the intermediate pattern between the younger and older age groups that we originally hypothesized. Instead, they showed a relatively more *positive* pattern, even compared to the older adults. The middle-aged individuals looked less at less negative stimuli even compared to older adults, and reported feeling better in some cases than older adults as well as (and thus substantially better than) younger adults. They showed less negative mood response to the upsetting videos and better moods throughout. It is especially interesting that some age differences in mood persisted through the final assessment points, as these took place quite a while after the end of the videos; inspection of Figure 1 suggests that this was due at least in part to the ongoing low moods of the younger adults. This may be a function either of their ongoing mood response to the task or their worse resting mood (though the younger adults had comparable moods at least to the older adults before the videos started).

This pattern corresponded not to our primary hypothesis of linear age differences, but rather to our alternative perspective in which the relevance of the negative stimuli might lead to a different age pattern from the predicted linear age effect. While either direction of effect seemed plausible, what we found was that middle-aged adults looked similarly or less than the older adults at the skin cancer videos, and felt as good as or better than the older adults. In other words, middle-aged individuals showed similar or greater "positivity effects" in their attention and how this attention influenced their mood even compared to older individuals. This pattern is most consistent with an interpretation that the relevance of the

stimuli to middle-aged adults influenced their response to it (see also Kunzmann & Grühn, 2005); in this case, making them focus not on engaging with the negative material but instead with regulating their mood response to it.

Whereas in their fixation and mood middle-aged adults were similar or even more positive than older adults, their skin cancer-related behavior was more similar to that of younger adults. While middle-aged individuals were more likely than the other age groups to check their skin before the study, they knew the least of any age group about skin cancer beforehand, and they learned the least from the videos. These findings are not terribly surprising given that middle-aged adults looked at the key areas of the videos the least, including the informative areas, which could have helped post-knowledge questionnaire performance. Middle-aged adults also took fewer give-away items than older adults but a similar number on average as younger adults. This is interesting because their visual fixation and mood patterns were more closely aligned to older adults, whereas their behavior was more similar to younger adults. One possibility is that middle-aged individuals' were defensively looking away to feel better, and this limited their ability to engage in positive health behaviors that had been suggested in the videos. However, Table 1 reveals a negative correlation between fixation to less negative LZs and number of give-away items taken, suggesting instead that it was actually greater engagement with some of the negative content that seemed to distract middle-aged individuals from engaging in the health-relevant behaviors. That pattern is more consistent with the interpretation of the younger adults fixation-behavior mismatch from the original study (Isaacowitz & Choi, 2012).

Overall, these findings suggest that age-related positivity effects in visual attention may not be limited to older adults, and may not always be a continuous linear process over adulthood (cf. Kisley et al., 2007). Instead, positive looking may be a strategy that individuals of any age can use when motivated to preemptively down-regulate strong negative affect that highly relevant negative information may elicit. While we do not have direct evidence on the goals of the middle-aged individuals, their performance suggests that they were trying to avoid attending to and emotionally reacting to the relevant negative material presented in the videos. Attentional deployment may be a particularly good way for individuals of any age to avoid a strong negative emotional response (Wadlinger & Isaacowitz, 2011), and it is thus not surprising that even younger adults have chosen disengaging distraction over reappraisal when making choices about how to regulate response to high intensity negative stimuli (Sheppes, Scheibe, Suri, & Gross, 2011).

In older adults, attentional deployment is especially helpful in improving the mood of those with good attentional functioning (Isaacowitz et al., 2009; Noh et al., 2011), so it may follow that middle-aged individuals (who are likely to have better cognitive abilities on average than their older counterparts) have the potential to benefit even more from positive looking than older adults. Thus, while positive looking may relate to hedonic goals in a way that is consistent with the arguments of socioemotional selectivity theory, the age component may need to be broadened to accommodate the apparently larger positivity effects of middle-aged as compared to older people, at least when confronted with highly relevant negative stimuli.

These findings may also have practical implications relevant to adult development. In terms of implications for health messages, middle-aged individuals may be even more likely to avoid certain relevant negative messages than older adults, and while this might help them regulate their mood, there is a cost in that they learn less and engage in fewer health-relevant behaviors. Thus, it may be important to use more positively-framed health messages with middle-aged people when presenting them with self-relevant negative material, to minimize the likelihood that they will avoid engaging with negative material in order to manage their mood (at the expense of paying attention to the information). Future adult lifespan replication samples will help to solidify these practical implications.

Important additional future directions for this work involve testing how attention and mood in the lab relate to changes in skin cancer behavior outside the lab, such as exposure to the sun and use of appropriate sunscreens. It will also be critical to evaluate what sorts of messages grab the attention of different age groups and different genders[3] in more real-world contexts in which multiple stimuli compete for attention (such as on the web or on television) rather than having a single stream of content that everyone must have on the screen.

Of course, the current findings cannot speak directly to *why* middle-aged individuals did not wish to engage with the relevant negative material. While we have focused on motivational and emotion-regulatory explanations for the findings, there are other possible explanations as well. For example, they could reflect cohort differences in the historical experience of middle-aged individuals leading them to be especially likely to avoid skin cancer information (albeit in a way unrelated to their age per se). There may also be effects of individual differences that we did not directly examine in the study; a key limitation of the study is our inability to rule out potential cohort and/or individual differences that might account for the observed pattern of findings. For example, the middle-aged individuals may have been especially high on individual differences like defensiveness or information avoidance, or low on Conscientiousness, and that may have influenced their fixation patterns. One previous study found differences between middle-aged and older adults in individual difference measures of identity assimilation and accommodation (Whitbourne & Collins, 1998); middle-aged individuals were especially likely to use assimilation for physical changes, suggesting that they tended to not integrate negative physical information into their identity. It is also plausible that the observed findings could reflect age-graded differences in responsibility: as middle-aged individuals may be especially busy with various roles at home and work, they may be relatively less like to attend to potentially threatening health information and from acting on it as well.

Any of these factors might predict the patterns we observed either directly or indirectly by influencing goals to avoid negative stimuli and to optimize mood state. For example, Sweeny et al. (2010) consider individual differences such as uncertainty orientation and coping, as well as what they term situational factors such as expectations, that predict motivation to regulate emotions and then the outcome of information avoidance. Our

[3]One issue in the current design was the unbalanced number of males and females across the different age groups. However, inclusion of gender in the fixation and mood analyses did not alter the main effects of age or associated interactions.

findings suggest potentially interesting differences across adult development in these processes and their relationships.

Given that these data were collected after the original study, there is the possibility that age differences may have emerged due to time-of-measurement effects. Future work could also differentiate between young-and older-middle-aged adults. While we did not find any differences in our key outcomes of interest when we split our midlife sample by age (median age = 48), future work with larger samples may be able to investigate this issue in further detail as well.

Another potential limitation involves our manipulation of instructions condition: We only found significant effects of instruction condition on patterns of fixation, and this was true only across age groups and not when considered only within the middle-aged group. Overall, it seems the instruction manipulation had limited impact on the pattern of age differences observed. It is possible that the study design was underpowered to detect differences among the instructions conditions (though similar sample sizes in YA and OA study revealed condition effects on fixation). Some past work has also found that age differences in emotion processing may be most apparent under baseline conditions rather than under instructions that may impact different age groups differently (Kunzmann, Kupperbusch, & Levenson, 2006). Another possibility is that the instructions were not potent enough to modulate the looking patterns and moods for middle aged individuals; if indeed middle-aged individuals are especially overburdened with role demands and favor an assimilative style, they may require especially dramatic manipulations to take notice and act on them.

Despite these limitations, and the need for more in-depth future work on potential underlying mechanisms, the current findings suggest that age differences in health-relevant processing may not solely be between younger and older adults, and that middle-aged individuals may have a unique profile of attention – mood –behavior links that requires its own set of considerations.

Acknowledgments

This research was supported by NIH grant AG026323 to the first author. The authors wish to acknowledge the help of YoonSun Choi in setting up the study and collecting the younger and older adult data, and Martin A. Weinstock for assistance with skin cancer materials.

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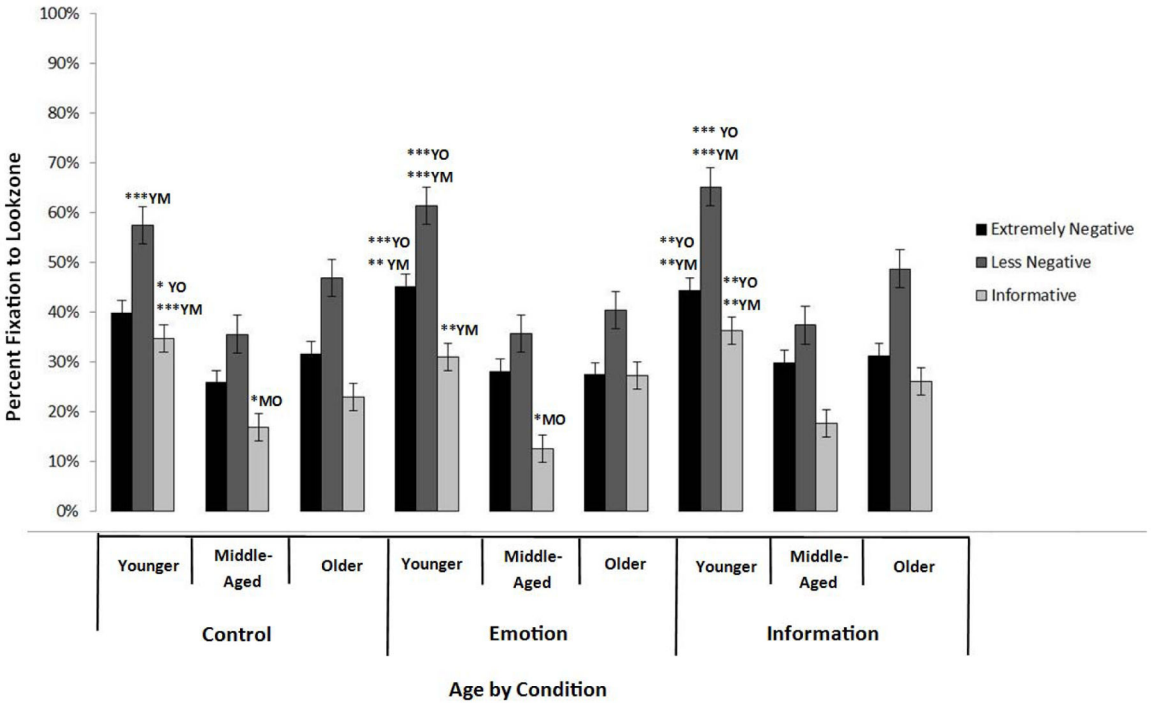

Figure 1.

Significance notation and labels indicate the age differences within each instruction group: * $p < .05$. ** $p < .01$. *** $p < .001$. YM=significant difference between younger and middle-aged adults; MO=significant difference between middle-aged and older adults; YO=significant difference between younger and older adults.

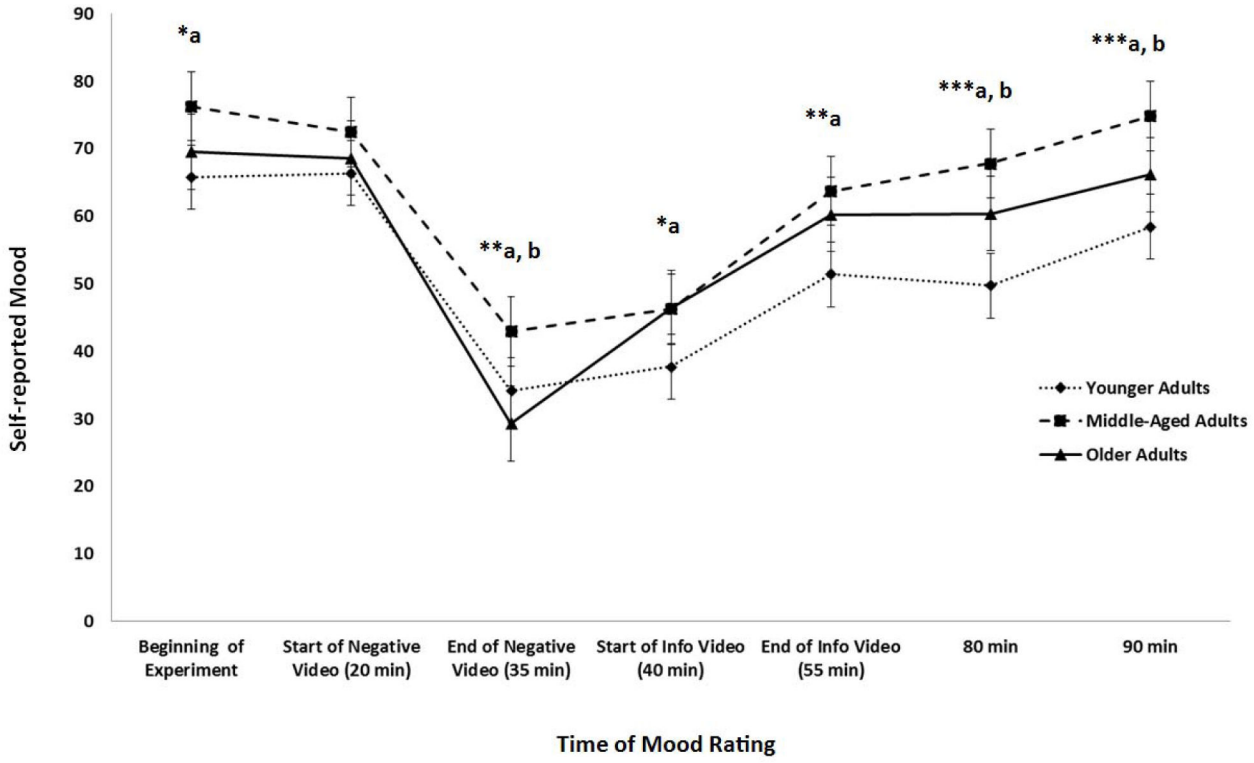

Figure 2.

Mood trajectories by age. Times noted in parentheses are elapsed time since the beginning of the experiment. Significance notation indicates the significance of the age difference: * $p < .05$. ** $p < .01$. *** $p < .001$. a=significant difference between younger and middle-aged adults; b=significant difference between older and middle-aged adults.

Table 1

Means, standard deviations, and intercorrelations among key study variables (in middle-aged participants only).

	Mean	Standard Deviation	Extremely Negative LZ	Informative LZ	Average mood	Change in mood across video 1	Change in mood across video 2	Change in knowledge score	Number of give-away items taken
Less Negative LZ	0.36	0.19	0.77**	.079**	−0.10	−0.04	−0.07	0.00	−0.27*
Extremely Negative LZ	0.28	0.16		0.68**	−0.10	−0.14	−0.02	−0.03	−0.19
Informative LZ	0.16	0.12	0.68**		−0.01	0.03	0.08	0.01	−0.18
Average mood	64.90	13.21	−0.10	−0.01		−0.19	0.27*	0.15	−0.04
Change in mood across video 1	29.69	27.21	−0.14	0.03	−0.19		0.09	0.35**	−0.11
Change in mood across video 2	17.41	21.61	−0.02	0.08	0.27*	0.09		0.15	0.24
Change in knowledge score	6.45	3.36	0.03	0.01	0.15	0.35**	0.15		0.10
Number of give-away items taken	2.75	1.66	−0.19	−0.18	−0.04	−0.11	0.24	0.10	

Significance notation indicates the significance of the p-values of the correlations:

* $p < .05$.

** $p < .01$.

Table 2

Summary of age comparison findings. There were no significant main effects of Instruction Type in any of the listed measures, so Instruction Type was omitted from the table.

	Age Group	Fixation Type	Interaction(s)
Fixation	$F(2,205)=32.62$, $p<.001$, $\eta_p^2=.24$	$F(2,204)=360.91$, $p<.001$, $\eta_p^2=.78$	Age Group X Fixation Type: $F(4,410)=10.14$, $p<.001$, $\eta_p^2=.09$ Fixation Type X Age X Instruction Group $F(8,410)=2.28$, $p<.05$, $\eta_p^2=.04$
View naturally	$F(2,69)=11.72$, $p<.001$, $\eta_p^2=.25$	$F(2,68)=105.22$, $p<.001$,$\eta_p^2=.76$	Fixation Type X Age Group $F(4,138)=2.40$, $p<.05$, $\eta_p^2=.07$
Emotion-focused	$F(2,66)=8.44$, $p=.001$, $\eta_p^2=.20$	$F(2,67)=118.46$, $p<.001$, $\eta_p^2=.78$	Fixation Type X Age Group $F(4,136)=9.28$, $p<.001$, $\eta_p^2=.21$
Information-focused	$F(2,68)=14.46$, $p=.001$, $\eta_p^2=.30$	$F(2,67)=152.16$, $p<.001$, $\eta_p^2=.82$	Fixation Type X Age Group $F(4,136)=3.77$, $p=.001$, $\eta_p^2=.006$
Mood	**Age Group**	**Time of Rating**	**Interaction(s)**
	$F(2,182)=11.32$, $p<.001$, $\eta_p^2=.11$	$F(6,1092)=125.94$, $p<.001$, $\eta_p^2=.41$	Time of Rating X Age Group $F(12,1092)=2.45$, $p=.004$, $\eta_p^2=.03$
Behavior	**Age Group**	**Interaction(s)**	
Give-away items	$F(2,205)=7.05$, $p=.001$, $\eta_p^2=.06$	*n.s.*	
	Age Group	**Test time (pre/post)**	**Interaction(s)**
Change in knowledge	$F(2,205)=8.84$, $p<.001$, $\eta_p^2=.08$	$F(1,205)=746.25$, $p<.001$, $\eta_p^2=.78$	Test Time X Age Group $F(2,205)=12.33$, $p<.001$, $\eta_p^2=.12$

Note: values in this table are reported without including gender in the model. Including gender in the model did not change the main effects or interactions.