positive low arousal, neutral, negative low arousal, negative high arousal]) repeated-measures ANOVA.[2] Both the age group, $F(1, 46) = 540.32$, $p < .001$, $\eta_p^2 = .92$, and the target category, $F(4, 184) = 8.98$, $p < .001$, $\eta_p^2 = .16$, main effects were significant, as well as the Age Group × Target Category interaction, $F(4, 184) = 3.59$, $p = .008$, $\eta_p^2 = .07$. This interaction appeared to reflect the fact that for the younger adults, positive high-arousal targets were detected faster than targets from all other categories, ts$(23) < -1.90$, $p < .001$, with no other target categories differing significantly from one another (although there were trends for negative high-arousal and negative low-arousal targets to be detected more rapidly than neutral targets; $p < .12$). For older adults, all emotional categories of targets were detected more rapidly than were neutral targets, ts$(23) > 2.56$, $p < .017$, and RTs to the different emotion categories of targets did not differ significantly from one another. Thus, these results provided some evidence that older adults may show a broader advantage for detection of any type of emotional information, whereas young adults' benefit may be more narrowly restricted to only certain categories of emotional information.

Discussion

As outlined previously, there were three plausible alternatives for young and older adults' performance on the visual search task: The two age groups could show a similar pattern of enhanced detection of emotional information, older adults could show a greater advantage for emotional detection than young adults, or older adults could show a greater facilitation than young adults only for the detection of positive information. The results lent some support to the first two alternatives, but no evidence was found to support the third alternative.

In line with the first alternative, no effects of age were found when the influence of valence and arousal on target detection times was examined; both age groups showed only an arousal effect. This result is consistent with prior studies that indicated that arousing information can be detected rapidly and automatically by young adults (Anderson, Christoff, Panitz, De Rosa, & Gabrieli, 2003; Ohman & Mineka, 2001) and that older adults, like younger adults, continue to display a threat detection advantage when searching for negative facial targets in arrays of positive and neutral distractors (Hahn et al., 2006; Mather & Knight, 2006). Given the relative preservation of automatic processing with aging (Fleischman, Wilson, Gabrieli, Bienias, & Bennett, 2004; Jennings & Jacoby, 1993), it makes sense that older adults would remain able to take advantage of these automatic alerting systems for detecting high arousal information.

However, despite the similarity in arousal-mediated effects on detection between the two age groups, the present study did provide some evidence for age-related change (specifically, age-related enhancement) in the detection of emotional information. When examining RTs for the five categories of emotional targets, younger adults were more efficient in detecting positive high-arousal images (as presented in Table 2), whereas older adults displayed an overall advantage for detecting all emotional images compared with neutral images. This pattern suggests a broader influence of emotion on older adults' detection of stimuli, providing support for the hypothesis that as individuals age, emotional information becomes more salient.

It is interesting that this second set of findings is clearly inconsistent with the hypothesis that the positivity effect in older adults operates at relatively automatic stages of information

processing, given that no effects of valence were observed in older adults' detection speed. In the present study, older adults were equally fast to detect positive and negative information, consistent with prior research that indicated that older adults often attend equally to positive and negative stimuli (Rosler et al., 2005). Although the pattern of results for the young adults has differed across studies—in the present study and in some past research, young adults have shown facilitated detection of positive information (e.g., Anderson, 2005; Calvo & Lang, 2004; Carretie et al., 2004; Juth et al., 2005; Nummenmaa et al., 2006), whereas in other studies, young adults have shown an advantage for negative information (e.g., Armony & Dolan, 2002; Hansen & Hansen, 1988; Mogg, Bradley, de Bono, & Painter, 1997; Pratto & John, 1991; Reimann & McNally, 1995; Williams, Mathews, & MacLeod, 1996)—what is important to note is that the older adults detected both positive and negative stimuli at equal rates. This equivalent detection of positive and negative information provides evidence that older adults display an advantage for the detection of emotional information that is not valence-specific.

Thus, although younger and older adults exhibited somewhat divergent patterns of emotional detection on a task reliant on early, relatively automatic stages of processing, we found no evidence of an age-related positivity effect. The lack of a positivity focus in the older adults is in keeping with the proposal (e.g., Mather & Knight, 2006) that the positivity effect does not arise through automatic attentional influences. Rather, when this effect is observed in older adults, it is likely due to age-related changes in emotion regulation goals that operate at later stages of processing (i.e., during consciously controlled processing), once information has been attended to and once the emotional nature of the stimulus has been discerned.

Although we cannot conclusively say that the current task relies strictly on automatic processes, there are two lines of evidence suggesting that the construct examined in the current research examines relatively automatic processing. First, in their previous work, Ohman et al. (2001) compared RTs with both 2 × 2 and 3 × 3 arrays. No significant RT differences based on the number of images presented in the arrays were found. Second, in both Ohman et al.'s (2001) study and the present study, analyses were performed to examine the influence of target location on RT. Across both studies, and across both age groups in the current work, emotional targets were detected more quickly than were neutral targets, regardless of their location. Together, these findings suggest that task performance is dependent on relatively automatic detection processes rather than on controlled search processes.

Although further work is required to gain a more complete understanding of the age-related changes in the early processing of emotional information, our findings indicate that young and older adults are similar in their early detection of emotional images. The current study provides further evidence that mechanisms associated with relatively automatic processing of emotional images are well maintained throughout the latter portion of the life span (Fleischman et al., 2004; Jennings & Jacoby, 1993; Leclerc & Hess, 2005). It is critical that although there is evidence for a positive focus in older adults' controlled processing of emotional information (e.g., Carstensen & Mikels, 2005; Charles et al., 2003; Mather & Knight, 2005), the present results suggest that the tendency to focus on the positive does not always arise when tasks require relatively automatic and rapid detection of information in the environment.