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**Aging and positivity: A cognitive comparison
of encoding and memory retrieval in two different age groups.**

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ABSTRACT

The positivity effect refers to a developmental trend in which the ratio of positive over negative events becomes more pronounced over the lifespan, suggesting that older adults evaluate, encode and retrieve stimuli from recall differently from young adults. Previous research has focused on identifying the positivity effect, on whether memory distortion has caused it, and for how long older adults can maintain positive emotion. The aim of this experiment was to investigate the cognitive functions behind the positivity effect. It examined differences in the encoding and memory retrieval of neutral, positive and negatively valenced images in young and old adults by comparing measures of self-reported intensity of arousal in 30 females aged 18-30 with 30 females aged 65-80. A slideshow of 60 valenced images from the International Affective Picture System was shown in either a direct emotion or an indirect emotion task, followed by a brief interference task, after which all participants were rated on the accuracy of their recognition of the valenced images. Results revealed that older adults had a positivity effect in most tasks when compared with younger adults, enhanced by a diminished preference for negative images. Psycho-social implications of this positively-biased view of themselves and the world include concerns over personal health care and safety issues related to independent living.

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CHAPTER 1

INTRODUCTION TO THE STUDY

Are our schooldays really the best days of our lives? Was that first love really as passionate and painful as we remember? Or maybe the memories have been distorted over time, and the passions of youth have become regulated with aging, so that life is seen as if 'through rose-tinted spectacles'. The cognitive processes behind this positivity effect are dependent on the encoding of stimuli and the retrieval of neutral, positive and negatively valenced memories. The aim of this study was to investigate whether older adults react differently from younger adults to valenced stimuli, and whether their memory retrieval of valenced images is also different.

The positivity effect examined in this study refers to a developmental trend in which the ratio of recall given to positive over negative events becomes more pronounced over the lifespan (Carstensen & Mikels, 2005; Mather & Knight, 2005). General cognitive decline through the normal aging process is not thought to affect emotional experience, while emotional regulation appears to remain intact or even improve (Charles, Mather & Carstensen, 2003; Craik & Salthouse, 2000; Mather & Carstensen, 2005). Consequently, it is assumed that evaluation of an emotional stimulus in the present moment is affected by memories of previous similar stimuli, implying that a longer life experience will result in a larger store of memories to draw on. The current study investigated any such age-related

differences by comparing the self-reported intensity ratings of young and old female adults to a series of neutral, positive and negative images presented for the first time. Then, after a brief delay, the study attempted to examine the way stimuli had been encoded, by rating the accuracy of participants' recognition of previously seen and novel affective images.

Emotional reactions are usually measured in psychology by the assessment of affect – the conscious, subjective reaction of an individual to a stimulus (Barlow & Durand, 2002). Affect reflects the extent to which a person feels enthusiastic, active, and alert. High positive affect is indicated by high energy, full concentration, and pleasurable engagement with stimuli, whereas low positive affect is characterized by sadness and lethargy (Watson, Clark & Tellegen, 1988). On the other hand, high negative affect describes a general dimension of subjective distress, including a variety of unpleasant mood states such as anger, guilt and fear, with low negative affect indicated by a state of calmness and serenity (Watson, Clark & Tellegen, 1988). The current experiment used affective stimuli to capture emotion rather than mood, through measuring the intensity of responses to neutral, positive or negative images in the International Affective Picture System (IAPS; Lang, Bradley & Cuthbert, 2001).

Previous research has found that older adults remember more positive than negative information (Mather & Carstensen, 2005). This may be due to selective attention given to positive stimuli, distorted autobiographical memories, or experiential learning (Bryce, 2005; Charles, Mather, & Carstensen, 2003; Mather & Carstensen, 2005; Mikels, Larkin, Reuter-

Lorenz & Carstensen, 2005). Investigations of the positivity effect have focused on working memory (WM) and long term memory (LTM), supported by evidence from functional magnetic resonance imaging (fMRI) of brain activity in response to valenced visual images (Bush, Luu & Posner, 2000). However, it is not known whether the positivity bias occurs at the encoding stage, during attentional processing, or even by selective recall.

This chapter reviews the literature on the positivity effect as it applies to the current experiment. Relevant issues include aging, attention and memory; aging and emotion; and a review of current theories on the positivity effect. The chapter ends with a description of the study and the hypotheses being investigated.

1.1: The Effect of Aging on Attention and Memory

Attention is the mechanism by which all cognitive processing occurs: it is assumed to have a limited capacity, since it may not process all available stimuli simultaneously (Willingham, 2001, p.101). It is a conscious activity, with response to stimuli determined by an individual's driving forces, such as hunger, sexual need or shelter (Lang, Bradley & Cuthbert, 1997, p.97). Attention is also selective, whether automatic or controlled, dependent on evaluation and judgement refined through a lifetime of viewing images either actively or passively (Lang, Bradley & Cuthbert, 1997). While the current study does not discuss innate motivations, it does suggest that response patterns of attention are regulated by affective reactions such as valence and arousal.

Normal aging in the human brain demonstrates a slow overall decline in attention, sometimes leading from mild to moderate and eventual major cognitive impairment (Rombouts, Barkhof, Goekoop, et al., 2005). When an individual perceives a stimulus, the limbic system, which integrates incoming data from the attentional and affective systems, produces activation in the anterior cingulate cortex (Bush, Luu & Posner, 2000). Age-related changes to the limbic system, which includes the hippocampus and amygdala, are still being investigated, but research so far suggests that the impact of emotionality on behaviour remains constant throughout the lifespan (Johnson, Raye, Mitchell, et al., 2005; Narita, Kuzumaki, Narita, et al., 2006). However, Narita, Kuzumaki and Narita (2006) have conducted experiments on mice which indicate that the amygdala decays with age: while the human amygdala is obviously not to be compared with mice, the physiological similarities of the limbic system are worth noting. It therefore seems unsafe to assume that the emotionality which influences behaviour remains constant with age, given that the functionality of the amygdala declines over the lifespan.

Sequential longitudinal studies offer the most useful method for collecting data on age-related changes to memory, by following trends in cohort groups over a number of years. The Victoria Longitudinal Study, for example, was initiated in Canada in 1986 specifically to investigate memory change in the aged (VLS; Hultsch, Herzog, Dixon & Small, 1998). The team of VLS researchers found strong evidence of individual differences in WM, confounding the predictive validity of any research into the effect of aging on the processing speed, processing ability, capacity and duration of WM. For example, variables

such as education, gender and early developmental ability were not found to be significantly related to later cognitive decline, although novel information processing in intellectually stimulating activities was positively related to significant cognitive change. The VLS (p.276) concluded that age-related effects over-ride all other variables at all levels of cognition, with a slow decline up to the mid-70s, accelerating after that. This finding of changes to WM, while non-specific, impacts on all research into the positivity effect using samples of older adults, including the current study.

Similar effects have been found by the Seattle Longitudinal Study of Aging (Schaie, 2000), which has been collecting data on cognitive decline for over 40 years. Schaie asserts that older adults maximise cognitive functioning by a process known as 'selective optimisation with compensation' (Freund & Baltes, 2002, p.642): by optimising positive abilities, a person can compensate for any loss of function. Schaie's theory builds on previous research by Tulving and Schacter (1990) and the VLS (Hultsch et al., 1998), who suggest that if an older adult actively develops their cognitive ability, mental acuity retains enough plasticity to help compensate for losses, through self-learned strategies. But despite its valuable contribution to the understanding of age-related changes in WM and LTM, the Seattle Longitudinal Study did not report on such specific cognitive declines as encoding or attention, important issues in the current study.

Attention to valenced images, the basis of the current study, is obviously dependent on visual cognition, an area of cognitive decline where the clash of physiology, psychology

and psychometrics has led to a paucity of information. Declines in contrast and brightness evaluation that lead to the loss of fine detail are known to affect attention and impact on encoding and it is expected that age-related changes, such as cataracts or glaucoma, may affect basic visual functions (Schneider & Pichora-Fuller, 2000). Useful data on vision cognition has come from the ongoing Baltimore Longitudinal Study of Aging, which has charted 1,400 adults aged in their 20s to 90s since 1958 (National Institute on Aging, 2006, p.1). The study has rated participants for over 27 years on the Benton Visual Retention Test, reporting little cognitive decline through the early 60s, but substantial declines from the mid-60s to mid-70s (Giambra, Arenberg, Zonderman, Kawas & Costa, 1995). By contrast, the Duke Longitudinal study measured subjects aged 60-94 on the Wechsler Memory Scale Visual Reproduction sub-test (Hutsch et al., 1998), finding significant cognitive declines in visual reproduction over the whole time frame. These results suggest that age-related physiological changes to vision cognition could affect the retention and recognition of IAPS images in the current study, although it is possible that the emotional content of the images may override these effects.

1.2: Aging and Emotion

The regulation of attention and emotional processing is one of the functions of the anterior cingulate cortex, the part of the limbic system which contains the hippocampus and amygdala: long term memory is strongly associated with the hippocampus, and emotionality with the amygdala (Bush, Luu & Posner, 2000). This is supported by evidence from neuroimaging with fMRI, showing that memory and emotionality are co-dependent

but related by motivation (Bush, Luu & Posner, 2000). For example, a study of cognition by Whalen, Bush, Shin and Rauch (2006) used fMRI in a repeated measures design with two Stroop-like interference tasks, one cognitive and one affective. One of the tasks was to respond by counting a number of neutral words (such as the number 'three' written four times) followed by an interference task (such as 'dog' written three times), while another was to respond to the same number of emotionally-charged words (such as 'murder' written three times). The fMRI record showed that activations in the amygdala were suppressed, or biased against, negative input when the participants engaged in the cognitive task, but enhanced during the emotional task (p.294). This evidence is important because it demonstrates the separation of attention and affect in the anterior cingulate cortex, with a bias against negative stimuli.

This interaction of emotion and attention argues for an interdependence of the cognitive processes, which would include encoding and retrieval from memory (Lazarus, 1991). A certain piece of music, for example, could be associated with a particular emotion, so that whenever that music is played, the same emotion is evoked – such as a love song associated with a particular time and person. Reflexively, if emotion and cognition were not integrated, one would interrupt the other, with intellect and reason over-riding emotion at all times. This implies that learning is linked to emotional input, hence the recognition of positive, neutral and negative stimuli are basic cognitive functions inseparable from emotions (Zajonc, 1997). It follows that learning to evaluate positive versus negative stimuli is an attentional process of WM emotionally linked to LTM over the lifespan (Lutz, 2005).

Evidence for the influence of emotion on attention was found in an experiment by Christianson, Loftus, Hoffman and Loftus (1991), who compared the detail recalled by subjects on highly emotional versus neutral visual images. They tracked eye movements as their subjects watched a series of slides, finding that eye fixations were stronger and longer on central detail when viewing highly emotional images. After a five-minute filler task, participants were asked to recall both central and peripheral information. Since the central detail of the highly emotional images was recalled better than other details, it appears that selective attention was influenced by the emotional content of the stimuli. The implication for the current experiment is that the accuracy of participants' recognition of valenced images is likely to reflect their encoding and memory retrieval process.

It seems that as people get older, they experience more positive emotions (Mather & Carstensen, 2005). Substantiating this, the Baltimore Longitudinal Study of Aging (Terracciano, McCrae, Brant, et al., 2005) has been recording age-related personality changes for 15 years, finding significant elevations to 'agreeableness' in personality, through analysing data from 5,027 assessments ($N = 1,944$; 967 female; age in years >20- >90) (National Institute on Aging, 2006, para. 2). Cohort effects were reported to be small, and changes to agreeableness were attributed to age correlated with genetic factors or life experience. Other research into aging and personality has also found moderate increases in agreeableness over the life span (Wood & Roberts, 2006). Hence older adults, having a

higher ratio of agreeableness in their personality when compared to younger adults, could be more likely to view life with a positive attitude.

1.3: The Positivity Effect

The positivity effect, as previously stated, refers to a developmental trend in which the ratio of recall given to positive over negative events becomes more pronounced over the lifespan (Carstensen & Mikels, 2005). This section discusses current theories and conflicting evidence about the existence of any positivity effect.

Socio-emotional selectivity theory and the positivity effect

“Socio-emotional selectivity theory predicts that individuals select goals in accordance with their perceptions of the future as being either limited or open-ended” (Carstensen, Isaacowitz & Charles, 1999, p.128). This means that with increasing age, it could be expected that emotionally satisfying goals are prioritised to make the most of time remaining, leading to a more positive than negative outlook in life. The theory also suggests that goals change from being knowledge-related in youth, to emotion-related in old age, so that attention and memory function are focused on a positively-biased emotional regulation aimed at maximising pleasure in a limited time-frame (Mikels, et al., 2005).

Socio-emotional selectivity theory (Carstensen, Isaacowitz & Charles, 1999) broadly encompasses both life experience and emotional regulation, with empirical evidence to support claims of the development of a cognitive control system which is refined with age

despite normal cognitive decline (Blanchard-Fields, 2005; Charles, Mather & Carstensen, 2003). Based on this theory, a significant positivity effect has been found in old adults when compared with young adults when viewing emotive stimuli (e.g. Carstensen & Mikels, 2005; Mikels, et al., 2005). By contrast, studies using verbal rather than visual affective stimuli report a memory enhancement in older adults for the recall of negative information (Denberg, Buchanan, Tranel, & Adolphus, 2003; Kensinger, Brierley, Medford, Growdon, & Corkin, 2002). Alongside these two opposing results, Gruhn, Smith and Baltes (2005) argue against any bias at all in older adults, supporting their claim with a study which also used verbal stimuli. This confusion might be explained by a suggestion that emotional goal-setting and cognitive control are variable interactive resources, dependent on cognitive capacity, with both visual and verbal responses subject to normal age-related declines (Mather & Knight, 2005). Another tentative explanation, which has not been examined, is that negative stimuli require more elaborative processing than positive, leading to a positivity bias in older adults as a means of compensation for cognitive decline (Blanchard-Fields, 2005).

Despite these conflicting results, a growing body of evidence is finding that older adults consistently exhibit higher response and recall rates to positive rather than negative stimuli (e.g. Carstensen, Isaacowitz & Charles, 1999; Mather & Carstensen, 2005; Mikels, et al., 2005). In an experiment similar to the current one, Mikels et al. (2005) investigated age-related differences in working memory for emotional information. Their experiment was based on socio-emotional selectivity theory (Carstensen, Isaacowitz & Charles, 1999) and investigated the positivity effect in two groups of participants: 20 aged 18-28, and 20 aged

64-80; 50% male and 50% female. Participants were asked to rate the emotional intensity of a set of IAPS images, maintain the emotion over a brief delay, and then rate them again from memory. The delay time was unspecified, but the stated assumption was that only WM would hold the intensity of emotion. This is important because while WM is thought to be affected by slow but predictable age-related changes, both LTM and the amygdala have variable age-related cognitive declines in encoding, storage and retrieval (Papalia, Stern, Feldman & Camp, 2002). The results of Mikels et al.'s study revealed that although older adults had an age-related cognitive deficit for visual information, their WM for emotion was unimpaired (p.542). Furthermore, older adults gave greater attention to positive than negative stimuli before and after the delay, while young adults demonstrated the opposite effect. Another study based on socio-emotional selectivity theory added credence to these findings by comparing young, middle-aged and older adults in the recognition and recall of a set of IAPS images (Charles, Mather & Carstensen, 2003). The finding of a positivity bias that increased with age across the three age bands suggests that any change from negative to positive bias is age-related – a linear shift rather than a sudden threshold.

A later study by Mather and Carstensen (2005) examined socio-emotional selectivity theory in greater depth (Carstensen, Isaacowitz & Charles, 1999). Their explanation of the core strategies regulating the positivity effect is that older adults use a cognitive control system of motivated attention to enhance positive and diminish negative information (p.496). Such a strategy would serve to compensate for age-related cognitive decline in WM and LTM by using enhanced emotional control to regulate increasingly limited attentional resources (Carstensen & Mikels, 2005; Freund & Baltes, 2002).

Physiological evidence for a positivity effect

Physiological evidence for age-related changes to WM is particularly relevant to the current experiment because it is involved in the manipulation and possible encoding of stimuli such as the IAPS images. Encoding may be defined as the selective evaluation and storage of novel stimuli (Eysenck, 2001). Research suggests that motivated attention to even brief visual stimuli leads to encoded data being transferred from WM to LTM (Intraube, 1999). Also, stimuli with a high emotional content are thought to be disproportionately encoded through a wider system of inter-related nodes and so are more likely to be transferred to LTM (Bower, 1981; Lutz, 2005).

Working memory, according to the VLS (Hultsch et al., 1998), suffers definite age-related changes which over-ride variables such as gender, education and heredity, with a steady decline up to the mid-70s and accelerating after that age. However, off-setting this decline, research into the perceptual identification of objects by Tulving & Schacter (1990) has found that regardless of age, even pre-attentive exposure to visual stimuli causes increased neuronal generation, resulting in a 'priming' effect of faster recognition time. Similarly, Lutz (2005) proposes an algebraic summation theory in which the number of neuronal links to a visual memory cue are correlated to the richness of that memory. As an example of how neuro-anatomical enrichment links attention with visual experience, one could think of a piece of fried bacon: this might prompt recall of its sizzling in the pan, the rich aroma, the spitting of the fat, and finally the taste of it, all in the context of a relaxed Sunday breakfast. This richly encoded positive autobiographical memory is stored in LTM as 'frying bacon',

ready to be recalled at the next verbal or visual cue. Conversely, treading on a fat worm with bare feet would be encoded negatively, with an associated negative emotion.

Accordingly, a longer lifespan of visual experience could lead to enrichment of the neurons in the visual cortex, with associated strong emotional memory links built up from years of attentional encoding and processing (Curtis & Nelson, 2003).

Supportive physiological evidence for a positivity effect in older adults comes from a study by Mather, Canli and English et al. (2004), who showed a set of IAPS images to a group of older adults while simultaneous fMRI scans examined activation in their amygdalas. The fMRI scans showed the most intense activations when participants viewed positive images, indicating a higher arousal level for positive images than for neutral or negative. This finding adds construct validity to the current study, which depends on self-rated measures of emotional reactivity to IAPS images as a way to capture encoding and memory retrieval.

Further physiological evidence of the effect of attention, encoding and recall on WM and LTM was provided in an experiment by O'Craven and Kanwisher (2000). Using fMRI to compare brain scans, participants were asked to concentrate on visual cues and then recall them as vividly as possible. The experiment demonstrated that the same cortical region is used for both real and imagined images. O'Craven and Kanwisher found that variations in brain activity were influenced by two factors: firstly, the force and magnitude of the perceived stimulus corresponded to the force and intensity of the imagined stimulus, pointing to an emotional correlation between the two events. Secondly, the results suggest a

cognitive control over the process of recalling visual stimuli (p.1020), which in the current study could influence any response bias in the recognition of IAPS images.

It should also be noted that memory for images is very personal regardless of age (Lutz, 2005), with visual images more easily recalled than semantic facts. It is easier, for instance, to visualise the face of one's mother than to describe it. Lutz (2005) proposes a simple explanation for this: because imagery is autobiographical, he suggests, it has easier-to-recall semantic links. This explanation substantiates the findings of Tulving and Schacter (1990) and the VLS (Hultsch et al., 1998) on rich encoding and the plasticity of the aging brain, although it fails to explain why a positivity effect should bias autobiographical memory.

Experiential theories for the positivity effect

Experiential learning refers to the development of a criterion for reacting to novel stimuli through experience (Lutz, 2005). Experience fine-tunes this evaluation from infancy to late adulthood: an infant, for instance, may cry when handed to a stranger, before learning about stranger-danger as it gets older, eventually maturing into an adult with experience at character stereotyping. It can be seen that evaluation needs both positive and negative reinforcement to operate, so the individual must learn when a response is appropriate before making judgement decisions. Since a negatively reinforced judgement tends to be extinguished, an opportunity for a positivity bias occurs (Lutz, 2005): for example, we learn that is safe to talk to most, but not all, strangers. Consequently, it is likely that a longer

lifespan of experience in evaluation offers more opportunities for a positivity bias to form in older adults, evidenced by diminished attention given to negative stimuli.

Both aging and experience seem to play an important part in the development of emotional regulation for cognitive tasks (Mather & Carstensen, 2005), with emotional regulation appearing to improve across the lifespan (Blanchard-Fields, 2005; Charles, Mather & Carstensen, 2003; Mikels et al., 2005). Mather and Knight (2005, p.554) speculate that an experiential change in regulation leads to older adults focusing more on positive and less on negative stimuli. They further suggest that older adults have a cognitive control system of preference for encoding more positive and less negative information. Such changes in cognitive control, through either experience or aging, could be expected to influence the amount of attention given to emotional stimuli. Mather and Knight's supposition is supported by a study which compared five very diverse groups of young, middle-aged and older adults on questions about self-control: the study found that emotional regulation appears to strengthen with age, with older adults believing they had greater control over their emotions than younger adults (Gross, Carstensen, Pasupathi, et al., 1997).

Furthermore, older adults try to maintain a positive state for longer than a neutral or negative state (Carstensen, Pasupathi, Mayr, et al., 2000). While these studies are all based on subjective self reports, rather than objective research, it may be assumed that the low external reliability is offset by higher construct validity.

Following on from the suggestion of an improved cognitive control system in older adults, Kennedy, Mather and Carstensen (2005) propose that over the lifespan, memory distortion enhances positive and diminishes negative events. In a longitudinal study of 300 Franciscan nuns (mean age 73 years), they compared the Sisters' emotional reactions to autobiographical memories recorded in 1987 with their current emotional reactions to the same memories. A statistically significant positivity effect was found, which was explained as a probable memory distortion. The generalisability of this study is questionable, however, since the researchers' claims of increased emotional control and regulation of positive and negative memories could be equally attributed to the Sisters' progress in a life of simplicity. However, if memory distortion results from selective recall in older adults, the theory of a regulated cognitive control system developing with increasing age seems quite feasible.

Any such cognitive control system would be subject to practice effects as the individual became more expert and able to make finer evaluations between categories such as positive, negative and neutral (Eysenck, 2001). Also, because it takes time to learn evaluation, over the lifespan it is logical to expect a greater effect (Luthar, 2003). This is in line with the experiential bias theory proposed by Bryce (2005). She suggests that a positivity bias may develop through experience in dealing with real-world stimuli, with a cognitive control system comparing memories stored in LTM with current stimuli being manipulated in WM. In a qualitative study of the meaning of anxiety to healthy males and females aged 65-80 years, she found a consistent attitude of 'been there, done that': participants said they had successfully overcome previous negative events, such as financial struggles or ill-health,

and so gained confidence in their ability to deal with similar events in the future. Their previous experience thus served as a strategy for evaluating stimuli by a process of comparison (“is this as bad as what I coped with before?”). Bryce also found that goal-setting in older adults was motivated by both chronological and real-world limitations, a broader aspect which includes the views set out in socio-emotional selectivity theory (Carstensen, Isaacowitz & Charles, 1999).

1.4: Assumptions About the Positivity Effect

Current research has consistently found a positivity effect in the visual cognition of older adults, with a corresponding negativity effect in young adults, indicating that an automatic or controlled cognitive process is regulating their emotional responses (e.g. Carstensen & Mikels, 2005; Mikels, et al., 2005; O’Craven & Kanwisher, 2000). The strongest theory supporting this positivity effect is socio-emotional selectivity theory, which predicts that with increasing age, emotionally satisfying goals are prioritised, leading to a more positive than negative outlook in life (Carstensen, Isaacowitz & Charles, 1999). Mather and Knight (2005, p.554) speculate that this is because older adults choose to focus more on positive stimuli and less on negative stimuli, using a cognitive control system of preference for encoding positive information rather than negative.

Older adults also react more intensely to positive than to negative images, real or imagined (Mather, Canli & English et al., 2004). As an example, when older adults viewed a set of IAPS images, fMRI brain scans showed more intense activations for positive images than

neutral or negative images (Bush, Luu & Posner, 2000). In another experiment, fMRI brain scans found that brain activity for a perceived stimulus had the same force and magnitude as for an imagined stimulus, pointing to an emotional correlation between the two events (O'Craven & Kanwisher, 2000). Further strong evidence was found in an experiment which found that eye fixations on affective visual cues were stronger for central details than for peripheral details, suggesting that highly emotional stimuli would be more richly encoded than less emotional stimuli (Christianson, et al., 1991).

Experiential learning also impacts on the development of a positivity effect in a number of ways. For example, the evaluation of emotive images into valenced categories appears to be refined with aging. Another factor is that since a negatively reinforced judgement tends to be extinguished over time, a positivity bias may emerge over the lifespan (Lutz, 2005). Memory distortion with aging is also thought to give a positive bias to autobiographical memories (Kennedy, Mather & Carstensen, 2005). Similarly, successful life experience may inspire confidence in overcoming negative input (Bryce, 2005). Support for the positivity effect was also established in the Baltimore Longitudinal Study of Aging (Terraciano, McCrae, Brant, et al., 2005) which reported significant positive elevations to agreeableness in personality assessments over the course of 18 years.

1.5: Factors Impacting on the Positivity Effect

While strong evidence exists for a positivity effect in older adults, more research is needed into any negativity effect before generalisability may be assumed. For example, studies

using verbal rather than visual affective stimuli report a memory enhancement in older adults for the recall of negative information, suggesting different cognitive control systems for visual and verbal recognition (Denberg, et al., 2003; Kensinger, et al., 2002). Another study which used verbal stimuli found no affective bias in older adults, casting doubt on the value of using only visual stimuli to make assumptions (Gruhn, Smith & Baltes, 2005). These factors could undermine both socio-emotional selectivity theory (Carstensen, Isaacowitz & Charles, 1999) and theories of experiential bias (e.g. Bryce, 2005; Kennedy, Mather & Carstensen, 2005). However, the fMRI evidence of higher arousal in the brain for positive rather than neutral or negative images, and for highly emotional versus non-emotional words, is difficult to refute.

Empirical evidence points to a regulatory cognitive control system that may or may not lead to a positivity effect, given that visual and verbal affective cues appear to prompt opposing responses from older adults (e.g. Denberg, et al., 2003; Kennedy, Mather & Carstensen, 2005; Mikels et al., 2005). Such a control of selective attention to affective stimuli, encoding into WM and retrieval from LTM, would offer opportunities for any bias to form, but investigations into age-related changes in memory (e.g. Hultsch, 1998; Schaie, 2000) offer no information on specific decline at the attentional or encoding stages of cognition. Perhaps a cognitive control system diminishes negative stimuli simply because they require more elaborative processing than positive (Blanchard-Fields, 2005). Research currently offers no explanation of the core set of strategies required to evaluate between neutral, positive and negative images: they may be subject to a cognitive control system, physiological decline, or any other unknown factors.

It is also possible that the positivity effect is one of the compensatory strategies of evaluation practised by older adults, such as selective optimisation (Freund & Baltes, 2002), with the selection process being a controlled subjective judgement, rather than an automatic emotional decision. If so, the IAPS ratings of emotional intensity are missing the cause of the positivity effect, because it is not known whether evaluation of neutral, positive and negative stimuli is automatic or controlled. Current research with the IAPS tends to focus on the maintenance of intensity of emotion in WM (e.g. Mikels et al., 2005), rather than investigating the encoding and memory retrieval processes of cognition: suppositions such as positivity or negativity effects should be disconfirmed before general acceptance. Furthermore, vision cognition research suggests that age-related declines (Giambra, et al., 1995; Hutsch et al., 1998) could affect the retention and recognition of visual cues, undermining claims of a positivity effect in studies using the IAPS. It appears that comparative studies focused on attention and encoding rather than just memory, such as the current study, could be valid methods of investigating emotional cognition.

1.6: The Study

Strong evidence from empirical sources indicates that older adults have a more positive attitude than younger adults (e.g. Mather & Carstensen, 2005; Mikels et al., 2005; National Institute on Aging, 2006), but reasons for this positivity effect are unclear. Selective attention to both visual and verbal stimuli has been investigated, with disparate results. Nor is it clear whether a positivity effect impacts just on the self-identity of older adults or if it affects their whole worldview. This project investigated differences between younger and

older adults by comparing their responses in a subjective (direct emotion) and an objective (indirect emotion) condition. These two conditions were possible indicators of the way older adults see themselves and their world, with ratings of the neutral, positive and negative images providing evidence of any positivity effect.

The study compared the responses of young and old adults to empirically validated visual cues of emotional arousal, using an experiment in two parts to investigate the presence of any positivity effect in the samples. The two groups were aged 18-30 and 65-80, with sufficient numbers to enable between-subject and between-group comparisons. In Part 1, half of each group were in the Valence (direct emotion) condition, and the other half in the Paper Headline (indirect emotion) condition. The Valence condition examined the subjective intensity of affective reactions, as participants responded to the valence, arousal and dominance of neutral, positive and negative IAPS visual stimuli. The Paper Headline condition avoided the word emotion, to prevent demand characteristics, asking instead for a response to the images as if they were on the front page of a newspaper. These two conditions sought to capture participants' immediate emotional reactions to a set of 60 IAPS stimuli at the attentional stage, providing written evidence of affective encoding. Part 2 of the experiment asked all participants to review another set of 60 IAPS stimuli, noting which were previously seen and which were novel images. This recognition task was intended to reveal any bias in the encoding specificity of LTM. The direct comparison between older and younger adults was expected to highlight any differences in retrieval accuracy as a possible result of cognitive decline, as well as any bias in retrieval of valenced images.

The theories reviewed above suggest that older adults use a cognitive control system of motivated attention to enhance positive and diminish negative information (e.g. Carstensen & Mikels, 2005; Mather and Carstensen, 2005; Mather & Knight, 2005; Mikels et al., 2005). Consequently, it was expected that in Part 1 of the current experiment, older adults would demonstrate a higher intensity rating for positive images than for neutral or negative images, and that in Part 2, they would recognise more positive than neutral or negative images. The whole study was designed to examine aging and positivity through a cognitive comparison of the way young and old adults respond to neutral, positive and negative visual images. It attempted to break down cognition by function, comparing differences between the age groups in encoding and memory retrieval.

1.7: The hypotheses

Part 1

H_{1V} = Older adults will report a different reaction from young adults when they rate a series of novel positive, negative and neutral valenced images.

H_{1V0} = There is no difference between the reported reactions of young and old adults when they rate a series of novel positive, negative and neutral images.

H_{2PH} = Older adults will rate a series of novel positive, neutral and negative images for a newspaper front page photo differently than young adults.

H_{2PH0} = Older adults will rate a series of novel positive, neutral and negative images for a newspaper front page photo the same as young adults.

Part 2

H_{3R} = Older adults will recognise a different ratio of positive, neutral and negative images than younger adults in a series of images.

H_{3R0} = There is no difference between older and younger adults' recognition of a series of positive, negative and neutral images.

CHAPTER 2

RESEARCH METHOD

2.1: Participants

The opportunity sample for this study was recruited through university classes and by personal approach to the managers of local retirement villages. Sixty women voluntarily took part in the experiment: thirty younger adults aged between 18 and 30 (mean age = 24 years) and thirty older adults aged between 65 and 80 (mean age = 73 years). The participants had normal or corrected vision, with English as a first language, and had no cognitive deficiency likely to affect the outcome of the experiment. All participants were allocated alternately to either the Valence or Paper Headline task. A gift voucher for NZ\$5 was given to each participant in appreciation of the forty-five minutes taken to complete the experiment.

2.2: Apparatus

The younger adults came either alone or in pairs to the university psychology laboratory, where IBM computers with 17" monitors were used to present the IAPS stimuli. The older adults came singly to a quiet room made available in their retirement villages, where a Compaq laptop computer with a 15" wide screen was used to present the IAPS stimuli. Images were presented as a timed PowerPoint slide show with each image presented for 5 seconds, followed by its number presented on a blank background for 15 seconds before the next image appeared.

Booklets of Self-Assessment Manikins (SAMs; Lang, 1980; cited in Lang, Bradley & Cuthbert, 2001) were used to capture the intensity of participants' reactions to the visual cues (please refer to Appendices 5 and 6). These SAMs are graphic representations of a line of manikins, presented in 1 – 9 Likert scale format, over which the participant puts a tick to indicate their reaction to the stimulus. Each page in the booklet has 3 columns of manikins, with 10 lines in each. In this experiment, every participant was given an 8-page rating booklet, made up of the PANAS scale on the front page, with 4 practice IAPS ratings, followed by 6 pages of SAMs numbered 1-60 used for Part 1. The recognition task for Part 2 was on Page 8 of each booklet: it had 3 columns numbered 1-60, with a space for a tick or cross to report whether the image was previously seen or novel.

The first task in Part 1 was Valence (direct emotion). It had labels above the 3 SAM columns to indicate where a participant should rate the images for Valence, Arousal and Dominance – these are the standard IAPS ratings (please refer to Appendix 5). The second task was Paper Headline (indirect emotion). This rated the same IAPS images but had different labels above the 3 SAM columns to indicate a participant's rating as Likeable, Eye-catching and Appropriate, if they were used as a 'newspaper headline' front page photo (please refer to Appendix 6). The terms chosen for labels were intended to measure the same emotional intensity in both tasks, but from a different perspective. The subjective/objective equivalent ratings were valence/likeable; arousal/ eye-catching; and dominance/appropriate. In all other respects, the booklets were the same.

The 10-minute distracter task presented between Part 1 and Part 2 of the experiment was a puzzle (please refer to Appendix 4). A four-piece set of plastic shapes was required to be put together into various letter shapes, with verbal instructions that there was no pressure to complete these, it was simply for fun.

The International Affective Picture System (IAPS; Lang, Bradley & Cuthbert, 2001) is an instrument designed to measure an individual's attentional and emotional response to affective visual stimuli. Its format is a range of 700 high quality colour images which are considered to have neutral, positive or negative content, reflecting the emotional reactivity of the individual to the images. Emotional intensity ratings may be self-reported in the SAM booklets, with a possible range of score values for each image being 1 to 9. The IAPS has been in use for ten years, with reliability norms based on rating results forwarded by researchers using the system.

The Positive and Negative Affect Schedule (PANAS; Watson, Clark & Tellegen, 1988) was used in this study to examine whether there was any difference between the moods of the two age groups, to rule out mood as a confounding variable in the outcome. The PANAS has a Cronbach's coefficient α ranging from .86 to .90 for positive affect and from .84 to .87 for negative affect. The scale was normed on a wide sample ($N =$ approximately 4,000) but non-specific data is given, without the ages of participants. Median test-retest reliability after an 8-week interval is .68 ($N = 101$) although split-half

reliabilities are not reported. The PANAS is assumed to be a reliable, valid, and efficient means of measuring affect.

2.3: Stimuli

The 60 IAPS images selected for this experiment conformed closely to the normative mean and standard deviation ratings given for female adults, in order to enhance reliability. The selected means were neutral 4-6; positive 7- 9; and negative 1-3 (please refer to Appendix 3 for a complete list of images selected). For Part 1, 20 neutral, 20 positive and 20 negative images were randomly presented in a PowerPoint slideshow, while participants rated the intensity of their reactions from 1 to 60 in the SAM booklets. In Part 2, half of the previously seen images were replaced by novel images, with 20 neutral, 20 positive and 20 negative images again randomly presented in a PowerPoint slideshow. Participants responded with a tick in the booklet if they recognised the image as being previously seen, and a cross if they thought it was a novel image.

2.4: Procedure

An information sheet detailing the background and purpose of the study was given to each participant at the time of recruitment (see Appendix 1). At a prearranged time, participants were welcomed to the quiet room, and again assured of anonymity. The experimental procedure was briefly explained, and informed consent was gained before proceeding (see Appendix 2). Participants were individually tested, sitting at a table in front of a computer the whole time. Instructions were given verbally, and then the

practice images were presented, allowing participants to learn how to use the SAM rating booklet. After the PANAS scale was completed, the procedure began. The researcher sat beside each participant until they were comfortable with synchronising the SAM ratings with the stimulus presentations, then remained unobtrusively nearby, in case the participant needed assistance with erroneous ratings or timing.

Each image was viewed for five seconds, with a plain numbered prompt onscreen for the next fifteen seconds, allowing the rating sheet to be completed. At the end of Part 1, the participants were invited to play with the puzzle for ten minutes, making up letters from the four pieces. During this time, the sequence for Part 2 was opened on the computer ready to begin but with a blank screen displayed. The recognition task generally took under two minutes, since participants responded very quickly to the stimuli, preferring to fast-forward to the next image rather than follow the 15-second intervals between them.

After completing the experiment, participants were thanked for their contribution to psychological research and handed a NZ\$5 gift voucher in appreciation. A brief explanation of the purpose of the study was given, with particular reference to the effect of visual imagery on recall, and the possibility of a positivity effect on attention and memory.

Results were later entered into a Microsoft Excel spreadsheet, and then transferred to an SPSS spreadsheet for analysis.

CHAPTER 3

RESULTS

To simplify presentation of the results of Part 1 of this experiment, the data is shown as comparisons of ratings between young and old adults in the Valence (direct emotion) task and the Paper Headline (indirect emotion) task, with three questions in each. Then Part 2 presents results of the Recognition task, with an examination of the response bias in participant errors. When Mauchly's Test of Sphericity was violated, the Greenhouse-Geisser criterion was adopted, otherwise sphericity is assumed throughout.

3.1: The PANAS scale

The PANAS ratings for both younger ($M = 19.3$) and older adults ($M = 18.9$) were similar, confirmed by a non-significant independent samples t-test: $t = .174 (58)$, $p = n/s$. Any differences found in Parts 1 and 2 are thus more likely to result from age-related changes in attention and encoding than from age-related differences in mood or attitude.

3.2: Part 1 – Valence: direct emotion task

Three Analysis of Variance (ANOVA) analyses were performed, to show the interactions of the three questions in each of the Valence conditions, between the young and old adult groups.

1. Valence. The first question was Valence, which was scored 1 = pleasant, up to 9 = unpleasant. For young adults the mean intensity scores were: neutral = 4.753 ($sd .209$);

positive = 2.628 (*sd* .191); and negative = 7.711 (*sd* .222). For old adults the mean intensity scores were: neutral = 4.403 (*sd* .209); positive = 2.260 (*sd* .191); and negative = 6.930 (*sd* .222) (please refer to Figure 1).

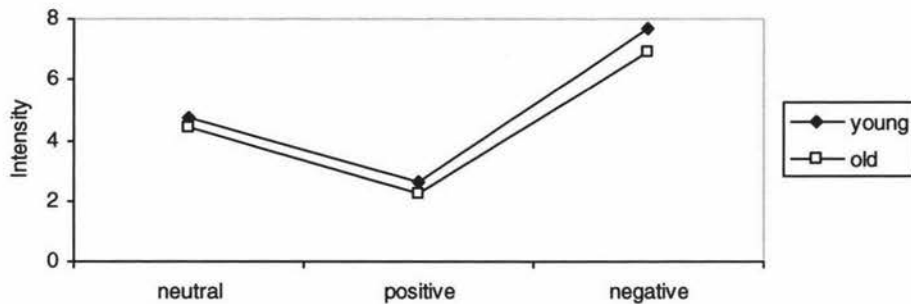


Figure 1: Comparison of groups in Valence task: Valence.

Visual inspection of the results suggested that neutral, positive and negative photos were rated similarly by both groups, but older adults rated all the images as more pleasant than young adults. To examine this further, the data was subjected to a repeated measures ANOVA . A significant main effect was found for the between-subjects factor of age (young and old): $F = 6.415 (1, 28)$, $p = .017$. There was also a significant main effect for image (neutral, positive and negative): $F = 336.669 (2, 56)$, $p = .0001$, showing that all participants rated positive images more positively than negative, with neutral images in between. There was no significant interaction of age and image.

2. Arousal. This question was scored 1 = aroused, up to 9 = calm. For young adults, the mean intensity scores were: neutral = 5.900 (*sd* .1.399); positive = 5.948 (*sd* .1.438); and negative = 3.949 (*sd* .1.017). For old adults, the mean intensity scores were:

neutral = 6.377 (*sd* .1.399); positive = 6.462 (*sd* .1.438); and negative = 4.276 (*sd* 1.535)

(please refer to Figure 2).

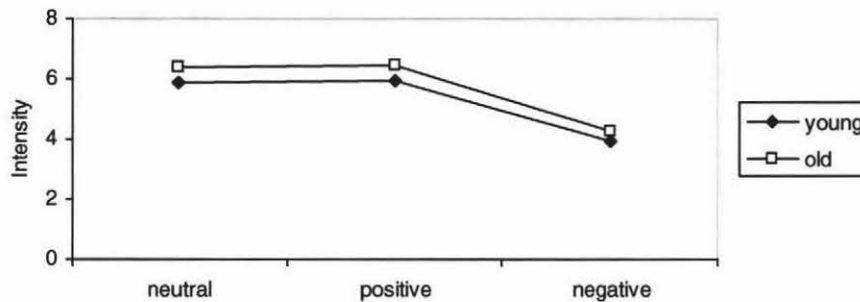


Figure 2: Comparison of groups in Valence task: Arousal

With a high intensity rating indicating less arousal, the data showed that older adults felt calmer than young ones when viewing all the images. The ANOVA showed a main effect for age: $F = 1.288 (1, 28)$, $p = .266$. There was also a significant main effect for image: $F = 50.374 (1.482, 56)$, $p = .0001$. Pairwise comparisons revealed this occurred as significant differences between neutral and negative, and positive and negative. There was no significant interaction between age and image.

3. Dominance. This question was scored 1 = in control, up to 9 = dominated. For young adults, the mean intensity scores were: neutral = 6.297 (*sd* 1.023); positive = 6.558 (*sd* .1.043); and negative = 4.025 (*sd* .999). For old adults, the mean intensity scores were: neutral = 5.600 (*sd* .3.204); positive = 5.835 (*sd* .3.266); and negative = 4.483 (*sd* 2.888) (please refer to Figure 3).

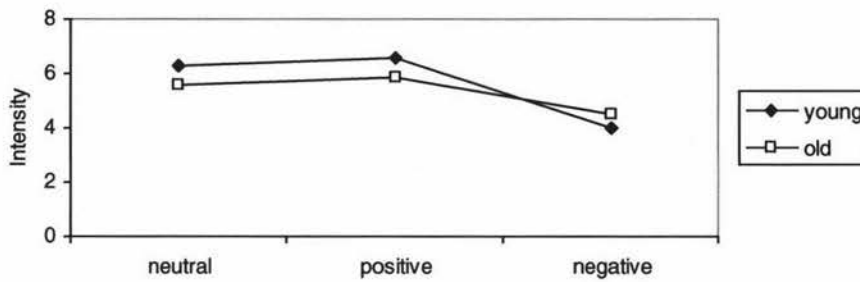


Figure 3: Comparison of groups in Valence task: Dominance.

In the Dominance question, ratings for old adults showed they felt more in control of neutral and positive images, but felt more dominated by negative images than young adults did. The ANOVA revealed no main effects for age or image. A significant interaction of age and image was confirmed by the ANOVA, where $F = 47.199$ (1.487, 56), $p = .0001$.

Summarising the results so far, ANOVAs on the Valence (direct emotion) task ratings revealed main effects for age in the Valence and Arousal questions, with the older group rating images as more pleasant and remaining calmer, and a significant interaction of age and image in the Dominance question, with older adults less dominated apart from the negative images. The population means were demonstrably not equal, with significant differences between older and younger adults in the way they responded to the series of valenced images.

3.3: Part 1 - Paper Headline: indirect emotion task

As before, three ANOVAs were performed to show the interactions of the three factors in each of the Paper Headline conditions, between the young and old adult groups.

4. Liking. The first question asked “Would you like to see this image as a front page photo?” This was scored 1 = yes, up to 9 = no. For young adults the mean intensity scores were: neutral = 6.337 (*sd* .299); positive = 4.498 (*sd* .332); and negative = 6.013 (*sd* .337). For old adults the mean intensity scores were neutral = 6.310 (*sd* .299); positive = 3.898 (*sd* .332); and negative = 6.800 (*sd* .337) (please refer to Figure 4).

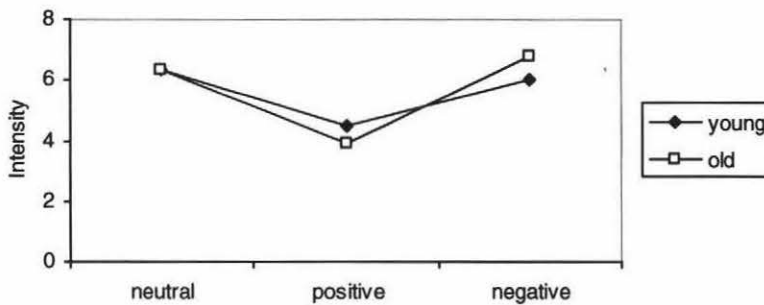


Figure 4: Comparison of groups in Paper Headline task: Liking

The results reveal that both groups rated neutral images similarly. However, the old adults wanted to see more pleasant and less unpleasant photos than the young adults. An ANOVA was performed to examine these differences, finding no main effect for age, but there was a main effect for image: $F = 47.432 (2, 56), p = .0001$. The ANOVA also found a significant interaction for age and image: $F = 3.678 (2, 56), p = .032$, suggesting that

older adults felt more in control of the images than young adults, except for the negative images.

5. Eye-catching. The second question asked “Is this photo eye-catching?”, which was scored 1 = yes, up to 9 = no. For young adults the mean intensity scores were: neutral = 6.170 (*sd* 1.106); positive = 4.192 (*sd* .750); and negative = 3.241 (*sd* 1.020). For old adults the mean intensity scores were neutral = 6.027 (*sd* .958); positive = 3.481 (*sd* .721); and negative = 4.438 (*sd* 1.186) (please refer to Figure 5).

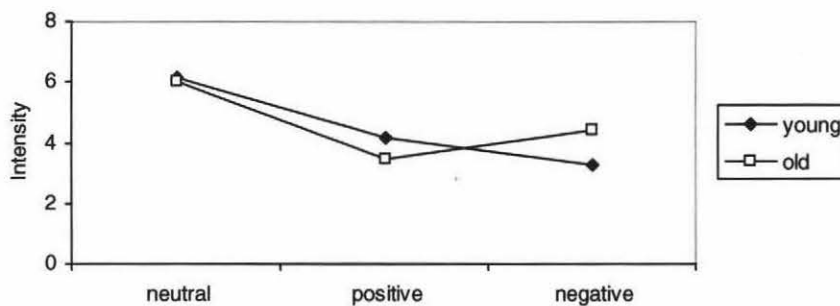


Figure 5: Comparison of groups in Paper Headline task: Eye-catching.

Figure 5 shows that both groups rated neutral images similarly and as less eye-catching than the other images. The older adults rated positive images as more eye-catching than the younger adults did. Younger adults, by contrast, rated negative images more eye-catching than older adults. Age was not found to be significant, but there was a main effect for image: $F = 66.720$ (1.660, 56), $p = .0001$. The ANOVA also revealed a significant interaction of age and image: $F = 9.413$ (1.660, 56), $p = .001$.

6. Appropriate. The third Paper Headline question asked “Is this photo appropriate?”, which was scored 1 = yes, up to 9 = no. For young adults the mean intensity scores were: neutral = 5.307 (*sd* 2.0); positive = 5.989 (*sd* 1.714); and negative = 5.156 (*sd* 1.425). For old adults the mean intensity scores were neutral = 3.67 (*sd* 1.132); positive = 5.368 (*sd* 1.462); and negative = 4.4 (*sd* 1.249) (please refer to Figure 6).

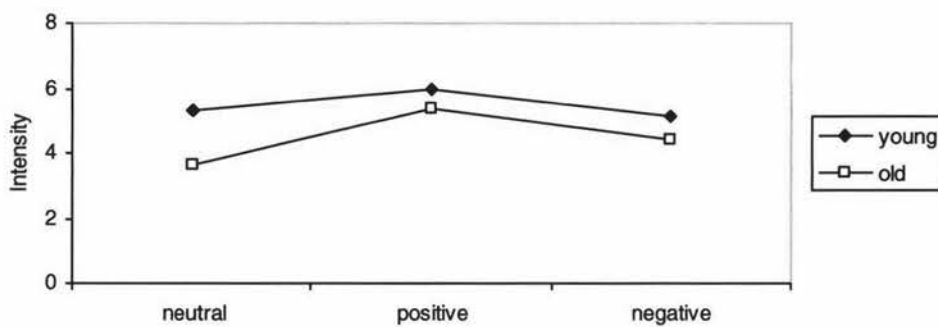


Figure 6: Comparison of groups in Paper Headline task: Appropriate.

A low intensity score shows that the participant thought the photo was appropriate as a newspaper front page photo. Figure 6 shows that young adults rated all the images as less appropriate than older adults, particularly neutral images. An ANOVA performed to investigate the differences showed a main effect of age, $F = 4.609 (1, 28), p = .041$. A second main effect for image, $F = 2.230 (2, 56), p = .117$, suggests that older adults found positive images significantly more preferable than neutral or negative. Pairwise comparisons for image revealed a significant difference between neutral and positive images. There were no significant interactions of age and image.

Summary of Part 1

The Valence (direct emotion) task had three questions which attempted to capture the same emotional intensity as the Paper Headline (indirect emotion) task. This summary compares results from the two sets of questions.

The first question set refers to Valence and Liking (please refer to Figures 1 and 4). For Valence, older adults rated all the images as more pleasant than younger adults. In the Paper Headline task, although older adults rated positive images higher than young adults, they also rated negative images lower than young adults. In both tasks, neutral images were rated in a similar way, showing little difference between groups. For Valence, there was a main effect for age, but none for image: nor was there an interaction (Figure 1). For Liking, the comparable indirect emotion question, the ANOVA revealed a main effect for image, and a significant interaction of age and image (Figure 4). Overall, older adults were more positive about negative images, but wanted to see them less than the young adults.

The second question set (please refer to Figures 2 and 5), was Arousal and Eye-catching. Figure 2 shows that the older adults rated all images as less arousing than young adults, indicating an overall calmness. In Figure 5 however, the main effect for image indicates that while neutral images were less eye-catching than others, older adults thought positive images were more eye-catching, and negative images less eye-catching, than did their

younger counterparts. Also, the significant interaction in Figure 5 suggests that older adults find negative images less eye-catching than do young adults. The Arousal question showed a main effect for age, but no other significant results. This may be compared with the Eye-catching question, which showed a main effect of image, and an interaction for age and image. The comparison of arousal and eye-catching again suggests that old adults were more positive about negative images than young adults.

The last question set was Dominance and Appropriate (please refer to Figures 3 and 6). In the Dominance (direct emotion) task, ratings for neutral images were higher in both groups than in the appropriate (indirect emotion) task. For both questions, older adults rated positive images higher than younger adults. After that, older adults rated negative images as more dominating, but more appropriate, than young adults. The ANOVA analysis revealed no main effects for Dominance, but there was a significant interaction between age and image. For the Paper Headline task Appropriate, there were main effects for both age and image, but no significant interactions. This comparison shows that the direct emotion ratings are again significantly different from the indirect emotion ratings.

While the differences between the groups' reactions to the neutral, positive and negative images were of interest, the focus of the hypotheses was on the statistically significant differences between the age groups. Main effects for age were found in questions 1, 2 and 6; main effects for image were found in questions 4, 5 and 6; and interactions of age and image were found in questions 3, 4, 5 and 6. Consequently, both null hypotheses of 'no

difference' between old and young adults were rejected, and the experimental hypotheses, that 'older adults will report a different reaction from young adults when they rate a series of neutral, positive and negative valenced images' were accepted.

3.4: Part 2 - Recognition task

The recognition sequence was made up of 30 old and 30 new images, with 20 each of neutral, positive and negative photos. The task was to identify the images as previously seen (scored, seen = 1) or novel (scored, novel = 0). Preliminary visual inspection of the data showed that older adults made more errors than young adults when recognising negative images, but both groups rated neutral and positive images similarly. This unexpected finding prompted an examination of the wrongly recognised images since it suggested a response bias could account for the difference in recognition of negative images. A response bias refers to an individual's tendency to use one or other of a forced choice when uncertain of the correct answer.

The results are shown in terms of Signal Detection Theory (SDT; Wild & Seber, 2000) which measures sensitivity and bias in two independent variables, as hits and false alarms. A hit occurs when a stimulus is present and the participant states it is there. A false alarm occurs when a stimulus is not present, but the participant states that it was. Using SDT, it is expected that d' , the distance between the two z-scores, indicates a response bias between two variables – the neutral, positive or negative images (Wild &

Seber, 2000). The d' for the Recognition task was calculated as $d' = z(\text{hits}) - z(\text{false alarms})$ for each group. Please refer to Table 1 for the calculations of d' scores.

Group	Neutral	Positive	Negative
Young - hits	4.281	4.351	3.950
Young - false alarms	.719	.649	1.050
Young - d' score	3.562	3.702	2.900
Old - hits	4.100	4.082	3.131
Old - false alarms	.900	.918	1.869
Old - d' score	3.200	3.164	1.262

Table 1: Calculation of d' from the z-scores of young and old adults.

Following SDT practice, z-scores of the hit (mean accuracy) ratings were used to compare the responses of young and old adults across the three factors of neutral, positive and negative (please refer to Figure 7).

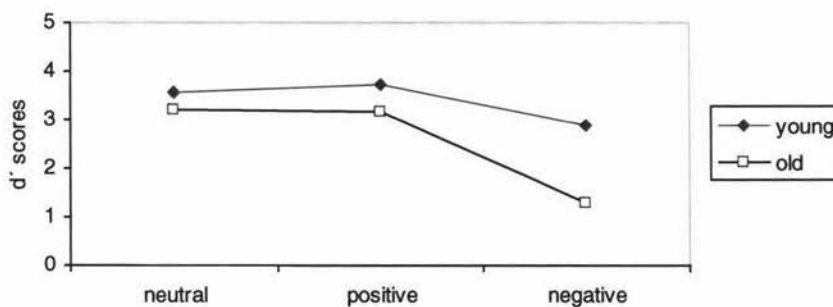


Figure 7: Between-group differences in recognition shown as d' scores.

The comparison of the results of d' scores in Figure 7 shows recognition of neutral and positive images for both groups was high, but accuracy was significantly lower for the older group with negative images.

Summary of Part 2

The results of the Recognition task were analysed using SDT, which revealed that young adults' recognition of all the images was higher than old adults'. Examination of the hits data (please refer to Table 1) showed that young and old adults both had high hit rates when recognising novel neutral and positive images, but that old adults had a pronounced high error rate in recognising negative images.

Since the overall accuracy rate was very high for both young and old adults, the results of Part 2 should be used with caution. Both groups performed close to maximum level, thus a ceiling effect impacts on the reliability of the d' analysis, due to the low variance in the z-scores (range of difference = 4.2%). However, young adults did recognise a different ratio of neutral, positive and negative images from older adults, so after examining all the results, the null hypothesis of 'no difference' was rejected and the experimental hypothesis was accepted.

CHAPTER 4

DISCUSSION

The aim of this experiment was to investigate whether there is a positivity effect in older adults when compared to younger adults. It was prompted by studies based on socio-emotional selectivity theory which have already established this effect, but extended them to issues of encoding and memory retrieval (e.g. Isaacowitz, Charles & Carstensen, 2002; Mikels et al., 2005; Mather & Carstensen, 2005). The older adults did demonstrate a positivity effect, but it arose from diminished response to negative stimuli when compared to younger adults, rather than the enhanced response to positive stimuli that was expected. The discussion is focused on data gained from the IAPS ratings, since the PANAS results were not significant, merely indicating that attitude was not an influential factor in either age group. Results are discussed in the light of previous research and theory, firstly as a comparison of the subjective and objective tasks, then the recognition task, followed by issues arising from the study and the conclusion.

4.1: Part 1 - Valence and Paper Headline Tasks

Older adults in this study demonstrated a positivity effect, as found by previous research based on socio-emotional selectivity theory and using the IAPS (e.g. Isaacowitz, Charles & Carstensen, 2002; Mikels et al., 2005; Mather & Carstensen, 2005): however, analysis revealed that the effect came from diminished attention to negative rather than the expected enhanced attention to positive stimuli. The tasks in Part 1 were expected to use

WM, a memory system reported to have only a slow decline until the mid-70s, to perceive, evaluate and report rating options in writing (Mikels et al., 2005).

Consequently, differences between the two age groups were thought to be based on encoding, rather than age-related changes to memory. ANOVAs confirmed statistically different ratios of emotional intensity both between-subjects and within-subjects across the two tasks, with significant interactions in some questions. Accordingly, both null hypotheses in Part 1 of 'no difference between young and old adults' were rejected.

One of the challenges in the design of this experiment was to maximise construct validity in the two tasks in Part 1, while conforming to the emotional validity of the SAM rating booklets (Lang, 1980; cited in Lang, Bradley & Cuthbert, 2001). The original labels measured emotional intensity for the subjective Valence task, intended to reflect the way that participants saw themselves: these were expanded to reflect an objective viewpoint in the Paper Headline condition, while still conforming as far as possible to the same emotional intensity. Replacing the personal emotional quotient with a considered value judgement of what participants considered to be emotionally interesting was intended to reflect the way they saw their world. The subjective/objective equivalent ratings were valence/suitability; arousal/ eye-catching; and dominance/appropriate (please refer to Appendices 4 and 5). It appeared that these sets of labels were functional, since all the participants were able to complete their tasks within the allotted time of 20 seconds, although the Paper Headline task was more cognitively demanding, requiring a higher degree of evaluation and categorisation. However, it is possible that individuals

interpreted the labels in the Paper Headline task in different ways, rating the images according to their subjective interpretation. This would of course impact on any finding of a positivity effect in this experiment.

Moving on to discuss the first comparable question set in Part 1, Valence and Liking (please refer to Figures 1 and 4), the data showed that age was having an effect on the intensity ratings, but this effect depended on whether the image was neutral, positive or negative. The older adults appear to be more positive about negative images than younger, but choose to avoid them. Interpreting this result, it seems that Valence captures the emotion, while Liking indicates the behaviour. It had been expected that the results would be similar across the tasks, but these opposing results immediately aroused interest over the participants' perception of themselves and others. Both groups rated neutral images higher than positive in this objective condition, suggesting a surprisingly high level of acceptability for prosaic images in the media.

This self-reported evidence of affective encoding captured participants' immediate emotional reaction to the stimuli at the attentional stage. The result supports previous experiments based on socio-emotional selectivity theory, demonstrating that older adults attend to more positive than negative information (e.g. Charles, Mather, & Carstensen, 2003; Mather & Carstensen, 2005; Mikels, et al., 2005). This difference in evaluation and judgement shown by the older adults perhaps reflects a wish to experience the world as a more positive place. They cope with negative stimuli better than young adults, seeming to

want to maximise positive experiences, as suggested by socio-emotional selectivity theory (Carstensen & Mikels, 2005; Mather & Knight, 2005). In line with this theory, the old adults demonstrated cognitive control and emotional selectivity through their reactions to the images.

However, the effect could be a confound of the self-reports: participants in the direct emotion task might rate what they feel at the time, but when it comes to the indirect emotion task, they report feeling something different, perhaps to fit in with social norms. The main effect was for age in Valence (see Figure 1) and image in Liking (see Figure 4) which supports this explanation for the inconsistent responses. For whatever reason, it seems that the older adults are regulating their emotions into a bias away from negative input. Reflexively, it would appear that the young adults are just as successful at regulating their responses into a negative frame, casting doubt on any assumption of a cognitive control system developing purely as a function of aging.

Although the intention in the second question set was to measure subjective and objective ratings of arousal, the disparate results suggest that perhaps the labels were confusing, or else the participants reacted very differently to direct and indirect emotion tasks (please refer to Figures 2 and 5). It can be seen that while old adults were calmer in the Arousal task, in the Eye-catching task they became more volatile, rating negative images more intensely unpleasant than young adults. Consequently, it was interesting to see that young adults rated negative images as most eye-catching, suggesting their worldview is one

where negative visual stimuli are welcome. These results seem to go beyond socio-emotional selectivity theory into experiential theories, because a process of cognitive control was needed to categorise the images. This implies a judgment decision based on criteria of previously seen stimuli stored in LTM (Eysenck, 2001; Lutz, 2005).

Initial evaluation of ratings of Arousal suggested that emotional self-regulation may improve as a function of aging, but then the data from the Eye-catching question suggested there may be another explanation: older adults could be actively against unpleasant photos in the media to shield others from negative stimuli. This supports the assertion by Mather and Carstensen (2005) that older adults regulate their world into a pleasant place, which in turn reflects back on their subjective viewpoint of staying calm. Thus the subjective and objective tasks, despite their significantly different ratios of emotional intensity, still point to a cognitive control system of positivity in older adults and negativity in younger adults.

Increased regulation with age is part of socio-emotional selectivity theory, which claims that as chronological age increases, attentional resources select and evaluate perceptual input, leading to a lowered overall arousal level (Mather & Carstensen, 2005). The existence of an age-related regulatory system is suggested by the overall calmness of old adults compared with the young adults. In line with previous research, it appears that there is an automatic or controlled regulation of attention, implying a subsequent influence on encoding. This regulation could be a result of experiential learning leading

to emotional practice effects, with an eventual lowering effect on arousal (Bryce, 2005; Lutz, 2005). It could also be suggested that regulating arousal is a compensatory mechanism for saving emotional and cognitive resources, in the process known as selective optimisation with compensation (Freund & Baltes, 2002). Whatever the explanation, the enhanced calmness exhibited by older adults suggests a cognitively controlled evaluation process which regulates arousal after a stimulus has been attended to. Whether this regulation is automatic or controlled is presently unclear.

The last question set in Part 1 was intended to explore the emotional dimensions of Dominance and control, with the Paper Headline label asking participants how Appropriate the images would be as a front page photo. Unfortunately, it seems the results were confounded by the labels: many participants queried the concept of images dominating or controlling them, so perhaps these psychological concepts and terms are unsuitable for self-reports. With hindsight, the Appropriate question was also an inappropriate choice of words, leading to confusion in the limited time frame and with a forced-choice rating booklet. Wide standard deviations for older adults were found only in this Dominance question, hidden in a regression to the mean, but they suggest the older adults in particular may have had difficulty understanding what the question meant. It is impossible to know if the Dominance question in the standard IAPS rating booklets has provoked such wide standard deviations before, but the issue raises questions about validity for this factor. As responses to the subjective and objective conditions bore no

discernable relationship to each other, perhaps the wording of this question set failed to capture the desired response.

However, a consistent theme of regulating emotions into a state of calmness recurs in the responses of old adults. For example, older adults reported that they felt more in control of neutral and positive images, but felt more dominated by negative images, than young adults (see Figure 3) suggesting that they regulate their emotions into a calm median, without the highs and lows exhibited by young adults. Negative images appear to upset this equilibrium, perhaps leading to a strategy of avoidance, as they actively develop their cognitive ability to maximise a pleasant worldview. Such a strategy would extend the conclusions of current theories about optimising cognitive resources and goal-setting (Tulving & Schacter, 1990; Hultsch et al., 1998; Mikels et al., 2005) into a possible reason for the positivity effect.

The main effects for both age and image in the Appropriate question also support the idea of a cognitive control system influencing the different worldviews held by young or old adults. These differences could have been due to important cohort effects acting as confounding variables in the study: intuitively, young adults tend to be more intensely emotional about topics such as war and famine shown in the IAPS images. Alternatively, their more intense ratings could also be due to a 'spillover' effect (Mikels et al. 2005, p.548), caused by one emotion running into the next during the IAPS sequence. If older adults have a greater emotional regulation than young (Carstensen, Pasupathi & Mayr,

2000; Gross, Carstensen, Pasupathi, et al., 1997), then by implication they are less likely to have such a spillover effect. So while the results suggest that both young and old adults have a cognitive control system, the old adults seem to have better emotional regulation.

The unexpected differences between ratings for the subjective (direct emotion) and objective (indirect emotion) tasks may be linked this emotional regulation, again due to confounds such as period and cohort effects. Period effects for older adults may include emotional backgrounds of a 'stiff-upper-lip' and 'ladies should control their emotions', (the male equivalent would be 'big boys don't cry'), leading to emotional regulation through social expectations. Conversely, young adults are exposed to intense emotion in everyday life, with images of sexual exploitation, violence and bloodshed proffered as entertainment by the media. Supporting this, it has been shown that exposure to multiple negative images affects the anterior cingulate cortex – involved in the cognitive and emotional processing linked to attention – leading to de-sensitisation (Bush, Luu & Posner, 2000, p.215). This could explain why negative images were rated as more acceptable by young adults (Bruggerman & Barry, 2002; Bushman & Anderson, 2001). By contrast, old adults are more likely to have experienced real dramas, and rather than accept negative images, might intuitively avoid the emotion connected to such memories (Tulving & Schacter, 1990). Another important cohort effect is the physical decline of older adults: their pleasures are becoming confined to emotional satisfaction, such as grandchildren or home comforts, while young adults can still enjoy the physical pleasures

of sports and thrill-seeking. Finally, a cohort effect for young adults seeking knowledge about the world is that negativity is needed as part of the experiential learning process (Mather & Carstensen, 2005). Until further research explores the differences underlying these cohort and period effects, the criterion validity of the IAPS as a valid assessment of emotional reactions in all age groups can only be accepted, despite any evidence of affective differences between older and younger adults.

It appears from the results discussed so far, that both young and old adults use a cognitive control system to regulate their emotions. This regulation seems to affect their emotional responses before or during the evaluation and attention stages of the cognitive process, when WM is used to respond briefly to affective stimuli. The results suggest that older adults are able to cope with their emotions better than young adults by being more pleasant, more calm, and more in control of inappropriate stimuli. Older adults seem to wish to maximise positive input, and thus minimise negative input. Consequently, they feel more dominated by negative stimuli because they wish to actively diminish its effect on them.

4.2: Part 2 – Recognition

The second part of this experiment moved on from ratings of emotional intensity to the recognition of encoded data. The task in Part 2 was intended to reveal any bias in the encoding specificity of LTM by asking whether there was a difference between young and old adults' recognition of a series of valenced images. Recognition accuracy was

very high for all images, as shown by the z -scores (Previously seen: young $M = 4.194$; old $M = 3.771$. Novel: young $M = 4.12$; old $M = 3.701$). There were ceiling effects for positive and negative images, but the negative images showed a much poorer recognition rate for old adults; therefore, the old adults demonstrated a positivity effect consistent with their responses in Part 1. Consequently, the null hypothesis was rejected in favour of the experimental hypothesis.

It was expected that young adults would have better recognition of images than older adults, due to an unknown variable cognitive decline in LTM (Hultsch et al., 1998; Schaie, 2000). An age-related variable decline in vision cognition was also expected to impact on retention and retrieval (Hultsch et al., 1998). Off-setting this, it was thought likely that older adults would have better recognition skills from a lifetime of semantic associations, following the theory of disproportionate encoding for emotional stimuli (Bower, 1981; Lutz, 2005). The lack of between-subject statistical significance was not unexpected given the high hit rates in both groups, but it was surprising that there seemed little evidence of a positivity effect in older adults. However, the sensitivity index d' showed significant differences between subjects, particularly with the negative images (see Table 1). These results became exciting as further analysis of the d' revealed a pattern of false alarms by older adults consistent with their previous results of diminished recognition for negative images. A response bias was clearly implicated, validating the use of SDT.

The significant *t*-test for the interaction of age and image in the negative false alarms data (see Table 1) suggests that while older adults had the ability to remember neutral or positive images, they either forgot or failed to recognise negative ones. Conversely, the *d'* also revealed that young adults had more false alarms with positive images, meaning that they had a tendency to recognise negative images better. The finding that both groups could recognise neutral images (young *M* = 4.281; old *M* = 4.1) as accurately as positive ones may possibly be explained by a lack of ecological validity: the unusual environment and level of concentration required probably increased the attention participants gave to all stimuli, with a subsequent impact on encoding and later recognition.

The results of Part 2 make the findings of Part 1 more reliable. Since the recognition of images depended on LTM, the results suggest that there is a difference between the way old and young adults encode stimuli, pointing to an explanation of selective attention due to a cognitive control system. It appears that the participants had already recognised the stimuli, discriminating them into categories of neutral, positive or negative before any encoding, evidenced by retrieval from LTM in Part 2 of the experiment

An automatic cognitive process is the most likely explanation for the fast, low attention-demanding evaluation into categories by all participants in Part 1 of this experiment, and also for the fast, accurate recognition of encoded stimuli in Part 2. Automatic processing may be defined as 'fast, demanding zero attention, and unavoidable', developing from prolonged practice, and with a resulting inflexibility once the process is established

(Eysenck, 2001, p.155). Experience is a prerequisite for an automatic process, as in order to recognise and categorise brief visual stimuli, there must be a neural link to a previously perceived visual stimulus (Eysenck, 2001); for example, if one had never seen a photocopier, its use would be a mystery, but once having seen a computer, there would be an association of ideas about functionality. Automatic processing could reasonably influence selective attention to create the biases revealed in the results, although it fails to explain any shift from negative to positive bias.

An explanation for the controlled attention demonstrated in this experiment is therefore likely to be a cognitive link in LTM between the present and past emotional stimuli. This is explained in the spreading activation model of long-term memory, proposed by Bower (1981), who suggested that a lifetime of experience leads to more emotional nodes and thus sharper recognition of stimuli. The significant negative false alarms d' for older adults suggests that they have encoded them differently from the positive images. Again, this points to an automatic process of selective attention to particular images. Given the inter-related processes of attention and memory (Bower, 1981), past experience could reasonably impact on future evaluation of stimuli into valenced categories, leading to an affective bias in older adults.

4.3: The positivity effect

The results of this experiment argue for an emotional regulation by older female adults, leading to an enhanced acceptance of neutral and a diminished acceptance of negative

images, creating a positivity bias. This is supported by the results of Part 1, which suggested that old adults did not wish to see negative images, and Part 2, where the older adults showed a diminished recognition of encoded negative images from LTM. A bias may be described as a two-tailed moderator open to outside influence, rather than a quantifiable, universal, predictable effect. Since the term positivity effect has been widely accepted, however, it will be used here despite evidence disputing the definitions, predictability and generalisability of such claims. So the positivity effect in this experiment emerges not from an enhanced reaction to positive stimuli, but rather from a diminished reaction to negative ones. As a simile, it compares to a 'volunteer' being left to stand alone at the front of the parade, when everyone else steps backwards: one factor stands out, merely because the other has been diminished.

The most convincing explanation for this effect was offered by Lutz (2005), who pointed out that because negatively reinforced judgements tend to be extinguished, a positivity bias may occur. Consequently, it is likely that a longer lifespan of experience in evaluation offers opportunities for a positivity bias to form in older adults. An individual would consequently respond more to pleasant stimuli than unpleasant, resulting in a positivity effect by ignoring negative stimuli.

There is also strong support in this experiment for socio-emotional selectivity theory, which asserts that older adults will have a higher ratio of response to positive over negative stimuli (Mather & Carstensen, 2005, p.496). Rather than giving the expected

higher positive responses, however, the old adults showed diminished attention and recognition of negative images.

Alternative explanations for diminished attention by older adults to negative images should be considered. For instance, they could have neglected negative input because it was not important to them: this would mostly refer to semantic information, on the premise that young adults are information-seeking while old adults are pleasure-seeking (Mather & Carstensen, 2005). So they diminished negative input by giving less attention to negative stimuli while still considering neutral to be useful, resulting in an enhanced positivity effect. This would be understandable in the subjective task of Part 1, but not in the objective task. In the recognition task for Part 2 (please refer to Figure 9), the significant d' rating for negative images strongly suggests the low accuracy of older adults is related to diminished attention. Another explanation is that the forced-choice categories for the images could have affected the results: perhaps there is a continuum of negative to positive, which was an unavailable option in this experiment. Against this, research suggests that attention and evaluation are subject to practice effects, with greater ability to define categories and fewer 'grey areas' (Luthar, 2003). Furthermore, the 100% successful task completion in Part 1, plus the response bias recognised by SDT in Part 2, argue for a difference in encoding and memory retrieval in older adults rather than a hesitancy in categorisation or even cognitive decline.

Another explanation for a positivity effect is that normal aging may have biased the results. Distorted autobiographical memory, correlated with aging in normal healthy adults, is thought to lead to a positivity effect (Kennedy, Mather & Carstensen, 2005). Age-related changes in vision cognition may be discounted as a cause of the positivity effect, since priming effects and perceptual skills improve over a lifespan of experience (Tulving & Schacter, 1990). Moreover, an emotionally enriched lifespan will lead to greater recall for visual images in old age because of more neuronal links to visual memory stores (Lutz, 2005). It follows that pro-active interference from previously encoded affective stimuli could have impacted on the results, causing an experiential bias (Bryce, 2005). Similarly, retro-active interference could have affected any older participants with unrecognised cognitive decline during the ten minute distracter task, acting as a variable with unknown influence on LTM (Eysenck, 2001). The high recognition accuracy for all images in Part 2 implies that both WM and LTM were comparable across the age groups, again discounting cognitive decline as an explanation for any between-group differences.

The positivity effect may simply be another way of describing a personality shift towards agreeableness in older adults, as claimed by the Baltimore Longitudinal Study of Aging (Terracciano, et al., 2005). However, the results of the PANAS scale did not indicate any age-related differences in mood or attitude. Nor would a shift to agreeableness explain the differences between the subjective and objective ratings of emotion in Part 1 of this experiment. An agreeable attitude towards life would have shown in the results through

enhanced positive ratings for old adults, which did not happen. Similarly, over-compensating for a positive attitude could have shown as enhanced negative ratings, whereas these ratings were diminished (please refer to Figures 4, 5 and 6). So while age-related personality change may be partly responsible for the positivity effect, it still appears that a cognitive control system in the old adults regulates selective attention into non-negative stimuli, as proposed by socio-emotional selectivity theory (Carstensen & Mikels, 2005; Carstensen, Pasupathi & Mayr, 2000; Mather & Carstensen, 2005). Furthermore, physiological evidence strongly supports the suppression of negative emotion in the amygdala when an individual is engaged in a cognitive task (Whalen et al., 2006), an effect clearly demonstrated by older adults in the current experiment.

4.4 : Further research and considerations

This experiment has provided evidence to support the existence of a positivity bias in older adults, although the results showed that the effect was more of a non-negative than a positivity effect. By a cognitive control system of emotional evaluation, older adults appear to perceive themselves and their world 'through rose-tinted spectacles'. These findings raise a number of questions which could be addressed by future research.

Firstly, the subject of an affective bias in all age groups could be explored in depth, since studies using verbal affective prompts report a negativity or neutral effect in older adults (Denberg et al., 2003; Gruhn, Smith & Baltes, 2005; Kensinger et al., 2002). This could be related to cognitive decline for verbal cues compared with a memory distortion of

emotive images, yet research has not so far made comparisons between the two types of affective cues. If a positivity effect results from distortion to autobiographical memories (Kennedy, Mather & Carstensen, 2005) then by implication other stimuli are also likely to be distorted (Hultsch et al., 1998), an issue which has repercussions for LTM beyond normal aging and cognitive decline. Other issues concern the age range of the positivity bias, its clinical significance, and whether there are ways to reverse an undesirable negative attitude to conform to the positive outcome of this study. There is also a question regarding the limits of the positivity bias: do older adults gain in positivity ad infinitum?

A claim of a positivity effect based only on studies of older women (e.g. Kennedy, Mather & Carstensen, 2005; and the current study) leads on to the question of gender differences. Males may have different patterns of evaluation from females, based on gender issues, cultural values and social norms (Wetherall, 1999). So while positivity may influence the way older women see themselves and their world, it is not safe to assume that men have the same biased outlook: male attitudes to acceptable negative images, such as the 'Appropriate' question in the Paper Headline task, are more likely to follow the hegemonic masculinity common to Western society (Wetherall, 1999). Thus ratings for the subjective and objective tasks for both sexes would give a useful indication of any gender differences, with practical applicability for social and health care in older adults. In addition, cohort effects such as the 1945-55 baby boomers' independence and attitude of self-gratification (Everingham, 2003) suggests a surge of predictable changes

of national importance, such as reduced visits to health professionals, extra-mural education demands, and independent living for the oldest-old.

Other practical issues could arise from a positivity effect. Old adults may get very agitated about conflicts: unpleasant media issues such as gang warfare and child abuse, for instance, may cause distress because of a desire to avoid negative issues and focus on the positive. This could lead to a rejection of negative influences through avoidance techniques such as living in safe retirement villages, moving to the countryside away from urban stress, or even frequent 'spend the kids' inheritance' holidays. The enhanced tolerance of neutral stimuli demonstrated in this experiment suggests that older adults may choose to live with minor annoyances rather than create an unpleasant fuss: this emotional regulation could extend to personal health and safety issues and is consequently of major concern.

As this experiment was conducted with a limited all-female population, and a ceiling effect was found in Part 2, the results should not be generalised. The student participants in the 18-30 age group were chosen to replicate the samples of similar studies, for enhanced reliability (e.g. Bush, Luu & Posner, 2000; Carstensen & Mikels, 2005; Mikels et al., 2005). However, the sample of 65-80 year-olds were residents of private retirement villages and thus shared a particular socio-economic status and worldview, possibly lowering the objective validity of the Paper Headline task. It would therefore be productive to broaden the sample in future research of a similar nature, including adults

from different socio-economic and ethnic groups. It would also be useful to investigate whether a threshold exists for a change from negative to positive bias, by including at least one median age group for comparison.

The inclusion of the PANAS to give an indication of positive and negative affect for this experiment has not produced any significant gain to the validity of the results. Most of the participants found it confusing, not being used to Likert scales, and said the single word probes were too extreme to respond to comfortably. It might have been better to omit a psychometric test, or to use a more relevant one, such as the Satisfaction With Life Scale (SWLS; Diener, Larsen & Griffin, 1985). The SWLS focuses on global satisfaction rather than affect, which is perhaps more relevant to a study of the positivity effect.

Further research using qualitative analysis for a comparison of age groups could include questions about why the individuals responded with a particular intensity to neutral, positive or negative images. This experiment was limited to quantitative data, missing the richness of contrasting verbal responses to, for instance, the negative image of the plane crash: these included an old adult who said “oh good, the survivors are walking away” and a young adult who said “oh how terrible, those poor people”. Such clues to the cognitive systems of affect regulation are missed in a design which meets empirical guidelines for publication.

Finally, it should be noted that statistically significant results have no implications for practical or theoretical significance: the numerous journals referred to in this thesis would

not have published a non-significant result. Accepting the null hypothesis on the basis of statistical significance is therefore of questionable value in practical terms.

4.5: CONCLUSION

Overall, this experiment identified a positivity bias in older adults when compared with young adults. It strongly supports research by Mather and Carstensen (2005) and Mather and Knight (2005), who also found that older adults choose to focus more on positive stimuli and less on negative stimuli, using a cognitive control system of preference for encoding positive information rather than negative. The finding that older adults had a response bias against negative images also supports the socio-emotional selectivity theory of selective attention based on a limited lifespan (Carstensen, Isaacowitz & Charles, 1999), although older adults in the current experiment did not demonstrate the expected enhanced positive scores. Another finding was that older adults appear to regulate their lives into calmness compared with the slightly more volatile young adults, in line with the theory of selective attention to preferred stimuli based on previous experience, proposed by Lutz (2005).

Interpreting these results in the light of current theory, it appears that positivity is not just a memory distortion that happens with age; rather, it is a developmental trend in which the ratio of recall given to neutral and positive rather than negative events becomes more pronounced over the lifespan (Carstensen & Mikels, 2005; Mather & Knight, 2005). The ratio is undefined in this experiment, since although statistically significant, the

differences between young and old adults were interpreted as a series of responses to neutral, positive and negative images rather than a simple between-group comparison.

The experiment suggested that older female participants view themselves and their world more positively than their younger counterparts. Young female adults did not want to see negative images themselves, but were more accepting of them objectively. It appears, therefore, that the older adults see themselves and the world differently from young adults, which in turn affects everything in their life. This could impact on wider issues such as health care and independent living for older adults. However, it was suggested that the response bias found in older adults should not be generalised to a wider population because of the small sample, gender specificity and ceiling effects.

Further investigation into both positivity and negativity effects is needed before the acceptance of an age-related bias is given predictive validity. However, the outcome of this experiment supports and enhances existing theories about the positivity effect in older adults, extending them to issues of encoding and memory retrieval.

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APPENDIX 1

A comparison of attention and memory in older and younger adults.

Information Sheet

The Research

You are invited to take part in a research study, which compares attention and memory systems in older and younger adults. The research is being undertaken by myself, Jane Bryce, for my Master of Science thesis at Massey University. Doctor Heather Buttle, a cognitive psychologist at Massey University, is supervising this research.

I would like to meet with adults aged 18 to 30, and 65 to 80, who are in good health mentally and physically. Participation would involve responding to a number of questions regarding the way that you see the world, and then responding to a series of photographs shown on a computer screen: this should take between 30 minutes and an hour, depending on which of two groups you are allocated to. Your written responses will be analysed later, so that I can compare the way you noticed and remembered the images. A \$5 Whitcoulls Voucher is offered as a gesture of appreciation for your time and participation.

There are no expectations of good or bad performance in the research, I am merely wanting to compare the two age groups. If any of the questions or photographs make you feel uncomfortable, or if you change your mind, you are free to withdraw at any time. You will not be asked to provide your name, and all the response sheets will be completely anonymous except for identifying numbers: they will be stored in a secure place at Massey University.

All participants will benefit from the stimulation of learning something new, while older participants will also benefit through the social interaction. At a community level, this research will give useful information about attention and memory in older and younger adults. Wider benefits include a deeper understanding of emotional disorders such as anxiety and depression, particularly in the aging population.

If you decide to participate, I will ask you to sign a consent form regarding the use of your information. You have the right to decline to answer any particular question, and to withdraw at any time, regardless of this consent.

Thankyou for your time.

APPENDIX 2



A comparison of attention and memory in older and younger adults.

PARTICIPANT CONSENT FORM

This consent form will be held for a period of five (5) years

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that my responses will be confidential, and used only for the purpose stated.

I agree to participate in this study under the conditions set out in the Information Sheet.

Date:

Signature:

.....

Full Name - printed

.....

APPENDIX 3

IAPS images used in this experiment.

NEUTRAL

Anchors

- a. 7010 basket
- d. 7570 skyline

POSITIVE

- c. 1750 bunnies

NEGATIVE

- b. 3101 burnt face

Set 1 - Reaction

- 1. 2357 man
- 4. 7038 shoes
- 8. 7224 file cabinets
- 10. 1850 camels
- 15. 2200 neutral face
- 19. 7550 office
- 23. 8311 golfer
- 26. 2383 secretary
- 28. 2901 boy
- 29. 5534 mushrooms
- 30. 7234 ironing board
- 32. 5920 volcano
- 38. 6150 outlet
- 39. 5950 lightning
- 41. 6314 attack
- 44. 7002 towel
- 45. 6569 hairdryer
- 48. 7009 mug
- 50. 7190 clock
- 58. 7080 fork

- 2. 1440 seal
- 5. 2304 girl
- 9. 1550 dog
- 12. 1603 butterfly
- 13. 1610 rabbit
- 16. 5831 seagulls
- 20. 1620 springbok
- 21. 1731 lion
- 24. 7330 ice cream
- 31. 2030 woman
- 33. 1812 elephants
- 36. 2040 baby
- 40. 2222 boys reading
- 46. 2150 baby
- 47. 2057 father
- 51. 2388 kids
- 54. 2630 male
- 55. 4561 erotic man
- 60. 5760 nature

- 3. 1111 snakes
- 6. 1201 spider
- 7. 2053 baby
- 11. 2095 toddler
- 14. 2490 man
- 17. 2683 war
- 18. 2691 riot
- 22. 2710 drug addict
- 25. 2800 sad child
- 27. 2900 crying boy
- 34. 3170 baby tumour
- 35. 3030 mutilation
- 37. 3160 eye disease
- 42. 6821 gang
- 43. 6200 aimed gun
- 49. 9040 starving child
- 52. 7631 slicer
- 53. 9001 cemetery
- 56. 9042 stickthruplip
- 57. 9050 plane crash
- 59. 9301 toilet

Set 2 – Recognition**NEUTRAL**

5. 2200 neutral face
6. 2383 secretary
10. 7211 clock
12. 7235 chair
15. 5950 lightning
16. 2661 baby
20. 7080 fork
24. 7035 mug
25. 2480 elderly man
30. 8311 golfer
31. 7150 umbrella
37. 6314 attack
38. 7234 ironing board
42. 7560 freeway
43. 5534 mushrooms
47. 2357 man
48. 7186 abstract art
55. 7570 skyline (9/11)
58. 7002 towel
59. 8010 runner

POSITIVE

1. 5760 nature
4. 1610 rabbit
9. 8190 skier
11. 2550 couple
14. 1603 butterfly
17. 5891 clouds
21. 5001 sunflower
22. 2150 baby
27. 7200 brownie
28. 1731 lion
35. 8502 money
36. 1440 seal
40. 1620 springbok
41. 2340 family
44. 5830 sunset
45. 4532 attractive man
49. 2388 kids
53. 5600 mountains
56. 2030 woman
60. 5831 seagulls

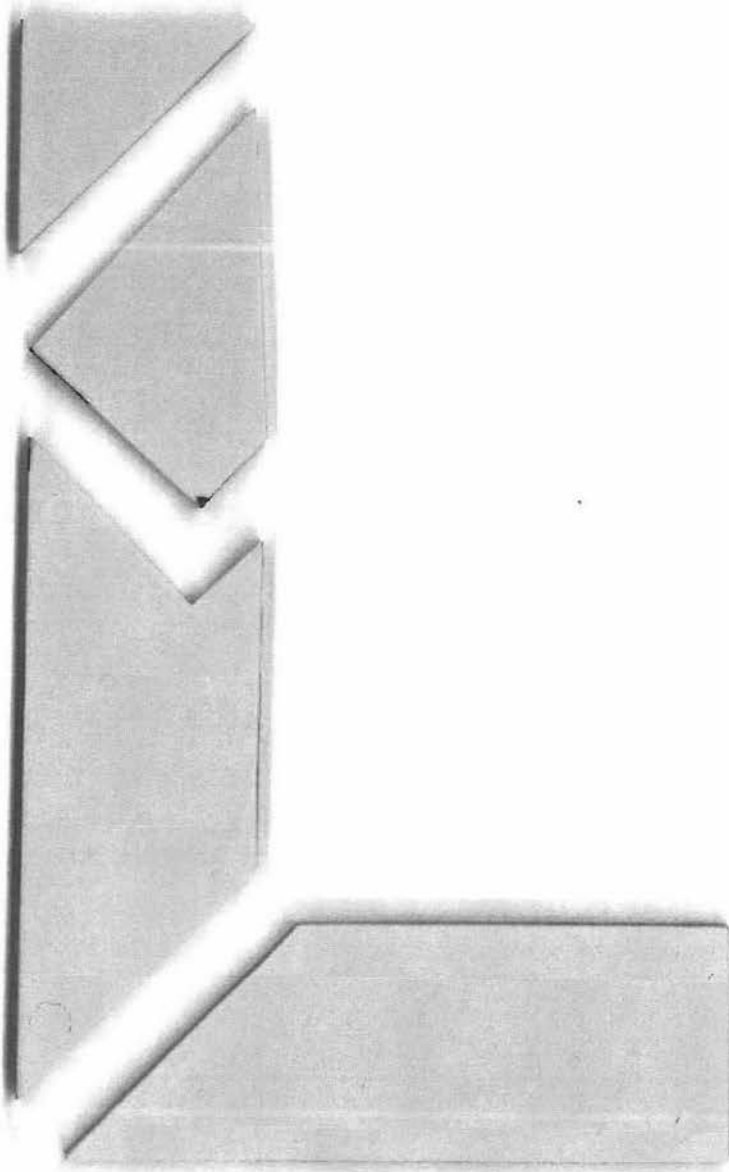
NEGATIVE

2. 9417 ticket
3. 1201 spider
7. 9001 cemetery
8. 2053 baby
13. 6570 suicide
18. 9592 injection
19. 9042 stickthruplip
23. 1111 snakes
26. 9410 soldier
29. 9140 cow
32. 3160 eye disease
33. 2490 man
34. 9280 smoke
39. 9570 dog
46. 3005 buried child
50. 6200 aimed gun
51. 2800 sad child
52. 9265 hung man
54. 6821 gang
57. 9300 dirty

Samples of IAPS images used in this experiment**NEUTRAL****POSITIVE****NEGATIVE**

APPENDIX 4

Distracter task between Part 1 and Part 2 of the experiment: a plastic puzzle.

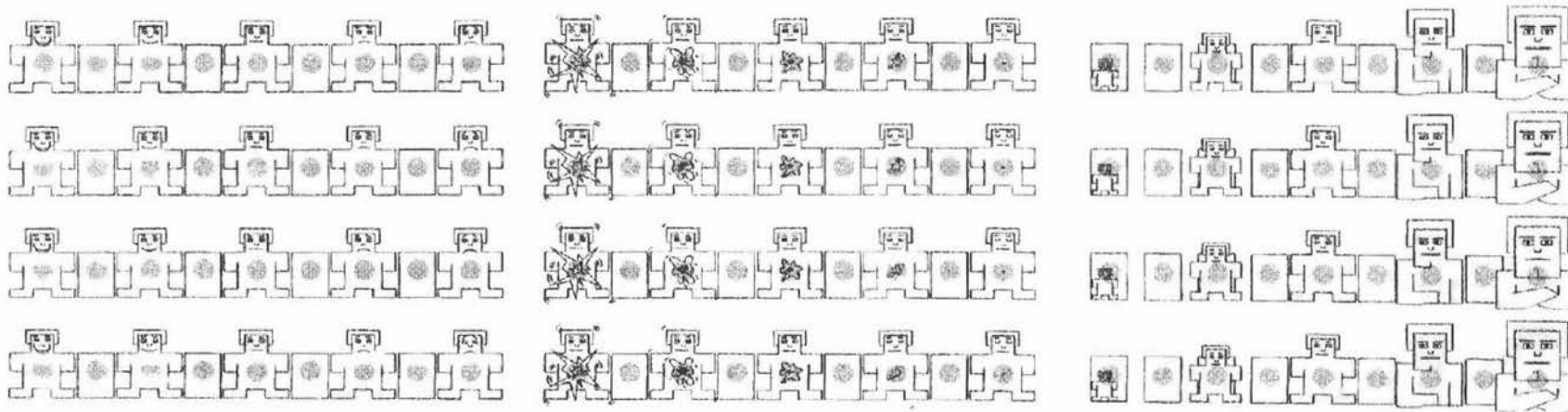


SAM Task 1 Valence..... Age group Participant No.

Pleasant Unpleasant

Aroused Calm

Dominated In Control



Please read through the following statements and decide how much you either agree or disagree with each.
 Using the scale provided write the number that best indicates how you feel on the line next to each statement.

- | strongly disagree | 1 | 2 | 3 | 4 | 5 | strongly agree |
|---------------------|---|---|---|---|---|------------------------|
| 1. _____ interested | | | | | | 15. _____ excited |
| 2. _____ upset | | | | | | 16. _____ guilty |
| 3. _____ scared | | | | | | 17. _____ enthusiastic |
| 4. _____ proud | | | | | | 18. _____ alert |
| 5. _____ ashamed | | | | | | 19. _____ nervous |
| 6. _____ determined | | | | | | 20. _____ jittery |
| 7. _____ active | | | | | | |
| | | | | | | 8. _____ distressed |
| | | | | | | 9. _____ strong |
| | | | | | | 10. _____ hostile |
| | | | | | | 11. _____ irritable |
| | | | | | | 12. _____ inspired |
| | | | | | | 13. _____ attentive |
| | | | | | | 14. _____ afraid |

SAM Task 1 Valence.....

Age group

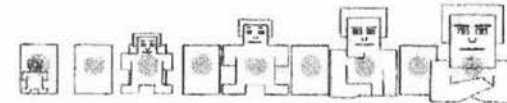
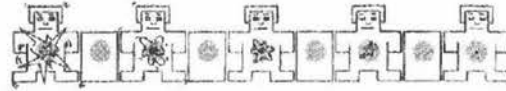
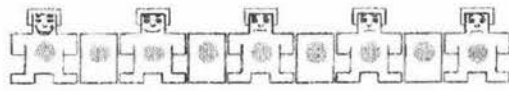
Participant No.

Pleasant Unpleasant

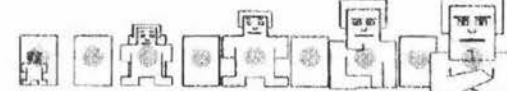
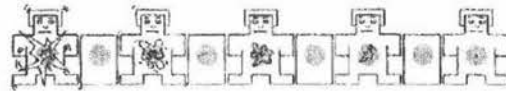
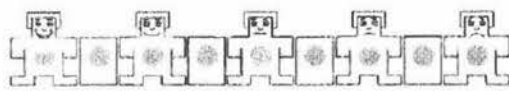
Aroused Calm

Dominated In Control

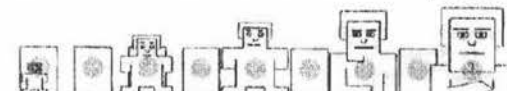
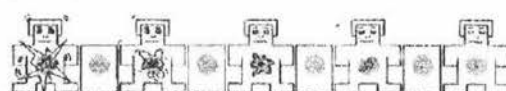
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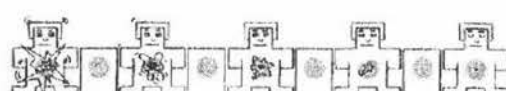
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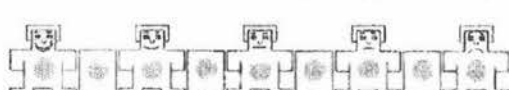
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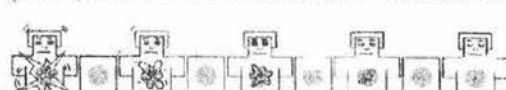
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5



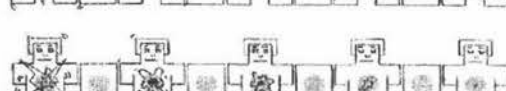
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7



8



9

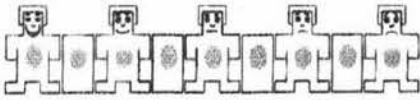
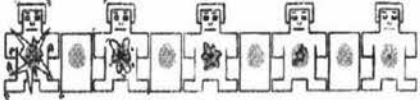
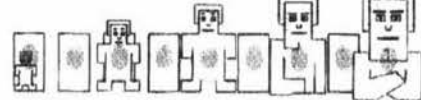
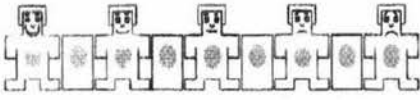

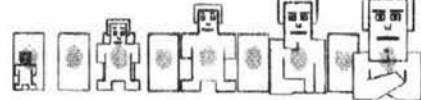
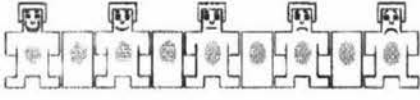
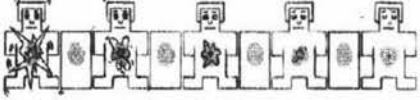
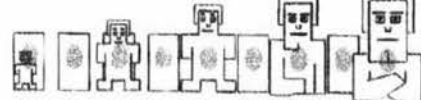
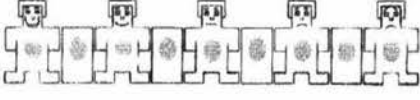
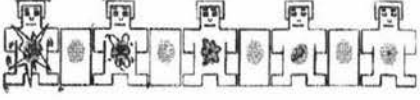
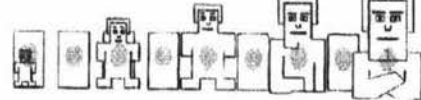


10



Part 2. Have you seen this image before? Please respond with a **√** for yes, or a **X** for no

- | | | | |
|----------|----------|----------|----------|
| 1 | 16 | 31 | 46 |
| 2 | 17 | 32 | 47 |
| 3 | 18 | 33 | 48 |
| 4 | 19 | 34 | 49 |
| 5 | 20 | 35 | 50 |
| 6 | 21 | 36 | 51 |
| 7 | 22 | 37 | 52 |
| 8 | 23 | 38 | 53 |
| 9 | 24 | 39 | 54 |
| 10 | 25 | 40 | 55 |
| 11 | 26 | 41 | 56 |
| 12 | 27 | 42 | 57 |
| 13 | 28 | 43 | 58 |
| 14 | 29 | 44 | 59 |
| 15 | 30 | 45 | 60 |

<p>Would you like to see this Yes as a front page photo? No</p> 	<p>Is it eye-catching? Yes No</p> 	<p>Is it appropriate? No Yes</p> 
		
		
		

Please read through the following statements and decide how much you either agree or disagree with each.
Using the scale provided write the number that best indicates how you feel on the line next to each statement.

strongly disagree 1 2 3 4 5 strongly agree

- | | | |
|---------------------|---------------------|------------------------|
| 1. _____ interested | 8. _____ distressed | 15. _____ excited |
| 2. _____ upset | 9. _____ strong | 16. _____ guilty |
| 3. _____ scared | 10. _____ hostile | 17. _____ enthusiastic |
| 4. _____ proud | 11. _____ irritable | 18. _____ alert |
| 5. _____ ashamed | 12. _____ inspired | 19. _____ nervous |
| 6. _____ determined | 13. _____ attentive | 20. _____ jittery |
| 7. _____ active | 14. _____ afraid | |

.....

	Would you like to see this as a front page photo?		Is it eye-catching?		Is it appropriate?	
	Yes	No	Yes	No	No	Yes
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

SAM Rating booklet : Paper Headline (page 2)

SAM Task Paper Headline.....

Age group

Participant No.

Part 2. Have you seen this image before? Please respond with a **√** for yes, or a **X** for no

1	16	31	46
2	17	32	47
3	18	33	48
4	19	34	49
5	20	35	50
6	21	36	51
7	22	37	52
8	23	38	53
9	24	39	54
10	25	40	55
11	26	41	56
12	27	42	57
13	28	43	58
14	29	44	59
15	30	45	60

SAM rating booklet: Paper Headline (page 8)