The Mere Exposure Effect: Application to Emotionally-Laden Stimuli

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Abstract

The mere exposure effect refers to the observation that repeated, unreinforced exposure to a stimulus increases affective evaluations of that stimulus. While the vast majority of past research has utilised neutral, meaningless stimuli and has found reliable mere exposure effects, studies exploring the mere exposure effect to emotional stimuli are relatively lacking. And, while those studies that exist were in agreement that the attitude enhancing effect of repeated exposure was robust for positive stimuli, there was debate over the effect to negative stimuli. However, despite these discrepancies, the stimuli used to characterize valenced conditions were highly questionable. Furthermore, even though emotional stimuli encompass the dimensions of valence and arousal, previous mere exposure research has only attempted to focus upon the role of stimulus valence, leaving the equally important role of stimulus arousal in the exposure-affect relationship relatively unexplored. Therefore, the primary aim of the current research was to examine the mere exposure effect to stimuli that were truly emotional and thus, differing in valence (positive, neutral, and negative) and arousal (low and high).

Importantly, because the stimuli used were in fact emotional, it was possible that the emotional properties of the stimuli (i.e., the valence and arousal intensity) could change as a result of repeated exposure. Thus, in addition to using liking (a commonly used measure of affect), participant valence and arousal ratings of the stimuli were also obtained. Additionally, when investigating the effect of repeated exposure to emotional stimuli, it could be expected that an individual’s level of sensation seeking (SS) would moderate the exposure-affect relationship. This would be expected on the basis that low and high SS individuals differ in their susceptibility to boredom and also in their preferences for familiar and emotional stimuli. However, of the limited research that has been conducted, no differential effect of repeated exposure has been found for low and high SS individuals. This unexpected finding presumably occurred also because of the failure to use stimuli that were truly emotional. Thus, a second aim of the current research was to clarify the influence of SS on the exposure-affect relationship for inherently emotional stimuli.

To first isolate the effects of valence and arousal on the mere exposure effect, a study which used neutral stimuli was conducted. Then, a follow-on study took place which
used negative low arousal, positive low arousal, negative high arousal and positive high arousal stimuli, for which standardised ratings of valence and arousal have been reliably established. Significant mere exposure effects were obtained for the high arousal conditions. The participants’ level of SS moderated the exposure-liking relationship for positive high arousal stimuli, with liking ratings only increasing for low but not high SS participants over the course of exposure. However, for negative high arousal stimuli, no differential effect of repeated exposure on low and high SS participants was found; liking ratings of all participants initially increased with increasing exposure frequency. In addition, while the valence intensity of the stimuli remained unchanged, both low and high SS participants rated the high arousal stimuli as less arousing (or more calming) with repeated exposure. No effects were obtained for the low conditions, including neutral.

In light of the significant effects obtained for the negative high arousal stimuli, a further study was conducted to examine the mere exposure effect to stimuli that were more socially salient, namely the cigarette health warning images. The findings of this study revealed that liking ratings of high SS participants initially increased with repeated exposure and thus demonstrated a mere exposure effect. No such effect was found for low SS participants. In addition, for both low and high SS participants, the health warning images were perceived to be more pleasant and less arousing over the course of exposure. However, in contrast to low SS participants, this occurred more quickly for high SS participants. These findings were considered problematic, especially because high SS individuals are more likely to engage in the behaviour that the warning images are designed to eliminate. Thus, not only did the current research provide clarification of the effect of repeated exposure to high arousal stimuli, it also added to the robustness of the mere exposure effect, occurring in response to stimuli that have profound social utility. The implications of the current research are far-reaching, and particularly call into question the reliance on the health warning images as an effective medium for communicating the health risks associated with smoking.
Acknowledgements

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I would also like to thank all of my family and friends for your help with obtaining the large sample sizes required for the experiments of this thesis. Your continued love and support is always appreciated and I consider myself extremely lucky to have you all in my life. To my partner Daniel, thank you for your encouragement and patience throughout this stressful time. You have shown me that together, we can conquer anything. I love you dearly. Finally, to my parents and brother, words cannot express how much you all mean to me. You have always motivated me to be the best I can be and have taught me the meaning of courage, determination and inner strength. Thank you for standing by me my entire life and being the greatest family anyone could wish for. I love you all with every piece of my heart.

I would like to dedicate this thesis to my grandparents: Walter and Joan Aimers; and Samuel George and Patricia Barber. You are all with me every day. I hope I have made you proud. This one is for you!
Declaration

I declare that this dissertation does not contain without acknowledgement any material which has been accepted for the award to the candidate of any other degree or diploma, and to the best of my knowledge it does not contain any material previously published or written by another person except where due reference is made in the text.

I further declare that the ethical principles and procedures specified in the Human Research Ethics Committee document have been adhered to in the preparation of this dissertation and that a final report was submitted to the ethics committee following cessation of the final study.

Name: Nicole L Aimers

Signed:
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# List of Abbreviations

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<th>Description</th>
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<tbody>
<tr>
<td>ANOVA</td>
<td>Analysis of Variance</td>
</tr>
<tr>
<td>ABS</td>
<td>Australian Bureau of Statistics</td>
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<td>bmp</td>
<td>Bitmap</td>
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<tr>
<td>BP</td>
<td>Boredom Proneness</td>
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<tr>
<td>dpi</td>
<td>Dots Per Inch</td>
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<td>EMG</td>
<td>Electromyography</td>
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<td>ERP</td>
<td>Event Related Potential</td>
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<td>ES</td>
<td>Effect Size</td>
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<td>HD</td>
<td>High Definition</td>
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<td>IAPS</td>
<td>International Affective Picture System</td>
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<td>ISI</td>
<td>Inter-Stimulus Interval</td>
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<tr>
<td>M</td>
<td>Mean</td>
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<td>NA</td>
<td>Negative Affect</td>
</tr>
<tr>
<td>N</td>
<td>Number of Participants</td>
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<tr>
<td>OLA</td>
<td>Optimal Level of Arousal</td>
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<td>%</td>
<td>Percentage</td>
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<td>PNS</td>
<td>Personal Need for Structure</td>
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<td>PA</td>
<td>Positive Affect</td>
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<td>RET</td>
<td>Repeated Evaluation Technique</td>
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<td>Sensation Seeking</td>
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<td>Sensation Seekers</td>
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<td>SD</td>
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<td>SE</td>
<td>Standard Error</td>
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<tr>
<td>SPSS</td>
<td>Statistical Package for Social Sciences</td>
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<td>WHO</td>
<td>World Health Organisation</td>
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Chapter 1
General Introduction
In his seminal monograph, Zajonc (1968) presented the findings of four experiments which indicated that repeated, unreinforced exposure to a stimulus is a sufficient condition to enhance affective evaluations of that stimulus. Zajonc termed this association between familiarity and affect as the mere exposure effect. By mere exposure, it is simply meant any “condition which just makes the given stimulus accessible to the individual’s perception” (p.1). The standard protocol for assessing the mere exposure effect in a laboratory setting involves two phases. The first is an exposure phase wherein an individual is repeatedly exposed to the target stimuli. The second is a test phase wherein the individual rates the stimuli to which they had been pre-exposed together with new, never-before-seen equivalents. Evidence of the mere exposure effect is obtained when more positive evaluations are ascribed to the frequently exposed stimuli from the exposure phase rather than the infrequently exposed stimuli from the test phase.

The findings of Zajonc (1968) sparked a great deal of interest into the mere exposure effect, with over 200 studies taking place by the time of Bornstein’s (1989) review twenty years later. The mere exposure effect has been identified as a robust and reliable phenomenon, with unreinforced stimulus exposures not only enhancing affect toward visual stimuli (e.g., Zajonc, 1968) but to auditory (e.g., Heingartner & Hall, 1974; Witvliet & Vrana, 2007), gustatory (e.g., Crandall, 1985; Pliner, 1982), and tactile (e.g., Jakesch & Carbon, 2012) stimuli as well. In addition, evidence for the exposure effect has also been obtained across cultures (Ishii, 2005), time (Zajonc, Shaver, Tavris, & Van Kreveld, 1972), and settings (laboratory: Stang & O’Connell, 1974; naturalistic: Zajonc & Rajecki, 1969).

Emerging from this sizeable body of research were several limiting factors of the mere exposure effect which subsequently formed the basis of Bornstein’s (1989) review. It was identified that factors pertaining to the stimuli, how the stimuli were presented and measured, and factors pertaining to the participants themselves could considerably influence the magnitude of the effect. Of particular interest to this thesis were two factors pertaining to the stimuli, namely stimulus type and stimulus valence, and one factor pertaining to the participants themselves; a personality trait called sensation seeking (SS).
Many mere exposure studies have utilised neutral, meaningless stimuli such as Chinese characters (to non-Chinese readers: e.g., Zajonc, 1968) and have found significant exposure effects (section 2.1.1.1, p. 10). Other studies, although relatively limited, have claimed to have used affectively valenced stimuli, however the findings of these studies are somewhat mixed (section 2.1.1.3, p. 22). Although there is a general consensus that the attitude enhancing effect of repeated exposure is robust for not only neutral stimuli but for positive stimuli as well, only some studies have found this to occur when using negative stimuli (Bukoff & Elman, 1979; Zajonc, Markus, & Wilson, 1974), with other studies finding a decrease in affect following repeated exposure (Brickman, Redfield, Harrison, & Crandall, 1972; Burgess & Sales, 1971; Grush, 1976; Perlman & Oskamp, 1971). One likely possibility accounting for the discrepancy in findings concerns the nature of the stimuli used to denote the affective conditions.

To establish stimulus valence, some studies have positioned a neutral stimulus in a positive or negative context and relied upon associative learning to occur (e.g., Burgess & Sales, 1971; Perlman & Oskamp, 1971). However, despite the stimuli being affectively neutral to begin with, this procedure was problematic. Specifically, as acknowledged by Zajonc, Markus et al. (1974), these studies no longer satisfied the conditions of “mere” exposure given that the task of actively engaging in associative learning processes goes beyond those of repeated exposure alone. Other studies (e.g., Brickman et al., 1972; Grush, 1976) have established stimulus valence by conducting pre-tests. However as will be discussed in the following chapter, it is highly questionable whether the stimuli used in these pre-tests were innately emotional to begin with. Thus, it is plausible that regardless of how stimulus valence has been previously established (either by associative learning or by conducting pre-tests), the stimuli used in all of these studies were not truly emotional. In addition, even though emotional stimuli are known to differ in terms of valence (i.e., ranging from unpleasant to pleasant) and arousal (ranging from calm [low arousal] to exciting [high arousal]; Lang, Bradley, & Cuthbert, 2008; Osgood, 1957), previous research has only attempted to focus on the role of stimulus valence in the mere exposure effect; leaving the role of stimulus arousal relatively unexplored. Therefore, the overarching aim of this thesis was to examine the mere exposure effect with stimuli that had inherent emotional properties, namely valence and arousal. As a consequence, application of the effect to more meaningful, real-world stimuli can also simultaneously be achieved.
After establishing the effect of repeated exposure to stimuli that are more meaningful and truly emotional than that of previous research, the next logical step would be to investigate the mere exposure effect using emotional stimuli which have greater social utility. Of interest to this thesis were the health warnings found on cigarette packets as they have been deliberately designed to be highly adverse and are considered to be an important medium for communicating the health risks associated with tobacco use (Hammond, 2011). Moreover, the warnings are aimed at providing high reach and frequency of exposure in the efforts to convey the quit message every time a person reaches for a cigarette (Department of Health, 2012). Hence, in addition to providing further clarification of the effect of repeated exposure to highly negative/adverse stimuli and to stimuli that are generally encountered in the real-world, this will also strengthen the robustness of the mere exposure as a real-world phenomenon that has profound societal application.

When investigating the role of stimulus valence in the mere exposure effect, another factor that needs to be considered is that people may already differ in their general preferences for emotional stimuli. One such differentiation between people relates to a personality trait called sensation seeking (SS). Few studies have investigated the role of SS in preferences for emotional stimuli and have found that while low and high SS individuals do not differ in preference ratings of neutral stimuli (Zaleski, 1984), high relative to low SS individuals prefer negative stimuli (Rawlings, 2003). There is also evidence to suggest that, in comparison to low SS individuals, high SS individuals have a greater preference for highly arousing stimuli, regardless of emotional valence (Joseph, Liu, Jiang, Lynam, & Kelly, 2009). This preference for highly arousing stimuli is not surprising given that high SS individuals actively seek more intense stimulation to maintain their Optimal Level of Arousal (OLA) relative to low SS individuals (Zuckerman, 1990). Furthermore, SS has been found to be intricately linked to boredom-proneness; a variable that has been shown to limit the occurrence of the mere exposure effect (Bornstein, Kale, & Cornell, 1990). Specifically, high SS individuals are reported to become bored and restless in repetitious situations more than low SS individuals and as such, are also more receptive to novel rather than familiar stimuli (Zuckerman, 1990). Thus, given that a mere exposure effect is based on the effects stimulus repetition and refers to a preference for familiar rather than novel stimuli, it would be expected that SS would moderate the exposure effect. However, of the very
limited research into this area, a study by Pheterson and Horai (1976) found no such
differential effect of SS on the mere exposure effect. Instead, both low and high SS
participants demonstrated effects of comparable magnitudes. However, similar to the
mere exposure studies discussed above, it is highly plausible that the unexpected
findings of Pheterson and Horai were also due to the failure to use stimuli that were
intrinsically emotional. Therefore, because low and high SS individuals are reported to
differ in their preference for emotional stimuli, in their susceptibility to boredom in
repetitive situations, and also in their preference for familiar and novel stimuli, a further
aim of this thesis was to examine the influence of SS on the exposure-affect relationship
for inherently emotional stimuli.

1.1 Overview of Chapters

This thesis begins with a review of the mere exposure literature from the time of
Zajonc’s (1968) monograph to the present (Chapter 2). This literature review concludes
with the final aims of the thesis. Before the overarching aim of this thesis could be
achieved, the mere exposure effect was investigated with neutral, yet meaningful stimuli
in order to obtain a baseline (Experiment 1). Consequently, the effect of repeated
exposure to stimuli that were truly emotional could then be explored (Experiment 2).
The findings of Experiments 1 and 2 are detailed in Chapter 3 along with the findings of
the effect of SS on the mere exposure effect. Chapter 4 then outlines the findings of the
final experiment of this thesis; the application of the mere exposure effect to cigarette
health warning images (Experiment 3B). Details of the pilot study which was conducted
to establish standardised ratings of valence and arousal for the health warning images
used in the test study are also presented within this chapter (Experiment 3A). In
addition, similar to Chapter 3, the influence of SS on the mere exposure effect is also
discussed in this Chapter. Finally, this thesis ends with a general discussion, linking the
findings of all experiments and thereby addressing the overall aims of the thesis
(Chapter 5).
Chapter 2
The Mere Exposure Effect
The mere exposure effect refers to the observation that repeated, unreinforced exposure to a stimulus increases affective evaluations of that stimulus (Zajonc, 1968). A typical mere exposure paradigm in a laboratory setting involves two phases: an exposure phase and a test phase. The exposure phase involves presenting participants with stimuli in succession, at varying exposure frequencies. These stimuli are generally meaningless and are shown to participants for a pre-determined length of time (e.g., one second), a variable known as exposure duration. The task of the participant during this phase is to passively view the stimuli. Following this, participants undergo the test phase, which can involve one of two different procedures. The first procedure involves a forced-choice format, wherein each stimulus from the exposure phase is presented again, one at a time, together with a similar but never-before-seen equivalent. Participants are required to select the stimulus out of the pair which they prefer. The second procedure also involves presenting the stimuli from the exposure phase again, one at a time, but the similar yet never-before-seen equivalents are dispersed among them. For this procedure, participants are required to rate, generally on a Likert scale, their degree of liking for each stimulus shown. For the first procedure, evidence of the mere exposure effect is obtained when participants consistently prefer the ‘old’ stimuli previously encountered in exposure phase over the ‘new’ stimuli encountered in the test phase only. Similarly, for the second procedure, evidence is obtained when participants consistently ascribe higher liking ratings to the frequently exposed stimuli from the exposure phase rather than the infrequently exposed stimuli from the test phase.

Since the seminal work of Zajonc (1968), the mere exposure effect has received a great deal of attention within numerous research domains such as design and social psychology. In 1989, Bornstein conducted a meta-analysis of a total of 208 experiments which had investigated and largely found support for the mere exposure effect. Thus, the exposure-affect relationship has been reported to be a robust psychological phenomenon. However, it is evident from Bornstein’s review that there are many variables which can influence the magnitude of the mere exposure effect. These variables can be grouped into four general areas: stimulus variables, presentation variables, measurement variables, and subject variables. Stimulus variables pertain to the stimulus content and include variables such the type of stimulus, the complexity of the stimulus, the valence category of the stimulus, and the degree to which the stimulus is a typical member of its category (i.e., prototypicality). Presentation variables refer to
the manner in which the stimuli are exposed to participants and include the number of stimulus exposures, the sequence in which the stimuli are presented in the exposure phase, and the duration for which the stimulus is exposed (including stimulus recognition). Measurement variables are those variables that refer to the procedure by which the dependent measures are obtained and include the type of dependent measure used, the test order used, and the period of delay used between exposure and rating. Finally, subject variables relate to the test participant themselves and include variations in personality traits within the normal continuum, personality aberrations to the extent of mental illness, and other distinguishing characteristics such as age.

The studies conducted in this thesis focused on meaningful, real-world stimuli; specifically, images varying in emotional content whereby levels of valence and arousal were manipulated. All stimulus exposures were clearly presented above the threshold of consciousness (i.e., they were supraliminal) to reflect how they would be encountered in the real-world. One second was chosen to denote the exposure duration because this duration has been used in previous supraliminal mere exposure research (e.g., Young & Claypool, 2010). Furthermore, the participant samples were recruited from non-clinical populations, and comprised adults, 18 years of age and above. Thus, the following review is limited to those variables from the aforementioned categories that are directly relevant to this thesis. Following a similar format to that of Bornstein (1989), the next section provides an in-depth discussion of the mere exposure research dating back to the influential work of Zajonc in 1968 to the present.

### 2.1 Variables Influencing the Mere Exposure Effect

#### 2.1.1 Stimulus Variables

**2.1.1.1 Stimulus Type**

Several studies have found support for the mere exposure effect using auditory (e.g., Heingartner & Hall, 1974; Witvliet & Vrana, 2007), gustatory (e.g., Crandall, 1985; Pliner, 1982) and tactile (e.g., Jakesch & Carbon, 2012) stimuli, however the majority of mere exposure research has focused on visual stimuli (see Bornstein, 1989, for a review). One cited reason for the reliance on visual stimuli is that in comparison to stimuli in other sensory domains, it is easier to quantify variables such as stimulus complexity (discussed in section 2.1.1.2, p. 14), which are known to influence the
exposure-affect relationship (Bornstein, 1989). Given this, only those studies which have utilised visual stimuli will be focused upon throughout this review.

Throughout the literature, researchers have employed the use of many different types of visual stimuli to investigate the mere exposure effect. The stimuli are generally neutral and meaningless (to the participant sample), as indicated in the literature review summary (Table 1) below.
Table 1

*List of Mere Exposure Research Using Different Types of Visual Stimuli*

<table>
<thead>
<tr>
<th>Stimulus type</th>
<th>Author(s) and date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line drawings of optical illusions</td>
<td>Bornstein, Kale, and Cornell (1990)</td>
</tr>
<tr>
<td>Welsh figures/drawings</td>
<td>Bornstein and D’Agostino (1992)</td>
</tr>
<tr>
<td></td>
<td>Bornstein et al. (1990)</td>
</tr>
<tr>
<td>Turkish words (to non-Turkish readers)</td>
<td>Brooks and Watkins (1989)</td>
</tr>
<tr>
<td></td>
<td>Harrison (1968)</td>
</tr>
<tr>
<td></td>
<td>Maltin (1970; 1971)</td>
</tr>
<tr>
<td></td>
<td>Stang (1974a)</td>
</tr>
<tr>
<td></td>
<td>Zajonc (1968)</td>
</tr>
<tr>
<td>Polygons</td>
<td>Bonanno and Stillings (1986)</td>
</tr>
<tr>
<td></td>
<td>Bornstein and D’Agostino (1992)</td>
</tr>
<tr>
<td></td>
<td>Bornstein, Leone, and Galley (1987)</td>
</tr>
<tr>
<td></td>
<td>Newell and Shanks (2007)</td>
</tr>
<tr>
<td></td>
<td>Seamon, Marsh, and Brody (1984)</td>
</tr>
<tr>
<td>Neutral unknown letters</td>
<td>Förster (2009)</td>
</tr>
<tr>
<td>Letter strings</td>
<td>Gordon and Holyoak (1983)</td>
</tr>
<tr>
<td>Chinese characters (to non-Chinese readers)</td>
<td>Harrison (1968)</td>
</tr>
<tr>
<td></td>
<td>Saegert and Jellison (1970)</td>
</tr>
<tr>
<td></td>
<td>Suedfeld, Epstein, Buchanan, and Landon</td>
</tr>
<tr>
<td></td>
<td>(1971)</td>
</tr>
<tr>
<td></td>
<td>Zajonc (1968)</td>
</tr>
<tr>
<td>Non-sense words/syllables</td>
<td>Kail and Freeman (1973)</td>
</tr>
<tr>
<td></td>
<td>Zajonc (1968)</td>
</tr>
<tr>
<td></td>
<td>Moreland and Zajonc (1977)</td>
</tr>
<tr>
<td>Trigrams</td>
<td>Zajonc et al. (1972)</td>
</tr>
<tr>
<td>Ambiguous figures</td>
<td>Craver-Lemley and Bornstein (2006)</td>
</tr>
</tbody>
</table>
As can be seen in Table 1, a variety of meaningless neutral stimuli have been used, although there appears to be a preference for Turkish words, polygons and Chinese characters in the effort to elucidate the exposure-affect relationship. One cited advantage of utilizing neutral, unfamiliar stimuli is that prior exposure is highly unlikely, allowing variables such as exposure frequency which are known to influence the mere exposure effect to be finely controlled (Hekkert, Thurgood, & Whitfield, 2013). In addition to the types of stimuli displayed in Table 1, researchers have also used more meaningful stimuli such as paintings (e.g., Brickman et al., 1972; Cutting, 2003; Meskin, Phelan, Moore, & Kieran, 2013; Zajonc et al., 1972, Experiment 1) and photographs of faces (e.g., Bornstein & D’Agostino, 1992; Harrison, 1968; Newell & Shanks, 2007; Zajonc, 1968; Zajonc et al., 1972, Experiment 3), adding to the robustness and diverse nature of this preference enhancing effect. However, the findings of the meta-analysis conducted by Bornstein (1989) revealed that the magnitude of the mere exposure effect can depend on stimulus type. Specifically, meaningful word, polygon, and photograph stimuli have been reported to produce the strongest exposure effects (documented effect sizes [ESs] were .486, .413, and .367 respectively) whereas non-sense word/syllable, ideograph, and real person/object stimuli (e.g., paintings)\(^1\) have been reported to produce relatively weaker exposure effects (documented ESs were .239, .220, and .198 respectively) (Bornstein, 1989).

As evidenced by the types of stimuli reported in Bornstein’s (1989) meta-analysis and in Table 1, early research investigating the effect of repeated exposure was largely dominated by the use of meaningless, non-semantic stimuli. However, more recently, researchers have begun to utilise more real-world, meaningful stimuli such as consumer products. In a study by Hekkert et al. (2013), reliable mere exposure effects were found for rectangles that resembled common objects such as windows and doors (Experiment 1), and also for three artificial yet plausible images of products, namely a portable smoke-filter, a bass-enhancer and an electromagnetic radiation reducer (Experiment 2). Interestingly, unlike Experiment 2, wherein exposure frequency was finely controlled, Hekkert and colleagues still found significant effects in Experiment 1, when mere exposure was not experimentally manipulated. Specifically, in this experiment, Hekkert and colleagues explored the effect of existing familiarity (termed

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\(^1\) The weaker exposure effects obtained for paintings could be explained by the findings of Faerber, Leder, Gerger, and Carbon (2010), who suggested that highly complex stimulus materials such as paintings require more active and deeper processing for attitude change than that provided by passive mere exposure alone.
natural frequencies), which, as noted by researchers, is important when utilizing real-world stimuli because participants could have been previously exposed to the object any number of times. The findings of Experiment 1 were consistent with previous research which also found reliable exposure effects when investigating exiting familiarity (Leder, 2001) and frequency counts (as estimates of prior exposure; Cutting, 2003) to artworks.

Other paradigms, which are similar to mere exposure, have also been used in the investigation of the attitude enhancing effects of repetition to real-world, meaningful stimuli. Such paradigms include the Repeated Evaluation Technique (RET; Carbon & Leder, 2005) and incidental exposure. The RET is similar to the mere exposure paradigm in that both procedures involve repetition. However, unlike the mere exposure paradigm which focuses on repetition of exposure, RET focuses on repetition of evaluation which, according to Carbon and Leder (2005), allows for more active rather than passive processing of the stimuli. The RET is particularly suitable for investigating preferences for stimuli such as consumer products, because the more active processing element of this procedure simulates how consumers evaluate such stimuli in the real-world, outside of the laboratory environment. The RET procedure also incorporates a test-retest design and as such, is also useful when exploring dynamic constructs (see Carbon & Leder, 2005, for a review), especially those which are fundamental to the field of consumer research.

One such construct which has been investigated using RET is attractiveness, particularly in relation to innovative stimuli. Specifically, Carbon and Leder (2005) explored changes in attractiveness ratings of car interior designs which differed in levels of innovation (low, medium and high). Findings of this study revealed that medium and high innovative designs were initially disliked upon their initial rating, but were subsequently rated as more attractive following RET. However, even though low innovative designs were initially liked the most, there was a tendency for participants to rate this stimulus type as less attractive following RET. These findings are distinct from those the mere exposure theory would have predicted; that simple mere exposure to stimuli would enhance their attractiveness ratings. Hence, the findings of Carbon and Leder suggest that the RET might be more suitable than mere exposure when investigating affective evaluations for stimuli whose affective properties could be expected to change over time.
In addition to the RET, another paradigm used to investigate the attitude enhancing effects of repetition/repeated exposure to real-world, meaningful stimuli is called incidental exposure. The concept of incidental exposure is grounded within the knowledge that repeated exposure can lead to more positive evaluations of a stimulus even in the absence of conscious awareness (i.e., subliminal mere exposure effects). According to Shapiro, Macinnis and Heckler (1997), a typical incidental exposure paradigm involves directing the attention of the participant to a primary task, such as reading an article or browsing a Web page, thereby reducing the resources available to process secondary information such as an advertisement, which is the target stimulus. This secondary information (target stimulus) is located near the primary information and its distance is often described in degrees (e.g., peripheral is greater than three degrees from the attended/primary information) (Shapiro et al., 1997). Because the target stimulus fails to receive direct foveal attention of the participant due to the processing requirements associated with the primary task, participants often can’t explicitly recognize the secondary information (target stimulus), thereby simulating the subliminal mere exposure effect conditions. An incidental exposure effect is found when the processing requirements associated with the attended focal task enhance, rather than degrade, the affective response toward non-focal, target stimuli (Janiszewski, 1993). Hence, the point of difference between a typical mere exposure paradigm and a typical incidental exposure paradigm is how the attention of the participant is directed to the target stimuli. Within the mere exposure effect framework, attention is explicitly encouraged whereas within the incidental exposure framework, attention is deliberately incidental.

Enhanced affective responses following repeated, incidental exposure have been found for a diverse range of real-world product stimuli, including quasi advertisements for digital cameras (Nordhielm, 2002) and earrings/jewellery (Fang, Singh, & Ahluwalia, 2007). Furthermore, repeated incidental exposure has also been found to increase the likelihood that products such as couches, briefcases, computer laptops, mobile phones and DVD movies (Shapiro, 1999; Yoo, 2008) will be included in a person’s consideration set, which is defined as a list of products or brands a consumer would consider purchasing (Shapiro et al., 1997). Lastly, enhanced affective evaluations have also been obtained for complex drawings of women’s fashion apparel (Cox & Cox, 2002). However, unlike the incidental exposure studies described above, Cox and Cox
(2002) explicitly directed the attention of participants towards the target stimulus (i.e., an advertisement for fashion apparel) for 20 seconds, which consequently, more closely reflected a typical mere exposure experiment. This was done via the use of a 15-page booklet, which contained the target stimulus (at one of three levels of exposure), amongst other advertisements for other brands (presumably of fashion apparel) through which the participant was required to browse. However, while these incidental and mere exposure studies described above accurately reflect how stimuli can be encountered outside of the laboratory environment, they are limited in that exposure duration and exposure frequency could not be controlled. For example, even though Cox and Cox allowed participants to view each page of the booklet for 20 seconds, it is unknown how long each participant looked at the target stimulus when other advertisements were also present on each page. As will be made clear in section 2.1.2.1 (p. 34), factors such as exposure frequency are crucial to investigations of repeated exposure as they have been found to influence the magnitude of the exposure-affect relationship. For the remainder of this review, only studies which have been able to control limiting factors such as exposure frequency and/or have explicitly directed the attention of the participant towards the target stimulus will be focused upon.

In summary, in comparison to the sizable body of research which has explored the effect of repeated exposure to meaningless stimuli such as polygons (refer Table 1, p. 10), research utilizing more real-world and meaningful stimuli is relatively limited. And, of those studies which exist, the RET or incidental exposure paradigms have mainly been used because, in part, of the dynamic nature of stimuli and/or the desire to capture real-world experiences. Thus, application of the mere exposure effect to real-world, meaningful stimuli in a controlled setting is a relatively neglected area of research and therefore, warrants further review.

2.1.1.2 Stimulus Complexity

In addition to stimulus type, stimulus complexity is another variable which has been found to influence the mere exposure effect. A total of nine studies were included in Bornstein’s (1989) meta-analysis which investigated the effect of repeated exposure to simple and complex stimuli. Although the findings from Bornstein’s analysis were mixed, the majority (six) of these studies found more positive affect ratings following
repeated exposure to complex, rather than simple stimuli. For example, Saegert and Jellison (1970) employed a within-subjects design, with all participants viewing one complex and one simple stimulus for three seconds at each exposure frequency (0, 1, 2, 5, 10 and 25). Findings revealed that liking ratings of complex stimuli (Chinese characters) increased with repeated exposure. However, for simple stimuli (brushstrokes which formed the Chinese characters), liking ratings initially increased but then declined at higher exposure frequencies. Hence, a stronger mere exposure effect was found for complex stimuli. These findings were consistent with that of Berlyne (1970, Experiment 3) and Oskamp and Scalpone (1975).

Other studies have found the opposite to occur. Specifically, Zajonc et al. (1972) employed a between-subjects design, with one group of participants viewing two complex stimuli (Experiment 1) and another group of participants viewing two simple stimuli (Experiment 2) for two seconds at each exposure frequency (0, 1, 2, 5, 10 and 25). The complex stimuli used in Experiment 1 consisted of colour reproductions of non-representational paintings, whereas the simple stimuli used in Experiment 2 consisted of smaller sections of the Experiment 1 paintings. Findings revealed that participant liking ratings only increased in Experiment 2 wherein simple stimuli were utilised. In Experiment 1, no mere exposure effect was found for complex stimuli. Hence, in contrast to the findings of Saegert and Jellison (1970), this study found a stronger mere exposure effect for simple, rather than complex stimuli.

Zajonc and colleagues (1972) explained their findings in terms of the association between stimulus discriminability and the response competition hypothesis which was proposed by Harrison (1968). Specifically, when an individual encounters a novel stimulus, the degree of similarity or discriminability this stimulus has with a previously encountered familiar stimulus will determine the intensity and the number of generalized responses that are activated at the time of the first exposure. The greater the familiarity, the greater the number of responses that are elicited which in turn, leads to greater response competition; an adverse state. Subsequent exposure to the stimulus is believed to eliminate some of the responses which therefore, will reduce response competition. Consequently, liking toward the stimulus is increased. In the context of Zajonc et al.’s study, the complex paintings used in Experiment 1 were argued to be extremely discriminable. Thus, given the lack of familiarity, there was little response
competition to reduce, which therefore meant that liking towards these complex stimuli could never emerge. Although this explanation may seem plausible, it was unable to be applied to other discriminable stimuli such as faces (discussed further in section 2.1.2.1, p. 36). Hence, Zajonc and colleagues speculated that the response competition idea may be unique to painting stimuli.

Bornstein (1989) postulated that the discrepancy in findings concerning stimulus complexity could be explained in terms of the experimental design utilised. Specifically, the studies which found a stronger mere exposure effect for complex stimuli (e.g., Saegert & Jellison, 1970) all used a within-subjects design, wherein the same participants were exposed to and rated both the simple and complex stimuli. According to Bornstein, participants in these studies may have (unintentionally) compared the simple stimuli to the complex stimuli, such that their affective responses were made relative to each other over the course of repeated exposures. In these instances, complex stimuli may have been liked more than simple stimuli because they were considered to be more interesting. However, in Zajonc et al. (1972) study wherein the reverse was found (i.e., an increase in liking ratings for simple but not complex stimuli), a between-subjects design was used. As mentioned above, participants in this study were only exposed to one type of level of complexity. According to Bornstein, because of this type of experimental design, participants were unable to compare the two types of stimuli. Consequently, the simple stimuli could not be considered less interesting relative to the complex stimuli, allowing the mere exposure effect to occur.

To test his theory of “contrast” effects, Bornstein et al. (1990) conducted two experiments. In one experiment, a within-subjects design was used, with all participants exposed to both complex (optical illusions) and simple (Welsh figures) stimuli. In the other experiment, a between-subjects design was used, with some participants exposed to only complex optical illusion stimuli and other participants exposed to only simple Welsh figure stimuli. In both experiments, the target stimuli were presented for five seconds at each exposure frequency (0, 1, 2, 5, 10, 25 and 50). On average, participants gave more positive affect ratings towards the complex, rather than the simple stimuli. However, the findings of these experiments did provide strong support for the hypotheses of Bornstein and colleagues. When a within-subjects design was employed, positive affect ratings increased with increasing exposure frequency for complex but not
for simple stimuli. In fact, no exposure effect was obtained for the simple stimuli at all. However, when a between-subjects design was employed, different results were found. Specifically, although affect ratings of complex stimuli increased more rapidly than affect ratings of simple stimuli over the course of exposure (demonstrating a stronger mere exposure effect), both types of stimuli still showed a monotonic increase in affective judgments with increasing exposure frequency. According to Bornstein et al. these findings can be explained in terms of the predicted “contrast” effects. In the first experiment, the simple Welsh figure stimuli were liked least over the course of exposure because they were deemed to be less interesting in comparison to the complex optical illusion stimuli. Hence, the exposure effect for simple stimuli was inhibited. However, in the other experiment, when participants were exposed to only complex or simple stimuli, no comparison was able to be made. Consequently, the exposure effect for simple stimuli was able to eventuate.

Extending upon Bornstein et al.’s (1980) study, a later study by Cox and Cox (2002) also aimed to investigate “contrast” effects using real-world complex and simple product designs. This study used a between-subjects design, with participants exposed to one complex or one simple drawing of women’s fashion apparel. The target stimulus was presented for twenty seconds at one of three exposure frequencies (0, 1 or 3). Unlike the findings of Bornstein et al., this study only found an increase in liking ratings following repeated exposure for complex designs. For simple designs, liking ratings slightly decreased. Cox and Cox speculated that their findings were consistent with the uncertainty reduction hypothesis, which states that when an individual initially encounters a novel and complex stimulus, feelings of uncertainty are produced. However, through repeated exposure, uncertainty is attenuated and liking is enhanced. The failure to find an exposure effect for simple stimuli was explained by the same account. Liking ratings never increased because participants can instantly familiarize themselves with simple stimuli and hence, no uncertainty is experienced upon the first encounter. Presumably because of boredom, repeated exposure to these simple stimuli leads to a decrease in liking. The findings of Cox and Cox suggested that exposure effects can differ markedly depending on a product’s visual design, with simple designs leading to detrimental effects.
In summary, the magnitude of the mere exposure effect can depend on stimulus complexity. Irrespective of the type of experimental design employed, the majority of research has identified stronger mere exposure effects for meaningless complex stimuli as compared with simple stimuli. However, presumably because of “contrast” effects, it would seem that exposure effects for meaningless simple stimuli are mainly produced when participants are not concurrently exposed to complex, more interesting stimuli (as they would be when a within-subjects design is employed). In the case of real-world stimuli, exposure effects have been found for visually complex stimuli only, with liking ratings for real-world simple stimuli decreasing with repeated exposure. However, the findings concerning real-world stimuli should be interpreted with caution until other product classes, not just women’s fashion apparel, have been investigated.

2.1.1.3 Stimulus Valence

As mentioned, the mere exposure effect refers to the observation that repeated, unreinforced exposure to a stimulus increases affective judgments of that stimulus (Zajonc, 1968). As displayed in Table 1 (section 2.1.1.1, p.10), an abundance of research has shown the mere exposure effect to be robust for a range of meaningless neutral stimuli, with many studies employing the use of Turkish words, polygons and Chinese characters. However, relatively few studies have examined the mere exposure effect to stimuli that are emotionally charged. A summary of these studies is presented in Table 2.  

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2 It is acknowledged that the mere exposure studies presented in Table 2 were predominantly conducted more than 40 years ago. With the exception of Young (2007; refer section 2.1.1.3.1, p. 32) more recent research into the mere exposure effect has been primarily focused on the consumer research domain (e.g., Cox & Cox, 2002; Fang et al., 2007; Hekkert et al., 2013; Nordhielm, 2002).
Table 2

**Summary of Research Investigating Mere Exposure Effects Using Emotionally Charged Stimuli**

<table>
<thead>
<tr>
<th>Author(s) and date</th>
<th>Study objective</th>
<th>N</th>
<th>Stimuli type</th>
<th>Study findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brickman et al. (1972, Experiment 3)</td>
<td>To examine if the semantic satiation hypothesis can be applied to the mere exposure literature and as such, investigate if both negative and positive stimuli lose affective meaning.</td>
<td>48</td>
<td>Abstract paintings which were pre-rated as the most negative, neutral and positive</td>
<td>Liking ratings of both positive and neutral paintings were significantly enhanced following repeated exposure. However, for negative paintings the opposite result was found. Liking ratings decreased with repeated exposure although this finding was only marginally significant.</td>
</tr>
<tr>
<td>Bukoff and Elman (1979)</td>
<td>To explore the robustness of the mere exposure effect to stimuli differing in initial favourability</td>
<td>144</td>
<td>Male portraits from a college yearbook which were pre-rated as unlikeable (negative), neutral or very likeable (positive) (manipulation one) and as having negative, neutral or positive social characteristics (manipulation two)</td>
<td>In both manipulations, the three classes of stimuli produced similar exposure-favourability slopes. More positive evaluations of all types of stimuli were obtained following repeated exposure.</td>
</tr>
<tr>
<td>Burgess and Sales (1971, Experiment 2)</td>
<td>To investigate the strength of the mere exposure effect in contexts which are known to have a positive or negative meaning</td>
<td>60</td>
<td>Non-sense words which were paired with either positive or negative meaningful words</td>
<td>Ratings of non-sense words in the positive contexts became more positive following repeated exposure. However, non-sense words in the negative contexts became more negative with repeated exposure.</td>
</tr>
</tbody>
</table>
### Table 2 (Continued)

*Summary of Research Investigating Mere Exposure Effects Using Emotionally Charged Stimuli*

<table>
<thead>
<tr>
<th>Author(s) and date</th>
<th>Study objective</th>
<th>N</th>
<th>Stimuli type</th>
<th>Study findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grush (1976, Experiment 1)</td>
<td>To investigate whether repeated exposure would make evaluations of positive words become more positive and negative words become more negative.</td>
<td>60</td>
<td>Pre-rated infrequent positive words (e.g., gardenia) and infrequent negative words (e.g., corrosive)</td>
<td>Negative words were evaluated more negatively with increased exposure. However, even though participants had a tendency to rate positive stimuli more positively, this finding failed to reach significance</td>
</tr>
<tr>
<td>Perlman and Oskamp (1971)</td>
<td>To investigate the effect of content (i.e., positive, neutral and negative settings) on attitudes toward Negroes and to also investigate the effect of exposure frequency to those three classes of stimuli (i.e., positive, neutral and negative stimuli)</td>
<td>96</td>
<td>Photographs of Blacks or Whites in a positive, neutral and negative setting</td>
<td>Overall, findings revealed that repeated exposure enhanced attitudes toward stimuli. Specifically, the exposure effect was strong for photographs of Whites or Blacks in positive settings (i.e., evaluations became more positive), weak for neutral settings (i.e., evaluations became slightly more positive) and slightly reversed for negative settings (i.e., evaluations became slightly more negative)</td>
</tr>
</tbody>
</table>
Table 2 (Continued)

*Summary of Research Investigating Mere Exposure Effects Using Emotionally Charged Stimuli*

<table>
<thead>
<tr>
<th>Author(s) and date</th>
<th>Study objective</th>
<th>N</th>
<th>Stimuli type</th>
<th>Study findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zajonc, Markus et al. (1974)</td>
<td>To examine the contributions of initial stimulus affect and of associative learning to the effect of repeated stimulus exposures.</td>
<td>96</td>
<td>Photographs of Chinese men who were described as scholars/scientists (positive stimuli) or criminals (negative stimuli) and associated with the field of contribution (e.g., medicine: positive condition) or crime (e.g., kidnapping: negative condition)</td>
<td>Repeated exposure to negative and positive stimuli and to negative and positive conditions resulted in more positive evaluations</td>
</tr>
</tbody>
</table>
As can be seen in Table 2, there is a general consensus across studies that the mere exposure effect is robust for not only meaningless neutral stimuli but for positive stimuli as well, with participant affect ratings becoming more positive following repeated exposure. However, for negative/adverse stimuli, the effect of repeated exposure appears to be more controversial. Specifically, as shown in Table 2, studies have reported that evaluations of negative stimuli become more negative with increasing exposure (Brickman et al., 1972; Burgess & Sales, 1971; Grush, 1976; Perlman & Oskamp, 1971), while other studies have reported that evaluations become more positive with increasing exposure and hence, found stimulus valence to be irrelevant (Bukoff & Elman, 1979; Zajonc, Markus et al., 1974).

In an attempt to explain why positive stimuli became more positive and negative stimuli became more negative following repeated exposure, Burgess and Sales (1971) and Perlman and Oskamp (1971) argued that the exposure effect is due to associative learning. They suggested that stimuli presented within a mere exposure paradigm are actually not ‘merely’ exposed. Rather, because of affect transference, stimuli exposed in a particular context assume the affective valence which characterizes that context. That is, the positive or negative connotations inherent within a context become associated with the target stimulus and due to repeated exposure, the associative bond between the context and stimulus become stronger, resulting in an increase in positive or negative evaluations. Similar to Burgess and Sales and Perlman and Oskamp, Brickman and colleagues (1972) also found that ratings of positive stimuli were enhanced with repeated exposure. However, even though participants displayed a tendency to rate negative stimuli less favorably following repeated exposure, this finding was only marginally significant. Although Brickman and colleagues initially based their predictions on the semantic satiation hypothesis and consequently hypothesized that negative and positive stimuli would become affectively neutral following exposure, their unexpected findings were later interpreted by the associative learning argument put forward by Burgess and Sales and Perlman and Oskamp.

3 The semantic satiation hypothesis suggests that repetition to valenced stimuli leads to a decrease in evaluative meaning such that, negative stimuli will become less negative and positive stimuli will become less positive following repeated exposure. In contrast, the semantic generation hypothesis suggests that repetition leads to an increase in evaluative meaning, with negative stimuli becoming more negative and positive stimuli becoming more positive with repeated exposure. However, given that these hypotheses have failed to provide an adequate account of the mere exposure effect (see Berkowitz, 1977, for a review), no further discussion will take place.
Guided by this associative learning explanation, it would be plausible to assume that the decrease in participant evaluations due to negative contexts would be of similar magnitude to the increase in participant evaluations due to positive contexts. However, this was not found in either of the studies conducted by Burgess and Sales (1971) and Perlman and Oskamp (1971). Rather, these studies found stronger mere exposure effects for positive stimuli and relatively weaker effects for negative stimuli. Perlman and Oskamp proposed that even when stimuli are presented within a negative context, repeated exposure still exerts a positive influence. However, the transference of negative affect due to associative learning is greater than the opposing positive effect of exposure, thus explaining why stimuli presented in a negative context were evaluated more negatively. To explain the difference in magnitude of the effect for negative and positive stimuli, Perlman and Oskamp suggested that the positive influence of exposure, together with the transference of positive affect due to associative learning, results in a stronger effect for positive stimuli. However, for negative stimuli, the effect is somewhat weaker because this type of stimuli only has one and not two positive influences (from exposure but not from associative learning).

Burgess and Sales (1971) interpreted the difference in the magnitude of the effect for negative and positive stimuli in a similar vein. These authors argued that stronger effects were found for positive than negative stimuli because of the experimental context. Specifically, Burgess and Sales purported that even though mere exposure researchers commonly believe that laboratory environments are affectively neutral, these environments are actually affectively positive. This is most likely due to the positive experience of participant participation. As a consequence, stimuli which are presented within these environments acquire positive meaning and thus, are not ‘merely’ exposed. Stronger effects were argued to be found for positive stimuli (i.e., positively associated non-sense words; refer Table 2) than negative stimuli (i.e., negatively associated non-sense words) because they were shown in a positive experimental context, resulting in greater polarization than the negative condition. The rationale for their proposition that laboratory environments are affectively positive and therefore, exert a positive influence comes from a previous study wherein Burgess and Sales utilised a “personal reaction” questionnaire. Findings revealed that for participants who felt positive about the experiment, liking ratings increased with repeated exposure and thus, demonstrated the mere exposure effect. However, contrary to expectations,
participants who felt negative about the experiment did not exhibit a decrease in liking following repeated exposure; they exhibited no exposure effect at all. This unexpected finding was speculated to have occurred because the participants who constituted the ‘negative’ group didn’t actually dislike the experiment. Rather, their attitudes toward the experiment were neutral. Thus, because the majority of participants reported that they liked the experiment, the participants who felt neutral were considered to feel more negatively relative to the positive group.

More recent research has also investigated the role that contextual factors play in the evaluation of real-world designed objects. In a study conducted by Carbon, Faerber, Gerger, Forster, and Leder (2013), the impact of situational contexts on the appreciation of design innovation was explored, using artificial car interior designs as the study’s stimuli. Innovation was chosen as a variable of interest in this study because of the documented effect it has on predicting the success of car designs (Leder & Carbon, 2005). Innovation was treated as a within-subjects variable, with participants being exposed to both low and high innovative designs. Two associative contexts were also devised and manipulated across participants; some participants were allocated into a “danger” condition, which highlighted the negative aspects of the car interior designs while other participants were allocated into a “fascination” condition, which highlighted the positive aspects of the designs. The findings pertaining to the highly innovative/novel designs were of particular interest, given that previous research has identified a negative relationship between innovation and attractiveness, with a tendency for more innovative/novel designs to be rated as less attractive, at least initially (Leder & Carbon, 2005). Findings of this study also supported this by revealing that low/typical innovative designs were initially preferred by participants in both the danger and fascination conditions. However, for highly innovative designs, attractiveness ratings only improved and were preferred over time for participants who were in the fascination condition. For the danger condition, participants continued to prefer the low rather than high innovative designs. These findings highlighted the importance of context in aesthetic appreciation, particularly the need for marketers and product developers to concurrently implement fascinating contexts when introducing highly innovative products to the market. Even though Carbon and colleagues did not use a mere exposure paradigm, these findings still suggest that the effect of context on the evaluation of stimuli can be applied to other experimental paradigms (not just mere
exposure), such as the Repeated Evaluation Technique (RET) (refer section 2.1.1.1, p. 12), which was employed by these researchers.

In accordance with the mere exposure studies discussed thus far (i.e., Brickman et al., 1972; Burgess & Sales, 1971; Perlman & Oskamp, 1971), a later study by Grush (1979) also found that evaluations of adverse stimuli became significantly more negative with increasing exposure. However, even though participants displayed a tendency to rate positive stimuli more positively with repeated exposure, this finding failed to reach significance. Probing these effects further, Grush conducted another experiment that sought to investigate the merit of the various explanations given by different researchers of the mere exposure effect (refer Grush, 1979, for a review). One such explanation which was investigated was that of Burgess and Sales (1971), who theorized about the effect of participant attitudes toward the experimental setting. The findings of this second experiment only found support for the attitude formation hypothesis, which posits that when an individual first encounters a novel stimulus, only a few associations are initially generated. With subsequent exposure, more associations to the stimulus are elicited. If the associations are positive, then increased exposure will lead to more positive evaluations of the stimulus. Conversely, if associations are negative, then increased exposure will lead to more negative evaluations of the stimulus. The attitude formation hypothesis seems to contradict the response competition hypothesis proposed by Harrison (1968) which, as previously stated, assumes that an abundance of associations are initially activated. Following repeated exposure, some of these associations are eliminated which consequently leads to an increase in liking. No other explanations, including that of Burgess and Sales described previously, were supported by Grush. However, a possible limitation of the two experiments conducted by Grush was that stimulus valence was treated as a within-subjects variable. As discussed in section 2.1.1.2 (p. 16), it is plausible that participants may have made comparative judgments of the stimuli, such that positive stimuli received more favourable evaluations and a greater number of positive associations relative to the negative stimuli because, regardless of exposure frequency, positive stimuli were more favourable to begin with. This probable “contrast effect” casts doubt over Grush’s interpretation of findings.
The mere exposure studies discussed thus far have established stimulus valence in two ways. Some studies have associated a relatively neutral stimulus (e.g., a nonsense word) with another stimulus or context that is believed to have an affective component (e.g., meaningful word: Burgess & Sales, 1971). Other studies have conducted pre-tests and established stimulus valence prior to the commencement of the experiment (e.g., Brickman et al., 1972). The majority of these studies have found that evaluations of positive stimuli were enhanced with repeated exposure while evaluations of negative stimuli decreased with repeated exposure. In addition, the majority of these studies (e.g., Brickman et al., 1972; Burgess & Sales, 1971; Perlman & Oskamp, 1971) have also attributed this finding to the effect of the context in which the stimulus was placed. Specifically, because of associative learning, stimuli exposed within a particular context assume the affective valence of that context, resulting in negative or positive evaluations of the target stimulus. However, as acknowledged by Zajonc, Markus et al. (1974), the studies that have discussed associative learning have failed to provide a clear separation between the impact of initial stimulus valence (obtained by conducting pre-tests) and the impact of associations on the mere exposure effect. Arguably, the way in which these studies established stimulus valence (through pre-tests or associations) could have influenced the exposure effect in different ways.

Bukoff and Elman (1979) conducted an experiment which sought to investigate the impact of both initial stimulus valence (using pre-rated negative, neutral or positive stimuli) and associations (using stimuli which were described as having negative, neutral or positive social characteristics) on the mere exposure effect. Findings of this study revealed that none of the exposure-favorability slopes were significantly different from one another. Thus, irrespective of whether participants were exposed to stimuli which were considered affectively valenced to begin with, or were provided with an opportunity for associative learning to take place, the attitude enhancing effect of repeated exposure was found for all conditions.

Previous to Bukoff and Elman (1979), Zajonc, Markus et al. (1974) also conducted a study with the intention to unravel the effect of repeated exposure to stimuli differing in affective valence and contexts. The authors suggested that if the processes of associative learning were inhibited throughout the experiment, then the effect of repeated exposure on attitude change to affectively charged stimuli could be accurately
determined, without the effects of associative learning being intertwined. Thus, the opportunity of associative learning was manipulated in the experiment that rendered four experimental conditions: two control groups (one who viewed positive stimuli and another who viewed negative stimuli) where no opportunity for associative learning was permitted, and two experimental groups (one who viewed positive stimuli and another who viewed negative stimuli) where associative learning was permitted. Consistent with Bukoff and Elman (1979), findings of this experiment revealed that in all groups, favorability ratings increased with repeated exposure. However, unlike Bukoff and Elman who found no significant differences between the slopes of the conditions, Zajonc, Markus et al. found that the slope of the line of the negative experimental condition (where participants were exposed to negative stimuli and the opportunity for associative leaning was allowed) was considerably flatter than those of the other conditions. According to Zajonc, Markus et al., this effect was expected on the basis that associative learning facilitates the reduction in response competition.

As discussed earlier, the response competition theory posits that several generalized responses are activated when an individual encounters a novel stimulus, which consequently results in competition and an adverse state. Subsequent exposure to the stimulus is believed to eliminate some of these responses, which therefore reduces the competition and leads to liking. According to Zajonc, Markus et al. (1974) associative learning facilitates the reduction in response competition, and therefore affects the slope (or rate of change) between exposure and attitudes. When stimuli are paired with positive associations, the rate of change further increases (becomes steeper) because the very presence of these associations, coupled with their positivity, have a harmonious effect on making the stimulus more attractive. However, when stimuli are paired with negative associations, the rate of change is shallower because even though the very presence of these associations is positive, the negative affective content has an antagonistic effect and thus, depresses it.

From these findings, Zajonc, Markus et al. (1974) and Bukoff and Elman (1976) both concluded that the mere exposure effect was not dependent upon initial stimulus valence. Thus, the attitude enhancing effect of repeated exposure was robust for not only neutral and positive stimuli, but for negative stimuli as well, provided that the degree of negativity was within moderate ranges and not extreme. Furthermore, Zajonc,
Markus et al. also concluded that the attitude enhancing effect of repeated exposure can be attenuated, but only when associative learning is deliberately induced, which as Zajonc, Markus et al. argues, no longer satisfies the “mere” exposure conditions. Rather, additional factors pertaining to associative learning contribute their own consequences which are above and beyond the consequences of repeated exposure alone. It is plausible that this explanation provided by Zajonc, Markus and colleagues could account for the findings of Burgess and Sales (1971) and Perlman and Oskamp (1971) who, as stated previously, intentionally provided an opportunity for associative learning to take place and found that negative stimuli became more negative following repeated exposure.

It is clear that the mere exposure literature has reported inconsistent results concerning the consequence of repeated exposure to negatively valenced stimuli. These inconsistencies appear to stem from differences in experimental designs which have been employed by the researchers. However, irrespective of this, a fundamental limitation of all of the mere exposure studies discussed thus far relates to the types of stimuli utilised. Specifically, the stimuli were not intrinsically emotional. As can be seen in Table 2 (p. 19), Bukoff and Elman (1979) used slides of male portraits from a college yearbook which, as stated earlier, had been pre-rated as being negative, neutral and positive and as having negative, neutral and positive social characteristics. Zajonc, Markus et al. (1974) used photographs of Chinese men depicting a similar expression and overall appearance. Participants in this study were informed that the men in the photographs were either scholars/scientists (positive stimuli) or criminals (negative stimuli) and were associated with the field of their contribution (e.g., medicine: positive condition) or crime (e.g., kidnapping: negative condition). Furthermore, Burgess and Sales (1971) used non-sense words which were paired with meaningful words known to evoke positive and negative affect, whereas Perlman and Oskamp (1971) used photographs of models that were of Black and White ancestry and were presented to participants in negative, neutral and positive contexts. In the negative context, models were presented in a socially devalued setting which included wearing disheveled clothing such as overalls and holding an identification number, mimicking a police line-up. In the neutral context, models were presented in a plain background, similar to a year-book type setting, and were wearing typical clothing such as a sport shirt. In the positive context, models were presented in a socially valued setting which included
wearing relatively prestigious clothing such as a graduation gown. Lastly, Grush (1976) used pre-rated, infrequent positive (e.g., gardenia) and negative (e.g., corrosive) words, while Brickman et al. (1972) used abstract paintings which, unlike other studies, were pre-rated by the same group of participants used in the test study. The failure to use a different group of participants, coupled with the failure to use stimuli which were objectively emotional, casts further doubt over the interpretation of Brickman and colleagues findings. Because participants had already been exposed to the target stimuli, it is plausible that their ratings given in the test phase were impeded by their memory of ratings given in the pre-test, such that they tried to keep them consistent.

From the above description of the type of stimuli used in mere exposure research, it is clear that the effect of repeated exposure to emotionally-charged stimuli remains to be properly investigated. In order to investigate the effect of repeated exposure to emotionally-charged stimuli, particularly adverse stimuli, and substantiate any conclusions made, it is crucial that stimuli with intrinsic negative and positive affective valence are used. However, given that emotional stimuli differ in terms of valence (ranging from unpleasantness and pleasantness) and arousal (calm [low] to exciting [high]) (Osgood, 1957), it is imperative to also take stimulus arousal level into account. Without doing so, it would be difficult to determine whether changes in participant liking ratings across the exposure frequency levels were due to stimulus valence or whether the changes were confounded by arousal level. This possibility is strengthened by the observation that images with strong valence are also rated as highly arousing (Lang et al., 2008). Thus, one way to ensure that the stimuli used are truly emotional and as such, contain valence and arousal properties is through the use of the International Affective Picture System (IAPS; Lang et al., 2008). A review of the IAPS will now be undertaken.

2.1.1.3.1 International Affective Picture System

The IAPS (pronounced “eye-aps”) was created by Lang et al. (2008) as part of a research program at the NIMH Centre for the Study of Emotion and Attention (CSEA) at the University of Florida. The IAPS is a set of over 1,000 colour photographs that depict a broad range of semantic categories and include pictures of mutilated bodies, dangerous animals, cemeteries, household objects, sporting events, nature, erotica and
more. To date, the IAPS has been used in a countless and diverse range of studies, particularly in those that have investigated emotion. For example, the IAPS has been used as stimuli in studies exploring elements of emotion (e.g., emotional processing, emotional reactivity, substance users; de Arcosa et al., 2005), and in clinical populations such as autism (Bolte, Feineis-Matthews, & Poustka, 2008), hypertension (Wilkinson & France, 2009), amyotrophic lateral sclerosis (Lule et al., 2005), and schizophrenia (Hempel et al., 2005). In addition, the IAPS has also been used to elucidate some physiological (e.g., heart rate; Bradley, Codispoti, Sabatinelli, & Lang, 2001; Stins & Beek, 2007) as well as some electrophysiological indicators of emotional processing (e.g., Event Related Potentials; Briggs & Martin, 2009; Britton, Taylor, Sudheimer, & Liberonz, 2006; Deiss, Rossignol, & Bourdiol, 2008; Keil et al., 2002; Schupp, Junghoffer, Weike, & Hamm, 2004), and have also been applied to explore the varying role of emotion in personality traits such as extraversion (Mardaga, Laloyaux, & Hansenne, 2006; Morrone-Strupinsky & Lane, 2007).

The most frequently cited reason for the popularity of the IAPS is that each photograph has a standardised rating of valence, arousal and dominance. According to Lang et al. (2008), decisions regarding the emotional judgments selected for standardization were based on the seminal work of Osgood (1957). Specifically, through the use of factor analyses, three dimensions were identified to account for the variance in emotional judgments: hedonic valence, arousal and to a lesser extent, dominance. Hedonic valence refers to the quality of an emotion and ranges from “unpleasant” (e.g., unhappy) to “pleasant” (e.g., happy), while arousal refers to the perceived level of activation associated with an emotional response and ranges from “calm” to “excited” (refer Bradley & Lang, 2007, for a review).

Standardised ratings of valence/pleasure and arousal were acquired by using the Self-Assessment Manikin (SAM; Lang, 1980). The SAM is a non-verbal, illustrative assessment tool that was used to obtain participant ratings of the aforementioned emotion dimensions for each IAPS photograph (refer to Figure 1 below). The SAM was developed to reduce the reliance on language requirements, enabling children to also

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4 Given that the third dimension of emotion, called dominance, has been found to account for much less variance in semantic evaluation research in comparison to valence and arousal (Bradley & Lang, 2007), this dimension will not be focused upon.
provide ratings on the same instrument as adults, and so that ratings from different cultures could be compared (Backs, da Silva, & Han, 2005). To date, the IAPS have been validated in numerous counties such as Brazil (Lasaitis, Ribeiro, & Bueno, 2008) and Chile (Dufey, Fernandez, & Mayol, 2011), indicating that the standardised ratings are universally accepted.

As can be seen in Figure 1, each dimension is represented by five graphic figures. For valence/pleasure ratings, the SAM figures range from smiling and happy to frowning and unhappy. For arousal ratings, the SAM figures range from excited and alert to relaxed and sleepy. The participants involved in the IAPS rating procedure were given set instructions on how to complete the task (refer to Lang et al., 2008, for a detailed description). Put briefly, participants were advised that they would be shown images (from the IAPS database) and that their task was to rate each image according to the SAM. To clarify what the concepts of valence/pleasure and arousal meant, the participants were given a list of adjectives which described the extremes (anchor points) of each scale\(^5\). Specifically, for the valence/pleasure scale, participants were told that if

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\(^5\) According to Bradley and Lang (2007), the list of adjectives were used to avoid a reliance on a single, specific adjective which may be used more frequently in a context associated with a specific hedonic valence.
they felt completely happy, pleased, satisfied, contented or hopeful, they would indicate this response by placing an “X” over the far left figure (see Figure 1, top row). However, if they felt completely unhappy, annoyed, dissatisfied, melancholic, despaired or bored, they would indicate this response by placing an “X” over the far right figure. For the arousal scale, participants were told if they felt completely stimulated, excited, frenzied, jittery, wide-awake or aroused, they would indicate this response by placing an “X” over the far left figure (see Figure 1, bottom row). However, if they felt completely relaxed, calm, sluggish, dull, sleepy or unaroused, they would indicate this response by placing an “X” over the far left figure. If required, participants were also advised that they could mark the box that appeared in the middle of two figures in each scale if this better represented their immediate personal experience when each of IAPS picture was viewed. This rating procedure reflected a 9-point scale (see Figure 1 above), such that a score of one represented a low rating on each dimension and nine represented a high rating on each dimension (Lang et al., 2008).

Prior to the development of the IAPS, researchers interested in emotion faced an array of challenges which mainly related to the selection of emotional stimuli to be used in experiments. This issue, which was particularly pertinent in laboratory environments, produced a negative chain of events. Specifically, obvious parameters to organise, group and categorise emotional stimuli were lacking. As a consequence, researchers needed to create unique emotional stimuli for each experiment. However, this then led to problems with replication because the stimuli used in these experiments were rarely available to other laboratories or a detailed description required for the recreation of the stimuli was lacking (Bradley & Lang, 2007). This domino effect often resulted in different stimulus materials being used and thus, clearly highlighted the need for standardised emotional stimuli which were easily and widely available to researchers. Hence, the IAPS was developed. As a result of standardisation, the IAPS has improved the study of emotion by providing superior experimental control in the selection of affectively valenced stimuli; allowing for comparisons of research findings across studies and by permitting replication within and across different research domains (e.g., psychology and marketing) (Bradley & Lang, 2007).

Interestingly, even though the IAPS has been widely used in research, to date, only one study has applied the IAPS to the mere exposure effect (Young, 2007). This is
surprising given that the IAPS would be highly suited to experimental research investigating people’s affective responses to stimuli, which essentially reflects a typical mere exposure experiment (Zajonc, 1968). However, even though Young (2007) used the IAPS, the primary aim of this study was to investigate the behavioural effects of mere exposure. Specifically, the effect of familiarity on approach/avoidant behaviour to stimuli that were neutral and affectively negative (learned threatening stimuli and innately threatening stimuli) was examined (refer Young, 2007, for a review). Hence, while this was a novel study, the gap in the mere exposure literature concerning the effect of repeated exposure on affective evaluations of innately emotional stimuli, particularly negative stimuli, is still yet to be properly addressed. Furthermore, given that emotional stimuli are known to vary on at least two important dimensions, namely valence and arousal (Osgood, 1957), it is important to ensure that both dimensions (i.e., not just stimulus valence) are taken into account when exploring the mere exposure effect with emotional stimuli.

In summary, there is a consensus across studies that the attitude enhancing effect of repeated exposure is robust for neutral and positive stimuli. However, for negative stimuli, the effect of repeated exposure appears to be more controversial. Some studies have reported that evaluations of negative stimuli become more negative, while other studies have reported that evaluations become more positive with increasing exposure. Despite the variability between studies in their methods used to establish stimulus valence, the proposition made by researchers that the stimuli were emotionally charged is highly questionable. Even though, in some cases, participants pre-rated stimuli as being negative or positive (relative to each other), while in other cases, the stimuli were associated with negative or positive contexts, none of the stimuli presented in Table 2 (p. 19) were innately emotional. As a consequence, the effect of repeated exposure to intrinsically emotional stimuli, particularly negative or adverse stimuli, remains to be properly investigated. One way this could be achieved is by using the IAPS which contains standardised ratings of both stimulus valence and arousal for each IAPS image. Importantly, to gain a holistic insight into the mere exposure effect using emotional stimuli, both of these dimensions (valence and arousal) need to be investigated. Due to the extensive validation of the IAPS, researchers can be confident that their selected stimuli are innately emotional. In addition, by using the IAPS, this would also allow the
mere exposure effect to be examined with more meaningful, real-world stimuli, thereby expanding upon this limited body of mere exposure research (see section 2.1.1.1, p. 11)

2.1.2 Presentation Variables

2.1.2.1 Number of Exposures

It is clear that variables relating to the stimuli (i.e., stimulus type, stimulus complexity and stimulus valence) have been found to influence the mere exposure effect. However, in addition to these variables, other variables pertaining to how the stimuli are presented have also been found to exert an effect. The premise behind the mere exposure effect is that repeated, unreinforced exposure to a stimulus increases affective judgments of that stimulus (Zajonc, 1968). However, is there a point at which affective judgments begin to decline? If so, after how many exposures does this begin to occur? Several studies have investigated these questions and have found that changes in affect ratings are often not just contingent upon the number of exposures, but can be influenced by a number of other variables as well.

In Bornstein’s (1989) meta-analysis, it was reported that mere exposure studies generally present stimuli to participants up to a maximum of 10-50 times, with the mean ceiling of exposures reported to be 20.95 ($SD = 32.28$). Even though this low ceiling of stimulus exposures may not permit adequate testing of the exposure-affect relationship, a decline in affect ratings has still been found, even after this relatively small number of exposures (e.g., Stang & O’Connell, 1974; Zajonc et al., 1972). Hence, studies which have used 100 or more stimulus exposures have been found to produce much weaker mere exposure effects (Bornstein, 1989). However, upon further review of many mere exposure studies, including some of those discussed in Bornstein’s meta-analysis, it appears that other variables were conjointly impacting upon the exposure frequency-affect relationship. These variables include: stimulus discriminability, stimulus complexity, presentation sequence and delay between exposure and rating.

Subliminal exposure duration has also been found to influence the exposure frequency-affect relationship; however it will not be discussed within this review.

One study investigating the effect of exposure frequency described in Bornstein’s (1989) meta-analysis was that by Zajonc et al. (1972). According to Bornstein, affect ratings of abstract paintings used in this study increased through 10

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6 Subliminal exposure duration has also been found to influence the exposure frequency-affect relationship; however it will not be discussed within this review.
exposures but then reached a plateau. However, the exposure frequency-affect relationship was dependent, in part, on the discriminability of the stimuli. Specifically, Zajonc and colleagues conducted three experiments investigating the proposition that affect ratings may begin to decline after an excessive number of exposures, and as such, display a curvilinear relationship. The procedure used in all three experiments was identical: participants were exposed to the stimuli of interest for two seconds and these were counterbalanced across six exposure frequencies (i.e., 0, 1, 2, 5, 10 and 25). Then, participants were required to rate each stimulus for liking on a 7-point scale. The only element that differed between the experiments was the type of stimuli utilised. In the first experiment, abstract paintings that were easy to distinguish from one another were used. Findings of this experiment revealed that affect ratings began to decline after only a few exposures. In fact, easily discriminable paintings presented 25 times were liked substantially less than those paintings never presented in the exposure phase (i.e., at frequency 0). To further investigate the effect of stimulus discriminability on the exposure frequency-affect relationship, Zajonc and colleagues used paintings again in Experiment 2, but this time they were more similar to one another. In contrast to the findings of Experiment 1, the findings of Experiment 2 revealed that the downturn in affect ratings began at a much higher exposure frequency. Thus, a stronger mere exposure effect was found when there was less discriminability (or difference) between the stimuli.

Zajonc et al. (1972) speculated that the difference in findings between Experiments 1 and 2 could be explained by the response competition hypothesis. As discussed in section 2.1.1.2 (p. 15), this theory posits that when an individual encounters a novel stimulus, the degree of similarity this stimulus has with a previously encountered familiar stimulus, will determine the intensity and the number of generalized responses that are activated at the time of the first exposure. The greater the familiarity, the greater the number of responses that are elicited which in turn, leads to greater response competition; an adverse state. Subsequent exposure to the stimulus is believed to eliminate some of the responses which therefore, will reduce the negative affect caused by response competition. Consequently, liking toward the stimulus is increased. In the context of Zajonc and colleagues’ first experiment, the paintings were extremely discriminable. Thus, given the lack of familiarity between the painting stimuli, there was little response competition to reduce, which therefore meant that
liking toward these paintings could never emerge. However, although this explanation was plausible, it may be limited to paintings only. Specifically, in the third experiment, Zajonc et al. utilised photographs of men’s faces which were highly discriminable. For example, some faces were of young men while others were of old men; some men were wearing hats while others were not. The discriminability of stimuli was also confirmed by preliminary tests. Contrary to expectation, affect ratings did not decline, rather they increased with increasing exposure frequency. In fact, the frequency-affect curve was almost identical to that of Zajonc’s (1968) original monograph where similar faces were used. Therefore, given that the predicted downturn failed to materialize, Zajonc et al. concluded that the effect of stimulus discriminability was unique to abstract paintings only. Returning to Bornstein’s (1989) meta-analysis, only the findings of Zajonc and colleagues’ second experiment were reported; affect ratings did appear to decline after 10 exposures, however this only occurred when the abstract paintings were difficult to distinguish from one another. In addition, even though these findings were displayed visually in a graph, the lack of further statistical tests (e.g., post-hoc) made it difficult to determine if this decrease at 10 exposures was statistically significant.

In addition to stimulus discriminability, another variable which has been found to influence the exposure frequency and affect relationship is stimulus complexity. As previously discussed in section 2.1.1.2 (p. 15), enhanced affective evaluations are more commonly obtained with complex, rather than simple stimuli (e.g., Bornstein et al., 1990; Cox & Cox, 2002; Saegert & Jellison, 1970). Hence, complex stimuli have been reported to produce stronger mere exposure effects. In the study by Saegert and Jellison (1970), all participants were exposed to one complex and one simple stimulus for three seconds at each exposure frequency (0, 1, 2, 5, 10 and 25). The complex stimuli used in this study consisted of Chinese characters whereas the simple stimuli consisted of brushstrokes which formed the Chinese characters. After exposure, participants were then required to rate each complex and simple stimulus for liking and goodness-of-meaning. The findings pertaining to liking ratings revealed that the interaction between exposure frequency and stimulus type approached significance. A test of the simple effects indicated that the effect of frequency on simple stimuli was not significant. However, the effect of frequency on complex stimuli was highly significant. Examination of the means revealed that for complex stimuli, liking ratings initially dropped very slightly and non-significantly, but then continued to increase to a high
level of 25 exposures. According to Saegert and Jellison (1970), this trend in the means for complex stimuli is consistent with the response competition hypothesis described above and the anticipated mere exposure effect. However, for simple stimuli, liking ratings reached asymptote only after two exposures and plateaued until dropping to a low level of 25 exposures. Thus, in contrast to complex stimuli, an inverted U-shaped relationship between exposure and liking was found for simple stimuli, although this was not significant. The findings pertaining to goodness of meaning ratings revealed a tendency for ratings to increase over the course of exposure for complex stimuli. For simple stimuli, goodness-of-meaning ratings also reached asymptote after only two exposures. However, the interaction between exposure frequency and stimulus type failed to reach significance. Thus, goodness-of-meaning ratings of simple and complex stimuli did not significantly differ across the frequency levels. This finding that goodness-of-meaning measures produced weaker exposure effects than measures of liking is consistent with the findings of Bornstein’s (1989) review, further discussed in section 2.1.3.1 (p. 43).

As previously discussed, enhanced liking ratings following repeated exposure could have possibly been obtained for complex but not for simple stimuli because of the within-subjects design employed by Saegert and Jellison (1970). Specifically, participants may have compared the simple stimuli to the complex stimuli, thus rendering the complex stimuli more interesting and better liked, relative to the simple stimuli. This theory gained support by a study conducted by Bornstein et al. (1990), which examined the relationship between frequency and affect for complex and simple stimuli using both a within-subjects and a between-subjects design. In one experiment, a within-subjects design was used, with all participants exposed to both complex (optical illusions) and simple (Welsh figures) stimuli. In the other experiment, a between-subjects design was used, with some participants exposed to only complex optical illusion stimuli and other participants exposed to only simple Welsh figure stimuli. In both experiments, the target stimuli were presented for five seconds at each level of exposure frequency (0, 1, 2, 5, 10, 25 and 50). When a within-subjects design was used, the relationship between frequency and affect was different for the complex and the simple stimuli. Specifically, for complex stimuli, affect ratings initially increased at the lower exposure frequencies and then gradually declined at the higher exposure frequencies. However for simple stimuli, affect ratings remained relatively unchanged.
throughout the lower exposure frequencies and then also gradually declined. Thus, for both complex and simple stimuli, high levels of exposure resulted in a decline in affect ratings, with ratings of complex stimuli returning to baseline and ratings of simple stimuli falling significantly below baseline. However, in the second experiment when a between-subjects design was used, different results were found. Specifically, although affect ratings of complex stimuli increased more rapidly than affect ratings of simple stimuli over the course of exposure (demonstrating a stronger mere exposure effect), both types of stimuli still showed a monotonic increase in affect ratings with increasing exposure frequency. The differences in findings between the two experiments were speculated to have occurred because when participants were exposed to only complex or simple stimuli, no comparison was able to be made. Consequently, the exposure effect for simple stimuli was able to eventuate. However, similar to Zajonc et al. (1972), Bornstein and colleagues also failed to report any post-hoc tests. Thus, even though the findings of both experiments were presented graphically and further analyses were performed on “low” (i.e., 0, 1, 2 and 5 exposures) and “high” (i.e., 5, 10, 20 and 25 exposures) frequency groups (refer Bornstein et al., for a review), it is again difficult to determine exactly when (i.e., at what frequency level) these significant changes in affect ratings occurred in both experiments.

Other variables that have been found to influence the exposure frequency and affect relationship are presentation sequence and delay between exposure and rating (further discussed in sections 2.1.2.2 [p. 40] and 2.1.3.3 [p. 48] respectively). In a study by Harrison and Crandall (1972), participants were either allocated into a heterogeneous (i.e., in which several stimuli are interspersed) or homogeneous (i.e., in which a given stimulus repetitiously follows itself) exposure sequence group and were presented with Chinese ideographs at varying exposure frequencies (0, 1, 3, 9 and 27 times). In Experiment 1, after all of the stimuli had been presented, both groups of participants were required to rate each stimulus for goodness-of-meaning according to a 7-point scale. A significant main effect of frequency was found, with goodness-of-meaning ratings of both groups increasing with repeated exposure. However, more importantly, a significant interaction between exposure frequency and sequence condition was also found. The effect of exposure on goodness-of-meaning ratings was different for participants in the heterogeneous and homogeneous conditions. Specifically, at high frequency levels (27 exposures) greater goodness-of-meaning ratings were given by
participants in the heterogeneous condition, with ratings somewhat attenuated in the homogeneous condition. In Experiment 2, another group of participants were exposed to the same Chinese Ideographs in a homogenous exposure sequence only, and goodness-of-meaning ratings were obtained on the last massed presentation of each stimulus. Unlike the findings of Experiment 1, goodness-of-meaning ratings in this homogeneous condition increased throughout the lower exposure frequencies, but were then followed by a sharp decline with further exposure. According to Harrison and Crandall, the absence of interspersed stimuli (reflecting the type of presentation sequence), coupled with immediate ratings after exposure of each massed stimulus, presumably allowed tedium to occur and thus, influenced the exposure frequency and affect relationship.

In summary, the exposure frequency-affect relationship is not always straightforward. Despite many studies reporting a decline in affect ratings after 10-50 exposures, other variables have been found to influence this relationship. The limiting effect of stimulus discriminability seems to be unique to painting stimuli only, with affect ratings declining after only a few exposures, a finding that did not occur with easily discriminable faces. The frequency-affect relationship was also contingent upon the complexity of stimulus. In contrast to meaningless complex stimuli, affect ratings of meaningless simple stimuli declined after a lower number of exposures. However, presumably because of “contrast” effects, it would seem that exposure effects for meaningless simple stimuli are prevented from occurring when participants are concurrently exposed to complex, more interesting stimuli. This suggests that the experimental design is responsible for the influence of stimulus complexity on the exposure-affect relationship. Lastly, exposure presentation sequence and the delay between exposure and rating can also impede the relationship between frequency and affect. The lack of interspersed stimuli in homogeneous presentation sequences, together with collecting affect ratings immediately after massed presentations of each stimulus allows boredom to occur, resulting in a decline in affect over the course of exposure. However, given that many studies only reported that a significant difference in affect was found but failed to report exactly when this change occurred, only the question “is there a point at which affective judgments begin to decline?” can be answered. This leaves the question “if so, after how many exposures does this begin to occur?” relatively unexplored.
2.1.2.2 Exposure Presentation Sequence

The exposure phase in a mere exposure experiment involves presenting participants with a series of stimuli at varying exposure frequencies. Within this phase, researchers can choose to display the stimuli using; a homogeneous presentation sequence, a heterogeneous presentation sequence or in some cases, both (e.g., Stang & O’Connell, 1974). As mentioned above in section 2.1.2.1 (p. 38), in a homogeneous presentation sequence, each stimulus repetitiously follows itself until the total number of exposures is attained. In contrast, in a heterogeneous presentation sequence, no stimulus follows itself, with several other stimuli being randomly interspersed. The type of sequence employed in the exposure phase has been reported to influence the magnitude of the mere exposure effect. Specifically, according to Bornstein’s (1989) meta-analysis, studies which use a heterogeneous presentation sequence produce moderate effects (documented ES was .301), whereas studies which use a homogeneous presentation sequence often fail to produce an exposure effect at all (documented ES was -.020). However, similar to the way in which the number of exposures can influence the effect (as discussed above), other variables have also been found to exert an influence on the presentation sequence and affect relationship. Such variables include exposure frequency and length of delay between exposure and rating.

In terms of exposure frequency, two studies (i.e., Bornstein et al., 1980; Harrison & Crandall, 1972) have found weaker mere exposure effects for stimuli presented in a homogeneous sequence rather than a heterogeneous sequence at high frequency levels only. For example, Harrison and Crandall (1972; Experiment 1) found that goodness-of-meaning ratings given by participants in a homogeneous sequence condition were extremely attenuated relative to the ratings given by participants in a heterogeneous condition after 27 stimulus exposures. Both Bornstein et al. (1980) and Harrison and Crandall suggested that this occurred because the lack of interspersed stimuli in a homogeneous sequence induced boredom. However, in addition to this explanation, the effect that exposure frequency and presentation sequence has on a dependent measure of affect also seems to be reliant on the length of delay between exposure and rating.

Despite affect ratings being attenuated at high frequencies in homogenous conditions, both Bornstein et al. (1980) and Harrison and Crandall (1972) still found
affect ratings to increase with increasing exposure frequency in both presentation sequence conditions. Thus, the question is raised that if homogeneous conditions induce boredom, then why didn’t the homogeneous frequency-affect curve in both studies downturn, especially at high frequency levels? To investigate this question, Harrison and Crandall conducted a second experiment which varied the point at which affect ratings were obtained from participants. In comparison to Experiment 1 wherein affect ratings were collected at the end of the entire exposure phase, Experiment 2 obtained affect ratings after the last massed presentation of each stimulus, prior to the presentation of the next stimulus. A stark contrast in findings between the two experiments was identified. Within this experiment (Experiment 2), affect ratings initially increased but then sharply declined with increasing exposure frequency. Hence, even though homogeneous presentation sequences impair the frequency-affect relationship due to boredom, it would seem that providing a period of delay; by collecting affect ratings at the end of the exposure phase, lessens this impact. When ratings are immediately obtained before additional stimuli are presented, the effects of boredom predominate as the stimuli are increasingly exposed.

In summary, homogeneous presentation sequences produce weaker mere exposure effects than heterogeneous sequences, particularly at high frequencies. This presumably occurs because the repetitious exposure of the same stimulus and the absence of other interspersed stimuli results in the occurrence of boredom in homogeneous conditions. Boredom is also increased by collecting ratings directly after massed presentations of each stimulus, allowing no period of delay between exposure and rating, and consequently produces a downturn in the frequency-affect curve in homogeneous experimental designs.

2.1.3 Measurement Variables

2.1.3.1 Type of Dependent Measure

A classic mere exposure study involves two phases: an exposure phase and a test phase. The exposure phase involves presenting participants with stimuli in succession, at varying exposure frequencies. Following this, participants undergo the test phase, which can involve one of two different procedures. The first procedure involves a forced-choice format, wherein each stimulus from the exposure phase is presented
again, one at a time, alongside a similar but never-before-seen equivalent. Participants are required to select one stimulus out of the pair (i.e., are forced to choose between them) according to an affective dimension such as liking. This forced-choice format has been used in many mere exposure studies, particularly those investigating subliminal effects (e.g., Newell & Shanks, 2006; Seamon et al., 1984). The second procedure also involves presenting the stimuli from the exposure phase again, one at a time, but the similar yet never-before-seen equivalents are dispersed among them. For this procedure, participants are required to indicate on a rating scale their affective judgment of each stimulus shown. This rating scale format has also been used in many mere exposure studies (e.g., Bornstein et al. 1990; Zajonc, Markus et al., 1974). In both types of test phase procedures, evidence of the mere exposure effect is obtained when participants ascribe more positive affective evaluations to the ‘old’ or frequently exposed stimuli from the exposure phase rather than the ‘new’ or infrequently stimuli they encountered in the test phase.

Affective evaluations are multi-faceted and as such, can be measured in numerous ways. Within the mere exposure literature, the most commonly used dependent measure is “liking”. To explore the exposure-affect relationship, liking has been evaluated in both the forced-choice and rating scale procedures. Studies employing the use of the forced-choice procedure have assessed liking by asking participants to choose a stimulus out of a similar pair which they like the most (e.g., Kunst-Wilson & Zajonc, 1980). Alternatively, studies employing the rating scale procedure have assessed liking by asking participants to indicate, generally on a 7-point or 9-point Likert scale; how much they like each stimulus shown (e.g., Brickman et al., 1972). Other dependent measures of affect include, but are not limited to, pleasantness (e.g., Stang, Faranda, & Tantillo, 1977; Stang & O’Connell, 1974; Hansen & Bartsch, 2001), goodness-of-meaning (e.g., Burgess & Sales, 1971; Saegert & Jellison, 1970; Zajonc, 1968; Zajonc, Crandall, Kail, & Swap, 1974; Zajonc, Markus et al., 1974), preference (e.g., Bornstein et al., 1987) interestingness-boringness (e.g., Bornstein et al., 1990) and attractiveness (e.g., Hekkert et al., 2013).
Although relatively limited, other studies have used multiple dependent measures of affect\(^7\). As a result, a comparison of the effects of exposure along several rating dimensions could be discussed. For example, Kail and Freeman (1973, Experiment 2), exposed participants to Chinese characters and asked each participant to rate the stimuli according to four different dimensions. These dimensions were ‘stable/changeable’, ‘beneficial/harmful’, ‘attracting/repelling’ and ‘interesting/boring’. In addition to these dimensions, goodness-of-meaning (i.e., ‘good/bad’) data from an unpublished study at the time was also used in the comparison (Zajonc, Crandall et al., 1974). Despite Bornstein (1989) reporting that this study found weaker effects for goodness-of-meaning ratings than for interestingness or attractiveness ratings, different results were actually reported by the authors. Specifically, according to the analysis of variance (ANOVA) performed by Kail and Freeman, ratings of ‘stable/changeable’ and ‘good/bad’ produced the strongest effects, with ratings on both of these dimensions becoming more positive with increasing exposure frequency. Negative exposure effects were found for the ‘interesting/boring’ dimension (i.e., ratings declined) and no exposure effects were found for the ‘attracting/repelling’ or ‘beneficial/harmful’ dimensions.

Other studies have also compared goodness-of-meaning with liking ratings and have produced inconsistent results. For example, some studies have found stronger effects for liking than goodness-of-meaning of ratings (e.g., Zajonc, Markus et al., 1974), other studies have found comparable effects (e.g., Saegert & Jellison, 1970), and yet other studies have found stronger effects for goodness-of-meaning than liking ratings (e.g., Zajonc, Crandall et al., 1974). However, despite these inconsistencies, clearer results were reported within Bornstein’s (1989) meta-analysis. According to Bornstein, while all affective measures can produce significant effects, liking and multiple measures of affect have produced the strongest effects and thus, support the findings of Zajonc, Markus et al. (1974).

In addition to these subjective, self-report measures of affect, other mere exposure studies have utilised more objective methods. For example, Harmon-Jones and

\(^{7}\) Studies have also used measures of recognition in addition to measures of affect in the same study. However, subliminal exposure and consequently, stimulus recognition is beyond the scope of this thesis.
Allen (2001) measured facial electromyography (EMG) responses to repeatedly exposed and novel stimuli. Given that activity within the corrugator supercilii muscle region (brow) and the zygomatic muscle region (cheek) has been reliably associated with negative and positive affective states respectively, it was predicted that familiar stimuli would evoke greater zygomatic muscle region activity than novel stimuli. This prediction was based on the definition of a mere exposure effect; that repeated exposure to a stimulus is sufficient to produce more positive affect toward that stimulus (Zajonc, 1968). Findings of this study supported the researcher’s prediction and consequently, provided physiological support for the observation that repeated exposure enhances positive affect toward familiar stimuli. Furthermore, the use of a physiological marker of affect provides evidence that affective processes underlie the mere exposure effect (refer Harmon-Jones & Allen, 2001, for a review).

It could be argued that the type(s) of dependent measures employed would depend upon the stimulus type. For example, if emotional stimuli are used that are meaningful to participants then it is likely that repeated exposure could influence more measures of affect in comparison to when the stimuli are neutral and meaningless to participants. That is, given that the perception of emotional stimuli subsequently leads to an emotional response (Brosch, Pourtois, & Sander, 2010), affective measures could also include participant ratings of valence, which refers to the pleasantness of a stimulus, and arousal, which reflects the intensity of a stimulus and often varies from calm to exciting (Lang, Greenwald, Bradley, & Hamm, 1993). Furthermore, given that the mere exposure effect refers to enhancement of affect following repeated exposure (Zajonc, 1968) and that collectively, both valence and arousal have been identified as the two prominent dimensions of affect (Osgood, 1957) then it follows that the intensity of stimulus valence and arousal could also increase as a result of unreinforced repeated exposure. Clearly, because neutral stimuli are not pleasant (positive) or unpleasant (negative) and do not differ in arousal/intensity, such affective measures would not be suitable when investigating the mere exposure effect using neutral stimuli. However, even though past mere exposure research has claimed to have investigated emotional stimuli, the use of valence and arousal as dependent measures of affect is rare. This is presumably because the stimuli which have been used were not truly emotional (refer Table 2, section 2.1.1.3, p. 19) and as such, were unlikely to have been perceived by participants as unpleasant/pleasant and arousing to begin with.
Although the mere exposure effect refers to an increase in affect towards a stimulus following its repeated exposure, it is also equally plausible that these measures of affect would decrease with repeated exposure due to affective habituation. Affective habituation refers to when the intensity of the reaction (thought to be regulated by an evaluative system) to emotional stimuli decreases due to previous exposure (Leventhal, Martin, Seals, Tapia, & Rehm, 2007). It has been argued that it would be maladaptive for individuals not to habituate to emotional stimuli. That is, if the evaluative system failed to decrease in intensity and continually respond to a stimulus after an initial encounter, then the appropriate cognitive and behavioural resources devoted to effectively respond to the stimulus would be depleted, resulting in panic reactions (Dijksterhuis & Smith, 2002). In addition, it has also been argued that the magnitude of affective habituation (i.e., the rate at which affective reactions decrease in intensity during repeated exposure) depends upon the intensity of the emotional stimulus that is encountered. Specifically, extreme negative and/or positive stimuli are considered to have a more pronounced influence on the evaluative system and as such, the subsequent affective response to this stimuli is purported to decline at a faster rate in comparison to when the stimuli are less or only moderately extreme (Dijksterhuis & Smith, 2002; Leventhal et al., 2007).

However, research has identified that conditions which can facilitate the occurrence of a mere exposure effect can actually limit the process of affective habituation. Specifically, according to Leventhal and colleagues (2007), heterogeneous presentation sequences, wherein no stimulus follows itself, with several other stimuli being randomly interspersed, allow for the introduction of novel stimuli which have been found to counteract the habituation process. In contrast, as discussed in 2.1.2.2 above (p. 40), heterogeneous sequences are found to produce stronger mere exposure effects than homogeneous sequences (i.e., each stimulus repetitiously follows itself) because the former inhibits the occurrence of boredom. Interestingly however, novel stimuli are believed to oppose the affective habituation process because there is more variability between the stimuli (Leventhal et al., 2007). Thus, this rationale parallels the finding that stimulus discriminability (i.e., when the stimuli are different and easy to discriminate between) can limit the occurrence of the mere exposure effect, however this finding is believed to be unique to painting stimuli only (Zajonc et al., 1972). Thus, given the apparent contradictions in the effect of heterogeneous presentation sequences
which exist between the mere exposure and the affective habituation literature, and the relative lack of mere exposure research that has utilised valence and arousal ratings as dependent measures of affect, the effect of repeated exposure on participant valence and arousal ratings warrants further investigation.

In summary, while all affective measures can produce significant exposure effects, stronger effects have been found for liking and multiple measures of affect. In addition to these subjective measures, other objective physiological markers of affect have also been used to explore the frequency-affect relationship. Finally, given that past mere exposure research has failed to use stimuli that were inherently emotional, the effect of repeated exposure on participant valence and arousal ratings (i.e., stimuli specific measures of affect) in a controlled setting remains to be established.

2.1.3.2 Test Order

Although not discussed in Bornstein’s (1989) meta-analysis, test order is another measurement variable which can influence the mere exposure effect. This variable is only pertinent to those studies which have used multiple dependent measures of affect, as in the case of the studies discussed above. A difficulty with investigating more than one dependent measure is that participant responses to one measure may influence their response on the other, a phenomena known as order effects. This is likely to occur due to some preconceived idea about the relationship between the measures. Hence, it is possible that the order in which the dependent measures are presented in the test phase may bias participant responses. Mere exposure researchers and researchers in general, use numerous strategies to minimize the influence of order effects. However, the reliance on these strategies is greater and more common in subliminal rather than supraliminal mere exposure studies because more often than not, subliminal researchers not only use a measure of affect (e.g., liking) but also a measure of stimulus recognition. This is because the stimuli are exposed to participants for a rapid duration (e.g., four milliseconds), which is deemed to be below the threshold of consciousness. Within supraliminal studies, researchers have typically used only one dependent measure of affect (e.g., liking), with relatively few researchers using more than one measure (e.g., Kail & Freeman, 1973, Experiment 2; Saegert & Jellison, 1970; Zajonc, Crandall et al., 1974, Experiment 2). Therefore, even though the subliminal mere exposure literature is
beyond the scope of this thesis, some of these studies will still be briefly discussed in relation to the strategies used to combat order effects. Importantly, by doing so, insight can also be gained as to how order effects can be minimized when using multiple dependent measures of affect, as in the case of this thesis.

As previously mentioned in the section 2.1.3.1 above (p. 41), there are two ways in which the stimuli can be rated in the test phase: by a forced-choice or by a rating scale method. In addition to this, when multiple dependent measures are used, there are also two methods that determine when the ratings take place: by an item-by-item or test-by-test method. In an item-by-item method, the test stimulus is presented once. Before the next test stimulus is presented, the participant immediately rates it for either liking or recognition/other dependent measure of affect only (if using a single dependent measure), or for both whereby one measure is taken directly after the other. In the test-by-test method, the test stimulus is presented twice. Upon the first presentation, the participant rates it for liking or recognition/other dependent measure of affect and upon the second presentation, the participant rates the other dependent measure which was not previously obtained.

For both types of methods, mere exposure researchers have used numerous procedures to avoid or at least minimize the possibility that the participants’ response to one dependent measure may influence their response on the other. One such procedure frequently used is counterbalancing, wherein participants are presented with the dependent measures in different sequences. Counterbalancing has been used in many mere exposure studies employing the item-by-item method (e.g., Bornstein & D’Agostino, 1992; Brooks & Watkins, 1989, Experiment 5; Kail & Freeman, 1973, Experiment 2; Kunst-Wilson & Zajonc, 1980; Newell & Shanks, 2006; Saegert & Jellison, 1970; Zajonc, Markus et al., 1974) and also the test-by-test method (e.g., Mandler, Nakamura, & Van Zandt, 1987; Seamon Brody, & Kauff, 1983; Seamon et al., 1984). As a secondary precaution, some studies, in addition to counterbalancing, have also included the different test order sequences in the statistical analysis by creating an independent variable, often termed ‘test order’ (e.g., Brooks & Watkins, 1989; Kunst-Wilson & Zajonc, 1980; Newell & Shanks, 2006; Seamon et al., 1983; Seamon et al., 1984). Consequently, the statistical significance and hence its impact, can be assessed. Other procedures less commonly used include having different sets of test stimuli for
each dependent measure (e.g., Bornstein et al., 1987) and using different groups of participants to make one type of rating only (e.g., liking or goodness-of-meaning or recognition only) (e.g., Bonanno & Stillings, 1986; Moreland & Zajonc, 1977; Zajonc, Crandall et al., 1974).

In summary, while the majority of subliminal mere exposure studies have used multiple dependent measures in comparison to supraliminal mere exposure studies, the possible influence of order effects is equally relevant to both bodies of research. Specifically, regardless of whether stimuli are presented for a duration which is below or above the threshold of consciousness, a participant’s response to one dependent measure may influence their response on the other, based on a predetermined idea about the association between the measures. Strategies that have been used to minimize order effects are counterbalancing, including test order as an independent variable in the statistical analysis, using different sets of stimuli for each dependent measure or using different groups of participants to make only one evaluative judgment.

2.1.3.3 Delay Between Exposure and Rating

After participants have passively viewed stimuli in the exposure phase they are then required to rate the stimuli according to one or multiple dimensions of affect. However, the point at which these ratings occur has varied between studies. According to Bornstein (1989), there are four different periods of delay between exposure and collecting ratings of the merely exposed stimuli. Specifically, affective ratings can be collected immediately after the presentation of all stimuli (e.g., Bornstein et al., 1990), or, affective ratings can be collected after a defined period of delay such as five minutes (Stang et al., 1977) or one week (Zajonc et al., 1972, Experiment 4). Affective ratings can also be collected following a massed presentation of a particular stimulus (e.g., Harrison & Crandall, 1972) or, affective ratings can be obtained for stimuli in the natural environment for which the exact period of delay is unknown.

The findings of Bornstein’s (1989) analysis revealed that the different forms of delay can influence the exposure-affect relationship, with studies taking place within natural settings (for which the period of delay is often unknown) producing the largest overall effect size (documented ES was .572). However, in comparison to collecting
ratings immediately after the massed presentation of a particular stimulus, stronger exposure effects have been found when ratings are collected immediately following the presentation of all stimuli (documented ESs were .184 and .202 respectively). This finding was supported by Harrison and Crandall (1972) who conducted two experiments in which the delay between exposure and rating varied. Specifically, in Experiment 1, participants were allocated into either a heterogeneous or homogeneous exposure sequence group and were presented with Chinese ideographs at varying exposure frequencies (0, 1, 3, 9 and 27 times). After all of the stimuli had been presented, both groups of participants were then asked to rate each stimulus for goodness-of-meaning according to a 6-point scale. As expected, findings of this experiment revealed that the attitude-enhancing effects of exposure were evident in the heterogeneous condition. However, contrary to expectation, affect ratings in the homogenous condition failed to show a gradual decline; a finding commonly reported when utilizing homogenous designs (refer Stang, 1974b, for a review). Rather, the effect was only attenuated in comparison to the heterogeneous condition at high frequency levels only. Harrison and Crandall speculated that this unexpected finding was due to the separation (or delay) between the rating and exposure phases. Specifically, obtaining ratings at the end of the entire exposure phase after other stimuli had been interspersed, could have negated the expected effects of tedium. Thus, in Experiment 2, another group of participants were exposed to the same Chinese Ideographs in a homogenous exposure sequence only and affect ratings were obtained on the last massed presentation of each stimulus. While a few exposures led to enhanced ratings, further exposures led to the predicted decrease in ratings. According to the Harrison and Crandall, the absence of interspersed stimuli coupled with no delay between exposure and rating presumably allowed tedium to occur and hence, influenced the exposure effect.

In another study investigating the effects of delay on ratings, Zajonc et al. (1972, Experiment 4) conducted an experiment which involved two testing sessions. In the first session, participants viewed consonant-vowel-consonant trigrams for three seconds, which were counterbalanced across four levels of exposure (2, 5, 10 and 25 times). Following this, participants then rated each trigram for liking according to a 7-point scale. One week later, the same participants returned and liking ratings were obtained again (i.e., the second session). Zajone and colleagues found an overall increase in liking ratings with increasing exposure frequency but found no effect of delay on
ratings; liking ratings collected immediately after exposure were comparable to those obtained one week post-exposure. Similar findings were also reported in a later study by Stang et al. (1977). Within this study, participants were exposed to non-sense syllables and pleasantness ratings of each stimulus were obtained either immediately after or five minutes after the exposure phase. Again, no effect of delay on pleasantness ratings was found, with higher exposure frequencies leading to increased pleasantness ratings both immediately and five minutes post-exposure. Thus, the findings of Zajonc et al. and Stang et al. not only provided support for the existence of the mere exposure effect but also suggested that the effect is stable over time.

In summary, mere exposure studies have found that introducing a period of delay between exposure and ratings can influence the strength of the mere exposure effect. According to Bornstein’s (1989) meta-analysis, while naturalistic studies produce the largest overall effect, studies which collect affect ratings immediately following the last massed presentation of each stimulus produce weaker effects, whereas studies which collect affect ratings immediately following the presentation of all stimuli produce relatively stronger effects. This was supported by the study of Harrison and Crandall (1972) who found that affect ratings declined at higher levels of exposure only when ratings were obtained after the last repetition of a given stimulus. While studies did not find a period of five minutes (Stang et al., 1977) or one week (Zajonc et al., 1972, Experiment 4) to enhance the strength of the effect, these findings did suggest that the mere exposure effect is stable over time and likely to be extended beyond the laboratory setting.

2.1.4 Subject Variables

In addition to variables relating to the stimuli and the way in which the stimuli are presented and measured, factors pertaining to the participants themselves have also been found to influence the mere exposure effect. These factors can be grouped and classified as individual difference and personality variables. Of equal importance, other factors such as chronic illness (e.g., Alzheimer’s disease; Winograd, Goldstein, Monarch, Peluso, & Goldman, 1999) have not been found to influence the mere exposure effect. This preservation in patients who have a range of neurocognitive deficits such as memory provides insight into the mechanisms involved in the effect.
2.1.4.1 Individual Difference and Personality Variables

While an abundance of mere exposure studies have taken place, relatively few researchers have investigated the role that individual difference and personality variables play in the mere exposure effect. To date, some of these variables which have been investigated include the participants attitude towards the experiment (Burgess & Sales, 1971), affective styles (Harmon-Jones & Allen, 2001), personal need for structure (Hansen & Bartsch, 2001), sensation seeking (Pheterson & Horai, 1976) and boredom proneness (Bornstein et al., 1990). A brief review of these mere exposure studies will now be undertaken.

2.1.4.1.1 Attitudes

The first variable to be discussed which has been found to influence the mere exposure effect is participants’ attitudes toward the experiment. In a study conducted by Burgess and Sales (1971), a “personal reaction” questionnaire was administered to participants which measured their attitudes towards a variety of factors such as life in general and the experiment itself. Prior to its completion, participants were shown nonsense words and were asked to indicate on a 7-point scale how “good” or “bad” they perceived each word to be. As expected, a positive linear relationship between goodness-of-meaning and familiarity was found. However, while participant attitudes toward life in general exerted no effect, attitudes toward the experiment was found to influence the relationship. Specifically, participants who felt positively demonstrated strong exposure effects while participants who felt negatively demonstrated no exposure effect at all.

2.1.4.1.2 Affect

According to Ekkekakis (2012), the constructs of affect, mood and emotion are collectively referred to as affective phenomena. He argues that these constructs co-exist but are largely independent of one another. However, other researchers (e.g., Watson, 2000) use the terms affect, mood and emotion interchangeably which consequently, has produced inconsistent conceptual and operational definitions of each construct. Despite
this controversy, a slight consensus appears to exist that researchers make clearer
distinctions between mood and emotion than they do between mood and affect (Reed,
2005). This is particularly evident by the widely used definition of mood, which even
incorporates the term ‘affect’ in its description. Specifically, according to Forgas
(1992), moods are defined as “low intensity, diffuse and relatively enduring affective
states [that occur] without a salient antecedent cause and therefore [involve] little
cognitive content” (p. 230). In contrast, emotions are defined as “more intense, short-
lived and usually have a definite cause and [therefore involve] clearer cognitive
content” (Forgas, 1992, p.230). Thus, the fundamental differences between moods and
eotions mainly relate to intensity, time and the breadth of the construct (Reed, 2005).
Therefore, given the lack of clarity of the possible differences between affect and mood
and that an in-depth review of this literature is beyond the scope of this research, the
terms affect and mood will now be used interchangeably.

In an attempt to identify a structure of mood, many different factor analysis
studies have been undertaken (e.g., semantic analyses of affect and self-reports of
emotional experience) (e.g., Watson, 1988). The findings from the majority of these
studies were that a two-factor structure repetitively emerged. These factors, which are
reported to be orthogonal (Watson & Clark, 1997) were subsequently labeled Positive
Affect (PA) and Negative Affect (NA) and together, have been reported to account for a
large proportion of the variance among distinct mood states (e.g., pleasure, nervousness
etc.) According to Watson, Clark and Tellegen (1988), PA reflects the degree to which
an individual feels excited, active and attentive. Individuals who are high in PA exhibit
cheerfulness, energy and high levels of concentration, whereas individuals who are low
in PA exhibit melancholy, fatigue and high levels of distraction. In contrast, NA
reflects the degree to which an individual feels distressed and encompasses many other
adverse mood states such as fear and anger. Individuals who are high in NA exhibit
irritability and nervousness, whereas individuals who are low in NA exhibit calmness
and tranquility.

In a study by Harmon-Jones and Allen (2001), individual differences in state
affective styles were shown to influence the mere exposure effect. State mood is best
categorized as being changeable and responsive to situational contingencies whereas
trait mood is best characterized as being stable across time and contexts (George, 1991).
It was hypothesized that participants with higher levels of NA and participants with lower levels of PA would display more zygomatic (cheek) muscle activity and less corrugator (brow) muscle activity, measured by facial electromyography (EMG), to the familiar than to the unfamiliar stimuli. This was predicted on the basis that zygomatic (cheek) activity and corrugator (brow) activity have been reliably associated with positive and negative affective states respectively (Lang, Bradley, & Cuthbert, 1997). Despite the researchers failing to provide rationale for their hypothesis, the findings were as expected. Specifically, participants high on NA and low in PA displayed greater zygomatic (cheek) activity to the familiar than to the novel stimuli. According to Harmon-Jones and Allen, given that zygomatic muscle activity is a physiological indicator of positive affect, these findings suggested that the mere exposure effect is moderated by individual differences in affective styles, namely high NA and low PA.

The findings of Harmon-Jones and Allen (2001) appear to be at odds with the findings of Burgess and Sales (1971). Even though Burgess and Sales investigated participant attitudes toward the experiment, it is reasonable to assume that state, not trait mood, as measured in the study of Harmon-Jones and Allen, would parallel how the participants felt at the time of the experiment. The findings of Burgess and Sales revealed that participants who felt positively demonstrated strong exposure effects while participants who felt negatively demonstrated no effect at all. However, the opposite was indirectly found by Harmon-Jones and Allen, such that participants high in NA (i.e., often characterized by irritability and nervousness) and low in PA (i.e., often characterized by fatigue and high levels of distraction) demonstrated the strongest exposure effects.

2.1.4.1.3 Personal Need for Structure

In addition to the above individual difference variables, a personality trait which has been found to influence the mere exposure effect is personal need for structure (PNS). According to Neuberg and Newson (1993), this trait refers to how much organization a person prefers to have in their world, with individuals high in PNS preferring to organize their environment into a simplistic, less complex form. In addition, in comparison to individuals low in PNS, high PNS individuals have a tendency to use categorization more when making judgments. In a study by Hansen and
Bartsch (2001), the effect of PNS on the mere exposure effect was examined. Participants were shown a list of unfamiliar Turkish words, with two words shown at each exposure frequency, ranging from zero to nine. After a two minute period, participants were then given another sheet of paper which listed the Turkish words again, as well as two new Turkish words which were omitted from the exposure phase (i.e., the initial list) which constituted the zero frequency condition. Using a 6-point Likert scale, participants were required to rate each word for pleasantness and were also required to complete the PNS scale, which was developed by Neuberg and Newson. Correlational analyses revealed that all participants demonstrated the mere exposure effect, but the effect appeared to be stronger for participants who scored higher in PNS. Presumably, because individuals high in PNS use categorization more when making decisions, those low in PNS are less likely to use familiarity as a cue when making affective judgments (Hansen & Bartsch, 2001). Thus, PNS was found to influence the magnitude of the mere exposure effect.

2.1.4.1.4 Sensation Seeking

Another personality trait, particularly relevant to this thesis, called sensation seeking (SS), can be characterized by “the seeking of varied, novel, complex and intense sensations and experiences, and the willingness to take physical, social, legal and financial risks for the sake of such experience” (Zuckerman, 1994, p.27). The construct of SS arose out of early research investigating the notion that every individual has a preference for a certain amount of environmental stimulation, which was termed ‘Optimal Level of Stimulation’ (OLS). Specifically, when environmental stimulation (which is determined by properties such as complexity, novelty etc.) is below optimum, an individual will endeavor to increase stimulation. However, when stimulation is above optimum, an individual will attempt to reduce it (Raju, 1980). The concept of OLS was originally proposed by Wilhelm Wundt in 1893 but was later extended upon by many theorists (e.g., Duffy, 1951; Berlyne, 1960) and re-named Optimal Level of Arousal (OLA). Early researchers investigating individual differences in OLA highlighted the need for these differences to be quantified. Hence, the first SS scale was developed by Zuckerman, Kolin, Price, and Zoob (1964).
Individuals can differ in levels of SS along the trait continuum. At one extreme, high SS individuals typically require greater stimulation to reach their OLA. As such, these individuals are more receptive to novel stimuli, become bored and restless in repetitious situations and frequently pursue sources of renewed arousal (Zuckerman, 1990). At the other extreme, low SS individuals are easily aroused and consequently, reach their OLA with less stimulation. These individuals tend to prefer more familiar than novel stimuli, are less likely to become bored and pursue sources of arousal (Zuckerman, 1990). It follows then that high SS individuals should become bored more quickly with repeated stimulus exposure than low SS individuals and therefore, show a downturn in affect ratings as the stimuli are repeatedly exposed (i.e., an inverted U-shape function). For low SS individuals, affect ratings should positively increase with increasing exposure frequency and thus, display the mere exposure effect.

In a study conducted by Pheterson and Horai (1976), the effect of SS on the mere exposure effect was examined. Positive (photographs of physically attractive people) or negative (photographs of physically unattractive people) stimuli were shown to groups of low and high SS participants for two seconds and were counterbalanced across five levels of exposure (i.e., 1, 2, 5, 10 or 25 times). Contrary to expectations, findings of this study revealed that liking ratings of both low and high SS participants increased with increasing exposure frequency for both types of stimuli (attractive and unattractive). Thus, regardless of the stimulus type or the level of SS, both groups of participants displayed the mere exposure effect. Pheterson and Horai speculated that 25 exposures may not have been sufficient to elicit boredom in high SS participants and hence, could explain why the expected downturn in liking ratings was not found at higher levels of exposure. However, the unexpected findings of Pheterson and Horai could also be explained by the type of stimuli utilised. Specifically, because the researchers failed to conduct any manipulation checks or pre-tests to establish stimulus valence, the degree to which participants perceived the attractive photographs as positive and the unattractive photographs as negative is uncertain. Therefore, the impact of SS on the mere exposure effect warrants further attention.

In addition to low and high SS individuals differing in their susceptibility to boredom in repetitious situations and as such, also differ in their preference for familiar and novel stimuli, another reason why SS should be explored, particularly when
applying the mere exposure paradigm to emotional stimuli, is because low and high individuals are also reported to differ in their preferences for emotional stimuli. Specifically, in a study by Rawlings (2003), paintings which had been pre-rated as either negative or positive in valence were used and the preference ratings of both low and high SS participants were compared. The findings of Rawlings indicated that high SS participants had a greater preference for the negative/unpleasant paintings in comparison to low SS participants. Conversely, no such differences were found for the positive/pleasant paintings. However, preference for emotional stimuli not only encompasses the type of stimuli (i.e., valence) but also its intensity (i.e., arousal). The need to take arousal into account is particularly important in the investigation of SS, given the documented findings that high SS individuals actively seek more intense stimulation to maintain their OLA in comparison to low SS individuals (Zuckerman, 1990). This need has been further highlighted by the findings of studies which have utilised psychophysiological methods and have established that low and high SS individuals differ in their neurobiological profile when exposed to emotional imagery. For example, Joseph et al. (2009) used functional magnetic resonance imaging (fMRI) and found that in comparison to low SSs, high SS participants displayed greater activation in the brain areas associated with arousal and reinforcement (e.g., insula) when viewing negative and positive high arousal pictures (from the Chinese Affective Picture System). In contrast, low SS participants displayed more activation in brain areas involved in emotional regulation (e.g., anterior cingulate), with greater sensitivity to the valence level of the stimuli. Hence, irrespective of emotional valence, high SS participants displayed a greater preference for high arousal stimuli than their low SS counterparts.

The findings of Joseph et al. (2009) can be interpreted in terms of how low and high SS individuals interact with their environments. Typically, high SS individuals engage in a variety of intense and highly stimulating activities (e.g., extreme sports: rock climbing, parachute jumping, sky surfing) and also risky behaviours (e.g., substance use, unsafe sex, gambling) (Roberti, 2004). Hence, in comparison to low SSs, high SS individuals perceive and appraise their environment to be less threatening (Zuckerman, 1994). Therefore, the findings of Joseph and colleagues support the assumption that low SS individuals give more consideration and attention toward significant emotionally laden stimuli in order to avoid possible negative consequences.
In contrast, high SS individuals prefer to explore their environment with little regard for unknown danger and threatening situations that may occur (Lissek & Powers, 2003).

In summary, the findings regarding the influence of SS on the mere exposure using emotional stimuli are not well established. Thus, further research into this area is clearly warranted particularly because low and high SS individuals are reported to not only differ in their susceptibility to boredom but also their preference for emotional stimuli. To gain a more holistic insight into the relationship between SS and the mere exposure effect, it is crucial that researchers not only manipulate stimulus valence (negative and positive) but also stimulus arousal (low and high). Furthermore, it is also vital to use stimuli that are innately emotional. As described in section 2.1.1.3.1 (p. 29), this can be achieved by utilising the IAPS in which standardised ratings of valence and arousal for each image have been reliably established.

2.1.4.1.5 Boredom Proneness

The last individual difference and personality variable to be discussed is boredom proneness (BP), which has been identified as a dimension of SS (Zuckerman, Eysenck, & Eysenck, 1978). Given that a mere exposure experiment involves stimulus repetition, it is plausible to assume that individuals who are susceptible to boredom (including those high on SS) should show weaker exposure effects than non-BP individuals (including those low on SS). In a study conducted by Bornstein et al. (1990), the effect of BP on the mere exposure effect was examined. By utilising the BP scale (Farmer & Sundberg, 1986), participants were classified into low and high BP groups. In the exposure phase, Welsh figure stimuli were presented to participants for five seconds and were counterbalanced across seven levels of exposure (0, 1, 2, 5, 10, 25 and 50 times). Following this, a booklet was then given to participants requiring them to rate each stimulus according to three 9-point Likert scales: “like-dislike”, “interesting-boring”, and “simple-complex”. Because participant liking and interestingness ratings were highly correlated, these ratings were averaged to form an overall measure of affect. While no significant main effect of exposure frequency or interaction between exposure frequency and level of BP was found for complexity ratings, significant effects were found for affect ratings. Specifically, as expected, low BP participants
reported more positive affect ratings to the higher than lower frequency stimuli and thus, demonstrated the mere exposure effect. In contrast, high BP participants gave comparable affect ratings to the low and high frequency stimuli and thus, failed to show any evidence of a mere exposure effect at all. Bornstein and colleagues concluded that BP is a limiting condition of the mere exposure effect and that these findings provided support for the two-factor of exposure effects which will be discussed in section 2.2.1 (p. 62).

2.1.4.2 Summary of Individual Difference and Personality Variables

Research has indicated that some individual difference and personality variables can influence the magnitude of the mere exposure effect. Participants with positive attitudes toward the experiment have been found to demonstrate stronger mere exposure effects whereas those with negative attitudes have failed to demonstrate the effect at all. Participants high on NA and low on PA were found to display greater zygomatic (cheek) activity (a non-subjective measure of positive affect) to the familiar, rather than novel stimuli and thus, showed that state affective styles can also moderate the mere exposure effect. Participants high in PNS were found to produce stronger mere exposure effects in comparison to those low in PNS, while high BP participants were found to not produce the effect at all. However, even though one would expect individuals high on SS to produce weaker exposure effects than those low on SS due to boredom and their preferences for novel rather than familiar stimuli, this was not found to be the case. Rather, liking ratings of both low and high SS participants increased with increasing exposure. In addition, the relationship between SS and the mere exposure effect becomes more perplex when emotional stimuli are used. This is because of the documented tendency for low and high SS individuals to differ in their preference for such stimuli. Thus, the influence of SS on the mere exposure effect to emotional stimuli warrants further investigation. Importantly, both the valence and arousal level of the stimuli must be manipulated. Thus, a stimulus set which has been reliably validated as being intrinsically emotional, such as the IAPS, should be used.

2.1.5 Summary of the Variables Influencing the Mere Exposure Effect

The mere exposure effect is defined as the increase in positive affect that results from repeated confrontation with previously unfamiliar stimuli. A typical mere
exposure experiment in a laboratory setting has two phases: an exposure phase and a test phase. In the exposure phase, participants are presented with the target stimuli in succession, at varying exposure frequencies. In the test phase, participants are presented with the stimuli again, together with similar, but never-before-seen equivalents. Within this phase, participants are required to rate all the stimuli which they have seen, either by selecting one stimulus out of a pair which they prefer (i.e., forced-choice format) or by using a Likert-scale which assesses a dimension of affect such as liking (i.e., rating-scale format). Evidence of the mere exposure effect is obtained when participants prefer or rate the frequently exposed stimuli from the exposure phase more positively than the infrequently stimuli that they encountered in the test phase only.

Through Bornstein’s (1989) review, it was made apparent that an array of variables can influence the magnitude of the mere exposure effect. These variables related to the stimuli used, the manner in which the stimuli were presented and measured, and finally, the characteristics of the participants. In terms of stimulus variables, it was evident that the majority of early mere exposure research used neutral, meaningless stimuli, with photograph, polygon, and meaningful word stimuli producing the strongest effects. However, with the exception of one recent study which found reliable mere exposure effects for artificial yet plausible consumer products (Hekkert et al., 2013), application of the mere exposure procedure to the investigation of real-world, meaningful stimuli has been relatively overlooked and therefore, warrants further attention. Stimulus complexity has also been found to influence the exposure effect. Specifically, in comparison to simple stimuli, stronger mere exposure effects have been found for complex stimuli. However, this finding is commonly reported when participants are concurrently exposed to both simple and complex stimuli because the latter are perceived to be more interesting. In other words, exposure effects for simple stimuli can occur but mainly when between-subjects designs are used. The last stimulus variable, stimulus valence, has also been found to impact the mere exposure effect. Although there is a general consensus that the attitude enhancing effect of repeated exposure is robust for neutral and positive stimuli, there is conjecture about the effect of repeated exposure to negative stimuli. Some studies have reported that evaluations of negative stimuli become more negative, while other studies have reported that evaluations become more positive with increasing exposure. The inconsistent findings are presumably due to the failure to use stimuli which are innately emotional. As a
consequence, the effect of repeated exposure to affectively valenced stimuli, particularly negative or adverse stimuli, remains to be properly investigated. In addition, even though emotional stimuli vary in terms of valence and arousal, previous mere exposure researchers have predominately focused upon the role that stimulus valence plays in the mere exposure; with the role of stimulus arousal largely ignored. Thus, to gain a holistic understanding of the effect of repeated exposure to emotional stimuli, the influence of both stimulus valence and arousal needs to be explored. In order to ensure that the stimuli used are innately emotional and as such, are affectively valenced and arousing, the IAPS; a stimulus set with known emotional properties, could be employed.

Despite the uncertainties concerning some of the stimulus-related variables, studies are in agreement that certain conditions relating to how the stimuli are presented and measured can assist in the minimization of boredom. These conditions include using fewer stimulus exposures and a heterogeneous exposure presentation sequence. However, it was identified that the frequency-affect relationship and the presentation-affect relationship were not straightforward and thus, depended in part, on other variables. These variables included stimulus discriminability (when utilising painting stimuli), stimulus complexity (discussed above) and imposing a delay between exposure and rating.

Other measurement variables have also been found to play a significant role in a mere exposure experiment. In addition to the length of delay between exposure and rating mentioned above, the type of dependent measure and test order used are also of importance. Specifically, studies using “liking” and multiple dimensions of affect are reported to produce the strongest effects. However, when using multiple measures, strategies to minimize the possible influence of order effects must be implemented. Such strategies include counterbalancing, including test order as an independent variable in the statistical analysis, using different sets of stimuli for each dependent measure or using different groups of participants to the different types of evaluative judgments.

Finally, participant characteristics are the last set of variables which have been found to influence the mere exposure effect. Positive attitudes toward the experiment, higher levels NA and lower levels of PA, and higher levels of PNS are some individual
difference and personality traits that produce stronger mere exposure effects. Furthermore, given that complex stimuli, fewer stimulus exposures, and heterogeneous presentation sequences are used to reduce boredom, it is not surprising that low BP participants also produce stronger exposure effects. However, even though BP is a dimension of SS, no significant difference between low and high SSs has been found, with both low and high SS participants showing an increase in affect following repeated exposure. Thus, given that only one study has investigated the effect of SS on the mere exposure effect and found unexpected results, further research is needed. To properly investigate the relationship between SS and the mere exposure effect, images from the IAPS database could be employed which not only assures that the stimuli will be truly emotional, but also allows for the manipulation of the valence and arousal level of the stimuli.

2.2 Models of the Mere Exposure Effect

Despite the abundance of support which exists for the observation that repeated, unreinforced exposure to a stimulus increases affective judgments towards that stimulus, a clear explanation for how and why this occurs is lacking. This section will briefly review the explanations which were prevalent at the time of Bornstein’s (1989) review, namely the opponent-process (Solomon & Corbit, 1974), arousal (Berlyne, 1966) and two-factor (Berlyne, 1970; Stang 1973) models. Please refer to Bornstein’s review for a detailed description. While it has been made clear that a discussion of subliminal mere exposure effects is beyond the scope of this review, these effects will be briefly mentioned here as they highlight the inaccuracies of many mere exposure models put forward at this time. Following this discussion, a fourth model called the modified two-factor model (Bornstein, 1989), will be introduced which offers a more comprehensive account of both supraliminal and subliminal exposure effects. Even though these models of mere exposure are relevant to this review, the information contained within this section should be interpreted with caution as a universal model is still yet to be agreed upon.

2.2.1 Opponent-Process, Arousal and Two-Factor Models

At the time of Bornstein’s (1989) meta-analysis, there were three leading models which purported to have unraveled the underlying mechanisms of the mere exposure
effect. The first model described in Bornstein’s review was the opponent-process model which was originally proposed by Solomon and Corbit (1974). The premise of the opponent-process model is that when an unfamiliar stimulus is first encountered, a negative emotional response is generated and subsequent removal of this stimulus evokes the opposite, positive emotional response. In the context of mere exposure, repeated stimulus exposures are thought to weaken the initial negative emotional response and simultaneously strengthen the opposite positive emotional response. The next model of exposure effects, called the arousal model, was originally described in the work by Berlyne (1966). This model arose out of the finding that individuals seek to establish a moderate level of arousal, similar to that described in the research by Wundt (1893) when investigating the construct of SS (refer section 2.1.4.1.4, p. 54). According to the arousal model, when deviances from this moderate level of arousal arise, the individual interprets this as negative or unpleasant which consequently, leads to a decline in affect towards the stimulus associated with this over-or-under arousal. Lastly, the third model of exposure effects discussed in Bornstein’s (1989) review is the two-factor model (Berlyne, 1970; Stang, 1973). This model describes the mere exposure effect in terms of the combined effects of stimulus habituation and boredom which is speculated to reflect the inverted U-shape frequency-affect curve. Specifically, habituation occurs when the stimulus becomes more familiar to the participant and thus no longer threatening, resulting in enhanced affect towards the stimulus. Then, after repeated excessive exposure, boredom sets in which ultimately, leads to a decline in affect. According to Bornstein (1989), this downturn in affect generally occurs after 10 or so stimulus exposures.

Although all three models discussed thus far may seem plausible, they are not without their limitations. The main limitation which is common to all three models is that they all fail to adequately address subliminal mere exposure effects. That is, all three models seem to depend upon conscious recognition of the stimulus which has been consistently proven to not be a prerequisite for the mere exposure effect to occur (e.g., Bonnano & Stillings, 1986; Bornstein et al., 1987; Kunst-Wilson & Zajonc, 1980; Mandler et al., 1987). To overcome this weakness, Bornstein (1989) offered a modified two-factor model in an evolutionary framework which will now be discussed below.
2.2.2 Modified Two-Factor Model in an Evolutionary Framework

Extending upon the two-factor model described above, the modified two-factor model allows for stimulus habituation to occur via both conscious and non-conscious processes. However, these non-conscious processes are based on the findings from Bornstein’s (1989) review that stronger exposure effects are obtained for subliminal stimuli than those that are clearly recognized. In an attempt to explain why stronger subliminal effects are found, Bornstein argues that stimulus recognition actually inhibits the exposure effect. This occurs because individuals are believed to engage in conscious counter-control processes, such as defensive strategies. These processes are thought to scrutinize the recognized stimuli and counteract affect which subsequently reduces the stimuli’s impact. According to Bornstein, subliminal and supraliminal stimuli may initially produce comparable exposure effects, but the exposure-affect relationship for supraliminal stimuli is later attenuated by these counter-control processes. However in contrast to Bornstein, recent studies have failed to replicate stronger subliminal effects; with some finding the mere exposure effect to occur only when recognition performance was at its highest (e.g., Newell & Shanks, 2007).

In addition to addressing subliminal effects, another point of difference between the modified two-factor model and the other models described in section 2.2.1 above (p. 61), is that Bornstein (1989) also explains the mere exposure effect from an evolutionary perspective. By doing so, possible insights into the developmental changes in the mere exposure effect can be gained. Specifically, in comparison to children who have been found to prefer novel stimuli than familiar stimuli, adults generally prefer the reverse and hence, display the mere exposure effect\(^8\) (refer Bornstein’s, 1989 review, for a detailed discussion of the effect of subject age on the mere exposure effect). Bornstein proposed that the stronger mere exposure effects found in adults can be due to adaptation. Specifically, it is an evolutionary advantage to seek the familiar and safe because of the potential threat of the unknown. The rationale of this advantage has evolved over many generations, where organisms that had a fear of the unfamiliar were more likely to survive longer than organisms that did not. Similarly, the weaker mere exposure effects found in children can also be explained by the same account.

\(^{8}\) As mentioned at the beginning of this review, even though subject age has been found to influence the mere exposure effect, this variable was not discussed. This was because the participants used in the experiments of this thesis were over the age of 18 years.
According to Bornstein (1989), it is also adaptive for children to seek and prefer novel than familiar stimuli because it facilitates learning. In addition, when children are of a very young age, their ability to control impulses and make an assessment of the dangers and risks when exploring the world are inhibited. However, later on in childhood when children become more autonomous, a preference for the familiar than novel develops and hence, the mere exposure effect begins to emerge.

### 2.3 Aims of Thesis

The overall aim of this thesis was to investigate the mere exposure effect to innately emotional stimuli in a controlled setting. As a consequence, application of the mere exposure effect to more meaningful, real-world stimuli could also be achieved. A second aim was to explore the effect of SS on this exposure-affect relationship for emotional stimuli. In order to achieve these aims, a number of steps were undertaken.

Before investigating the mere exposure effect to emotional stimuli, a study which used neutral stimuli was conducted to obtain a baseline. However, unlike the abundance of mere exposure studies that have used neutral, meaningless stimuli such as polygons (e.g., Newell & Shanks, 2007), this study used neutral stimuli that were more meaningful. Not only would this extend upon the relative lack of mere exposure research using real-world stimuli, but it would also allow for the most appropriate assessment of the effect of repeated exposure to meaningful emotional stimuli by using comparable neutral stimuli (Murphy & Isaacowitz, 2008). This study (Experiment 1) is reported in Chapter 3.

As described in Chapter 2 (section 2.1.1.3, p. 28), because of the failure of previous mere exposure research to utilise stimuli that were truly emotional, uncertainty exits concerning the effect of repeated exposure to emotional stimuli. Thus, to ensure that the stimuli used in this thesis were in fact emotional, images from the IAPS (Lang et al., 2008) were used. This database of images contains standardised ratings of valence and arousal for each IAPS image which have been reliably established across a diverse range of cultures. Given that emotional stimuli include the dimensions of both valence (ranging from unpleasant to pleasant) and arousal (ranging from calm [low arousal] to exciting [high arousal]) (Osgood, 1957), four categories of images were investigated:
negative low arousal images, positive low arousal images, negative high arousal images, and positive high arousal images. Thus, unlike past mere exposure studies which mainly attempted to ascertain the role of stimulus valence in the mere exposure effect, this study also investigated the role of arousal which has been relatively overlooked. This allowed for a more comprehensive understanding of the role of these dimensions of emotion in the exposure-affect relationship. Importantly, to ensure that any differences in participant affect ratings across the frequency levels could not be attributed to differences in the intensity of the emotional content, the degree of unpleasantness and pleasantness (i.e., valence intensity) and the degree of calmness and excitability (i.e., arousal intensity) of the IAPS images used in each category were matched. This study (Experiment 2) is also reported in Chapter 3.

After investigating the effect of repeated exposure to stimuli that were innately emotional, the next logical step was to apply the mere exposure paradigm to emotional stimuli that have greater societal importance. Of interest were the health warning images found on cigarette packets. Not only are these warning images designed to be highly adverse, but they are also salient in today’s society to increase awareness about the dangers of smoking. Thus, in addition to providing further clarification of the effect of repeated exposure to highly negative/adverse stimuli, a further intention of this study was to add to the robustness of the mere exposure effect by applying the procedure to stimuli that have pronounced social and clinical utility. This study (Experiment 3B) is reported in Chapter 4. However, before this study could take place, a pilot study was conducted to establish standardised ratings of valence and arousal for the health warning images. This therefore allowed for the most unpleasant and arousing health warning images to be identified which were subsequently used in the test study (Experiment 3B). This pilot study (Experiment 3A) is also reported in Chapter 4.

As discussed in section 2.1.4.1.4 (p. 54), when applying the mere exposure procedure to emotional stimuli, it is important to take individual difference variables, such as SS into account. This is because high relative to low SS individuals have a tendency to become more boredom prone in repetitious situations (Zuckerman, 1990); a variable which has been found to influence the mere exposure effect (Bornstein et al., 1990) and as such, prefer novel rather than familiar stimuli. Furthermore, low and high SS individuals are also reported to differ in their preference for emotional stimuli (e.g.,
Joseph et al., 2009; Rawlings, 2003). However, despite these differences between low and high SSs, one study which investigated the influence of SS on the mere exposure effect using stimuli that were claimed to be emotional found that SS failed to moderate the exposure-affect relationship (Pheterson & Horai, 1976). This unexpected finding was presumably due to the type of stimuli utilised. Again, similar to the mere exposure literature discussed above, the stimuli used in this study were also not innately emotional.

Thus, the second aim of this thesis; to explore the effect of SS on the exposure-affect relationship for emotional stimuli, was achieved by using the Sensation Seeking Scale Form V (SSS-V; Zuckerman et al., 1978) which has sound psychometric properties. Consequently, participants were able to be classified into low and high SS groups, based on a median split of their total SS scores. Thus, the participants’ level of SS was able to be used as a between-subjects variable in Experiments 1-3 outlined above, allowing for any differences in affect ratings between the SS groups over the course of exposure to be identified. The findings pertaining to this second aim are also detailed in Chapters 3 and 4.

Importantly, guided by the findings of Bornstein (1989) and the studies discussed in the literature review of this thesis, the presentation (refer section 2.1.2, p. 34) and measurement (refer section 2.1.3, p. 41) variables which have been found to influence the magnitude of the mere exposure effect were taken into account in all experiments described in this thesis.
Chapter 3
The Mere Exposure Effect: Application to Neutral and Emotionally-Laden IAPS Images
3.1 Introduction

It has been established that mere, repeated exposure to a stimulus enhances affective evaluations of that stimulus; an occurrence known as the mere exposure effect (Zajonc, 1968). Given that over 200 studies have investigated and largely found support for this preference for the familiar, the mere exposure effect is known as a robust and reliable phenomenon (see Bornstein, 1989, for a review). As documented in Bornstein’s (1989) review and section 2.1.1.1 (p. 11) of this thesis, the majority of mere exposure research has used neutral, meaningless stimuli such as Turkish words (to non-Turkish readers: e.g., Brooks & Watkins, 1989; Harrison, 1968; Stang, 1974a; Zajonc, 1968) and polygons (e.g., Bornstein & D’Agostino, 1992; Kunst-Wilson & Zajonc, 1980; Newell & Shanks, 2007). However, even though it is advantageous to use neutral, meaningless stimuli because prior exposure is unlikely, this stimulus type is not representative of what people generally encounter in the real-world and as such, restricts the validity of the mere exposure effect to laboratory settings.

Although relatively limited, other studies have claimed to have extended upon the use of neutral, meaningless stimuli by applying the mere exposure paradigm to affectively valenced stimuli. However, while these studies appear to be in agreement that the mere exposure effect is robust for not only neutral stimuli but for positive stimuli as well, the findings pertaining to negative stimuli are far less decisive. Specifically, some studies have found that evaluations of negative stimuli increase with repeated exposure (e.g., Bukoff & Elman, 1979; Zajonc, Markus et al., 1974) while other studies have found the opposite to occur (e.g., Brickman et al., 1972; Burgess & Sales, 1971; Grush, 1976; Perlman & Oskamp, 1971). One of the reasons for this discrepancy in findings is presumably due to the ways in which stimulus valence was established.

The studies which found a decrease in affect following repeated exposure to negative stimuli have established stimulus valence either by conducting pre-tests (e.g., Brickman et al., 1972; Grush, 1976), or by pairing a relatively neutral stimulus with another stimulus or context that is believed to be affectively toned (e.g., Burgess & Sales, 1971; Perlman & Oskamp, 1971). With the exception of Grush, all of these studies have explained their findings in terms of associative learning. Specifically, it has
been suggested that the mere exposure procedure is not so “mere” after all but rather, because of affect transference, stimuli exposed within a context assume the affective valence that characterizes that context. In other words, the positive and negative connotations of the context become associated with the target stimulus and due to repeated exposure, the associative bond between the context and stimulus becomes stronger, resulting in an increase in positive or negative evaluations. However, as acknowledged by Zajonc, Markus et al. (1974), the studies that have attributed their findings to associative learning have failed to provide a clear separation between the impact of initial stimulus valence (obtained by conducting pre-tests) and the impact of associative learning on the mere exposure effect. Consequently, two studies (Bukoff & Elman, 1976; Zajonc, Markus et al., 1974) were conducted in an attempt to disentangle the relative contributions of each (i.e., initial stimulus valence and associative learning) on the exposure-affect relationship.

The findings of Bukoff and Elman (1976) and Zajonc, Markus et al. (1974) were similar. Regardless of whether the stimuli were initially negative in valence or had been made to be negative through associations, repeated exposure resulted in more positive affective evaluations in both conditions. However, unlike the findings of Bukoff and Elman, Zajonc, Markus et al. found that the attitude enhancing effect was somewhat attenuated in the negative associative learning condition. Hence, Zajonc, Markus et al. concluded that the mere exposure effect can be reduced when a blatant attempt is made to induce negative affect through forming an associative bond. However, by doing so, the conditions of “mere” exposure are no longer satisfied. Specifically, according to Zajonc, Markus et al., additional factors pertaining to associative learning contribute their own consequences which are above and beyond the consequences of repeated exposure alone. Thus, it was also concluded that when the conditions of the mere exposure effect are fulfilled (i.e., when opportunities for associative learning are not concurrently provided), the mere exposure effect is not reliant upon initial stimulus valence. Such that, in addition to neutral and positive stimuli, the attitude enhancing effect of repeated exposure is robust for negative stimuli as well.

While the discrepancy in findings concerning the effect of repeated exposure to negative stimuli can be explained by the variability between studies in their methods used to establish stimulus valence, another problem which is common to all studies
discussed above is the type of stimuli utilised. Specifically, as discussed in Chapter 2 (section 2.1.1.3, p. 28), photographs of men (e.g., Bukoff & Elman, 1979; Perlman & Oskamp, 1971; Zajonc et al., 1972), abstract paintings (Brickman et al., 1972), and words (e.g., Burgess & Sales, 1971; Grush, 1976) have mainly been employed. Hence, even though these studies have claimed to have investigated the mere exposure effect to affectively valenced stimuli, the stimuli used in these studies were not innately emotional. As a consequence, the effect of repeated exposure to stimuli that are truly emotional still remains to be properly investigated. Because emotional stimuli not only vary in terms of valence (ranging from unpleasant to pleasant) but also arousal (ranging from calm [low arousal] to exciting [high arousal]; Osgood, 1957), it is important to ensure that both of these dimensions of emotion are taken into account. As a consequence, clearer insights can be gained into the role that both stimulus valence and arousal play in the exposure-affect relationship. Therefore, the overarching aim of this study (and this thesis) was to apply the mere exposure paradigm to stimuli that were intrinsically emotional and thus, varying in valence and arousal. By doing so, application of the mere exposure effect to more real-world, meaningful stimuli (as opposed to neutral, meaningless stimuli such as Chinese characters and polygons; refer Table 1, section 2.1.1.1, p. 10) can also simultaneously be achieved.

As discussed in Chapter 2 (section 2.1.1.3.1, p. 29), one way that researchers can ensure the stimuli are truly emotional is to use the IAPS (Lang et al., 2008). The IAPS is a large database of images that depict a wide range of semantic categories and contains standardised ratings of valence and arousal for each image which have been validated across cultures. Interestingly, despite the IAPS being used in a diverse range of studies of emotion (e.g., Bolte et al., 2008; Deiss et al., 2008; Mardaga et al., 2006) to date, only one study (whose aims were different to that of the current study, see section 2.1.1.3.1, p. 32, for a more detailed review) has utilised this stimulus set in the mere exposure paradigm (Young, 2007). This is surprising given that the IAPS would be highly suited to experimental research exploring people’s affective responses to stimuli, which essentially reflects a typical mere exposure experiment (Zajonc, 1968). Therefore, given that the IAPS has been extensively validated and as such, has been identified as a reliable stimulus set of innately emotional images, the IAPS will be utilised in the current study. In addition, given that the IAPS images have standardised ratings of unpleasantness/pleasantness (i.e., valence intensity) and calmness/excitability
(i.e., arousal intensity), it is possible to examine whether these attributes are also influenced by the effect of repeated exposure. Consequently, in addition to using “liking” as a dependent measure of affect, participant valence and arousal ratings of the images to which they are exposed will also be collected, and subsequently used as dependent measures in this study. Importantly, guided by previous mere exposure research that has used multiple dependent measures of affect and thus, have implemented strategies such as counterbalancing and including test order as an independent variable in the statistical analysis to minimize order effects (refer section 2.1.3.2, p. 47), these strategies will also be implemented in the current study.

When exploring the mere exposure effect, it is important to consider that an array of variables can influence the magnitude of the exposure-affect relationship. One such variable that has been briefly investigated in past mere exposure research is a personality trait called sensation seeking (SS; refer section 2.1.4.1.4, p. 54) which is characterized by “the seeking of varied, novel, complex and intense sensations and experiences, and the willingness to take physical, social, legal and financial risks for the sake of such experience” (Zuckerman, 1994, p.27). In a study by Pheterson and Horai (1976), it was expected that affect ratings of high SS individuals would initially increase but then decline with increasing exposure frequency and thus, display the form of an inverted U-shape function. This expectation was based on the commonly reported findings that high SS individuals desire much varied stimulation and as such, become more bored in repetitious situations than those who are low on SS (Zuckerman, 1990). This expectation was also consistent with findings of Bornstein et al. (1990), who suggested that boredom-proneness is a limiting condition of the mere exposure effect. In addition, despite limited justification, Pheterson and Horai also anticipated that the inverted U-shape curve for high SS individuals would be more pronounced for the negative than the positive stimuli. However, contrary to expectations, the findings of Pheterson and Horai’s study revealed that both low and high SS participants demonstrated a mere exposure effect of an equivalent magnitude for both the positive and negative stimuli. As discussed in section 2.1.4.1.4 (p. 55), it is highly plausible that the unexpected findings of Pheterson and Horai were also due to the failure to use stimuli that were intrinsically emotional. Specifically, photographs of physically attractive people (i.e., the positive stimuli) and photographs of physically unattractive people (i.e., the negative stimuli) were used. And, given that Pheterson and Horai did
not conduct any manipulation checks or pre-tests to establish stimulus valence, whether the participants truly perceived the attractive photographs as positive and the unattractive photographs as negative is uncertain. Therefore, a further aim of the current study was to explore the effect of SS on the relationship between repeated exposure (to innately emotional stimuli) and affect.

In addition to boredom-proneness and the finding that SS individuals are more receptive to either novel (high SS individuals) or familiar (low SS individuals) stimuli, another important reason to investigate the impact of SS on the mere exposure effect using emotional stimuli is that low and high SS individuals are reported to differ in their preference for such stimuli. Specifically, as discussed in Chapter 2 (section 2.1.4.1.4, p. 56), one study found that high relative to low SSs preferred negative stimuli, while no such differences were identified for positive stimuli (Rawlings, 2003). Furthermore, when also exploring a difference in preference for not only stimulus valence but also stimulus arousal, another study which utilised functional magnetic resonance imaging (fMRI) found that in comparison to low SSs, high SS individuals displayed greater activation in the brain areas associated with arousal and reinforcement (e.g., insula) when viewing negative and positive high arousal pictures (Joseph et al., 2009). Thus, irrespective of stimulus valence, high SSs preferred stimuli that were high in arousal in comparison to their low SS counterparts. This finding is consistent with Zuckerman (1990), who stated that high SS individuals actively seek more intense stimulation to maintain their OLA relative to low SS individuals. Thus, because the stimuli used in the current study differed in both valence and arousal, it is possible to investigate a difference in preference for these two dimensions between low and high SS groups.

In order to isolate the effects of valence and arousal on the mere exposure effect, it is necessary for a baseline measure to be obtained. Given that “the comparison of emotional stimuli to comparable neutral stimuli is the most appropriate assessment of emotional salience” (Murphy & Isaacowitz, 2008, p. 265), neutral, yet meaningful stimuli were used in a baseline experiment. Thus, before the mere exposure effect was examined to stimuli that were innately emotional (the overarching aim of this thesis), the mere exposure effect was examined with neutral stimuli, which were also selected from the IAPS database. The findings of this baseline study would also simultaneously extend upon the mere exposure and real-world stimuli literature which, as stated
previously, is relatively lacking in comparison to the abundance of mere exposure studies that have used neutral, meaningless stimuli such as polygons (e.g., Bornstein & D’Agostino, 1992; Kunst-Wilson & Zajonc, 1980; Newell & Shanks, 2007).

The impact of SS was also investigated in this baseline experiment and this occurred for three reasons. Firstly, regardless of the stimulus type (i.e., negative [low and high arousal], neutral, or positive [low and high arousal]), SS has been found to be intricately linked to boredom-proneness which, as stated previously, has been shown to limit the manifestation of the mere exposure effect (Bornstein et al., 1990). Secondly, given that the mere exposure effect encapsulates the notion of preference for the familiar, it is possible, also regardless of stimuli type, that repeated exposure will have a differential impact on low and high SS individuals because of their inclination for familiar and novel stimuli respectively (Zuckerman, 1990). Finally, the data concerning the influence of SS on the exposure (to meaningful, neutral stimuli) and affect relationship was of interest in order to obtain a baseline to which the data from Experiment 2 (which used emotional stimuli) could be compared. However, unlike Experiment 2, the baseline study only used one dependent measure of affect, namely “liking”. This was because neutral stimuli are not affectively valenced nor arousing (Lang et al., 2008) and as such, cannot be measured on these respective affective dimensions.

The overarching aim of this study, therefore, was to examine the mere exposure effect to innately emotional stimuli in a controlled setting. However, to first isolate the effects of stimulus valence and arousal on the mere exposure effect, Experiment 1 aimed to investigate the mere exposure effect to neutral, yet meaningful stimuli in order to obtain a baseline. Then, Experiment 2 aimed to investigate the mere exposure effect to images differing in valence (i.e., negative and positive) and arousal (i.e., low and high) which were truly emotional. Subsequently, given that the stimuli used in Experiment 1 and 2 were meaningful, the findings of these studies would therefore extend upon the mere exposure and real-world stimuli literature which is relatively lacking. A further aim of both experiments was to also explore the influence of SS on the mere exposure effect.
3.2 Experiment 1. Application of the Mere Exposure Effect to Neutral IAPS Images and an Examination of the Influence of Sensation Seeking

Experiment 1 was designed to investigate the effect of repeated exposure on liking ratings of neutral, meaningful stimuli, namely images from the IAPS in a controlled setting. Because the overarching aim of this thesis was to establish the effect of repeated exposure to stimuli that were inherently emotional, Experiment 1 was primarily conducted to obtain a baseline and simultaneously examine the mere exposure effect to real-world, meaningful stimuli. In addition, a further aim of Experiment 1 was to explore the possible moderating influence of sensation seeking (SS) on this exposure-liking relationship. Again, the data pertaining to SS was of interest in order to obtain a baseline to which findings of Experiment 2 (which utilised inherently emotional stimuli) could be compared.

All participants completed liking ratings of seven neutral IAPS images to which they were exposed. These images were counterbalanced across seven levels of exposure (0, 1, 2, 5, 10, 20, 25 exposures). All participants also completed the SS questionnaire, for which their total scores were subjected to a median split to obtain low and high SS groups9. Thus, participant liking ratings were analyzed using a 2 (Level of SS: Low, High) x 7 (Exposure Frequency: 0, 1, 2, 5, 10, 20, 25) mixed design ANOVA, with the level of SS as the between-subjects variable and exposure frequency as the within-subjects variable. Evidence of the mere exposure effect was obtained if participants ascribed significantly higher liking ratings to the frequently exposed than infrequently exposed neutral IAPS images. Furthermore, evidence of the moderating influence of SS was obtained if this relationship between exposure and liking was different for low and high SS participants.

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9 Please note that total SS scores had a normal distribution prior to performing the median split.
3.2.1 Method

3.2.1.1 Participants

Forty-nine participants, 21 of whom were male and 28 of whom were female, were involved in Experiment 1. Participants were recruited from local businesses and government organisations. One participant reported that he didn’t have normal or corrected to normal vision and was consequently excluded from further analysis. Thus, the final sample consisted of 48 participants, 21 of whom were male ($M = 44.43$ years, $SD = 15.08$ years) and 27 of whom were female ($M = 46.07$ years, $SD = 12.99$ years).

The majority of participants (89.60%) were born in Australia and only one participant reported a first language other than English. More than half the sample (52.10%) had obtained a tertiary or postgraduate level of education and none of those participants reported having a background in design or psychology\(^{10}\). All participants signed a consent form which indicated their willingness to participate and the study was granted approval by the Swinburne University Human Research Ethics Committee on the 9\(^{th}\) May, 2011 (refer Appendix A1 for a copy of this approval). Participants received a chocolate bar upon completion of their involvement and were also entered into a raffle to win a $165.00 Coles/Myer voucher for their time and effort.

3.2.1.2 Design

The study was a mixed design, with the level of SS (low and high) as a between-subjects variable and exposure frequency (0\(^{11}\), 1, 2, 5, 10, 20 and 25 exposures) as a within-subjects variable. In order to ensure that each of the seven images were shown at each of the seven exposure frequencies approximately the same number of times, there were seven image sequence conditions which were counterbalanced across participants. These sequence conditions were devised according to a Latin square design. All participants completed liking ratings for stimuli presented in the exposure phase and the test phase.

\(^{10}\) Study discipline, particularly psychology and design, was deemed to be important because this study investigated a psychological phenomenon. Furthermore, if participants had a background in design, they may have been more critical of the image properties such as colour.

\(^{11}\) Stimuli in the zero frequency condition were excluded from the exposure phase. That is, the stimuli were presented in the test phase only.
3.2.1.3 Materials

3.2.1.3.1 International Affective Picture System (IAPS)

Because there were seven exposure frequencies, this meant that seven neutral images were required to be selected from the IAPS (Lang et al., 2008)\(^{12}\) database. The process by which these images were selected will now be described below.

3.2.1.3.1.1 Selection Process

The process of selecting the seven images was guided by previous literature and by the IAPS technical manual, which contained standardised ratings of valence and arousal for each IAPS image. According to Lang and colleagues (2008), both valence and arousal were scored on 9-point scales, where nine represented a high rating on the given dimension (i.e., high pleasure or high arousal) and one represented a low rating on the given dimension (i.e., low pleasure or low arousal). Consequently, the intensity of the affective valence and arousal of each IAPS image was able to be identified and was grouped accordingly.

Neutral images were interpreted to have a valence mean ranging between 4.50 and 5.50 and this interpretation was supported by previous literature (e.g., Mikels et al., 2005; Calvo & Avero, 2009; Moulton et al., 2011). Therefore, images with a valence mean below 4.49 were considered to be negative (i.e., low pleasure) and images with a valence mean above 5.51 were considered to be positive (i.e., high pleasure). Three excel spreadsheets containing all negative, neutral and positive IAPS images were then devised. The process of selecting the seven neutral images was further refined by the use of low arousal images. In line with the 9-point arousal scale used by Lang and colleagues (2008), images with an arousal mean below 4.50 were broadly considered as low in arousal and images with an arousal mean above 5.50 were broadly considered as high in arousal.

Using the ‘sort’ function in excel, the images in the neutral group spreadsheet with low arousal means were able to be identified. Those with high arousal means were excluded from the selection process. However, not all images with the lowest arousal

\(^{12}\) Permission to use the IAPS was obtained from the NIMH Centre for Emotion and Attention (CSEA) at the University of Florida via e-mail on the 28/07/11.
means were able to be utilised because, in preparation for Experiment 2, the arousal means had to be matched in each of the three image groups (negative, neutral and positive). This was to ensure that any differences in the dependent measure (i.e., liking) across the levels of exposure could be attributed to exposure frequency and not to differences in the intensity of the emotional content of the images. Subsequently, the seven neutral IAPS images had valence means ranging between 4.50 and 5.50 and arousal means ranging between 3.50 and 4.00. Images in this group mainly depicted real-world common objects such as a suitcase and a drill. Please refer Appendix Table B1 for a list of the IAPS images that were used in this experiment.

All images were converted from JPEG (jpg) to bitmap (bmp) format. Images were presented centrally on an 18.4 inch full high definition (HD) computer screen, and the presentation and timing of the images was controlled by the software package DirectRT (Empirisoft, 2006). The size of each bitmap image was 1024 x 768 pixels with a resolution of 72 dpi (dots per inch).

3.2.1.3.2 Study Questionnaire

The questionnaire comprised of basic demographics and an established SS scale with sound psychometric properties (see Appendix C for study questionnaire). Demographic questions consisted of the participant’s gender, age, place of birth, first language, highest education level achieved, study discipline, if the participant had normal or corrected to normal vision and if the participant was colour blind. The latter two demographic questions were deemed important to include because participants were required to view colour images.

3.2.1.3.2.1 Sensation Seeking

Sensation seeking (SS) was measured by the Sensation Seeking Scale Form V (SSS-V; Zuckerman et al., 1978)\textsuperscript{13}. This 40-item scale identified the participants’ optimal level of stimulation. The SSS-V consisted of four subscales: thrill and adventure seeking (TAS); experience seeking (ES); disinhibition (DIS) and boredom susceptibility (BS). The four subscales represented different dimensions of SS and were each scored using 10 sub-items which were presented in a forced-choice format. Thus,

\textsuperscript{13} Permission to use the SSS-V was obtained from Marvin Zuckerman via e-mail on the 10/07/12.
each of the 40-items had two alternate responses (i.e., choice A and choice B), which participants were required to choose between. Participants were advised to choose the one response which better described their likes and feelings.

Thrill and adventure seeking (TAS) was defined by items such as “I often wish I could be a mountain climber” (choice A) or “I can’t understand people who risk their necks climbing mountains” (choice B). Items in this subscale reflected the desire to engage in sports or activities involving danger or risk-taking. Experience seeking (ES) was defined by items such as “people should dress in individual ways even if the effects are sometimes strange” (choice B) or “people should dress according to some standard of taste, neatness, and style” (choice A). Items in this subscale reflected the desire to seek novel experiences through the mind and senses by travelling and by a leading a non-conforming lifestyle. Disinhibition (DIS) was defined by items such as “I like ‘wild’ uninhibited parties” (choice A) or “I prefer quiet parties with good conversation” (choice B). Items in this subscale reflected the desire for social and sexual disinhibition by partying, drinking and seeking variety in sexual partners. The final subscale, boredom susceptibility (BS), was defined by items such as “I can’t stand watching a movie that I’ve seen before” (choice B) or “there are some movies I enjoy seeing a second or even a third time” (choice A). Items in this subscale reflected intolerance for routine, repetition and “dull” people.

The two alternate responses (i.e., choice A and choice B) for the 10 sub-items in each subscale each represented a SS propensity. One response represented the presence of the respective dimension of SS (e.g., boredom susceptibility), which was given a score of one and the other response represented the absence of the dimension, which was given a score of zero. A total score for each subscale ranged from 0-10, with higher scores indicating higher levels of that dimension of SS. The four sub-scale scores were then summed to produce a total SS score, which was used in this thesis. This score ranged from 0-40, with higher scores reflecting a higher, overall level of SS.

The total SS score has demonstrated high internal reliability (Cronbach’s $\alpha = .83-.86$) and the reliabilities for the four subscales (TAS, ES, DIS and BS) have been reported to be $.77-.82$, $.61-.67$, $.74-.78$ and $.56-.65$ respectively (Zuckerman, 1994). In addition, the SSS-V has also demonstrated good convergent validity (Zuckerman,
A more recent factor analysis conducted by Roberti, Storch and Bravata (2003), provided greater support for the psychometric properties of the SSS-V. Specifically, in addition to good convergent validity, Roberti and colleagues reported higher internal reliabilities in comparison to Zuckerman (1994). These were .80, .75, .80 and .76 for the TAS, ES, DIS and BS subscales, respectively. For the present study, the Cronbach’s alpha value for the total SS score was .76, indicating acceptable/good internal consistency.

3.2.1.4 Procedure

3.2.1.4.1 Assignment to Experimental Conditions

Because each IAPS image needed to appear at each frequency level equally often across participants, seven image sequence conditions were devised and counterbalanced according to a Latin square design. To ensure equal participant numbers in each image sequence condition, the 49 participants were randomly assigned to each condition on a rotating basis. Thus, the first participant was allocated into image sequence A (the first condition), the second participant into image sequence B (the second condition) and so on.

3.2.1.4.2 Exposure Phase

Participants were seated in front of a computer screen and were advised by the researcher that they were taking part in a study investigating how people respond to visual stimuli. Participants were informed that they would be presented with a series of images and that their sole task was to view and pay attention to them. Participants were informed that each image would be preceded by a white screen with a central black fixation cross and to focus on the cross because that was where the images would appear. Participants were informed that there would be 63 image presentations and that the majority of images would be presented more than once. Participants were also advised that this phase of the experiment would take approximately 4 minutes to complete. Finally, participants were informed that after this initial exposure phase, they would then be asked to complete a series of liking ratings; however this phase of the experiment would be further explained at a later time.
After reading the project information statement, participants were asked if they had any questions about the requirements of the task and if they were willing to participate in the present study. After answering any questions and agreeing to be involved, participants signed a project consent form. Participants were advised that signing the form would indicate their voluntary participation in the present study. Before the exposure phase commenced, participants were asked to complete the study questionnaire. However, because of possible time constraints, particularly during work hours, participants were also given the option of returning the questionnaire at a later stage. The point at which participants completed the questionnaire (before or after the experiment) was included as an independent variable in the analysis. This therefore allowed for the statistical significance and hence its impact, to be assessed.

The seven neutral images were displayed on the computer screen. Each image was displayed at one of seven exposure frequencies (i.e., 0, 1, 2, 5, 10, 20 and 25 exposures) equally often across participants. For example, one image was displayed once, another image was displayed twice, another image was displayed five times etc. The image which was displayed at each exposure frequency was dependent upon the image sequence condition to which the participant was allocated. Consequently, there were a total of 63 stimulus presentations for each participant. All images were presented in a random, heterogeneous exposure sequence for 1 second. Each image was preceded by a central black fixation cross on a white background for 2 seconds and was then followed by a blank black screen for 1 second. Thus, the inter-stimulus interval (ISI; defined as the duration between the offset of the target stimulus to the onset of next stimulus, in this case the fixation cross) was 1 second in duration. Refer Figure 2 for a schematic representation of the exposure phase.
Figure 2. Schematic representation of the experimental procedure used in the exposure phase of the neutral IAPS mere exposure study. 

Note: The blank black screen which was displayed for 1 second was required by DirectRT to allow time for the next trial to be prepared. In addition, for copyright reasons, the actual neutral IAPS images were not shown in Figure 1 above.
3.2.1.4.3 Test Phase

Participants were advised that this was the next phase of the experiment and they were about to view seven more images. However, unlike the exposure phase wherein their sole task was to view and pay attention to them, participants were informed that their task now was to rate each image for liking. They were also informed that this would occur through the use of 9-point Likert scale, which they would view on the computer screen.

Participants were then shown a diagram of 9-point scale which they would view when making their liking response. The liking scale was anchored 1 = *strongly dislike* to 9 = *strongly like* and was worded “to what extent do you like the image?” After the participants were familiarised with the diagram, they were then advised that they needed to press a number from one to nine on the computer number pad which corresponded with their first impression for the rating condition. If the participant was indifferent to the image, they were advised to press the middle number, five. Participants were then informed that each image would be presented for 1 second but there would be no time limit to make their liking responses. However, participants were reminded to respond with their first impression and hence, advised to make their responses as quickly as possible.

The same six images that were presented in the exposure phase were presented again in the test phase, together with one, never-before-seen equivalent. In contrast to the exposure phase, where each image was displayed at one of seven exposure frequencies (i.e., 0, 1, 2, 5, 10, 20 and 25 exposures), each image was only displayed once. However, similar to the exposure phase, all images were presented in a random, heterogeneous exposure sequence for 1 second. Each image was preceded by a central black fixation cross on a white background for 2 seconds, which was then followed by the self-paced liking rating scale. Participants were not given feedback regarding their performance at the time of each response. Please refer Figure 3 for a schematic representation of the test phase.
Figure 3. Schematic representation of the experimental procedure used in the test phase of the neutral IAPS mere exposure study. 

Note: The blank black screen which was displayed for 1 second was required by DirectRT to allow time for the next trial to be prepared. In addition, for copyright reasons, the actual neutral IAPS images were not shown in Figure 2 above.
3.2.2 Results

Participant liking ratings of the seven neutral IAPS images were recorded by DirectRT (Empirisoft, 2006) and were later transferred into the Statistical Package for Social Sciences (SPSS) version 21.0 (IBM, 2012) for analysis. Participant responses to the demographic questions (e.g., gender) and the sensation seeking (SS) scale were also entered into SPSS for analysis. Total scores for the SS scale were calculated by summing participant scores of each item.

3.2.2.1 Data Screening and Preliminary Data Analysis

One of the requirements of an ANOVA is to have one or more categorical independent variables. Therefore, following the protocol of other SS studies (e.g., Lang, Chung, Lee, Schwartz, & Shin, 2005; Lissek et al., 2005; Lissek & Powers, 2003), participants were divided into low and high SS groups, based on a median split of their total SS scores\(^\text{14}\). In the current study, the median score was 16. Thus, participants with a score of 16 or lower were labelled low SSs \((n = 22)\), whereas participants with a score of 17 or higher were labelled high SSs \((n = 26)\).

Initial inspection of the data revealed no out of range or missing values. To identify possible outliers, histograms and boxplots were produced for the dependent variable (i.e., liking) at each frequency level, comparing by the grouping variable: the level of SS (low and high). Inspection of these graphs revealed one potential outlier for the low SS group for the ‘Liking_1’ variable (i.e., liking ratings of neutral images shown once). However, examination of the corresponding z-score revealed that this outlying case was within three standard deviations of the mean and hence, the decision was to retain all cases. No effect of when the participant completed the questionnaire (before or after the experiment) was found so this variable was excluded from the analysis. All of the assumptions of a mixed design ANOVA were satisfied. Please refer to Appendix D1 for a detailed description of assumption checking.

3.2.2.1.1 Manipulation Checks

As previously mentioned, the selection of stimuli used in Experiment 1 was guided by the IAPS technical manual which provided standardised ratings of valence

\(^{14}\) Please note that total SS scores had a normal distribution prior to performing the median split.
and arousal for each IAPS image. To ensure that participant ratings of the selected neutral stimuli in the current study were similar to what would be expected based on the ratings contained within this manual, a series of manipulation checks were conducted. For comparative purposes, the low arousal stimuli (i.e., negative and positive) used in Experiment 2 will be used in the subsequent manipulation checks of this experiment. The low arousal stimuli were selected for this comparison because neutral stimuli are also meant to be low in arousal (Lang et al., 2008). Hence, the manipulation would be successful if there was no significant difference in participant arousal ratings but there was a significant difference in participant valence ratings among the three image groups. Specifically, participants should perceive the neutral images to be more pleasant than the negative images but less pleasant (or more unpleasant) than the positive images.

Because the mere exposure effect encapsulates the notion of repeated exposure, this therefore meant that the seven images in each image group (i.e., negative low arousal, neutral and positive low arousal) were displayed at one of seven exposure frequencies (i.e., 0, 1, 2, 5, 10, 20 and 25 exposures), equally often across participants. In order to match the procedure used by Lang et al. (2008) to obtain the standardised IAPS ratings, only the participant valence and arousal ratings of the images which were displayed once were included in the subsequent manipulation checks.

3.2.2.1.1 Valence Manipulation Check

The means and standard deviations of the participant valence ratings are presented in Table 3. A one-way ANOVA indicated that there was a significant difference between participant valence ratings among the image groups \( F(2, 139) = 37.53, p = <.001 \).
Table 3

Means and Standard Deviations of Valence Ratings for Negative Low, Neutral, and Positive Low Arousal Images

<table>
<thead>
<tr>
<th>Image Group</th>
<th>M</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative low arousal</td>
<td>3.62</td>
<td>1.90</td>
<td>48</td>
</tr>
<tr>
<td>Neutral</td>
<td>4.85</td>
<td>2.02</td>
<td>48</td>
</tr>
<tr>
<td>Positive low arousal</td>
<td>6.70</td>
<td>1.55</td>
<td>46</td>
</tr>
</tbody>
</table>

To investigate this further, follow-up tests were needed. Given that the differences expected between the image groups were a priori and based on theory, planned contrasts would have seemed appropriate. However, because planned comparisons would have taken the average (or the mean) of the negative low arousal group and positive low arousal group and compared this to the mean of the neutral image group, post-hoc tests were conducted instead. Because the three groups of images were matched in their degree of unpleasantness and pleasantness (i.e., the intensity of affective valence) to allow for comparisons, taking the mean of the negative and positive low arousal image groups would have essentially matched the mean of the neutral images. Consequently, planned contrasts would not have adequately reflected the actual differences among the image groups, if these differences existed.

In light of this, Gabriel’s\textsuperscript{15} post-hoc tests were conducted. As expected, the results indicated that there was a significant difference in participant valence ratings between the neutral and negative low arousal image groups ($p = .001$) and between the neutral and positive low arousal image groups ($p = <.001$)\textsuperscript{16}. As can be seen in Table 3, participants rated the neutral images as more pleasant than the negative low arousal images but less pleasant, or more unpleasant, than the positive low arousal images. Therefore, the participant valence ratings of the neutral images used in the current study were in the expected direction and in line with the IAPS database.

\textsuperscript{15}Gabriel’s post-hoc tests were conducted because the group sizes were slightly unequal (Field, 2013).

\textsuperscript{16}Please note that the results relating to the difference between the negative and positive low arousal images will be discussed in section 3.3.2.1.1.1 (p. 106).
3.2.2.1.2 Arousal Manipulation Check

The means and standard deviations of participant arousal ratings are presented in Table 4. As expected, a one-way ANOVA indicated that there was no significant difference in participant arousal ratings between the image groups ($F(2, 139) = 1.34, p = .265$).

Table 4

<table>
<thead>
<tr>
<th>Image Group</th>
<th>M</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative low arousal</td>
<td>3.35</td>
<td>2.37</td>
<td>48</td>
</tr>
<tr>
<td>Neutral</td>
<td>4.02</td>
<td>2.06</td>
<td>48</td>
</tr>
<tr>
<td>Positive low arousal</td>
<td>4.02</td>
<td>2.44</td>
<td>46</td>
</tr>
</tbody>
</table>

As can be seen in Table 4, participants, on average, rated all types of low arousal images (i.e., negative, neutral and positive) as being similar in their degree of calmness (i.e., low arousal). Therefore, similar to participant valence ratings, the participant arousal ratings of the neutral images were also in line with the IAPS database.

3.2.2.2 Statistical Analysis

Participant liking ratings of the neutral IAPS images were analysed using a 2 (Level of SS: Low, High) x 7 (Exposure Frequency: 0, 1, 2, 5, 10, 20, 25) mixed design ANOVA, with the level of SS as the between-subjects factor and exposure frequency as the within-subjects factor. The means and standard deviations are presented in Table 5.
Table 5

Means (M) and Standard Deviations (SD) of SS and Overall Liking Ratings for Neutral Images Across the Frequency Levels

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Level of SS</th>
<th>M</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Low</td>
<td>5.27</td>
<td>1.98</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>5.54</td>
<td>2.06</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>5.42</td>
<td>2.00</td>
<td>48</td>
</tr>
<tr>
<td>1</td>
<td>Low</td>
<td>5.36</td>
<td>1.94</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>4.58</td>
<td>2.19</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>4.94</td>
<td>2.10</td>
<td>48</td>
</tr>
<tr>
<td>2</td>
<td>Low</td>
<td>5.50</td>
<td>1.95</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>4.81</td>
<td>2.45</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>5.13</td>
<td>2.24</td>
<td>48</td>
</tr>
<tr>
<td>5</td>
<td>Low</td>
<td>5.09</td>
<td>1.63</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>4.62</td>
<td>2.12</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>4.83</td>
<td>1.91</td>
<td>48</td>
</tr>
<tr>
<td>10</td>
<td>Low</td>
<td>5.46</td>
<td>1.77</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>4.46</td>
<td>2.23</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>4.92</td>
<td>2.07</td>
<td>48</td>
</tr>
<tr>
<td>20</td>
<td>Low</td>
<td>5.23</td>
<td>2.49</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>4.58</td>
<td>2.23</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>4.88</td>
<td>2.35</td>
<td>48</td>
</tr>
<tr>
<td>25</td>
<td>Low</td>
<td>5.41</td>
<td>2.22</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>4.46</td>
<td>2.28</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>4.90</td>
<td>2.28</td>
<td>48</td>
</tr>
</tbody>
</table>

The 2 x 7 ANOVA outlined above revealed that the SS x Exposure Frequency interaction was not significant, $F(6, 276) = .569$, $p = .755$, *observed power* = .23, that the main effect of exposure frequency was not significant, $F(6, 276) = .465$, $p = .834$, *observed power* = .19, and that the main effect of SS, $F(1, 46) = 3.43$, $p = .070$, *observed power* = .44, was not significant (refer Appendix Table E1 for the overall liking means of low and high SS participants). Therefore, no significant effects were found for the neutral IAPS images.
3.2.3 Discussion

3.2.3.1 Overview of Aims and Findings

Experiment 1 was designed to investigate the effect of repeated exposure on liking ratings of neutral, meaningful stimuli, namely images from the IAPS, and to explore the possible moderating influence of SS on this exposure-liking relationship. The overall purpose of Experiment 1 was to obtain a baseline to which the findings of Experiment 2, which used innately emotional stimuli, could be compared and simultaneously examine the mere exposure effect to real-world, meaningful stimuli.

There were no significant effects found. The non-significant SS x Exposure Frequency interaction indicated that the profile of the mean liking ratings across the frequency levels was the same for low and high SS participants. Therefore, SS was not found to moderate the relationship between exposure and liking for the neutral stimuli. In addition, the non-significant main effect of exposure frequency indicated that liking ratings, overall, did not vary across the frequency levels. Thus, participants (both low and high SSs) in Experiment 1 failed to show a mere exposure effect. Inspection of the means at each exposure frequency level (displayed in Table 5), indicated that the liking ratings overall, and for low and high SS participants separately, were not even in the correct direction for a mere exposure effect (i.e., liking ratings did not increase with increasing exposure frequency), nor was there any trend which was suggestive of an inverted U-shaped relationship (i.e., liking ratings did not initially increase but then decrease with increasing exposure frequency). Rather, all of the means displayed no identifiable pattern; liking ratings randomly increased and decreased across the frequency levels. Cursory examination of the mean liking ratings for each individual stimulus also indicated no effect. Finally, the non-significant main effect of SS indicated that overall, low and high SS participants did not differ in their liking ratings of the neutral images. A brief yet integrated account of the findings will now take place. Please note that an in depth discussion of the current findings will occur in the Chapter 5 (general discussion, p. 176).

3.2.3.2 An Integrated Account of Findings

Even though low and high SS participants have not been found to differ in their preference/liking ratings of neutral stimuli (Zaleski, 1984) which was supported by the
findings of the current study, it could have expected that the level of SS would moderate
the exposure-liking relationship for neutral stimuli because of boredom and their
receptiveness to familiar and novel stimuli. That is, as mentioned in Chapter 2 (section
2.1.4.1.4, p. 55), low relative to high SS individuals are less inclined to become bored in
repetitive situations and are also more inclined to prefer familiar rather than novel
stimuli (Zuckerman, 1990). Thus, because a mere exposure effect is essentially based on
the effects of repetition, thereby rendering the stimuli more familiar to participants, it
could have been assumed that liking ratings of low SS participants would increase with
repeated exposure, thereby demonstrating a mere exposure effect. Equally, it could have
also been expected that liking ratings of high SS participants would initially increase but
then decline at higher exposure frequencies because of boredom and also because their
preference for novel stimuli was not enabled. However, the findings of the current
study indicated the effect of repeated exposure on liking ratings of the neutral stimuli
did not change or depend upon the participants’ level of SS. Even though participant
scores on the SSS-V (i.e., the SS scale; Zuckerman et al., 1978) were subjected to a
median split, it is unlikely that this dichotomization of SS could explain why the
participants’ level of SS did not exert an effect on the exposure-liking relationship for
the neutral stimuli. That is, because total SS scores had a normal distribution prior to
performing the median split, this negates the possibility that there was an inadequate
range of low and high SS scores to begin with. The failure to find a mere exposure
effect at all was surprising given that an abundance of previous mere exposure research
have found significant exposure effects using neutral, meaningless stimuli such as
polygons, and to a lesser extent, also using neutral, more meaningful stimuli such as
consumer products (refer Chapter 2, section 2.1.1.1, p. 11).

One plausible explanation for why the effect failed to eventuate (at least initially
for high SS participants) was because of the lack of similarity between the stimuli that
were utilised. Specifically, the neutral IAPS images in the current study depicted
different objects such as a suitcase and a drill. However, in previous mere exposure
studies, the stimuli used have all been similar; all polygons (e.g., Newell & Shanks,
2007); all trigrams (e.g., Zajonc et al., 1972) or all Welsh figures (e.g., Bornstein et al.,
1990) etc. This notion that the effect of repeated exposure can be inhibited when
different stimulus categories are used is partially consistent with that of Zajonc et al.
(1972), who suggested that stimulus discriminability (i.e., when stimuli are easy to
distinguish between) can reduce the magnitude of the mere exposure effect, but only when painting stimuli are used (refer section 2.1.2.1, p. 36). However, because participants in the current study were not exposed to painting stimuli, it may seem that the effect of stimulus discriminability on the mere exposure effect is more widespread. It is likely when stimuli are easy to distinguish from one another; existing personal preferences for some stimuli may outweigh the attitude-enhancing effect of repeated exposure. This will be further discussed in the Chapter 5 (general discussion, p. 176).

Given that the following experiment used emotional stimuli that were also easily discriminable from one another (some more than others); this possibility that stimulus discriminability may have prevented a mere exposure effect from occurring will be further investigated. However, whether or not stimulus discriminability limits the occurrence of the mere exposure effect only when neutral stimuli are used will also be ascertained.

3.3 Experiment 2. Application of the Mere Exposure Effect to Emotionally-Laden IAPS Images and an Examination of the Influence of Sensation Seeking

Experiment 2 was primarily designed to investigate the effect of repeated exposure on liking, valence and arousal ratings of stimuli that were inherently emotional, namely images from the IAPS, in a controlled setting. As a consequence, application of the mere exposure effect to more meaningful, real-world stimuli was also achieved. In addition, Experiment 2 explored the possible moderating influence of sensation seeking (SS) on the abovementioned exposure-affect relationships.

Both valence and arousal levels of the IAPS images were manipulated, resulting in four experimental image groups: negative low arousal, positive low arousal, negative high arousal, and positive high arousal. All participants completed liking, valence and arousal ratings of the seven IAPS images to which they were exposed. As in Experiment 1, these images were counterbalanced across seven exposure levels (0, 1, 2, 5, 10, 20, 25 exposures). All participants also completed the SS questionnaire, for which their total scores were subjected to a median split to obtain low and high SS groups. Thus,

17 Please note that total SS scores had a normal distribution prior to performing the median split.
participant liking, valence, and arousal ratings were analyzed using separate 2 (Level of SS: Low, High) x 4 (Image Group: Negative Low Arousal, Positive Low Arousal, Negative High Arousal, Positive High Arousal) x 7 (Exposure Frequency: 0, 1, 2, 5, 10, 20, 25) mixed design ANOVAs, with the level of SS and image group as between-subjects variables and exposure frequency as the within-subjects variable. Evidence of the mere exposure effect was obtained if participants ascribed significantly higher affect ratings to the frequently exposed than infrequently exposed emotional stimuli. Furthermore, evidence of the moderating influence of SS was obtained if this relationship between exposure and affect was different for low and high SS participants.

3.3.1 Method

3.3.1.1 Participants

One hundred and ninety-six participants, 94 of whom were male and 102 of whom were female, were involved in Experiment 2. Similar to Experiment 1, participants were also recruited from local businesses and government organisations. Six participants reported that they were colour blind and four participants failed to complete the study questionnaire. Hence, 10 participants were excluded from further analysis. Thus, the final sample consisted of 186 participants, 85 of whom were male (M = 47.77 years, SD = 17.37 years) and 101 of whom were female (M = 42.41 years, SD = 17.18 years).

Even though 49 participants were initially in each image group, the exclusion of some participants described above meant that the negative low arousal image group consisted of 48 participants, 22 of whom were male (M = 47.32 years, SD = 13.30 years) and 26 of whom were female (M = 39.42 years, SD = 13.23 years). The positive low arousal image group consisted of 46 participants, 21 of whom were male (M = 49.29 years, SD = 12.36 years) and 25 of whom were female (M = 44.40 years, SD = 13.42 years). The negative high arousal image group consisted of 45 participants, 25 of whom were male (M = 40.79 years, SD = 22.23 years) and 20 of whom were female (M = 45.80 years, SD = 18.64 years). Lastly, the positive high arousal image group consisted of 47 participants, 17 of whom were male (M = 56.88 years, SD = 16.47 years) and 30 of whom were female (M = 41.07 years, SD = 21.66 years).
Of the entire sample, the majority (78.50%) were born in Australia and only 6.5% of participants reported a first language other than English. More than half the sample (51.60%) had obtained a tertiary or postgraduate level of education and three of those participants reported having a background in psychology. None of the participants had a background in design\textsuperscript{18}. All participants signed a consent form which indicated their willingness to participate and the study was granted approval by the Swinburne University Human Research Ethics Committee on the 9\textsuperscript{th} May, 2011 (refer Appendix A1 for a copy of this approval). Participants received a chocolate bar upon completion of their involvement and were also entered into a raffle to win a $165.00 Coles/Myer voucher for their time and effort.

3.3.1.2 Design

The study was a mixed design, with level of SS (low and high) and image group (i.e., negative low arousal, positive low arousal, negative high arousal and positive high arousal) as between-subjects variables and exposure frequency (0\textsuperscript{19}, 1, 2, 5, 10, 20 and 25 exposures) as a within-subjects variable. In order to ensure that each image within each image group was shown at each of the seven exposure frequencies approximately the same number of times, there were seven image sequence conditions, which were counterbalanced across participants. These sequence conditions were devised according to a Latin square design. Within each image sequence group, there were seven different test order conditions, which were also counterbalanced across participants. These test order conditions were needed to prevent order effects (discussed in section 2.1.3.2, p. 46) because participants in the current experiment were required to rate each IAPS image on liking, valence, and arousal dimensions. These seven test orders were as follows: liking, valence and arousal rating (test order one); valence, liking and arousal rating (test order two); arousal, liking and valence rating (test order three); arousal, valence and liking rating (test order four); liking, arousal and valence rating (test order five); valence, arousal and liking rating (test order six) and liking, valence and arousal rating (test order seven). The seventh test order was the same as the first test order.

\textsuperscript{18} Study discipline, particularly psychology and design, was deemed to be important because this study investigated a psychological phenomenon. Furthermore, if participants had a background in design, they may have been more critical of the image properties such as colour. Given that only three participants had a background in psychology, it was considered unlikely that this would influence the statistical findings of this experiment.

\textsuperscript{19} Stimuli in the zero frequency condition were excluded from the exposure phase. That is, the stimuli were presented in the test phase only.
because multiples of seven were required. Each test order was maintained for each participant throughout the duration of the experiment. All participants completed liking, valence, and arousal ratings for stimuli presented in the exposure phase and the test phase.

3.3.1.2.1 Decision to Use a Mixed Design, with Image Group as a Between-Subjects Variable and not as a Within-Subjects Variable

Despite the lack of research investigating the effect of repeated exposure to stimuli differing in valence and arousal, the abundance of studies which have applied the mere exposure paradigm to other phenomena (e.g., stimulus complexity; Bornstein et al., 1990), have either used these independent variables of interest as a between-subjects variable(s) (e.g., Seamon et al., 1995; Marie et al., 2001; Willems, Adam, & Van der Linden, 2002) or as a within-subjects variable(s) (e.g., Grush, 1976). In the current study, there were a number of reasons why image group (negative low arousal, positive low arousal, negative high arousal and positive high arousal), in addition to the level of SS, was used as a between-subjects variable.

With the exception of Grush (1979), the majority of studies which have attempted to investigate the effect of repeated exposure to emotional stimuli have used the valence type of the stimuli as a between-subjects variable (e.g., Perlman & Oskamp, 1970; Suedfeld, Epstein, Buchanan, & Landon, 1971). However despite this, no rationale for their choice of design was provided. It could have been that if valence type was used as a within-subjects variable, comparisons between the valence groups could have been made. Participants may have liked positive images more than negative images, regardless of how many times the images were exposed. This reasoning was supported by Englund and Hellstrom (2012), who found that participants’ preference decisions were influenced in both magnitude and direction by the valence level of the stimuli they were required to choose between. Specifically, participants had a greater tendency to prefer the positive but not the negative images.

Within the mere exposure framework, the notions of preference and comparison have also been discussed. In a study conducted by Newell and Shanks (2007), the effect of repeated exposure on exposure duration (i.e., 400 and 40 milliseconds) was
investigated. These researchers speculated that when exposure duration was used as a within-subjects variable, the participants may have concentrated on the stimuli presented at the longer exposure duration and ignored the stimuli presented at the shorter exposure duration. Thus, between the two exposure durations, participants may have had a preference for longer exposure durations when directly weighted against shorter exposure durations.

Furthermore, other mere exposure researchers have also identified a preference for other types of stimuli when directly compared to each other. For example, Bornstein et al. (1990), investigated affect ratings towards repeatedly exposed complex (i.e., optical illusions) and simple (i.e., Welsh figures) stimuli. When stimulus type was used as a within-subjects variable, findings revealed that affect ratings of simple stimuli were significantly lower than affect ratings of complex stimuli. However, when stimulus type was used as a between-subjects variable, affect ratings towards simple stimuli significantly increased. Hence, when stimulus type was used as a within-subjects variable, affect ratings for the two types of stimuli were made relative to each other and a “contrast effect” occurred (Bornstein et al., 1990).

Therefore, in light of the possible limitations of using image group as a within-subjects variable, namely participant preference and comparative judgments, a mixed design using image group as one of the between-subjects variables was deemed to be most appropriate.

3.3.1.3 Materials

3.3.1.3.1 International Affective Picture System (IAPS)

A total of 28 images were selected from the IAPS (Lang et al., 2008)20 database. Because this study aimed to investigate the effect of repeated exposure to stimuli differing in valence and arousal, four categories of stimuli were utilised. These categories were negative low arousal images, positive low arousal images, negative high arousal images and positive high arousal images. Furthermore, because there were seven exposure frequencies, this therefore meant that seven images were required for

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20 Permission to use the IAPS was obtained from the NIMH Centre for Emotion and Attention (CSEA) at the University of Florida via e-mail on the 28/07/11.
each category. The process by which these images were selected will now be described below.

### 3.3.1.3.1.1 Selection Process

Similar to Experiment 1, the process of selecting the seven images in each image group was guided by previous literature (e.g., Lee, Lee, Raine, & Chan, 2010) and by the IAPS technical manual (Lang et al., 2008), which contained normative ratings of valence and arousal for each IAPS image. As previously discussed in section 3.2.1.3.1.1 (p. 76), both valence and arousal were scored on 9-point scales, where nine represented a high rating on each respective dimension (i.e., high pleasure, high arousal) and one represented a low rating on each respective dimension (i.e., low pleasure, low arousal) (Lang et al., 2008). Consequently, the intensity of the affective valence and arousal of each image was able to be identified and was grouped accordingly.

The two excel spreadsheets containing all negative and positive IAPS images devised in Experiment 1 were utilised. As previously mentioned, images with a valence mean below 4.49 were considered to be negative (i.e. low pleasure) and images with a valence mean above 5.51 were considered to be positive (i.e., high pleasure). Before the selection process for the current study commenced, all erotic images were removed from the positive IAPS spreadsheet and hence, excluded from the selection process. This was due to the finding that erotic stimuli produce large sex-related differences in participant valence and arousal ratings (e.g., Bradley et al., 2001).

To ensure that any differences in the dependent measures (i.e., liking, valence and arousal) could be attributed to exposure frequency and not to differences in the intensity of emotional content, the negative and positive images needed to have a comparable level of valence intensity (i.e., degree of unpleasantness and pleasantness). Thus, given that the dimension of valence was rated on a nine-point scale, negative images with a valence mean between 3.00 and 4.00 and positive images with a valence mean between 6.00 and 7.00 were then identified and selected. All other negative and positive IAPS images were then excluded from the selection process.
Next, all of the selected negative and positive images were then further divided into low and high arousal groups. As previously mentioned, images with an arousal mean below 4.50 were broadly considered as low in arousal and images with an arousal mean above 5.50 were broadly considered as high in arousal. Finally, similar to valence, the negative low and high arousal images and the positive low and high arousal images also needed to have a comparable level of arousal intensity (i.e., degree of calmness and excitability). Thus, given that the dimension of arousal was also rated on a 9-point scale, negative and positive low arousal images with an arousal mean between 3.50 and 4.00 and negative and positive high arousal images with an arousal mean between 6.00 and 6.50 were also identified and selected. All other IAPS images were then excluded and the selection process was complete.

It is noteworthy that the inclusion of low arousal images impacted upon the selection process. Specifically, the most unpleasant and the most pleasant IAPS images were not able to be utilised. This was because of the documented tendency that as valence ratings become increasingly more unpleasant or pleasant, so do arousal ratings (Lang et al., 2008). To further explain this point, the positive low and high arousal IAPS images will be made reference to. For comparative purposes, the positive low and high arousal images needed to have the same valence mean. Thus, because the most pleasant IAPS images were also the most highly arousing, the most pleasant IAPS images couldn’t be selected. For example, positive IAPS images with a valence mean between 8.00 and 9.00 didn’t have a corresponding arousal mean that was considered to be low (e.g., between 3.50 and 4.00). Therefore, the level of valence intensity needed to be reduced in order to accommodate for the use of low arousal images. This reasoning was also applied to the selection of the negative IAPS images used in this experiment.

It is also noteworthy that the selection criteria used in the current study shaped the depicted content of the selected high arousal images. For the negative high arousal group, after excluding images which didn’t have a valence mean between 3.00 and 4.00 and an arousal mean between 6.00 and 6.50, only 14 IAPS images were remaining. Of these 14 images, nine images depicted similar content such as sharks, spiders and snakes. For the positive high arousal group, after excluding images which didn’t have a valence mean between 6.00 and 7.00, an arousal mean between 6.00 and 6.50, and which didn’t display erotic content, only 10 IAPS images were remaining. Of those 10
images, eight images depicted similar identical content such as hang gliders and hikers. Thus, the selection criteria resulted in a narrow assortment of high arousal images to select as the study’s stimuli, namely dangerous animals and extreme sports for the negative and positive high arousal conditions respectively. Even though the restricted stimulus sets were imperfect, it was deemed more problematic to select images which couldn’t be comparable in terms of valence and arousal level and had a documented gender bias.

In summary, the seven negative low arousal IAPS images had a valence mean ranging between 3.00 and 4.00 and an arousal mean ranging between 3.50 and 4.00. Images in this group were scenes of pollution, a cemetery and people in unpleasant circumstances such as in jail or poverty. The seven positive low arousal IAPS images had a valence mean ranging between 6.00 and 7.00 and an arousal mean ranging between 3.50 and 4.00. Images in this group were mainly of animals such as elephants and horses. The seven negative high arousal IAPS images had a valence mean ranging between 3.00 and 4.00 and arousal mean ranging between 6.00 and 6.50. Images in this group were mainly of dangerous animals such as a shark and spiders. Finally, the seven positive high arousal images had a valence mean ranging between 6.00 and 7.00 and also had an arousal mean ranging between 6.00 and 6.50. Images in this group mainly depicted extreme sports such as ice and mountain climbing. Please refer Appendix Tables B2-B5 for a list of the IAPS images that were used in each of the four image groups in this experiment.

Similar to Experiment 1, all images were converted from JPEG (jpg) to bitmap (.bmp). Images were presented centrally on an 18.4 inch full high definition (HD) computer screen, and the presentation and timing of the images was controlled by the software package DirectRT (Empirisoft, 2006). The size of each bitmap image was 1024 x 768 pixels with a resolution of 72 dpi (dots per inch).

3.3.1.3.2 Study Questionnaire

The questionnaire used in Experiment 2 was identical to the questionnaire used in Experiment 1. Please refer section 3.2.1.3.2 (p. 77) for a detailed description but put briefly, the questionnaire contained basic demographics (e.g., gender, age) and the
Sensation Seeking Scale Form-V (SSS-V; Zuckerman et al., 1978). This established SS scale is reported to have sound psychometric properties (Roberti et al., 2003; Zuckerman, 1994). For the present study, the Cronbach’s alpha value for the total SS score when all image groups were combined was .82, indicating good internal consistency. For each image group, the Cronbach’s alpha values were .81, .82, .83 and .81 for the negative low arousal, positive low arousal, negative high arousal and positive high arousal image groups respectively. Hence, good internal consistency was also found for the items of the SSS-V within each image group. Please refer Appendix C for the study questionnaire.

3.3.1.4 Procedure

3.3.1.4.1 Assignment to Experimental Conditions

As previously mentioned, seven image sequence and test order conditions were devised for each image group (i.e., the negative low arousal, the positive low arousal, the negative high arousal, and the positive high arousal image group). Thus, for each image group, there were 49 experimental conditions (i.e., each participant was allocated into an experimental condition wherein the image sequence and test order was never the same) and thus, 196 experimental conditions in total (i.e., 4 [number of image groups] x 49 [experimental conditions]). To ensure equal participant numbers in each image group, each participant was assigned to one of the four image groups on a rotating basis. Thus, the first participant was assigned to the negative low arousal image group, the second participant to the positive low arousal image group and so on. Then, each participant was randomly assigned into one of the 49 experimental conditions within that respective image group.

3.3.1.4.2 Exposure Phase

The instructions to participants in the exposure phase were similar to those used in Experiment 1 (please refer section 3.2.1.4.2, p. 79, for a detailed description). The only difference between Experiments 1 and 2 was the type of stimuli utilised. In short, depending on which image group the participants were allocated into (i.e., negative low arousal, positive low arousal, negative high arousal or positive high arousal image group), participants were exposed to the seven IAPS images relevant to that image

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21 Permission to use the SSS-V was obtained from Marvin Zuckerman via e-mail on the 10/07/12.
group. Each image was again displayed on a computer screen at one of the seven exposure frequencies (i.e., 0, 1, 2, 5, 10, 20 and 25 exposures) equally often across participants. As in Experiment 1, all images were presented in a random, heterogeneous exposure sequence for 1 second. Each image was preceded by a central black fixation cross on a white background for 2 seconds and was then followed by a blank black screen for 1 second. Thus, the inter-stimulus interval (ISI; defined as the duration between the offset of the target stimulus to the onset of next stimulus, in this case the fixation cross) was 1 second in duration. Refer Figure 4 for a schematic representation of the exposure phase which was the same for each image group. However, please note that the only element which was different for each image group was the emotional properties (i.e., valence and arousal) of the stimuli which were utilised.
Figure 4. Schematic representation of the experimental procedure used in the exposure phase of the emotionally-laden IAPS mere exposure study.

Note: The blank black screen which was displayed for one second was required by DirectRT to allow time for the next trial to be prepared. In addition, for copyright reasons, the actual IAPS images were not shown in Figure 3 above.
3.3.1.4.3 Test Phase

The instructions to participants in the test phase were identical to those used in Experiment 1 (please refer section 3.2.1.4.3, p. 82, for a detailed description). However, in addition to the type of stimuli utilised, another difference between the Experiment 1 and 2 test phase was the inclusion of two other rating scales. Specifically, participants were not only asked to rate each IAPS image for liking but for valence and arousal as well. This was because the stimuli used in the present study were emotional (i.e., contained valence and arousal properties) and as such, it is possible that these properties could also change as a result of repeated exposure. Similar to Experiment 1, participants were informed that they would rate each IAPS image according to 9-point Likert scales, which they would view on the computer screen. Before the rating phase commenced, participants were shown three diagrams of the 9-point Likert scales; one which they would view when making their liking response, one which they would view when making their valence response and one which they would view when making their arousal response. The liking, valence and arousal scales were anchored 1 = strongly dislike to 9 = strongly like (as in Experiment 1), 1 = extremely unpleasant to 9 = extremely pleasant and 1 = I feel extremely calm to 9 = I feel extremely excited, respectively. The three scales were worded “to what extent do you like the image?” (the liking scale), “to what extent do you find the image to be pleasant?” (the valence scale), and “to what extent do you find the image to be arousing?” (the arousal scale). The valence and arousal scales were consistent with those used by Lang et al. (2008) when creating the standardised ratings of valence and arousal for the IAPS images.

To be consistent with the IAPS rating procedure, participants were then given more detail about what the wording of the anchor points meant on the valence and arousal scales. Specifically, for the valence scale, participants were advised that if they felt completely unhappy, annoyed, dissatisfied, despondent, or dejected when viewing the image, they needed to circle number one, “extremely unpleasant”. However, if they felt completely happy, pleased, satisfied, content or hopeful when viewing the image, they needed to circle number nine “extremely pleasant”. For the arousal scale, participants were also advised that if they felt completely relaxed, calm, sluggish, dull, sleepy or unaroused when viewing the image, they needed to circle number one, “I feel extremely calm”. However, if they felt completely stimulated, excited, frenzied, jittery,
wide-awake or aroused when viewing the image, they needed to circle number nine, “I feel extremely excited”. These descriptions of the scales were adapted from the IAPS technical manual (Lang et al., 2008).

Similar to Experiment 1, participants were required to press a number from one to nine on the computer number pad which corresponded with their first impression for each rating condition. If the participant was indifferent to the image for any rating condition, they were advised to press the middle number, five. Depending on which test order condition the participant was assigned to, some participants consistently viewed the 9-point liking Likert scale first whilst other participants consistently viewed the 9-point valence or arousal Likert scale first. The order in which the rating scales were presented was maintained for each participant throughout the duration of the test phase. All other aspects of the test phase were the same as Experiment 1. Please refer Figure 5 for a schematic representation of the test phase, which was the same for each image group. However, please note that the only element which was different for each image group was the emotional properties (i.e., valence and arousal) of the stimuli which were utilised.
Figure 5. Schematic representation of the experimental procedure used in the test phase of the emotionally-laden IAPS mere exposure study. Note: The blank black screen which was displayed for one second was required by DirectRT to allow time for the next trial to be prepared. In addition, for copyright reasons, the actual IAPS images were not shown in Figure 4 above.
3.3.2 Results

Participant liking, valence and arousal ratings of the seven images in each image group (i.e., negative low arousal, positive low arousal, negative high arousal and positive high arousal) were recorded by DirectRT and were later transferred into the Statistical Package for Social Sciences (SPSS) version 21.0 (IBM, 2012) for analysis. Participant responses to the demographic questions (e.g., gender) and the SS scale were also entered into SPSS for analysis. Total SS scores were calculated by summing participant scores of each item.

3.3.2.1 Data Screening and Preliminary Data Analysis

One of the requirements of an ANOVA is to have one or more categorical independent variables. Therefore, following the protocol of other SS studies (e.g., Lang et al., 2005; Lissek, et al., 2005; Lissek & Powers, 2003), participants were divided into low and high SS groups, based on a median split of their total SS scores. In the current study, the median score was 17. Thus, participants with a score of 17 or lower were labelled low SSs ($n = 95$), whereas participants with a score of 18 or higher were labelled high SSs ($n = 91$).

Initial inspection of the data revealed no out of range or missing values. To identify possible outliers, histograms and boxplots were produced for each of the dependent variables (i.e., liking, valence and arousal) at each frequency level. This was performed for low and high SS groups separately, within each image group. Inspection of these graphs revealed that there were several potential outliers. However, examination of the corresponding z-scores revealed that all of these outlying cases were within three standard deviations of the mean and hence, the decision was to retain all cases. No effect of when the participant completed the questionnaire (before or after the experiment), image sequence condition or test order condition (liking, valence or arousal first) was found for either the liking, valence or arousal data. Hence, these variables were excluded from further analysis. All of the assumptions of a mixed design ANOVA were satisfied for each data set (liking, valence and arousal). Please refer to Appendix D2 for a detailed description of assumption checking.

Please note that total SS scores had a normal distribution prior to performing the median split.
3.3.2.1.1 Manipulation Checks

As previously mentioned, the selection of stimuli used in Experiment 2 was guided by the IAPS technical manual which provided standardised ratings of valence and arousal for each IAPS image. To ensure that participant ratings of the selected stimuli in the current study were similar to the ratings that would be expected based on this manual, a series of manipulation checks were conducted.

Because the mere exposure effect encapsulates the notion of repeated exposure, this therefore meant that the seven images in each image group were displayed at one of seven exposure frequencies (i.e., 0, 1, 2, 5, 10, 20 and 25 exposures), equally as often across participants. In order to match the procedure used by Lang et al. (2008) to obtain the standardised IAPS ratings, only the participant valence and arousal ratings of the images which were displayed once were included in the subsequent manipulation checks.

3.3.2.1.1.1 Valence Manipulation Check

To investigate whether participant valence ratings of the negative (low and high arousal) and positive (low and high arousal) images used in this experiment were in line with the IAPS database, a one-way ANOVA was conducted. The means and standard deviations of participant valence ratings are presented in Table 6.

<table>
<thead>
<tr>
<th>Image Group</th>
<th>M</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative low arousal</td>
<td>3.62</td>
<td>1.90</td>
<td>48</td>
</tr>
<tr>
<td>Positive low arousal</td>
<td>6.70</td>
<td>1.55</td>
<td>46</td>
</tr>
<tr>
<td>Negative high arousal</td>
<td>4.31</td>
<td>2.20</td>
<td>46</td>
</tr>
<tr>
<td>Positive high arousal</td>
<td>6.02</td>
<td>2.04</td>
<td>47</td>
</tr>
</tbody>
</table>

There was a significant difference in participant valence ratings between the image groups, \( F(3, 185) = 28.56, p = .001 \). To investigate this further, follow-up tests
were conducted. As expected, Games-Howell post-hoc\textsuperscript{23} tests indicated that there was a significant difference in participant valence ratings between the negative low and positive low arousal image groups ($p = < .001$), and between the negative high and positive high arousal image groups ($p = .001$). As can be seen in Table 6, participants on average rated the negative low arousal images as more unpleasant (or less pleasant) than the positive low arousal images. Participants also rated, on average, the negative high arousal images as more unpleasant (or less pleasant) than the positive high arousal images.

In addition, also as expected, there was no significant difference in participant valence ratings between the negative low and negative high arousal image groups ($p = .164$) or between the positive low and positive high arousal image groups ($p = .280$). As can be seen in Table 6, participants, on average, rated the negative low and high arousal images and the positive low and high arousal images as being similar in their degree of unpleasantness and pleasantness respectively. Therefore, the participant valence ratings of the IAPS images used in the current study were in the expected direction and in line with the IAPS database.

### 3.3.2.1.1.2 Arousal Manipulation Check

To investigate whether participant arousal ratings of the low and high negative and positive images used in this experiment were in line with the IAPS database, a one-way ANOVA was conducted. The means and standard deviations of participant arousal ratings are presented in Table 7.

\textsuperscript{23} Please refer to section 3.2.2.1.1.1 (p. 86) for an explanation of why post-hoc tests and not planned contrasts were used.
Table 7

Means (M) and Standard Deviations (SD) of Arousal Ratings for Negative Low and High Arousal Images and Positive Low and High Arousal Images

<table>
<thead>
<tr>
<th>Image Group</th>
<th>M</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative low arousal</td>
<td>3.35</td>
<td>2.37</td>
<td>48</td>
</tr>
<tr>
<td>Positive low arousal</td>
<td>4.02</td>
<td>2.44</td>
<td>46</td>
</tr>
<tr>
<td>Negative high arousal</td>
<td>6.16</td>
<td>2.15</td>
<td>45</td>
</tr>
<tr>
<td>Positive high arousal</td>
<td>6.57</td>
<td>1.81</td>
<td>47</td>
</tr>
</tbody>
</table>

There was a significant difference in participant arousal ratings between the image groups, $F(3, 185) = 23.92, p = <.001$. To investigate this further, follow-up tests were conducted. As expected, Games-Howell post-hoc tests indicated that there was a significant difference in participant arousal ratings between the negative low and negative high arousal image groups ($p = <.001$), and between the positive low and positive high arousal image groups ($p = <.001$). As can be seen in Table 7, participants on average rated the negative low arousal images as more calming or less arousing than the negative high arousal images. In addition, participants rated on average the positive low arousal images as more calming or less arousing than the positive high arousal images.

In addition, also as expected, there was no significant difference in participant arousal ratings between the negative low and positive low arousal image groups ($p = .539$), or between the negative high and positive high arousal image groups ($p = .746$). Participants, on average, rated both types of low arousal images (i.e., negative and positive) as being similar in their degree of calmness (i.e., low arousal) and also rated the both types of high arousal images (i.e., negative and positive) as being similar in their degree of excitability (i.e., high arousal).

Therefore, similar to participant valence ratings, the participant arousal ratings of the IAPS images used in this experiment were also in the expected direction and in line with the IAPS database. Importantly, these findings support the claim that the stimuli used in this experiment were innately emotional.

24 Please refer to section 3.2.2.1.1.1 (p. 86) for an explanation of why post-hoc tests and not planned contrasts were used.
3.3.2.2 **Statistical Analysis**

Participant liking, valence and arousal ratings were analysed using separate 2 (Level of SS: Low, High) x 4 (Image Group: Negative Low Arousal, Positive Low Arousal, Negative High Arousal and Positive High Arousal) x 7 (Exposure Frequency: 0, 1, 2, 5, 10, 20, 25) mixed design ANOVAs, with the level of SS and image group as between-subjects factors and exposure frequency as the within-subjects factor.

The analyses for each dependent variable of affect (i.e., participant liking, valence, and arousal ratings) are presented below. Please note that the participants were randomly assigned to valence (negative and positive) and arousal (low and high) image groups according to pre-determined standardised ratings from the IAPS manual. However, the analyses pertaining to valence and arousal below refer to the participant ratings of the emotional stimuli. In cases yielding significant effects, post-hoc, pairwise comparisons were conducted to identify the point at which affect ratings changed significantly from the “0” exposure frequency condition (i.e., baseline; stimuli shown in test phase only), thereby expanding on previous mere exposure research (discussed in section 2.1.2.1, p. 36). In addition, if affect ratings increased but then declined, the comparison between the “0” to the “25” exposure frequency condition was also of interest, as this would identify if affect ratings returned to baseline, thus reflecting an inverted U-shaped function. All pairwise comparisons are reported in Appendix F.

3.3.2.2.1 **Liking**

The 2 x 4 x 7 ANOVA outlined above revealed that the SS x Image Group x Exposure Frequency interaction was highly significant, \(F(15.79, 937.03) = 2.93, p = .001, \text{ partial } \eta^2 = .047\). This indicated that there was a difference in liking ratings across the exposure frequency levels between low and high SS participants among the image groups. In view of the aims of this thesis which were to ascertain the effect of repeated exposure on affect ratings of emotional stimuli that varied in levels of valence and arousal, and to explore the influence of SS on these exposure-affect relationships, it was deemed most appropriate to further examine these simple interaction effects (i.e., the SS x Exposure Frequency interaction) for each type/category of emotional stimulus separately. Therefore, separate 2 x 7 (SS [low, high] x Exposure Frequency [0, 1, 2, 5, 10, 20, 25]) mixed design ANOVAs were conducted for each image group, with SS as
the between-subjects factor and exposure frequency as the within-subjects factor. The findings for each image group are presented below.

**Positive High Arousal Images.** The SS x Exposure Frequency interaction was highly significant, $F(3.99, 179.44) = 13.37, p = .001$, $partial \eta^2 = .229$. This suggested that exposure frequency-liking relationship for the positive high arousal images depended upon the participants’ level of SS. The means and standard deviations are presented in Figure 6.

![Figure 6](image.png)

*Figure 6.* Mean liking ratings of positive high arousal images for low and high SS participants by stimulus exposure frequency. Error bars denote standard deviations. Darker columns represent the 0 frequency level and when a significant change first occurred for both low ($n = 28$) and high ($n = 19$) SS groups.

Figure 6 shows mean liking ratings of positive high arousal images for low and high SS participants at each exposure frequency level. It is evident that liking ratings of low SS participants appeared to increase with increasing exposure frequency. However, for high SS participants, despite a slight initial increase, liking ratings seemed to remain unchanged across all levels of exposure. Post-hoc tests using Bonferroni adjusted alpha levels of .003 per pairwise comparison (.05/14) confirmed that, for low SS participants, liking ratings of the positive high arousal images first significantly increased from 0
stimulus exposures (i.e., baseline; stimuli shown in test phase only) at 5 exposures ($p < .001$). In contrast, for high SS participants, there were no significant differences between 0 and the other exposure frequency levels (all $p$’s $> .05$). Please refer to Appendix Table F1 for all pairwise comparisons for both low and high SS groups respectively.

The main effect of SS was also significant, $F(1, 45) = 9.56, p = .003$, partial $\eta^2 = .175$. High SS participants ($M = 6.42, SE = 0.30$) liked the positive high arousal images overall, more than low SS participants ($M = 5.24, SE = 0.24$). However, no main effect of exposure frequency was found, $F(3.99, 179.44) = 1.24, p = .295$, observed power = .383 (please refer Appendix Table G1 for the overall means and standard deviations of liking ratings at each frequency level for the positive high arousal images).

**Negative High Arousal Images.** The SS x Exposure Frequency interaction was not significant, $F(2.08, 89.28) = 1.66, p = .195$, observed power = .348 (refer Appendix Table G2 for the means and standard deviations of low and high SS liking ratings for the negative high arousal images across the frequency levels). However, the main effect of SS was highly significant, $F(1, 43) = 52.36, p = <.001$, partial $\eta^2 = .549$. High SS participants ($M = 5.62, SE = 0.25$) liked the negative high arousal images overall, more than low SS participants ($M = 3.27, SE = 0.20$). In addition, a highly significant main effect of exposure frequency was also found, $F(2.08, 89.28) = 28.49, p = <.001$, partial $\eta^2 = .399$. This suggested that the liking ratings of negative high arousal images varied significantly across the frequency levels. The means and standard deviations are presented in Figure 7.
Figure 7. Mean liking ratings of negative high arousal images by stimulus exposure frequency. Darker columns represent the 0 frequency level and when a significant change first occurred ($n = 45$).

Figure 7 shows the mean liking ratings of negative high arousal images for each exposure frequency level. As can be seen, liking ratings initially increased but then declined with increasing exposure frequency beyond 5 exposures. Post-hoc tests using Bonferroni adjusted alpha levels of .007 per pairwise comparison (.05/7) confirmed that the ratings first increased significantly from 0 (i.e., baseline; stimuli shown in test phase only) after only 1 exposure ($p = <.001$). In addition, even though liking ratings declined, ratings at 25 exposures were still significantly greater than baseline ($p = <.001$). However, because the mean difference in liking ratings between frequency level 0 and 1 was less than one$^{25}$, this finding, although significant, was deemed to be not meaningful. Therefore, for high SSs, the first meaningful increase in liking ratings from baseline occurred at 2 exposures. Please refer to Appendix Table F2 for all pairwise comparisons.

Positive Low Arousal Images. The SS x Exposure Frequency interaction was not significant, $F(4.82, 211.94) = .696, p = .622$, observed power = .244, the main effect SS was not significant, $F(1, 44) = .065, p = .800$, observed power = .057, and the main

---

$^{25}$ A difference of less than one was considered not meaningful because the 9-point liking scale used (refer section 3.3.1.4.3, p. 102) changed by increments of one.
effect of exposure frequency was not significant, $F(4.82, 211.94) = .711, p = .641$, observed power = .281. Therefore, no significant effects were found for the positive low arousal images. Please refer Appendix Tables G3 and G4 for the means and standard deviations of all non-significant findings pertaining to the positive low arousal image group.

**Negative Low Arousal Images.** The SS x Exposure Frequency interaction was not significant, $F(6, 276) = .638, p = .700$, observed power = .253, and the main effect of exposure frequency was not significant, $F(6, 276) = .450, p = .845$, observed power = .184 (please refer Appendix Table G5 for the means and standard deviations of these non-significant findings). However, a significant main effect of SS was found, $F(1, 46) = 8.58, p = .005$, partial $\eta^2 = .157$. High SS participants ($M = 3.97, SE = 0.19$) liked the negative low arousal images more than low SS participants ($M = 3.19, SE = 0.21$). Despite this, given that the mean difference in liking ratings was less than one\(^{26}\), this finding, although significant, was deemed to be not meaningful.

### 3.3.2.2.2 Valence

The 2 x 4 x 7 ANOVA revealed that the SS x Image Group x Exposure Frequency interaction was not significant, $F(18, 1068) = 1.40, p = .121$, observed power = .896, and that the Image Group x Exposure Frequency interaction was not significant, $F(18, 1068) = .634, p = .875$, observed power = .480 (please refer Appendix Table G6 for the means and standard deviations of these non-significant findings). However, a highly significant SS x Image Group interaction was found, $F(3, 178) = 6.90, p = <.001$, partial $\eta^2 = .104$. This indicated that there was a difference in valence ratings between low and high SS participants among the image groups. The means and standard deviations are presented in Table 8.

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\(^{26}\) Again, a difference of less than one was considered not meaningful because the 9-point liking scale used (refer section 3.3.1.4.3, p. 102) changed by increments of one.
Table 8
Means (M) and Standard Errors (SE) of Low and High SS Valence Ratings for Each Image Group

<table>
<thead>
<tr>
<th>Image Group</th>
<th>Level of SS</th>
<th>M</th>
<th>SE</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative low arousal</td>
<td>Low</td>
<td>3.13</td>
<td>0.24</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>3.42</td>
<td>0.21</td>
<td>27</td>
</tr>
<tr>
<td>Positive low arousal</td>
<td>Low</td>
<td>6.92</td>
<td>0.25</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>6.65</td>
<td>0.21</td>
<td>27</td>
</tr>
<tr>
<td>Negative high arousal</td>
<td>Low</td>
<td>3.53</td>
<td>0.21</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>5.25</td>
<td>0.26</td>
<td>18</td>
</tr>
<tr>
<td>Positive high arousal</td>
<td>Low</td>
<td>5.99</td>
<td>0.21</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>6.18</td>
<td>0.25</td>
<td>19</td>
</tr>
</tbody>
</table>

A simple effects analysis using a Bonferroni adjustment ($\alpha = .05/8 = .006$) was conducted to determine in which image groups the valence ratings of low and high SS participants differed. As can be seen in Table 8, findings from this analysis suggested that high SS participants rated the negative high arousal images on average, as significantly less unpleasant (or more pleasant) than low SS participants ($F(1, 178) = 27.38, p < .001, partial \eta^2 = .133$). However, there were no significant differences found for the negative low arousal image group ($F(1, 178) = .870, p = .352, observed power = .153$), the positive low arousal image group ($F(1, 178) = .675, p = .412, observed power = .129$), or the positive high arousal image group ($F(1, 178) = .370, p = .544, observed power = .093$).

3.3.2.2.3 Arousal

The 2 x 4 x 7 ANOVA outlined above revealed that the SS x Image Group x Exposure Frequency interaction was not significant, $F(16.79, 995.52) = .877, p = .601, observed power = .633$ (please refer Appendix Table G7 for the means and standard deviations for this non-significant finding). However, a significant SS x Image Group interaction, $F(3, 178) = 5.29, p = .002, partial \eta^2 = .082$, and a highly significant Image Group x Exposure Frequency interaction, $F(16.79, 995.52) = 4.81, p < .001, partial \eta^2 = .075$, were found. In relation to the SS x Image Group interaction, this indicated that
there was a difference in arousal ratings between the SS groups among the image groups. The means and standard deviations are presented in Table 9.

Table 9

<table>
<thead>
<tr>
<th>Image Group</th>
<th>Level of SS</th>
<th>M</th>
<th>SE</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative low arousal</td>
<td>Low</td>
<td>3.37</td>
<td>0.33</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>3.41</td>
<td>0.29</td>
<td>27</td>
</tr>
<tr>
<td>Positive low arousal</td>
<td>Low</td>
<td>4.79</td>
<td>0.35</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>3.89</td>
<td>0.29</td>
<td>27</td>
</tr>
<tr>
<td>Negative high arousal</td>
<td>Low</td>
<td>6.28</td>
<td>0.29</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>4.52</td>
<td>0.36</td>
<td>18</td>
</tr>
<tr>
<td>Positive high arousal</td>
<td>Low</td>
<td>6.77</td>
<td>0.29</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>4.47</td>
<td>0.38</td>
<td>19</td>
</tr>
</tbody>
</table>

As can be seen in Table 9, the simple effects analysis using a Bonferroni adjustment ($\alpha = .05/8 = .006$) indicated that high SS participants rated the negative high arousal images ($F(1, 178) = 14.60, p = .001$, partial $\eta^2 = .076$), and the positive high arousal images ($F(1, 178) = 26.05, p = .001$, partial $\eta^2 = .128$) as significantly more calming (or less arousing), on average, than low SS participants. However, there were no significant differences between arousal ratings of low and high SS participants for the negative low arousal images ($F(1, 178) = .011, p = .918$, observed power = .051), or the positive low arousal images ($F(1, 178) = 3.92, p = .049$, observed power = .503).

Furthermore, in relation to the significant Image Group x Exposure Frequency interaction outlined above, this indicated that there was a difference in participant arousal ratings across the exposure frequency levels between the image groups. Thus, to identify the image group(s) for which this effect occurred, separate one-way repeated measures ANOVAs were performed for each image group, with exposure frequency as the within-subjects factor. The findings for each image group are presented below.
**Positive High Arousal Images.** The main effect of exposure frequency was highly significant, $F(4.03, 185.18) = 22.58, p = .001$, partial $\eta^2 = .329$. This suggested that participant arousal ratings of the positive high arousal images varied significantly across the frequency levels. The means and standard deviations are presented in Figure 8.

![Figure 8](image_url)

**Figure 8.** Mean arousal ratings of positive high arousal images by stimulus exposure frequency. Darker columns represent the 0 frequency level and when a significant change first occurred ($n = 47$).

Figure 8 shows the mean arousal ratings of the positive high arousal images for each frequency level. It can be seen that arousal ratings declined with increasing exposure frequency, with an apparent decrease occurring beyond 1 exposure. Post-hoc tests using Bonferroni adjusted alpha levels of .007 per pairwise comparison (.05/7) confirmed this downward trend that the ratings first decreased significantly from 0 (i.e., baseline; stimuli shown in test phase only) after only 2 exposures ($p = <.001$). Please refer to Appendix Table F3 for all pairwise comparisons.

**Negative High Arousal Images.** The main effect of exposure frequency was highly significant, $F(4.26, 187.53) = 8.10, p = .001$, partial $\eta^2 = .154$. This indicated that participant arousal ratings of the negative high arousal images varied significantly across the frequency levels. The means and standard deviations are displayed in Figure 9.
Figure 9. Mean arousal ratings of negative high arousal images by stimulus exposure frequency. Darker columns represent the 0 frequency level and when a significant change first occurred ($n = 45$).

Figure 9 shows the mean arousal ratings of the negative high arousal images for each frequency level. As can be seen, arousal ratings appeared to remain unchanged throughout the lower exposure frequencies, but then began to decline beyond 10 exposures. This was confirmed by post-hoc tests using Bonferroni adjusted alpha levels of .007 which revealed that ratings first began to significantly decline from 0 stimulus exposures (i.e., baseline; stimuli shown in test phase only) at 20 exposures ($p = <.001$). Please refer to Appendix Table F4 for all pairwise comparisons.

**Positive Low Arousal Images.** The main effect of exposure frequency was not significant, $F(6, 270) = 1.10, p = .365$, observed power = .431. Please refer Appendix Table G7 for the means and standard deviations for this non-significant finding.

**Negative Low Arousal Images.** The main effect of exposure frequency was not significant, $F(6, 282) = 1.27, p = .272$, observed power = .496. Please refer Appendix Table G7 for the means and standard deviations for this non-significant finding.
3.3.3 Discussion

3.3.3.1 Overview of Aims and Findings

The mere exposure effect refers to the phenomenon whereby previously presented stimuli are rated more positively than their novel counterparts (Zajonc, 1968). As addressed in Chapter 2, section 2.1.1.3 (p. 28), previous studies that have investigated the mere exposure effect using emotional stimuli have suffered from the same weakness, namely the failure to employ stimuli that are truly emotional. In addition, even though emotional stimuli encompass the dimensions of both valence and arousal, researchers have mainly focused upon the role that stimulus valence plays in the exposure-affect relationship, with the role of stimulus arousal largely ignored. Thus, Experiment 2 was predominantly designed to establish the effect of repeated exposure on affect ratings of stimuli that were truly emotional, namely images from the IAPS, in a controlled setting. Both the valence and the arousal level of the stimuli utilised were manipulated, yielding four experimental groups: negative low arousal, positive low arousal, negative high arousal and positive high arousal. Given that the perception of an emotional stimulus subsequently leads to an emotional response (Brosch et al., 2010), it was plausible that repeated exposure could not only effect liking ratings (i.e., a commonly used dependent measure of affect in past mere exposure research), but also the participants’ perception of how unpleasant/pleasant (i.e., valence) and how calming/exciting (i.e., arousal) the images were perceived to be (over time). Hence, three dependent measures of affect were utilised: liking, valence and arousal.

A further aim of Experiment 2 was to explore the impact of SS on the exposure-affect relationship for the four abovementioned image groups. As discussed in Chapter 2, section 2.1.4.1.4 (p. 55), even though one study has previously explored the influence of SS on the mere exposure effect, this study, like many other mere exposure studies, also failed to use stimuli that were truly emotional. Also discussed in section 2.1.4.1.4 (p. 55), the inclusion of SS in the exploration of the mere exposure effect was considered important, particularly because low and high SS individuals are reported to differ in their preference for emotional stimuli (Joseph et al., 2009; Rawlings, 2008), in their susceptibility to boredom in repetitive situations, and also in their preference for familiar and novel stimuli (Zuckerman, 1990). The findings pertaining to the low arousal image groups (both negative and positive) will be described first, followed by
the findings for the high arousal image groups (both negative and positive). Then, a brief yet integrated account of the findings will follow. Please note that an in depth discussion of the current findings will take place in the Chapter 5 (general discussion, p. 176).

**Low Arousal Images.** The findings pertaining to the negative and positive low arousal images revealed that there were no significant effects. Specifically, the non-significant SS x Exposure Frequency interaction for participant liking, valence, and arousal ratings indicated that the profile of these ratings across the frequency levels was similar to low and high SS participants. Thus, the participants’ level of SS did not moderate the frequency-affect relationships for the low arousal stimuli. In addition, the non-significant main effects of exposure frequency suggested that participant liking, valence and arousal ratings overall, did not vary across the frequency levels. Thus, no effect of repeated exposure on participant affect ratings was found for both the negative and positive low arousal stimuli. Finally, the non-significant main effects of SS indicated that overall, low and high SS participants did not differ in their liking, valence and arousal ratings of the low arousal stimuli. Thus, for the latter two measures of affect, low and high SS participants perceived the negative and positive low arousal images to be equally unpleasant and pleasant respectively and also equally calming (i.e., low in arousal).

**High Arousal Images.** The findings pertaining to the negative and positive high arousal images revealed that there were significant effects. To aid with understanding, the findings will now be described below for each dependent measure of affect which was investigated.

**Liking.** For the positive high arousal images, the main effect of exposure frequency was not significant however, a significant SS x Exposure Frequency interaction was found. This indicated that while there was no effect of repeated exposure on liking ratings of the positive high arousal images overall, this exposure-liking relationship did depend upon the participants’ level of SS. As shown in Figure 6 (p. 110), liking ratings of low SS participants increased with increasing exposure frequency whereas liking ratings of high SS participants seemed to remain unchanged. Further tests confirmed these trends, with low SS participants exhibiting an increase in
liking ratings of the positive high arousal images from 0 exposures (i.e., baseline; stimuli shown in test phase only) at 5 exposures, whereas liking ratings of high SS participants failed to significantly change over the course of exposure. Therefore, the level of SS was found to moderate the effect of repeated exposure on liking ratings of positive high arousal stimuli, such that a strong mere exposure effect was found for low SS participants but not for their high SS counterparts. In addition, it was also identified that high SS participants significantly liked the positive high arousal images more, overall, than low SS participants.

For the negative high arousal images, the SS x Exposure Frequency interaction was not significant, but a significant main effect of exposure frequency was found. This indicated that while the participants’ level of SS did not moderate the frequency-liking relationship for the negative high arousal images, liking ratings, overall, did vary significantly across the levels of exposure. Inspection of the means (displayed in Figure 7, p. 112) suggested that liking ratings initially increased, and this was confirmed by post-hoc tests which indicated that participants began to ascribe significantly higher liking ratings to the negative high arousal stimuli after only 2 exposures. Inspection of the means also suggested that liking ratings began to decline beyond 5 exposures. However, given that liking ratings at 25 exposures were still significantly greater than ratings obtained at baseline (i.e., the 0 exposure frequency level; stimuli shown in test phase only), there was only a tendency for the frequency-liking curve for the negative high arousal images to show characteristics of an inverted U-shaped function. It is possible that, if additional frequency levels beyond 25 were investigated, then participant liking ratings may have returned to baseline and thus, more closely approximated an inverted U-shaped function. Therefore, regardless of the participants’ level of SS, a strong mere exposure effect was found for the negative high arousal images, particularly at the lower exposure frequencies levels. Furthermore, the findings also revealed that high SS participants significantly liked the negative high arousal images more, overall, than their low SS counterparts.

Valence. Even though there were significant effects of repeated exposure on participant liking ratings of the high arousal stimuli, this was not the case for participant valence ratings (i.e., the degree of unpleasantness/pleasantness). Specifically, the SS x Exposure Frequency interaction was not significant, which suggested that valence
ratings across the frequency levels did not differ between low and high SS participants within the negative and positive high arousal image groups. In addition, the main effect of exposure frequency was not significant. That is, valence ratings of both the negative and positive high arousal images did not vary significantly, overall, with repeated exposure. Therefore, regardless of the participants' level of SS, the participants did not perceive the negative and positive high arousal images to be more (or less) unpleasant or pleasant over the course of exposure. However, the findings did indicate that high SS participants perceived the negative high arousal images to be significantly more pleasant (or less unpleasant), overall, than low SS participants. No such difference was found for the positive high arousal images.

**Arousal.** Similar to participant valence ratings, there were no significant SS x Exposure Frequency interactions on participant arousal ratings of the high arousal stimuli. This suggested that the profile of arousal ratings across the frequency levels was similar for low and high SS participants within both of the high arousal image groups. However, the main effects of exposure frequency were significant, indicating that participant arousal ratings, overall, did significantly vary across the levels of exposure for both the negative and positive high arousal images. Inspection of the means displayed in Figure 8 (p. 116) and 9 (p. 117) for the positive and negative high arousal image groups respectively showed that for both groups, arousal ratings declined with repeated exposure. However, the rate of decline appeared faster for the positive than the negative high arousal images. Post-hoc tests confirmed these downward trends; the negative high arousal images first became less arousing (or more calming) at 20 exposures whereas the positive high arousal images first became less arousing after only 2 exposures. In addition, it was also identified that high relative to low SS participants perceived the negative and positive high arousal images to be significantly less arousing, overall. Thus, it would seem that while participants perceived the negative and positive high arousal images to be less arousing as a consequence of repeated exposure, their perception of the degree of how negative and positive the images were remained constant over the course of exposure.
3.3.3.2 An Integrated Account of Findings

This section will begin with a brief yet integrated account of the findings across all image groups explored (including neutral; Experiment 1), with a particular emphasis on participant liking ratings as this was the only measure of affect collected in Experiment 1. Following this, a brief discussion of the findings pertaining to the positive and negative high arousal images will then take place. The findings for the latter image group will highlight the need for another experiment to take place using different negative high arousal stimuli. Please note that all aspects of this section will be further discussed in Chapter 5 (general discussion, p. 176).

An Integrated Account of the Findings Across all Image Groups. The findings pertaining to the effect of repeated exposure on liking ratings of the low arousal images were consistent with Experiment 1, which used neutral stimuli that were matched on arousal intensity to the low arousal images used in the current experiment. That is, regardless of the participants’ level of SS, liking ratings failed to significantly increase with repeated exposure and thus, did not demonstrate a mere exposure effect. Also similar to Experiment 1, given that low and high SS participants did not differ in their preference/liking ratings of the low arousal images, a difference in the profile of liking ratings across the frequency levels between low and high SS participants could have been expected on the basis of boredom susceptibility, and also because of the difference in their preference for familiar and novel stimuli. Again, low relative to high SS individuals are reported to be less prone to boredom in repetitious situations, and are also more inclined to prefer familiar rather than novel stimuli (Zuckerman, 1990). However despite this, SS was again found to exert no influence in the low arousal conditions of the current study.

In regards to the negative low arousal condition, inspection of the images revealed that there was a lack of similarity between the stimuli. Specifically, the negative low arousal IAPS images depicted different scenes of poverty, pollution etc. Furthermore, the same was true for the positive low arousal IAPS images which depicted scenes of nature, animals etc. Thus, consistent with the explanation provided in Experiment 1 (refer section 3.2.3.2, p. 90), it is plausible that stimulus discriminability
can not only limit the occurrence of a mere exposure effect to neutral stimuli but to affectively valenced low arousal stimuli as well.

Unlike the findings concerning the effect of repeated exposure on liking ratings of low arousal stimuli (including neutral), significant effects were found for both the negative and positive high arousal stimuli. Specifically, liking ratings significantly increased with repeated exposure however, the exposure-liking relationship for positive high arousal images appeared to be moderated by the participants’ level of SS, with low but not high SSs demonstrating a mere exposure effect. As described in section 3.3.1.3.1.1 (p. 96), the images used in each image group (i.e., negative low arousal, neutral, positive low arousal, negative high arousal and positive high arousal) were equated in both valence and arousal intensity. Thus, although the differences in findings between the low and high arousal image groups may suggest that it is stimulus arousal, and not valence, that is influencing the occurrence of the mere exposure, a closer examination of the stimulus content of the high arousal conditions suggests an alternative explanation that is consistent with the limiting effect of stimulus discriminability.

The images used within each high arousal image group were more similar to each other in content than the images in the low arousal groups (negative, neutral, and positive). Specifically, in the negative high arousal condition, the majority of the IAPS images were of dangerous animals (e.g., a shark, a snake etc.) and in the positive high arousal condition, the majority of the IAPS images were of extreme sports (e.g., mountain climbing, hang gliding etc.). Thus, because the images in the high arousal groups may have been more difficult to discriminate one from another than those in the low arousal (including neutral) groups, it is plausible that this similarity between the content is why a mere exposure effect was able to eventuate.

The selection of similar images in the high arousal groups was not deliberate but rather, an unavoidable restriction of the IAPS database. In order to isolate the effects of stimulus valence and arousal on the mere exposure effect, both the degree of unpleasantness/pleasantness (valence) and the degree of calmness/excitability (arousal) of the images in each image group were matched. This meant that stimulus selection was directed by the standardised ratings (obtained from the IAPS technical manual), and
not by stimulus content. Thus, a wide range of different types of stimulus content in all experimental groups could not be ensured. For instance, while many objects encountered in everyday life fall under neutral or low arousal valenced categories (e.g., there are many types of common household objects, consumer products, naturalistic scenes, and so on), there is less variety among stimuli when trying to achieve very high arousal valenced categories (e.g., we are restricted to groupings like nudes, high-adrenalin sports, dangerous animals, and so on). Another inevitable consequence of emotional stimuli that were matched on valence and arousal from the IAPS database meant that it was not possible to use images from the semantic category between all experimental groups. For example, there were no images of animals that could be regarded as neutral as well as negative and positive and also low and high in arousal.

While these restrictions of using the IAPS might seem limiting, it was considered essential to use these stimuli in the current experiments. This was because the overarching aim of this thesis was to establish the effect of repeated exposure to emotional stimuli and as such, both the valence and arousal level of the stimuli needed to be finely controlled. If this did not occur, then it would be unclear whether differences in the arousal level of the negative and positive images, rather than the valence level, per se, could have accounted for any differences in participant affect ratings across the frequency levels. Future research would endeavor to investigate other stimulus sources in an attempt to address the aforementioned issues (this will be further discussed Chapter 5; general discussion. p. 176).

**A Discussion of Findings for the Positive and Negative High Arousal Image Groups.**

The findings indicated that the participants’ level of SS moderated the exposure-liking relationship for the positive high arousal condition only. Specifically, the liking ratings of low SS participants increased with increasing exposure frequency, thereby demonstrating a mere exposure effect. In contrast, for high SS participants, their liking ratings remained unchanged over the course of exposure and thus did not demonstrate a mere exposure effect. Interestingly, while the effect of repeated exposure was different for low and high SS participants in the positive high arousal condition, no such difference was found for the negative high arousal condition. Rather, liking ratings of both low and high SS participants initially increased throughout the lower exposure frequency levels and thus, a mere exposure effect was found for both low and high SS
groups. Therefore, given that high relative to low SS individuals have been reported to have a greater general preference for high arousal stimuli (i.e., regardless of valence; Joseph et al., 2009), which was confirmed by the findings of the current study, and are also presumed to differ in their susceptibility to boredom and preference for familiar/novel stimuli, why did SS only moderate the frequency-liking relationship for the positive high arousal condition and not the negative high arousal condition as well? A possible explanation is due to the effect of repeated exposure on participant arousal ratings for both the positive and negative high arousal stimuli, and the ability for SS participants to relate to the content which was depicted.

As can be seen in Figure 8 (p. 116) and 9 (p. 117), participant arousal ratings overall, were found to decline in both conditions. The need to incorporate the effect of repeated exposure on arousal ratings stems from the findings that low and high SS individuals differ in the amount of stimulation required to maintain their OLA, with high relative to low SSs requiring a greater amount of stimulation. Thus, in relation to the positive high arousal stimuli, it is highly plausible that because arousal ratings declined quite rapidly, specifically at 2 exposures, and continued to decrease with successive exposure, liking ratings of high SS participants could not increase. That is, because the intensity of the stimuli was substantially reduced, their OLA was unable to be maintained. Similarly, because low SS individuals require much less stimulation to maintain their OLA and as such, do not have a preference for intense stimuli (Zuckerman, 1990), the finding that their liking ratings increased over the course of exposure can also be explained by the same account. Specifically, because the positive high arousal images were no longer considered highly stimulating (evidenced by a decrease in arousal ratings overall), liking ratings could increase and their preference for the familiar could then prevail.

However, for negative high arousal images, even though arousal ratings also declined, this did not significantly occur until 20 exposures. This therefore meant that the negative high arousal images sustained their arousal intensity throughout the majority of the exposure frequency levels. As such, the OLA of high SS participants was able to be maintained, thereby explaining why a mere exposure effect occurred for these participants. However, the reasons why low SS participants also showed a mere exposure effect of equivalent magnitude (hence the finding that SS did not moderate the
frequency-liking relationship for this image group) is puzzling. This is particularly because low SS individuals become easily aroused and as such, reach their OLA with less stimulation. It is plausible that, even though low SS participants did perceive the negative high arousal images to be more unpleasant and arousing overall than high SS participants, they were able to detach themselves from the content which was depicted. That is, despite many of the images illustrating dangerous animals such as sharks which can inflict harmful or fatal injuries, the low SS participants may not have been able to relate to this type of unpleasant stimuli because of the low likelihood of encounter. Thus, this may explain why liking ratings were able to increase with repeated exposure for low SS participants and hence, why a mere exposure effect was found to occur for participants overall.

To further explore this possibility, additional research using different negative high arousal stimuli that are of greater personal and social significance needs to take place. One such stimulus type is the health warnings found on cigarette packets which depict the severe health consequences of smoking. Not only would it be more realistic for participants to consider the consequences of smoking and its prevalence than being attacked by a dangerous animal, it is also more likely that participants are frequently exposed to these images of disease such as cancer within society. Furthermore, even if some participants do not engage in cigarette smoking behaviors, the health warning images are still likely to be highly relevant as the diseases that are depicted can occur even in the absence of smoking. Not only would the use of health warning images provide further clarification of the effect of repeated exposure to negative high arousal stimuli, it would also add to the robustness of the mere exposure effect; occurring in response to stimuli that have profound societal application.

Lastly, returning to the findings of the current experiment, it was also identified that regardless of the participants’ level of SS, arousal ratings of both the positive and negative high arousal stimuli were found to decline over the course of exposure. Thus, given that a decrease and not an increase in arousal ratings occurred, this is consistent with theory of affective habituation (described in Chapter 2, section 2.1.3.1, p. 45) which refers to reductions in stimulus-evoked affective reactions (i.e., participant arousal and valence ratings) due to previous exposure (Leventhal et al., 2007). However, given that the findings also revealed that participant valence ratings of the
negative and positive high arousal stimuli remained unchanged over the course of exposure, this could suggest that it is only the arousal intensity of the stimulus (i.e., the degree of excitability/calmness) and not the valence intensity of the stimulus (i.e., the degree of unpleasantness/pleasantness) that is vulnerable to the effect of affective habituation. Alternatively, given that the valence intensity of the high arousal images was similar to the valence intensity of the low arousal images, which was confirmed by the manipulation check (refer section 3.3.2.1.1.1, p. 107), this therefore meant that the high arousal images were only moderately unpleasant (negative) and pleasant (positive). Hence, it is also plausible that the valence intensity of stimuli couldn’t be susceptible to affective habituation because, as stated by Dijksterhuis and Smith (2002) “a reaction that is already very mild cannot decrease much further” (p. 211). Therefore, given that the cigarette health warning images which will be used in the following experiment (see above) are more extreme in both valence and arousal intensity in comparison to the negative high arousal condition of the current study, the merit of these possibilities (for negative stimuli only) will be further investigated. Future research could endeavor to investigate these possibilities for extreme positive stimuli.
Chapter 4
The Mere Exposure Effect: Application to Cigarette Health Warning Images
4.1 Introduction

The previous experiment sought to examine the mere exposure effect to meaningful, real-world stimuli that were innately emotional. Given the discrepancies in past mere exposure research (discussed in Chapter 2, section 2.1.1.3, p. 22), Experiment 2 was particularly interested in the effect of repeated exposure to negative/adverse stimuli. The findings of this study showed that a mere exposure effect that usually occurs for neutral, meaningless stimuli also occurred for negative, highly arousing stimuli. Specifically, it was identified that regardless of whether the participants were low or high on SS, liking ratings initially increased (showing a mere exposure effect) but then non-significantly declined. Furthermore, the findings of Experiment 2 also identified that negative high arousal images become less arousing (i.e., more calming) with repeated exposure. Therefore, the next logical step was to examine the mere exposure effect to more socially salient stimuli that were likely to be of greater personal significance to participants.

The implications of the finding in Experiment 2 that negative high arousal stimuli are susceptible to the attitude-enhancing effect of repeated exposure is alarming, especially because this stimulus type is often used to increase risk perceptions (Kessels & Ruiter, 2012). One salient example of this is the graphic health warning images found on cigarette packets, which, according to Harris, Mayle, Mabbott, and Napper (2007), have become the key “battleground in the war against smoking” (p.437). The warnings on cigarette packets are highly visible and are considered as an important medium for communicating the health risks associated with tobacco use to consumers (Hammond, 2011). Even though a smoker is more likely to encounter these health warnings more regularly than a non-smoker, people in general are still repeatedly exposed. Hence, the conditions of mere exposure are simulated in the real-world in an un-meticulous way. That is, even though influencing variables such as exposure frequency are not finely controlled (refer section 2.1.2.1, p. 34), people are naturally subjected to repeated, unreinforced exposure to the health warning images in the efforts to encourage people not to engage in this “risky behaviour”. However, in light of the findings of the previous study, it is possible that repeated exposure to this type of negative high arousal stimulus may serve to increase and not decrease liking. Further support for this possibility comes from a study conducted by Morgenstern, Isensee, and Hanewinkel (2013) who
investigated the relationship between existing familiarity with a Marlboro advertisement and participant preferences for the advertisement. Interestingly, evidence of the mere exposure effect was found. The more familiar participants were with the ad, the more they reported to like it. Thus, even though the stimulus used in this study was more positive in comparison to the health warning images, this finding still suggests that repeated exposure can lead to favourable attitudes toward tobacco advertising which, according to Grimes and Kitchen (2007), can also influence consumer decision making. As a result, it is plausible to assume that repeated exposure to the health warning images may actually be counterintuitive to their specifically designed purpose of deterrence.

The need to combat cigarette smoking is clear. According to Scollo and Winstanley (2012), it is estimated that 1.25 billion adults smoke worldwide. Within Australia alone, approximately 8 million people aged 15 years and over have smoked at some time in their lives, with 2.8 million people reporting that they are current daily smokers (Australian Bureau of Statistics [ABS], 2014). These global and national prevalence statistics are disturbing considering the health consequences of smoking. While it is not possible to infer direct causality, smokers in comparison to non-smokers are reported to be six times more likely to develop emphysema and twice as likely to develop bronchitis (ABS, 2014). In addition, smokers are also more likely to develop cancer (e.g., lung and throat), chronic obstructive pulmonary disease, and ischaemic heart disease (Scollo & Winstanley, 2012). Thus, it is not surprising that cigarette smoking poses a considerable burden on the health care system. Within Australia, the latest economic report indicated that in the years 2004-2005, $318.4 million was spent on medical, hospital, nursing home, pharmaceutical and ambulance costs associated with tobacco use (Collins & Lapsley, 2008).

The most significant consequence of smoking is death, with tobacco being linked to 6 million deaths worldwide (World Health Organization [WHO], 2014) and 15,500 deaths in Australia (Scollo & Winstanley, 2012) each year. According to the WHO (2014), the global annual death rate is predicted to increase to more than 8 million by the year 2030. Thus, smoking is considered to be a leading cause of premature death and disease and consequently, is classed as a global epidemic (WHO, 2014). Therefore, due to the high prevalence rates, adverse health consequences and the remarkably high health care system costs, many interventions aimed at reducing and/or
eliminating cigarette smoking have been implemented. Although this has occurred in many countries, this review will only focus upon tobacco control in Australia. A brief review of this literature will now be undertaken.

Within Australia, there has been a long history of anti-smoking advertisements and tobacco control policies that have been implemented in order to reduce the prevalence of smoking (refer Appendix H a detailed timeline). In 1973, the first text-based health warning on cigarette packets was introduced (i.e., “Warning – Smoking is a health hazard”). However, health officials believed that this warning was too generic and needed to be strengthened (Chapman & Carter, 2003). Therefore, in 1987, this warning was replaced by one of four rotating text-based warnings: “smoking causes lung cancer”; “smoking causes heart disease”; smoking reduces your fitness” and “smoking damages your lungs” (Borland & Hill, 1997a). These health warnings occupied 15% of the surface area of all cigarette packets (Borland & Hill, 1997a).

A further revision to the warning labeling system then took place in 1995, which comprised more comprehensive messages about the hazards of smoking. Specifically, it was required that one of six text-based health warnings (e.g., “Smoking kills, “Smoking when pregnant harms your baby”) needed to be displayed, covering 25% or more of the surface area of all cigarette packets (Borland & Hill, 1997b). In addition, an “info-line” phone number was also required to be displayed (Borland & Hill, 1997b). Then, in June 1997, the National Tobacco Campaign, which was governed by the Australian Department of Health, was established and numerous other campaign strategies were developed (Hill & Carroll, 2003). For example, with the advice of medical experts, television commercials were created which depicted the detrimental health consequences of smoking (e.g., the build-up of fatty deposits in arteries which can cause stroke/death; refer Figure 10 below). Evidenced by an increase in call volume to the “Quitline” and surveys indicating an increase in public awareness of the adverse health effects, researchers concluded that the National Tobacco Campaign advertisements played an integral role in combating against smoking (e.g., Hill & Carroll, 2003; Scollo & Winstanley, 2012).
Figure 10. Examples of the television advertisements developed by the National Tobacco Campaign to raise awareness of the effects of smoking. Images taken from the Cancer Council Western Australia, (2014).

Extending upon the work of the National Tobacco Campaign, the Australian government then introduced the graphic cigarette packet warnings in March 2006. Specifically, in addition to the “Quitline” phone number, one of fourteen health warnings which comprised warnings statements, graphics, explanatory and information messages (located on the side of the packet) was mandated to be displayed on all cigarette and other tobacco packets such as cigars (Shanahan & Elliott, 2009). The fourteen warnings were divided into two sets; seven warnings in set A and seven warnings in set B, which were rotated annually. These health warnings included a combination of new and also familiar graphics and warning statements. The “familiar” warning statements were taken from the previous text-only warnings such as “smoking causes lung cancer”, while the “familiar” graphics were taken from the previous televised anti-tobacco campaigns such as those developed by the National Tobacco Campaign (refer Figure 10 above; Miller, Quester, Hill, & Hiller, 2011).

Strict specifications for the size and placement of the health warnings were also imposed which stated that the health warning must cover 30% of the surface area on the front (refer Figure 11.1) and 90% of the surface area on the back (refer Figure 11.2) of all packets. According to the Department of Health (2012), these graphic health warnings were designed to provide a strong and confronting message to smokers about the harmful health consequences of tobacco products and convey the quit message every time a person reaches for a cigarette. Thus, the health warnings are aimed at providing high reach and frequency of exposure; with individuals who smoke a packet of
cigarettes per day likely to be exposed to the health warnings over 7000 times per year (Hammond, 2011). Again, this notion of repeated exposure simulates the principles of mere exposure in the real-world, but within conditions that are not finely controlled.

![Figure 11.1](image.png)

*Figure 11.1.* An example of the graphic health warnings (graphic; top left and warning statement; top right) covering 30% of the surface area on the front of cigarette packets. Image taken from the Department of Health (2012).
An evaluation of the effectiveness of these graphic health warnings was conducted by Shanahan and Elliott (2009) on behalf of the Department of Health. The findings of this report were subsequently used to partly guide the government’s most recent tobacco reform; the introduction of plain packaging, which was announced in April 2010. Specifically, from December 2012, all tobacco products sold to consumers were required to be in plain packaging and labelled with the new and expanded health warnings (Department of Health, 2012). According to the Institute for Global Tobacco Control (2013), plain packaging has many benefits, including reducing brand appeal, reducing the attractiveness of the tobacco product, and also reducing the capability of packaging to mislead consumers that some products may be less harmful than others. Thus, all packaging became uniform, with strict specifications about the colour of the packaging (i.e., “drab” dark brown in a matt finish), the materials used to manufacture the packaging, and the position, font style, colour and size of the brand and variant name which appeared on the packaging (refer to the Tobacco Plain Packaging Act, 2011, for a detailed review).
In addition to the aesthetics of the plain package, all elements of the health warnings were also amended. Specifically, new warning statements were developed, 14 new graphics were created, and more detailed explanatory and information messages were devised (Australian Competition and Consumer Commission [ACCC], 2011). Lastly, modifications to the size of the health warnings were also made. According to the Department of Health (2012), to increase noticeability, recall, and impact, all new health warnings appearing on the front (and most visible surface) of the packet became larger in size, requiring the graphic and warning statement to cover at least 75% of the front surface area of all cigarette packets (refer Figure 12.1). However, the size of the warning displayed on the back of the cigarette packet was maintained (i.e., 90% of the surface area; refer Figure 12.2). Similarly, guided by the evaluation report (Shanahan & Elliott, 2009) mentioned above, it was revealed that the rotation of warnings every 12 months was “working well”. Thus, the periods of rotation and the number of health warnings used in set (i.e., seven in set A and seven in set B) also remained unchanged in this latest anti-smoking reform.

![Figure 12.1. An example of the plain packaging regulations on the front of cigarette packets. Image taken from the Department of Health (2012).](image-url)
One cited reason for the amendment in size of the graphic health warning was because larger warnings were believed to retain their effectiveness over time (WHO Framework Convention on Tobacco Control, 2011). However, this raises the question of “how long do the warnings retain their effectiveness over time”? One way that this question could be addressed is by applying the mere exposure paradigm to the graphic health warnings, which consequently would allow for a more specific analysis of when changes (in perceived effectiveness) do occur over the course of exposure, if at all. The findings of such a mere exposure study would also be highly beneficial and informative for the rotational guidelines. Specifically, the point at which health warnings decrease in effectiveness (if at all) would simultaneously highlight when the warnings would need to be rotated. As previously mentioned, two sets of seven health warnings are currently rotated every 12 months. However, even though previous research has addressed the issue of “wear out” or “message fatigue” and has acknowledged that warnings need to be updated and refreshed in order to sustain their salience and impact (e.g., Shanahan & Elliott, 2009; Institute for Global Tobacco Control, 2013), there appears to be a lack of experimental data to support the annual rotational period. Presumably, this lack of experimental data relates to the period of time for which warnings retain their effectiveness, which is currently unknown. In addition, by applying the mere exposure paradigm to the graphic health warning images, people’s preference ratings of these

*Figure 12.2. An example of the plain packaging regulations on the back of cigarette packets. Image taken from the Department of Health (2012).*
images over the course of exposure could also be ascertained. Importantly, this would test the assumption that these images are designed to have an aversive effect and as such, will not be liked when encountered. However, according to the theory of mere exposure, and in light of the Experiment 2 findings pertaining to the effect of repeated exposure on liking ratings of negative high arousal IAPS stimuli (refer section 3.3.2.2.1, p. 112), repeated exposure may actually assist in increasing liking/preference ratings over time. Such findings would seriously call into question the reliance of exposure to highly graphic and disturbing imagery as an effective strategy to deter people from smoking and thus combat the smoking epidemic.

Throughout the graphic warning literature, “effectiveness” has been operationalized by: measures of salience, such as noticing and reading the warnings; changes in health knowledge and perceptions of risk; intentions/motivations to quit; and behavioral changes, such as changes in consumption, attempts to quit and successful cessation (Hammond, Fong, Borland, Cummings, McNeill, & Driezen, 2007). However, as discussed by Ruiter and Kok (2005), measures of effectiveness such as “intentions to quit” that have high personal relevance to participants (i.e., smokers) are often susceptible to defensive reactions. Specifically, many studies have documented that, for high-relevance recipients, health-promoting messages, particularly those that use scare tactics, often result in avoidance, denial, and dismissal of information (e.g., Brown & Locker, 2009; Brown & Smith, 2007). Whilst an in-depth discussion of this body of literature is beyond the scope of this thesis, it is still deemed to be important for ways in which “effectiveness” could be operationalized. Given the actual graphic image of the health warning determines the strength of the warnings’ emotional impact (Hammond, 2011), examining the emotional properties of the image is an alternative way that “effectiveness” could be measured. Thus, by exploring changes in the participants’ perception of the emotional content (i.e., level of valence and arousal) of the image over time, participant defensive reactions (if the participant smoked) are more likely to be avoided in comparison to asking participants to make reference to their personal lives/smoking behavior. Furthermore, by examining the emotional properties of the graphic image, the fundamental objective of these graphic warnings (i.e., to portray highly confronting/aversive content) can also be examined. Importantly, given the abovementioned measures of effectiveness such as “intentions/motivations to quit” are presumably thought to occur because of the confronting graphic nature of the image, it
is essential to explore whether these graphic warnings are actually perceived to be highly confronting/aversive to begin with, and if so, for how long.

In addition to the ways in which effectiveness could be measured, another factor that needs to be considered when investigating the graphic health warnings is audience segmentation. Specifically, as noted by the Institute for Global Tobacco Control (2013), warnings may be more salient to one group than another. One such group for which this may occur is those who are high on SS. As previously mentioned in Chapter 2 (section 2.1.4.1.4, p. 55), high SS individuals actively seek more intense stimulation to maintain OLA (Zuckerman, 1990). This need for stimulation has also been further documented in psychophysiological studies which have found that high SS individuals often display a greater preference for highly arousing stimuli than their low SS counterparts (e.g., Joseph et al., 2009). Furthermore, high SS individuals also perceive and appraise their environment to be less threatening and as such, often participate in highly stimulating activities and risky behaviours (Zuckerman, 1994). Interestingly, one such risky behaviour that high SS individuals commonly engage in is cigarette smoking (e.g., Zuckerman, Ball, & Black, 1990). Thus, because the graphic health warnings are highly arousing and contain threatening content, it would be important to investigate whether the level of SS influenced the strength of the emotional impact that these warnings are designed to evoke. And, if such a difference in the strength of the impact was found between low and high SS individuals, this may highlight the need to tailor the warnings to better target high SS individuals, particularly because they are also more likely to engage in the behaviour that the warnings are targeted to eliminate.

In addition to the possible differences in the perceived strength of thematic content, another reason as to why the level of SS should be explored when investigating the graphic health warning is boredom. Specifically, also mentioned in Chapter 2 (section 2.1.4.1.4, p. 56), high SS individuals are prone to becoming bored in repetitious situations and frequently pursue sources of renewed arousal (Zuckerman, 1990). Hence, in relation to the implementation of larger health warnings in the efforts to retain their effectiveness over time, it is plausible that the concepts of “wear out” or “message fatigue” may occur more quickly for high SS individuals. Again, this would be particularly problematic due to their increased likelihood to smoke cigarettes in comparison to low SS individuals.
Therefore, the aim of the current study was to apply the mere exposure paradigm and thus explore the effect of repeated exposure to the graphic health warning images found on cigarette packets. Similar to Experiment 2, ratings of valence and arousal, in addition to liking, were collected as indicators of the exposure-affect relationship. Again, because the graphic images are considered to be highly emotional stimuli and as such, contain valence and arousal properties, it is possible that these properties could also change as a result of repeated exposure. Furthermore, given the graphic images are designed to have an emotional impact, ratings of valence/unpleasantness and arousal (dimensions of emotion; Osgood, 1957) were also used as indicators of the effectiveness of the warnings over time/course of exposure. The findings pertaining to this aim could potentially be used to gain insight into the efficacy of the current rotational periods which are designed to prevent “wear out” or “message fatigue”. Additionally, given that high SS individuals are more likely to smoke cigarettes, prefer highly arousing stimuli yet become bored in repetitious situations in comparison to low SS individuals, a further aim of the current study was to explore the effect of SS on the exposure-affect and effectiveness relationship.

When exploring the effect of repeated exposure in a controlled, experimental setting, it is important to ensure that the likelihood of prior exposure to the stimuli of interest is reduced. Although this is difficult to achieve when using meaningful, real-world stimuli because of the participants’ existing familiarity (Hekkert et al., 2013; refer Chapter 2 [section 2.1.1.1, p. 11]), stimuli that are more commonly encountered overseas could alternatively be used. Therefore, because it is assumed that many participants (smokers and non-smokers) will already be familiar with the health warnings within Australia, health warnings from different countries, namely Malaysia and Thailand, will be utilised as the study’s stimuli.

However, given the overarching aim of this thesis was to explore the effect of repeated exposure to stimuli that were innately emotional, a pilot study was conducted to confirm that the health warning stimuli were in fact considered truly emotional. This meant that, similar to the IAPS, standardised ratings of valence (i.e., degree of unpleasantness/pleasantness) and arousal (i.e., degree of calmness/excitability) could be obtained. Consequently, this would allow for the most unpleasant and the most arousing graphic images to be identified. Importantly, because the selection process used in
Experiment 2 restricted the degree of the emotional intensity of the IAPS images that could be used in that experiment (refer section 3.3.1.3.1.1, p. 97), the use of the most unpleasant and arousing graphic images will therefore broaden the spectrum of emotional stimuli examined in this thesis. Furthermore, because the health warning images are deliberately designed to depict the severe health consequences of smoking and as such, portray threatening and confronting content of equal magnitude, the most unpleasant and arousing images were also identified to reflect and complement this purpose.

Therefore, the aim of Experiment 3A (i.e., pilot study) was to establish standardised scores of valence and arousal for Malaysian and Thai cigarette health warning images. Theory and execution of this pilot study was guided by the work of Lang and colleagues (2008), when creating a similar database for the IAPS images. Importantly, the findings of this pilot study were used to guide the selection of stimuli used in Experiment 3B (i.e., the test study), which sought to investigate the mere exposure effect to the graphic health warning images and also explore the effect of SS on the exposure-affect and effectiveness relationship.

4.2 Experiment 3A (Pilot). Obtaining Standardised Ratings of Valence and Arousal for Foreign Cigarette Health Warning Images

The purpose of the pilot study was to ascertain mean valence and arousal ratings for Malaysian and Thai cigarette health warning images. The findings of this study were used to guide the selection of the seven most unpleasant and highly arousing health warnings to be used in the test study (Experiment 3B; refer section 4.3 below) and to also confirm that these warnings were inherently emotional.

4.2.1 Method

4.2.1.1 Participants

One hundred and twenty five people, 59 of whom were male and 66 of whom were female, were involved in the pilot study. Three participants failed to complete the task and were consequently excluded from the analysis. Thus, the final sample
comprised 122 participants, 57 of whom were male ($M = 49.32$ years, $SD = 17.40$ years) and 65 of whom were female ($M = 34.31$ years, $SD = 15.65$ years). The majority of participants (80.60%) were born in Australia and three participants reported a first language other than English. More than half the sample (53.40%) had obtained a tertiary or postgraduate level of education and none of those participants reported having a background in Design$^{27}$. All participants had normal or corrected to normal vision and no participants reported that they were colour blind.

Participants were recruited from local businesses and many were also family members and friends of the researcher. In addition, university students who were enrolled in a first year psychology course also took part in the study. These students received course credit for their participation and the other participants were entered into a raffle to win a $165.00 Coles/Myer voucher for their time and effort. All participants signed a consent form which indicated their willingness to participate and the study was granted approval by the Swinburne University Human Research Ethics Committee on the 17th February, 2012 (refer Appendix A2 for a copy of this approval).

4.2.1.2 Materials

4.2.1.2.1 Image Rating Booklet

In order to systematize the data collection, image rating booklets were created. Each booklet contained a project information statement, a project consent form, a brief questionnaire, image rating instructions and the 11 foreign health warnings with the corresponding 9-point valence and arousal Likert scales. The order of presentation of the 11 health warnings and the order of the two rating scales for each warning were counterbalanced across participants. Please refer Appendix I for a copy of the study’s rating booklet.

4.2.1.2.1.1 Questionnaire

The study questionnaire consisted of basic demographics (e.g., age, gender).

$^{27}$ If participants had a background in design, they may have been more critical of the image properties such as colour.
4.2.1.2.1.2 Rating Scales and Image Rating Instructions

In order to obtain participant ratings of valence (i.e., the degree of unpleasantness/pleasantness) and arousal (i.e., the degree of calmness/excitability), two 9-point Likert scales were developed. These scales were similar to those used in the previous experiment of this thesis and also to those used by Lang and colleagues (2008), when creating the standardised ratings of valence and arousal for the IAPS images. The valence and arousal scales were anchored 1 = extremely unpleasant to 9 = extremely pleasant, and 1 = I feel extremely calm to 9 = I feel extremely excited, respectively. The two scales were worded “to what extent do you find the image to be unpleasant/pleasant?” and “to what extent do you find the image to be arousing?” The wording of the valence scale used in this pilot study was slightly different to the wording of the valence scale previously used in this thesis. This was because it was deemed inappropriate to solely use the word “pleasantness” in the wording of a scale that was used for images that can be regarded as highly gruesome.

Unlike Experiments 1 and 2, where participants would meet with the researcher, the participants in the pilot study were able to complete the rating task on their own. Thus, image rating instructions were devised to further explain how to complete the task. The instructions showed the participants what the two rating scales looked like and provided a description of what the words of the anchor points meant. Specifically, for the valence scale, participants were advised that if they felt completely unhappy, annoyed, dissatisfied, despondent, or dejected when viewing the image, they need to circle number one, “extremely unpleasant”. However, if they felt completely happy, pleased, satisfied, content or hopeful when viewing the image, they need to circle number nine “extremely pleasant”. For the arousal scale, participants were also advised that if they felt completely relaxed, calm, sluggish, dull, sleepy or unaroused when viewing the image, they need to circle number one, “I feel extremely calm”. However, if they felt completely stimulated, excited, frenzied, jittery, wide-awake or aroused when viewing the image, they need to circle number nine, “I feel extremely excited”. These descriptions of the scales were adapted from the IAPS technical manual (Lang et al., 2008) and are consistent with the previous experiment of this thesis.
4.2.1.2.1.3 Health Warning Images

A total of 11 foreign cigarette health warning images were used in this pilot study, seven of which would be selected for use in the test study (to counterbalance across the seven levels of exposure; 0, 1, 2, 5, 10, 20, 25). Because it was crucial for the participants in the test study to have no prior exposure, as they would have if Australian images were used, health warnings from Malaysia and Thailand were utilised. Health warnings from these two countries were used for two reasons. Firstly, combining the Malaysian and Thai health warnings yielded a larger selection of possible stimuli to include in the pilot study. Secondly, a strong research alliance between the two neighbouring countries has resulted in their health warnings being very similar. This was particularly important for the selection process of the stimuli to be used in this pilot study.

The selection process began by viewing all health warnings from Malaysia and Thailand on the WHO health warnings database. The Malaysian health warnings were grouped by five topics (e.g., “health effects – lung”, “pregnancy”) and the Thai health warnings were grouped by eight topics (e.g., “health effects – heart”, “death”). In total, there were 18 possible health warnings to include. The selection process was refined by a two-step approach to their graphical content. Firstly, warnings needed to be comparable in terms of severity of the image. Secondly, warnings needed to be clear and unambiguous in their depicted content. This selection process resulted in 11 health warnings, all of which clearly illustrated diseased body parts or organs and/or fatal medical/health conditions.

For each of the 11 images, the accompanying warning statement explaining what the image depicted was written in either Malay or Thai. However, because previous research has highlighted the importance of presenting health messages in a language that was clearly understood (Fong et al., 2010), the text of each foreign health warning was translated into English and was placed in a text box underneath the image (please refer Figure 13 for an example). All translations were obtained from the WHO health warnings database.
4.2.1.3 Procedure

Participants were informed that they were taking part in an exercise which aimed to establish standardised ratings of valence (i.e., the degree of attraction or aversion that an individual feels toward an object) and arousal for foreign health warnings found on cigarette packets outside of Australia. Participants were informed that this exercise was linked to a larger study which aimed to investigate how pre-exposure to these foreign health warnings may affect the way in which people make subsequent affective judgments.

Participants were informed that the exercise would take five minutes to complete at any convenient time and location, and involved looking at 11 cigarette health warning images. Participants were also informed that their task was to indicate how unpleasant or pleasant and how calm or exciting each health warning was, according to 9-point rating scales. Participants were advised to indicate their response by circling a number from one to nine on each scale, which were found within the image rating booklet. Participants were advised to respond with their first impression and if they were indifferent to the health warning for either rating scale, to circle the middle number, five. Participants were advised of the importance of reading the image rating
instructions, as further information regarding the meaning of rating scales would be gained.

After answering any questions and agreeing to be involved, participants were given the image rating booklet and a postage paid addressed envelope for its return. Participants were asked to read the project information statement and to sign the project consent form. Participants were advised that by signing the form, this would indicate their voluntary participation in the study. Participants were advised that the health warnings contained within the booklet were very confronting and that they could withdraw their participation from the exercise at any time.

### 4.2.2 Results

Data was analysed using the Statistical Package for Social Sciences (SPSS) version 21.0 (IBM, 2012).

#### 4.2.2.1 Data Screening and Preliminary Data Analysis

Initial inspection of the data revealed no out of range or missing values. To identify possible outliers, histograms and boxplots were produced for participant valence and arousal responses to each of the 11 foreign health warning images. Inspection of these graphs revealed that there were several potential outliers; consequently z-scores were computed. Examination of the z-scores indicated that there were ten outlying cases which were more than three standard deviations above the mean. Hence, these ten cases were considered to be outliers.

One outlier was detected for each of the following variables: ‘Valence_HW1’ (i.e., valence responses to health warning image one); ‘Valence_HW2’ (i.e., valence responses to health warning image two); ‘Valence_HW5’ (i.e., valence responses to health warning image five); ‘Valence_HW6’ (i.e., valence responses to health warning image six); ‘Valence_HW8’ (i.e., valence responses to health warning image eight); ‘Valence_HW10’ (i.e., valence responses to health warning image ten). Furthermore, four outliers were detected for the ‘Valence_HW11’ variable (i.e., valence responses to health warning image eleven). Consequently, these outlying cases were assigned a new
score for the corresponding item which was one unit larger than the next most extreme score in that distribution (Tabachnick & Fidell, 2007).

To examine any deviations from normality, skewness statistics, histograms, boxplots, and normality plots were generated for participant valence and arousal ratings of each of the 11 health warning images. Inspection of these tests and graphs indicated that all variables were not normally distributed such that, the majority of participant valence ratings for each health warning were positively skewed, whereas the majority of participant arousal ratings were negatively skewed. These violations of normality were not surprising given the highly adverse nature of the stimuli. Thus, given it makes theoretical sense for the majority of participants to rate the graphic images as extremely unpleasant (i.e., a score of 1 on the 9-point Likert scale) and also extremely arousing (i.e., a score of 9 on the 9-point Likert scale), and given the central limit theorem which states that, for large sample sizes (i.e., 30 or more), normality can be assumed regardless of the shape of the sampling data (Field, 2013), it was decided not to apply any transformations and thus, proceed with the analysis with all data in the original form.

4.2.2.2 Descriptive Analysis

Descriptive statistics for all of the 11 health warnings were computed. Table 10 and Table 11 provide a summary of means, 95% confidence intervals, and standard deviations for the dimensions of valence and arousal, respectively. Please note that both tables are ranked from the highest mean to the lowest mean on each dimension. Specifically, the health warnings in Table 10 are ranked from the most unpleasant to the least unpleasant and the health warnings in Table 11 are ranked from the most arousing to the least arousing.
Table 10
**Means, 95% Confidence Intervals, and Standard Deviations of Valence Ratings for Health Warning Images of the Pilot Study**

<table>
<thead>
<tr>
<th>HW Number</th>
<th>Country of origin</th>
<th>HW Description</th>
<th>M</th>
<th>95% Confidence Interval for Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower Bound</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Malaysia</td>
<td>Cigarette Causes Neck Cancer</td>
<td>1.38</td>
<td>1.24</td>
<td>1.51</td>
</tr>
<tr>
<td>5</td>
<td>Malaysia</td>
<td>Cigarette Causes Mouth Cancer</td>
<td>1.52</td>
<td>1.33</td>
<td>1.71</td>
</tr>
<tr>
<td>9</td>
<td>Malaysia</td>
<td>Cigarette Causes Miscarriage</td>
<td>1.52</td>
<td>1.34</td>
<td>1.71</td>
</tr>
<tr>
<td>8</td>
<td>Thailand</td>
<td>Cigarette Smoke Causes 10 Types of Cancer</td>
<td>1.53</td>
<td>1.34</td>
<td>1.72</td>
</tr>
<tr>
<td>10</td>
<td>Thailand</td>
<td>Smoking Causes Oral Cancer</td>
<td>1.59</td>
<td>1.40</td>
<td>1.78</td>
</tr>
<tr>
<td>7</td>
<td>Malaysia</td>
<td>Cigarette Causes Gangrene</td>
<td>1.98</td>
<td>1.77</td>
<td>2.18</td>
</tr>
<tr>
<td>1</td>
<td>Malaysia</td>
<td>Cigarette Causes Lung Cancer</td>
<td>2.04</td>
<td>1.80</td>
<td>2.28</td>
</tr>
<tr>
<td>6</td>
<td>Malaysia</td>
<td>Cigarette Causes Premature Birth</td>
<td>2.35</td>
<td>2.09</td>
<td>2.62</td>
</tr>
<tr>
<td>3</td>
<td>Thailand</td>
<td>Smoking Causes Stroke</td>
<td>2.42</td>
<td>2.17</td>
<td>2.67</td>
</tr>
<tr>
<td>2</td>
<td>Thailand</td>
<td>Smoking Causes your Breath to Smell</td>
<td>2.50</td>
<td>2.24</td>
<td>2.76</td>
</tr>
<tr>
<td>4</td>
<td>Thailand</td>
<td>Smoking Causes Fatal Emphysema</td>
<td>2.82</td>
<td>2.55</td>
<td>3.09</td>
</tr>
</tbody>
</table>

*N = 122*
As previously mentioned, the valence and arousal scales were anchored, 1 = extremely unpleasant to 9 = extremely pleasant, and 1 = I feel extremely calm to 9 = I feel extremely excited, respectively. As can be seen in Table 10 and Table 11, the only difference between the seven most unpleasant health warnings and the seven most
arousing health warnings (i.e., the top seven) was the ‘cigarette causes premature birth’ and ‘cigarette causes lung cancer’ image. Specifically, in Table 10, the lung cancer image was rated on average as more unpleasant than the premature birth image, yet in Table 11, the premature birth image was rated on average as more arousing than the lung cancer image. All other health warnings in the top seven (for unpleasantness and arousal) were the same: gangrene; oral cancer; 10 types of cancer; miscarriage; mouth cancer and neck cancer.

Before making the final selection of the seven most unpleasant and highly arousing health warnings, an issue pertaining to the content of some of the warnings was noticed. Specifically, the “cigarette causes mouth cancer” and “smoking causes oral cancer” warning images were almost identical. In addition, the “cigarette causes miscarriage” and the “cigarette causes premature birth” warnings were also representing the same theme: the effect of second hand smoke to a foetus/baby. Thus, given the health warnings are designed to portray a range of topics (i.e., a range of detrimental health outcomes) because different images resonate with different people (ACCC, 2011), one health warning out of each similar pair needed to be removed. Therefore, as shown in Table 10 and 11, because the “cigarette causes mouth cancer” warning was rated on average as more unpleasant and more arousing than the “smoking causes oral cancer” warning, the latter was removed from the final selection of stimuli. Furthermore, also shown in Table 10 and 11, because the “cigarette causes miscarriage” warning was rated on average as more unpleasant and more arousing than the “cigarette causes premature birth” warning, the latter was also removed from the final selection of stimuli.

In summary, guided by the findings in Tables 10 and 11, the seven health warnings which were selected for the test study were: “cigarette causes neck cancer”; “cigarette causes mouth cancer”; “cigarette causes miscarriage”; “cigarette causes 10 types of cancer”; “cigarette causes gangrene”; “cigarette causes lung cancer” and “smoking causes stroke”.
4.2.3 Discussion

4.2.3.1 Overview of Aims and Findings

The purpose of the pilot study was to generate standardised ratings of valence and arousal for Malaysian and Thai cigarette health warning images. Guided by these ratings, the seven most unpleasant and highly arousing warnings, which depicted different health consequences of smoking, were able to be selected as the test study’s stimuli (Experiment 3B). In addition, confirmation that the health warning images were truly emotional was also obtained.

4.3 Experiment 3B (Test). Application of the Mere Exposure Effect to Cigarette Health Warning Images and an Examination of the Influence of Sensation Seeking

Guided by the findings of the pilot study, Experiment 3B was designed to investigate the effect of repeated exposure on liking, valence and arousal ratings of health warning images found on cigarette packets. Given that the graphic images are designed to have an emotional impact, ratings of valence/unpleasantness and arousal (dimensions of emotion; Osgood, 1957) were also used as indicators of the effectiveness of the warnings over time/course of exposure. A further aim of Experiment 3B was to explore the possible moderating influence of SS on this exposure-affect and effectiveness relationship. Because the health warning images are designed to increase awareness about the health effects of smoking, encourage cessation, and discourage smoking relapse or uptake (ACCC, 2011), the possible implications of this study are far reaching. Specifically, in addition to providing further clarification of the effect of repeated exposure to highly adverse stimuli, this study may also strengthen the robustness of the mere exposure as a real-world phenomenon; one that has a societal and clinical purpose. Furthermore, in relation to the annual rotation period which has been implemented to prevent “wear out” such that the noticeability of the graphic images does not wane, this study also seeks to gain insight into this period’s effectiveness.

All participants completed liking, valence and arousal ratings of the seven health warning images to which they were exposed. As in Experiments 1 and 2, these images
were counterbalanced across seven levels of exposure (0, 1, 2, 5, 10, 20, 25 exposures). All participants also completed the SS questionnaire, for which their total scores were subjected to a median split to obtain low and high SS groups. Thus, participant liking, valence, and arousal ratings were analyzed using separate 2 (Level of SS: Low, High) x 7 (Exposure Frequency: 0, 1, 2, 5, 10, 20, 25) mixed design ANOVAs, with the level of SS as the between-subjects variable and exposure frequency as the within-subjects variable. Evidence of the mere exposure effect was obtained if participants ascribed significantly higher affect ratings to the frequently exposed than infrequently exposed health warning images. Furthermore, evidence of the moderating influence of SS was obtained if this relationship between exposure and affect was different for low and high SS participants.

4.3.1 Method

4.3.1.1 Participants

Forty-nine participants, 26 of whom were male and 23 of whom were female, were involved in Experiment 3B. Similar to Experiments 1 and 2, participants were also recruited from local businesses and government organisations. One participant reported colour blindness and another participant failed to complete the questionnaire. Consequently, these participants were excluded from further analysis. Thus, the final sample consisted of 47 participants, 25 of whom were male (M = 46.88 years, SD = 12.37 years) and 22 of whom were female (M = 47.00 years, SD = 13.80 years).

The majority of participants (87.20%) were born in Australia and only one participant reported a first language other than English. More than half the sample (55.30%) had obtained a tertiary or postgraduate level of education and one of those participants reported having a background in psychology. None of the participants had a background in design. The majority of participants reported that they were not currently smokers of cigarettes (70.20%) however, of those participants that were, the majority (85.70%) scored high in levels of SS. Finally, none of the participants reported that they had travelled to Malaysia and/or Thailand in the past 12 months.

Please note that total SS scores had a normal distribution prior to performing the median split. Study discipline, particularly psychology and design, was deemed to be important because this study investigated a psychological phenomenon. Furthermore, if participants had a background in design, they may have been more critical of the image properties such as colour. Given that only three participants had a background in psychology; it was considered unlikely that this would influence the statistical findings of this experiment.
All participants signed a consent form which indicated their willingness to participate and the study was granted approval by the Swinburne University Human Research Ethics Committee on the 9th May, 2011 (refer Appendix A1 for a copy of this approval). Participants received a chocolate bar upon completion of their involvement and were also entered into a raffle to win a $165.00 Coles/Myer voucher for their time and effort.

4.3.1.2 Design

The study was a mixed design, with level of SS (low and high) as a between-subjects variable and exposure frequency (0, 1, 2, 5, 10, 20 and 25 exposures) as a within-subjects variable. Similar to Experiments 1 and 2, in order to ensure that each health warning was shown at each of the seven exposure frequencies approximately the same number of times, there were seven image sequence conditions which were counterbalanced across participants. These sequence conditions were devised according to a Latin square design.

Similar to Experiment 2, within each image sequence condition, there were also seven different test order conditions which were also counterbalanced across participants. Again, these test order conditions were needed to prevent order effects (discussed in section 2.1.3.2, p. 46) because participants in the current experiment were required to rate each health warning image on liking, valence, and arousal dimensions. The seven test orders were identical to those used in Experiment 2 and were as follows: liking, valence and arousal rating (test order one); valence, liking and arousal rating (test order two); arousal, liking and valence rating (test order three); arousal, valence and liking rating (test order four); liking, arousal and valence rating (test order five); valence, arousal and liking rating (test order six) and liking, valence and arousal rating (test order seven). The seventh test order was the same as the first test order because multiples of seven were required. Each test order was maintained for each participant throughout the duration of the experiment. All participants completed liking, valence, and arousal ratings for stimuli presented in the exposure phase and the test phase.

4.3.1.3 Materials

Stimuli in the zero frequency condition were excluded from the exposure phase. That is, the stimuli were presented in the test phase only.
4.3.1.3.1 Health Warning Images

The seven health warnings selected in Experiment 3A (i.e., pilot study) were placed on a black background and were used in the current experiment. Before testing commenced, several alterations to the health warnings were made. Firstly, all images were cropped and made to be the same height and width. Secondly, the foreign text was digitally removed from the image. Unlike the pilot study where the foreign text was translated into English, no text (foreign or English) was included within or near the health warning images in the current study. Despite the removal of text being inconsistent with the pilot study, including the text was deemed to be more problematic within a mere exposure experiment. Specifically, unlike the pilot study where participants could peruse the health warning booklet at their own leisure, participants in the test study were exposed to each health warning for only 1 second (refer section 4.3.1.4.2, p. 155, below): an exposure duration that has been used in previous mere exposure research (e.g., Young & Claypool, 2010). Thus, it was important to ensure that the participants’ attention was directed at the image. In addition, if the participant was exposed to both the image and the text, it would be difficult to delineate the effect of repeated exposure to each component. Please refer Figures 14.1 and 14.2 for an example of what a foreign health warning image looked like before (i.e., the original format) and after the editing process.

Figure 14.1. An example of a health warning image used in the test study before editing took place. Image taken from the WHO health warning database.
Figure 14.2. An example of a health warning image used in the test study after editing took place. Images were placed on a black background, made to be the same height and width and all text was removed.

All images were converted from JPEG (jpg) to bitmap (bmp) format. Similar to Experiments 1 and 2, the health warnings were presented centrally on an 18.4 inch full high definition (HD) computer screen, and the presentation and timing of the images was controlled by the software package DirectRT (Empirisoft, 2006). The size of each bitmap image was 1024 x 768 pixels with a resolution of 72 dpi (dots per inch).

4.3.1.3.2 Study Questionnaire

The questionnaire used in Experiment 3B was identical to the questionnaire used in Experiments 1 and 2. Please refer section 3.2.1.3.2 (p. 77) for a detailed description, but put briefly, the questionnaire contained basic demographics (e.g., gender, age) and the Sensation Seeking Scale Form V (SSS-V; Zuckerman et al., 1978)\(^{31}\). This established SS scale is reported to have sound psychometric properties (Roberti et al., 2003; Zuckerman, 1994). For the present study, the Cronbach’s alpha value for the total SS score was .82, indicating good internal consistency. However, unlike Experiments 1 and 2, participants in the current study were also asked if they had travelled to Malaysia and/or Thailand in the past 12 months. This was to ensure the participant had no or limited exposure to the study’s stimuli. Please refer Appendix C for the study questionnaire.

\(^{31}\)Permission to use the SSS-V was obtained from Marvin Zuckerman via e-mail on the 10/07/12.
4.3.1.4 Procedure

4.3.1.4.1 Assignment to Experimental Conditions

As previously mentioned, seven image sequence and test order conditions were devised. Thus, there were 49 experimental conditions in total (i.e., each participant was allocated into an experimental condition wherein the image sequence and test order was never the same). To ensure equal participant numbers in each experimental condition, the 49 participants were randomly assigned to each condition on a rotating basis. Thus, the first participant was allocated into the first experimental condition, the second participant into the second experimental condition and so on.

4.3.1.4.2 Exposure Phase

The instructions to participants were similar to those used in Experiments 1 and 2 (please refer section 3.2.1.4.2, p. 79, for a detailed description). However, the only difference in the exposure phases was the type of stimuli used. Specifically, the participants were informed that they would be presented with a series of cigarette health warning images. In addition, participants were also advised that if the health warnings were too confronting or disturbing, they could walk away at any time.

The seven health warning images were displayed on the computer screen. Each image was displayed at one of seven exposure frequencies (i.e., 0, 1, 2, 5, 10, 20 and 25 exposures) equally as often across participants. For example, one health warning was displayed once, another warning displayed twice, another warning was displayed five times etc. The warning which was displayed at each frequency was dependent upon the image sequence condition to which the participant was allocated. Consequently, there were a total of 63 stimulus presentations for each participant.

As in Experiments 1 and 2, all health warnings were presented in a random, heterogeneous exposure sequence for 1 second. Each image was preceded by a central black fixation cross on a white background for 2 seconds and then followed by a blank black screen for 1 second. Thus, the inter-stimulus interval (ISI; defined as the duration between the offset of the target stimulus to the onset of next stimulus, in this case the fixation cross) was 1 second in duration. Refer Figure 15 for a schematic representation of the exposure phase.
Figure 15. Schematic representation of the experimental procedure used in the exposure phase of the cigarette health warning mere exposure study.

Note: The blank black screen which was displayed for one second was required by DirectRT to allow time for the next trial to be prepared.
4.3.1.4.3 Test Phase

The instructions to participants in the test phase were identical to those used in Experiments 1 and 2 (please refer section 3.2.1.4.3, p. 82, for a detailed description). In addition, the rating scales used in the current study were also identical to those used in Experiment 2 (please refer section 3.3.1.4.3, p. 102). This was because the stimuli used in the present study were also emotional (i.e., contained valence and arousal properties) and as such, it is possible that these properties could also change as a result of repeated exposure. Participants were asked to rate each health warning image on three, 9-point rating scales (i.e., liking, valence and arousal) upon its presentation. Similar to the pilot study, the wording of the valence scale was “to what extent do you find the image to be unpleasant/pleasant?” The wording of the valence scale used in this study was slightly different to the wording of the valence scale used in Experiment 2. Again, it was deemed inappropriate to solely use the word “pleasantness” in the wording of a scale that was used for images that can be regarded as gruesome. As in Experiment 2 and the pilot study, participants were given more detail about what the wording of the anchor points meant on the valence and arousal scales (refer section 3.3.1.4.3 [p. 102] or 4.2.1.2.1.2 [p. 142]). Participants were advised to press a number from one to nine on the computer number pad which corresponded with their first impression for each rating condition.

The same six health warnings that were presented in the exposure phase were presented again in the test phase, together with one, never-before-seen, equivalent. In contrast to the exposure phase, where each health warning was displayed at one of seven exposure frequencies (i.e., 0, 1, 2, 5, 10, 20 and 25 exposures), each health warning was only displayed once. However, similar to the exposure phase, all health warnings were presented in a random, heterogeneous exposure sequence for 1 second.

Each health warning was preceded by a central black fixation cross on a white background for 2 seconds, which was then followed by the three self-paced rating scales. Depending on which test order condition the participant was assigned to, some participants consistently viewed the 9-point liking Likert scale first whilst other participants consistently viewed the 9-point valence or arousal Likert scale first. The order in which the rating scales were presented was maintained for each participant.
throughout the duration of the test phase. Participants were not given feedback regarding their performance at the time of each response. Please refer Figure 16 for a schematic representation of the test phase.
Figure 16. Schematic representation of the experimental procedure used in the test phase of the cigarette health warning mere exposure study.

Note: The blank black screen which was displayed for one second was required by DirectRT to allow time for the next trial to be prepared.
4.3.2 Results

Participant liking, valence and arousal ratings of the seven health warnings were recorded by DirectRT and were later transferred into the Statistical Package for Social Sciences (SPSS) version 21.0 (IBM, 2012) for analysis. Participant responses to the demographic questions (e.g., gender) and the SS scale were also entered into SPSS for analysis. Total SS scores were calculated by summing participant scores of each item.

4.3.2.1 Data Screening and Preliminary Data Analysis

One of the requirements of an ANOVA is to have one or more categorical independent variables. Therefore, following the protocol of other SS studies (e.g., Lang et al., 2005; Lissek et al., 2005; Lissek & Powers, 2003) and Experiments 1 and 2 of this thesis, participants were divided into low and high SS groups, based on a median split of their total SS scores\(^{32}\). In the current study, the median score was 15. Thus, participants with a score of 15 or lower were labelled low SSs \((n = 26)\), whereas participants with a score of 16 or higher were labelled high SSs \((n = 21)\).

Initial inspection of the data revealed no out of range or missing values. To identify possible outliers, histograms and boxplots were produced for each of the dependent variables (i.e., liking, valence and arousal) at each frequency level. This was performed for low and high sensation seekers separately. Inspection of these graphs revealed that there were several potential outliers. However, examination of the corresponding z-scores revealed that only two of these outlying cases were above three standard deviations of the mean and hence, were considered to be outliers.

One outlier was detected for the ‘Valence_0’ variable (i.e., valence ratings of the new health warnings exposed in the test phase only), and the other was detected for the ‘Valence_1’ variable (i.e., valence ratings of the health warnings exposed once). Consequently, these outlying cases were assigned a new score for the corresponding item which was one unit larger than the next most extreme score in that distribution (Tabachnick & Fidell, 2007). No effect of when the participant completed the questionnaire (before or after the experiment), image sequence condition or test order condition (liking, valence or arousal first) was found for either the liking, valence or

\(^{32}\) Please note that total SS scores had a normal distribution prior to performing the median split.
arousal data, so these variables were excluded from further analysis. All of the assumptions of a mixed design ANOVA were satisfied for each data set (liking, valence and arousal). Please refer Appendix D3 for a detailed description of assumption checking.

4.3.2.2 Statistical Analysis

Separate mixed design ANOVAs were conducted for each dependent measure of affect (i.e., participant liking, valence, and arousal ratings) and are presented below. In cases yielding significant effects, post-hoc, pairwise comparisons were conducted to identify the point at which affect ratings changed significantly from the “0” exposure frequency condition (i.e., baseline; stimuli shown in test phase only), thereby expanding on previous mere exposure research (discussed in section 2.1.2.1, p. 36). In addition, if affect ratings increased but then declined, the comparison between the “0” to the “25” exposure frequency condition was also of interest, as this would identify if affect ratings returned to baseline, thus reflecting an inverted U-shaped function. All pairwise comparisons are reported in Appendix J.

4.3.2.2.1 Liking

Participant liking ratings of the health warning images were analysed using a 2 (Level of SS: Low, High) x 7 (Exposure Frequency: 0, 1, 2, 5, 10, 20, 25) mixed design ANOVA, with the level of SS as the between-subjects factor and exposure frequency as the within-subjects factor. The means and standard deviations are presented in Table 12.
Table 12

**Means (M) and Standard Deviations (SD) of SS and Overall Liking Ratings for Health Warning Images Across the Frequency Levels**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Level of SS</th>
<th>M</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Low</td>
<td>1.85</td>
<td>1.08</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>2.52</td>
<td>0.81</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>2.15</td>
<td>1.02</td>
<td>47</td>
</tr>
<tr>
<td>1</td>
<td>Low</td>
<td>1.85</td>
<td>1.08</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>2.90</td>
<td>1.04</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>2.32</td>
<td>1.18</td>
<td>47</td>
</tr>
<tr>
<td>2</td>
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<td>1.07</td>
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<td>High</td>
<td>3.38</td>
<td>1.16</td>
<td>21</td>
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<tr>
<td></td>
<td>Total</td>
<td>2.55</td>
<td>1.33</td>
<td>47</td>
</tr>
<tr>
<td>5</td>
<td>Low</td>
<td>1.96</td>
<td>1.08</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>3.76</td>
<td>1.45</td>
<td>21</td>
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<tr>
<td></td>
<td>Total</td>
<td>2.77</td>
<td>1.54</td>
<td>47</td>
</tr>
<tr>
<td>10</td>
<td>Low</td>
<td>2.23</td>
<td>1.03</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>4.14</td>
<td>1.28</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>3.09</td>
<td>1.49</td>
<td>47</td>
</tr>
<tr>
<td>20</td>
<td>Low</td>
<td>2.27</td>
<td>1.00</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>High</td>
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<td>Total</td>
<td>2.72</td>
<td>1.12</td>
<td>47</td>
</tr>
<tr>
<td>25</td>
<td>Low</td>
<td>2.35</td>
<td>1.02</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>2.62</td>
<td>1.43</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>2.47</td>
<td>1.21</td>
<td>47</td>
</tr>
</tbody>
</table>

The 2 x 7 ANOVA outlined above yielded a highly significant SS x Exposure Frequency interaction, $F(2.44, 109.90) = 7.51, p = <.001, partial \eta^2 = .143$. This indicated that there was a difference in liking ratings of the health warning images across the exposure frequency levels between low and high SS participants. To aid with understanding, the means and standard deviations of this interaction displayed in Table 12 above will be presented graphically in Figure 17.
Figure 17. Mean liking ratings of cigarette health warning images for low and high SS participants by stimulus exposure frequency. Error bars denote standard deviations. Darker columns represent the 0 frequency level and when a significant change first occurred for both low (n = 26) and high (n = 21) SS groups.

Figure 17 shows mean liking ratings of health warning images for low and high SS participants at each exposure frequency level. It can be seen that, for low SS participants, liking ratings remained fairly constant across the frequency levels. However, for high SS participants, liking ratings appeared to increase throughout the lower exposure frequency levels but then declined beyond 10 exposures. Post-hoc tests using Bonferroni adjusted alpha levels of .003 per pairwise comparison (.05/14) confirmed that, for low SS participants, there were no significant differences in liking ratings between 0 stimulus exposures (i.e., baseline; stimuli shown in test phase only) and the other exposure frequency levels (all p’s > .05). In contrast, for high SS participants, liking ratings first significantly increased from 0 stimulus exposures at 5 exposures (p = .001), and then returned to baseline levels as there was no significant difference in liking ratings between 0 and 25 exposures (p = > .05). Please refer to Appendix Table J1 for all pairwise comparisons for both low and high SS groups respectively.

The main effect of exposure frequency was also highly significant, \( F(2.44, 109.90) = 9.39, p = <.001 \), \( partial \eta^2 = .173 \), indicating that overall, participant liking
ratings of the health warning images varied significantly across the frequency levels. As can be seen in Table 12, liking ratings seemed to gradually increase throughout the lower exposure frequencies and then decline beyond 10 exposures. In addition, a main effect of SS was also found, $F(1,45) = 20.52, p < .001, \text{partial } \eta^2 = .313$. High SS participants ($M = 3.23, SE = 0.19$) liked the health warning images overall, more than low SS participants ($M = 2.06, SE = 0.17$).

### 4.3.2.2.2 Valence

Participant valence ratings of the health warning images were analysed using a 2 (Level of SS: Low, High) x 7 (Exposure Frequency: 0, 1, 2, 5, 10, 20, 25) mixed design ANOVA, with the level of SS as the between-subjects factor and exposure frequency as the within-subjects factor. The means and standard deviations are presented in Table 13.
The 2 x 7 ANOVA outlined above yielded a highly significant SS x Exposure Frequency interaction, $F(2.02, 90.66) = 7.89$, $p = .001$, partial $\eta^2 = .149$. This indicated that there was a difference in participant valence ratings of the health warning images across the exposure frequency levels between low and high SS participants. To aid with understanding, the means and standard deviations of this interaction displayed in Table 13 above will be presented graphically in Figure 18.

Table 13

Means (M) and Standard Deviations (SD) of SS and Overall Valence Ratings for Health Warning Images Across the Frequency Levels

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Level of SS</th>
<th>M</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Low</td>
<td>1.46</td>
<td>0.76</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>2.10</td>
<td>1.04</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>1.74</td>
<td>0.94</td>
<td>47</td>
</tr>
<tr>
<td>1</td>
<td>Low</td>
<td>1.50</td>
<td>0.76</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>2.19</td>
<td>0.98</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>1.81</td>
<td>0.92</td>
<td>47</td>
</tr>
<tr>
<td>2</td>
<td>Low</td>
<td>1.58</td>
<td>0.76</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>2.86</td>
<td>1.06</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>2.15</td>
<td>1.10</td>
<td>47</td>
</tr>
<tr>
<td>5</td>
<td>Low</td>
<td>1.58</td>
<td>0.76</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>3.19</td>
<td>1.33</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>2.30</td>
<td>1.32</td>
<td>47</td>
</tr>
<tr>
<td>10</td>
<td>Low</td>
<td>2.00</td>
<td>1.13</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>4.05</td>
<td>1.20</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>2.91</td>
<td>1.54</td>
<td>47</td>
</tr>
<tr>
<td>20</td>
<td>Low</td>
<td>2.88</td>
<td>1.31</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>4.48</td>
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<td>1.61</td>
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</tr>
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<td></td>
<td>High</td>
<td>5.14</td>
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<td></td>
<td>Total</td>
<td>4.23</td>
<td>1.71</td>
<td>47</td>
</tr>
</tbody>
</table>
Figure 18. Mean valence ratings of cigarette health warning images for low and high SS participants by stimulus exposure frequency. Darker columns represent the 0 frequency level and when a significant change first occurred for both low ($n = 26$) and high ($n = 21$) SS groups.

Figure 18 shows mean valence ratings of health warning images for low and high SS participants at each exposure frequency level. As can be seen, valence ratings of low SS participants remained unchanged throughout the lower exposure frequency levels but then began to substantially increase at 20 exposures. For high SS participants, valence ratings appeared to be similar between 0 and 1 exposure, but then increased with increasing exposure frequency. Post hoc tests using Bonferroni adjusted alpha levels of .003 confirmed the apparent trend in both groups; valence ratings of low SS participants first significantly increased from 0 stimulus exposures (i.e., baseline; stimuli shown in test phase only) at 20 exposures ($p = <.001$). For high SSs, valence ratings first significantly increased from 0 at 2 exposures ($p = <.001$). However, because the mean difference in valence ratings between frequency level 0 and 2 was less than one\(^{33}\), this finding, although significant, was deemed to be not meaningful. Therefore, for high SSs, the first meaningful increase in valence ratings (i.e., when the images became more pleasant or less unpleasant) from baseline was at 5 exposures. Please refer

\(^{33}\) A difference of less than one was considered not meaningful because the 9-point valence scale used (refer section 4.3.1.4.3, p. 157) changed by increments of one.
to Appendix Table J2 for all pairwise comparisons for both low and high SS groups respectively.

The main effect of exposure frequency was also highly significant, $F(2.02, 90.66) = 106.77, p = <.001$, partial $\eta^2 = .703$, indicating that overall, participant valence ratings of the health warning images varied significantly across the frequency levels. As can be seen in Table 13, valence ratings appeared to remain unchanged between 0 and 1 exposure but then began to increase with increasing exposure frequency. Please note, given the larger effect size obtained for the main effect of exposure frequency, the SS x Exposure Frequency interaction should be interpreted with caution. In addition, a main effect of SS was also found, $F(1,45) = 23.65, p = <.001$, partial $\eta^2 = .345$. High SS participants ($M = 3.43, SE = 0.21$) rated the health warning images overall, as significantly less unpleasant (or more pleasant) than low SS participants ($M = 2.07, SE = 0.19$).

4.3.2.2.3 Arousal

Participant arousal ratings of the health warning images were analysed using a 2 (Level of SS: Low, High) x 7 (Exposure Frequency: 0, 1, 2, 5, 10, 20, 25) mixed design ANOVA, with the level of SS as the between-subjects factor and exposure frequency as the within-subjects factor. The means and standard deviations are presented in Table 14.
Table 14

Means (M) and Standard Deviations (SD) of SS and Overall Arousal Ratings for Health Warning Images Across the Frequency Levels

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Level of SS</th>
<th>M</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Low</td>
<td>8.27</td>
<td>0.96</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>7.33</td>
<td>1.39</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>7.85</td>
<td>1.25</td>
<td>47</td>
</tr>
<tr>
<td>1</td>
<td>Low</td>
<td>8.08</td>
<td>0.80</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>7.19</td>
<td>1.33</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>7.68</td>
<td>1.14</td>
<td>47</td>
</tr>
<tr>
<td>2</td>
<td>Low</td>
<td>8.04</td>
<td>0.66</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>6.43</td>
<td>1.21</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>7.32</td>
<td>1.24</td>
<td>47</td>
</tr>
<tr>
<td>5</td>
<td>Low</td>
<td>8.00</td>
<td>0.94</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>5.76</td>
<td>1.14</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>7.00</td>
<td>1.52</td>
<td>47</td>
</tr>
<tr>
<td>10</td>
<td>Low</td>
<td>7.42</td>
<td>1.10</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>4.95</td>
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<td>Total</td>
<td>6.32</td>
<td>1.67</td>
<td>47</td>
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<tr>
<td>20</td>
<td>Low</td>
<td>6.31</td>
<td>1.12</td>
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</tr>
<tr>
<td></td>
<td>High</td>
<td>4.14</td>
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<td>Total</td>
<td>5.34</td>
<td>1.63</td>
<td>47</td>
</tr>
<tr>
<td>25</td>
<td>Low</td>
<td>5.73</td>
<td>1.71</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>3.71</td>
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<td></td>
<td>Total</td>
<td>4.83</td>
<td>1.88</td>
<td>47</td>
</tr>
</tbody>
</table>

The 2 x 7 ANOVA outlined above yielded a highly significant SS x Exposure Frequency interaction, $F(2.23, 100.11) = 6.24$, $p = .002$, partial $\eta^2 = .122$. This indicated that there was a difference in participant arousal ratings of the health warning images across the exposure frequency levels between low and high SS participants. To aid with understanding, the means and standard deviations of this interaction displayed in Table 14 above will be presented graphically in Figure 19.
Figure 19. Mean arousal ratings of cigarette health warning images for low and high SS participants by stimulus exposure frequency. Darker columns represent the 0 frequency level and when a significant change first occurred for both low (n = 26) and high (n = 21) SS groups.

Figure 19 shows mean arousal ratings of health warning images for low and high SS participants at each exposure frequency level. It is clear that, for low SS participants, arousal ratings remained unchanged throughout the majority of the exposure frequency levels, but then gradually declined beyond 10 exposures. However, for high SS participants, arousal ratings appeared to decline at a faster rate, with a decrease occurring beyond 1 exposure. Post hoc tests using Bonferroni adjusted alpha levels of .003 indicated that arousal ratings of low SSs first significantly decreased from 0 stimulus exposures (i.e., baseline; stimuli shown in test phase only) at 20 exposures ($p < .001$). For high SSs, arousal ratings first significantly decreased from 0 stimulus exposures at 2 exposures ($p < .001$), thereby confirming the evident trends. However, similar to the valence ratings of high SS participants described above, the mean difference in arousal ratings between frequency level 0 and 2 was less than one\textsuperscript{34}. Thus, this finding, although significant, was also deemed to be not meaningful. Therefore, for high SSs, the first meaningful decrease in arousal ratings (i.e., when the images became more calming or less exciting) from baseline was at 5 exposures. Please refer to

\textsuperscript{34} A difference of less than one was considered not meaningful because the 9-point arousal scale used (refer section 4.3.1.4.3, p. 157) changed by increments of one.
Appendix Table J3 for all pairwise comparisons for both low and high SS groups respectively.

The main effect of exposure frequency was also highly significant, $F(2.23, 100.11) = 87.74, p = <.001$, partial $\eta^2 = .661$, indicating that overall, participant arousal ratings of the health warning images varied significantly across the frequency levels. As can be seen in Table 14, arousal ratings appeared to remain unchanged between 0 and 1 exposures but then gradually began to decline at 2 exposures. Please note, given the larger effect size obtained for the main effect of exposure frequency, the SS x Exposure Frequency interaction should be interpreted with caution. In addition, a main effect of SS was also found, $F(1,45) = 47.63, p = < .001$, partial $\eta^2 = .514$. High SS participants ($M = 5.65, SE = 0.19$) rated the health warning images overall, as significantly less arousing (or more calming) than low SS participants ($M = 7.41, SE = 0.17$).

4.3.3 Discussion

4.3.3.1 Overview of Aims and Findings

The mere exposure effect refers to the enhancement of affect following repeated exposures to a stimulus (Zajonc, 1968). In the previous experiment of this thesis (Experiment 2, refer section 3.3.2.2.1, p. 111), liking ratings of the negative high arousal IAPS stimuli increased with repeated exposure and this occurred for both low and high SS participants. It could have been assumed that liking ratings of low SS participants in Experiment 2 would not increase because, unlike high SS participants, they do not have a preference for intense sensory stimulation. However, given that an increase in liking was found, it was plausible that the negative IAPS images were of no personal relevance and as such, the low SS participants were able to detach themselves from the content to which they were exposed. Thus, the current study took place to further explore this possibility by using the cigarette health warning images which are particularly salient in today’s society. As mentioned in section 4.1 (p.132), these warnings are intentionally designed to explicitly portray the severe health consequences of smoking and were likely to be of greater significance than the negative high arousal IAPS stimuli. Therefore, the aim of the current study was to investigate the effect of repeated exposure on liking, valence and arousal ratings of cigarette health warning images. In addition, ratings of valence/unpleasantness and arousal were also
simultaneously used as indicators of the effectiveness of the warnings over time/course of exposure. A further aim of the current study was to also explore the possible moderating influence of SS on the exposure-affect and effectiveness relationship.

The findings indicated that all effects of repeated exposure on liking, valence, and arousal were significant. These findings will be described for each of these dependent measures of affect in turn below. Following this, a brief yet integrated account of the findings will follow. Please note that an in depth discussion of the current findings will take place in Chapter 5 (general discussion, p. 176).

**Liking.** Liking ratings of participants overall were found to significantly vary across the frequency levels such that, liking ratings initially increased but then declined with repeated exposure. In addition, high SS participants liked the cigarette health warnings more overall than their low SS counterparts. Importantly however, the exposure-liking relationship for the health warnings images was moderated by the participants’ level of SS. As shown in Figure 17 (p. 163), while liking ratings of low SS participants seemed to remain unchanged over the course of exposure, liking ratings of high SS participants initially increased but then declined with increasing exposure frequency. Further tests confirmed these trends; liking ratings of low SS participants failed to significantly change whereas liking ratings of high SS participants exhibited an increase from 0 exposures (i.e., baseline; stimuli shown in test phase only) at 5 exposures and then returned to baseline levels as there was no significant difference in liking ratings between 0 and 25 exposures. Therefore, the health warning frequency-liking curve obtained for high SS participants reflected the form of an inverted U-shaped function; a strong mere exposure effect occurred at lower exposure frequencies (up to 10 exposures) followed by a decline in liking at higher exposure frequencies (20 and 25 exposures). No mere exposure effect was obtained for low SS participants.

**Valence.** Valence ratings of participants overall were also found to significantly change over the course of exposure such that, participants rated the health warning images as more pleasant (or less unpleasant) with repeated exposure. In addition, high SS participants rated the images as more pleasant (or less unpleasant) overall than low SS participants. However similar to the effect of repeated exposure on liking ratings, the exposure-valence relationship for the health warning images was also moderated by SS.
Specifically, as shown in Figure 18 (p. 166), in comparison to low SS participants, valence ratings of high SS participants increased (became more pleasant) more rapidly. Further tests confirmed these trends, with a first significant increase in valence ratings occurring at 20 exposures (in comparison to 0 stimulus exposures; baseline condition) for low SS participants, whereas for high SS participants, valence ratings began to increase sooner, specifically at 5 exposures. Therefore, for both low and high SS participants, the health warning images were perceived to be more pleasant/positive over the course of exposure. However, in contrast to low SS participants, this occurred more quickly for high SS participants.

**Arousal.** Arousal ratings of participants overall were also found to significantly vary across the frequency levels; participants rated the health warning images as less arousing over the course of exposure. In addition, high SS participants rated the images as less arousing (or more calming) overall than low SS participants. Similar to the effect of repeated exposure on liking and valence ratings described above, the exposure-arousal relationship was also moderated by the participants’ level of SS. Interestingly, this difference in the profile of arousal means for low and high SS participants over the course of exposure parallels to the findings of valence described above. That is, as shown in Figure 19 (p. 169), in comparison to low SS participants, arousal ratings of high SS participants decreased more rapidly. Specifically, further tests revealed that for low SS participants, a first significant decrease in arousal ratings occurred at 20 exposures (in comparison to 0 stimulus exposures; baseline condition), whereas for high SS participants, arousal ratings began to decline sooner, specifically at 5 exposures. Thus, for high SS participants, the point at which the images were perceived as less arousing (or more calming) is also when the images were perceived pleasant (or less unpleasant). The same was true for low SS participants.

### 4.3.3.2 An Integrated Account of Findings

This section will begin with a brief discussion of the findings pertaining to effects of repeated exposure on participant liking, valence and arousal ratings of the health warning images. The findings of the effects of repeated exposure to the negative high arousal IAPS images obtained in Experiment 2 will also be compared. Next, a brief
yet integrated discussion of the effects of stimulus discriminability will then take place which will be elaborated on in more detail in Chapter 5 (general discussion, p. 176).

**Discussion of Significant Effects, Including the Findings Obtained in Experiment 2 for the Negative High Arousal IAPS Image Group.** The finding of the effect of repeated exposure on liking ratings of the negative high arousal IAPS images in Experiment 2 (Chapter 3, section 3.3.2.2.1, p. 111) revealed that the exposure-liking relationship was not moderated by the participants’ level of SS. Specifically, liking ratings of both low and high SS participants increased throughout the lower frequency levels and then non-significantly declined at the higher exposure frequencies. Thus, regardless of the participants’ level of SS, a mere exposure effect was found at the lower frequency levels for the negative high arousal IAPS images for all participants. In contrast, the findings of the current study revealed conflicting findings. Specifically, the exposure-liking relationship for the health warning images was moderated by the participants’ level of SS, with only high SS participants demonstrating a mere exposure effect at the lower frequency levels. Thus, in light of this finding, why did low SS participants demonstrate a mere exposure effect in Experiment 2 and not in the current experiment when both experiments utilised negative high arousal stimuli? One likely explanation relates to the difference in the salience of the stimuli utilised.

Even though low SS participants in Experiment 2 perceived the negative high arousal IAPS images to be more unpleasant and arousing in comparison to high SS participants, it is speculated that, as discussed in Chapter 3, section 3.3.3.2 (p. 126), the images used in the current study were more personally relatable. That is, in contrast to the content depicted by negative high arousal IAPS images, there was arguably a greater perceived chance that the content of the health warning images; disease/fatal health conditions, would occur or be experienced. Thus collectively, the findings of Experiment 2 and the current experiment suggested that negative high arousal stimuli can limit the occurrence of a mere exposure effect for low SS individuals, but only when these individuals are unable to distance themselves from the unpleasant and arousing content which is portrayed. The greater the probability that the content depicted will occur or will be encountered (including exposure via the media) the higher the likelihood that the OLA of low SS individuals will be exceeded, thereby resulting in
liking ratings not to increase and their preference for the familiar unable to prevail.

Even though arousal ratings of the health warning images declined over the course of exposure, which is consistent with the findings obtained for the negative high arousal IAPS images in Experiment 2, the exposure-arousal relationship in the current study was moderated by SS. Specifically, the rate at which arousal ratings declined was faster for high relative to low SS participants. The fact that arousal ratings decreased and not increased over the course of exposure is again consistent with the theory of affective habituation. However, in contrast to Experiment 2 wherein arousal ratings of the negative IAPS images were found to decline at 20 exposures for participants overall (refer Figure 9, p. 117), arousal ratings of the health warning images for high SS participants were found to decline at 5 exposures. Thus, because the magnitude (or rate of decline) of affective habituation is believed to be a direct function of the perceived intensity of the stimuli (Dijksterhuis & Smith, 2002), these findings may suggest that in contrast to the negative high arousal IAPS images, high SS participants perceived the health warning images to be more extreme, allowing for a greater reduction in arousal to occur. This possibility is further supported by the finding that high SS participants perceived the health warnings images to be more unpleasant overall than the negative high arousal IAPS images (refer results sections 3.3.2.2.2 [p. 114] and 4.3.2.2.2 [p. 165] for Experiment 2 and 3 SS means respectively).

Finally, the finding that valence ratings of the health warning images became more pleasant (or positive) in the current study but not in Experiment 2 can be explained by the same argument. Specifically, the valence intensity of the negative high arousal IAPS condition was matched to the valence intensity of the negative low arousal IAPS condition. Thus, in contrast to the health warning images, the negative IAPS images were less or only moderately intense. Consequently, “a [affective] reaction that is already very mild cannot decrease much further” (Dijksterhuis & Smith, 2002, p. 211). Interestingly however, the effect of repeated exposure on valence ratings of the health warning images was found to be moderated by the participants’ level of SS, such that high SS participants perceived the health warnings to be more pleasant (or positive) more quickly than low SS participants. Thus, this finding may suggest that affective habituation also depends upon SS. However, given that this study did not directly investigate the effects of habituation and as such, used an experimental procedure that
could be arguably different to that used in an affective habituation experiment, future research could further explore this possibility.

*The Effect of Stimulus Discriminability.* The findings of the previous experiments of this thesis (Experiments 1 and 2), have suggested that stimulus discriminability is likely to be a significant factor in the mere exposure effect, with strong mere exposure effects obtained in conditions wherein the emotional stimuli were similar to one another and no exposure effects obtained when the stimuli were different from one another. Thus, given that all the health warnings depicted similar rather than different content (i.e., the adverse health consequences of smoking; diseased body parts or organs and/or fatal medical/health conditions) and significant effects of repeated exposure were obtained, the findings of the current study are again consistent with the notion that the occurrence of a mere exposure effect depends upon the degree of discriminability between the stimuli.
Chapter 5
General Discussion
5.1 Overview of Aims and Findings

Throughout Chapter 2 of this thesis it was made apparent that there are several variables that can influence the magnitude of the mere exposure effect, a phenomenon which refers to the enhancement of affect following repeated exposure to a given stimulus. Of interest to the current research were two factors pertaining to the stimuli used in previous mere exposure studies: stimulus type and stimulus valence, and one factor pertaining to the participants themselves: a personality trait called sensation seeking (SS). While the vast majority of past research has utilised neutral, meaningless stimuli (e.g., polygons) and has found reliable mere exposure effects (see Chapter 2, section 2.1.1.1, p. 10), studies exploring the effect of repeated, unreinforced exposure to emotional stimuli are relatively lacking. And, while those few studies that exist were in agreement that the attitude-enhancing effect of repeated exposure was robust for positive (pleasant) stimuli; there was considerable debate over the effect of repeated exposure for negative (unpleasant) stimuli. Some studies reported an increase in affect, others reported a decrease, and yet other studies reported no difference in affect at all following repeated exposure. Regardless of these discrepancies, the stimuli used to characterise valenced conditions were highly questionable (Chapter 2, section 2.1.1.3, p. 28). Furthermore, although emotional stimuli encompass the dimensions of valence and arousal, previous mere exposure research has only attempted to focus upon the role of stimulus valence, leaving the equally important role of stimulus arousal in the exposure-affect relationship relatively unexplored. Therefore, the aim of this thesis was to ascertain the effect of repeated exposure to stimuli that were truly emotional and thus, differing in valence and arousal. As a consequence, application of the effect to more meaningful, real-world stimuli was concurrently achieved.

The personality trait termed SS was also of interest to this thesis because of the documented tendency for low and high SS individuals to differ in their predisposition to boredom, in their preferences for the familiar as opposed to the novel, and also in their preferences for emotional stimuli (refer Chapter 2, section 2.1.4.1.4, p. 55). Interestingly, despite these differences between SS groups, the one study which had investigated the impact of SS on the mere exposure effect failed to find a differential effect. That is, both low and high SS participants displayed a mere exposure effect of an equivalent magnitude. However, again, the valence level of the stimuli used in this
study was the only dimension of emotion that was manipulated, and importantly, the stimuli were not truly emotional (refer Chapter 2, section 2.1.4.1.4, p. 55). Therefore, an additional aim of this thesis was to explore the impact of SS on the exposure-affect relationship for inherently emotional stimuli.

Four experiments took place in order to achieve the overall aims of this thesis. Before the effect of repeated exposure to emotional stimuli (differing in both valence and arousal) could be ascertained, a study which used neutral, meaningful stimuli was conducted (Experiment 1, Chapter 3), enabling a baseline measurement for which the findings pertaining to the emotional stimuli (Experiment 2, Chapter 3) could be compared. Importantly, given it was of fundamental importance to ensure that the stimuli used in Experiment 2 were in fact emotional, the IAPS was employed to fulfil this crucial requirement. The IAPS is a large database of images for which standardised ratings of valence and arousal have been reliably established (see Chapter 2, section 2.1.1.3.1, p. 29). In addition, given the most appropriate assessment of the effect of repeated exposure to meaningful emotional stimuli occurs by using comparable neutral stimuli (Murphy & Isaacowitz, 2008), the stimuli used in Experiment 1 were also selected from the IAPS database. Following from this, the next and final step was to apply the mere exposure procedure to stimuli that were of greater real-world significance and practical importance, namely the health warnings found on cigarette packets (Experiment 3B, Chapter 4). Importantly, because these images are intentionally designed to depict the severe health consequences of smoking and as such, portray threatening and confronting content of equal magnitude, the most unpleasant and arousing images needed to identified to reflect and complement this purpose. Thus, before the test study (Experiment 3B) could be conducted, a pilot study took place (Experiment 3A, Chapter 4) to identify and select these images for inclusion in the test study.

The findings across all studies indicated that the occurrence of a mere exposure effect depended upon the arousal level of the stimuli to which participants were exposed and also the participants’ level of SS. That is, mere exposure effects were found for the negative and positive high arousal IAPS images (Experiment 2) and the health warning images (also highly negative and arousing; Experiment 3B). Interestingly, the exposure-liking relationship for the positive high arousal images and the health warning images
was moderated by the participants’ level of SS. Precisely, only the low SS participants exposed to the positive high arousal IAPS images and the high SS participants exposed to the cigarette health warnings displayed a mere exposure effect. While it could have been expected that SS would also moderate the exposure-liking for the negative high arousal IAPS images as well (Experiment 2), with no mere exposure effect occurring for low SS participants, it was possible that the content displayed lacked personal relevance to these participants, thereby allowing the liking ratings of low SS participants to still increase with exposure (see Chapter 3, section 3.3.3.2, p. 126). Furthermore, no mere exposure effects at all were found for the neutral or low arousal (negative and positive) stimuli.

Despite using a similar procedure, the finding that a mere exposure effect failed to occur with neutral stimuli (Experiment 1) is inconsistent with an abundance of studies that have found evidence of an effect using neutral, meaningless stimuli (e.g., Welsh figures; Bornstein & D’Agostino, 1992; Bornstein et al., 1990). And, although relatively lacking, this finding is also inconsistent with studies which have used neutral, more meaningful stimuli (e.g., consumer products; Hekkert et al., 2013) (discussed in Chapter 2, section 2.1.1.1, p. 11). In addition, the finding that a mere exposure effect failed to eventuate with negative and positive low arousal images is also inconsistent with the findings of Bukoff and Elman (1979) and Zajonc, Markus et al. (1974; see Chapter 2, section 2.1.1.3, p. 26-27). However, because Bukoff and Elman and Zajonc, Markus et al. failed to use stimuli that were truly unpleasant and pleasant respectively, a direct comparison of findings is difficult. Furthermore, because previous research exploring the effect of repeated exposure on liking ratings of negative and positive high arousal stimuli is sparse, a comprehensive comparison of these significant findings of the current research is also difficult.

Even though past mere exposure research exploring the impact of SS on the exposure-liking relationship is also limited, the finding that SS failed to moderate the exposure-liking in Experiment 1 (neutral stimuli) and Experiment 2 (negative and positive low arousal stimuli) is partially consistent with the one study that has taken

35 Please note that this inconsistency only relates to the conditions that Bukoff and Elman (1979) and Zajonc, Markus et al. (1974) deliberately prevented associative learning from occurring, which parallels the experimental procedure used in the current study.
place. Specifically, although Pheterson and Horai (1976) used images of unattractive (negative) and attractive (positive) faces that were presumed to be low in arousal\textsuperscript{36} and found that liking ratings significantly increased with repeated exposure (which is contrary to the findings of the low arousal conditions of the current study), it was also found that this occurred for both low and high SS participants. However, as mentioned in Chapter 2, section 2.1.4.1.4 (p. 55), the findings of Pheterson and Horai need to be interpreted with caution because the unattractive and attractive face stimuli used to denote negative and positive conditions respectively was highly questionable. Specifically, it is likely that the faces were not considered truly unpleasant and pleasant by participants to begin with, thereby rendering the findings as inconclusive. In fact, it could be argued that the face stimuli were more representative of neutral stimuli, hence the reason why the finding of Experiment 1 of the current study, which used neutral stimuli, was also included in this comparison of findings. Nevertheless, the findings of the current study (Experiment 1 and 2; low arousal conditions only), together with the findings of Pheterson and Horai, both suggested that regardless of whether there was a significant change in liking ratings overall, the effect of repeated exposure was not different for low and high SS participants for low arousal stimuli.

The findings thus far have indicated that stimulus arousal played a significant role in the occurrence of a mere exposure effect. That is, significant mere exposure effects were obtained for high but not low arousal stimuli (including neutral), and a differential impact of repeated exposure between low and high SS participants was also found only within the high arousal conditions. However, as mentioned in Chapter 3, sections 3.2.3.2 (p. 90) and 3.3.3.2 (p. 122), inspection of the images used in each of the experimental conditions suggests an alternative explanation; which seems not to relate to stimulus arousal but rather to the content which was depicted. Particularly, the images used within each of the low arousal conditions (i.e., neutral, negative low arousal and positive low arousal) were more distinct from one another than the images used within each of the high arousal conditions (i.e., negative high arousal; including the health warning images, and the positive high arousal). Thus, it was speculated that a mere exposure effect failed to occur in Experiments 1 and 2 (low arousal images only) because of stimulus discriminability (i.e., when stimuli are easy to distinguish between).

\textsuperscript{36} Even though the researchers did not specify the arousal level of the stimuli employed (because stimulus arousal was not investigated), it is highly unlikely that faces were considered to be high in arousal.
The notion that stimulus discriminability can limit the occurrence of a mere exposure effect is partially consistent with the findings of Zajonc et al. (1972). Precisely, Zajonc and colleagues concluded that discriminability between the stimuli can reduce the magnitude of the mere exposure effect, but only when painting stimuli are used; a finding that did not occur with easily discriminable faces (refer Chapter 2, section 2.1.2.1, p. 36). Thus, because participants in the low arousal conditions of the current study were not exposed to paintings, nor were they exposed to stimuli from one category type (i.e., there was considerable variability in the content within these conditions), the findings pertaining to the low conditions suggest that effect of stimulus discriminability on the mere exposure effect is more far reaching than that for artwork stimuli alone. Conversely, given that the images used in the high arousal conditions (i.e., negative high arousal IAPS images, positive high arousal IAPS images and negative high arousal health warning images) were more similar to one another in the content which was depicted within each group, it is highly likely that the effect of stimulus discriminability was attenuated, thereby allowing for a mere exposure effect to occur. Possible reasons for why stimulus discriminability can limit the occurrence of a mere exposure effect will be further discussed below (section 5.2, p. 183).

However, the findings of the current research suggested that even when the stimuli were more similar to one another, the relationship between stimulus discriminability and the mere exposure effect is not always straightforward, particularly when emotional stimuli are utilised. Evidence for this was obtained by the finding that SS moderated the exposure-liking relationships for the high arousal conditions, except in the negative high arousal IAPS condition wherein the content depicted presumably lacked personal relevance, particularly for the low SS participants (see Chapter 3, section 3.3.3.2, p. 126).

It is likely that SS moderated the exposure-liking relationship in the positive high arousal IAPS condition and the negative high arousal health warning condition because of the decrease in arousal ratings that also occurred as a result of exposure, a finding that is consistent with the theory of affective habituation (refer Chapter 2, section 2.1.3.1, p. 45). Specifically, for the positive high arousal IAPS images used in Experiment 2, arousal ratings were found to decline for participants overall at 2 exposures. Thus, these images were perceived as no longer exciting (high in arousal)
with fairly minimal exposure. Therefore, as previously discussed in Chapter 3, section 3.3.3.2 (p. 125), it is possible that liking ratings of high SS participants did not increase because they were unable to satisfy their need for intense stimulation that was required to maintain their OLA (Zuckerman, 1990). In contrast, because low SS participants require much less stimulation to maintain their OLA (Zuckerman, 1990), and the positive high arousal IAPS images were perceived as exponentially calming with successive exposures, liking ratings were able to increase and thus demonstrate a mere exposure effect. In addition, for the negative high arousal health warning condition, arousal ratings for low SS participants did not decline until 20 exposures. Thus, because the OLA for low participants was probably exceeded (i.e., the health warning images preserved their intensity throughout the majority of the exposure frequency levels), it is likely that this is why their liking ratings remained unchanged and thus, did not display a mere exposure effect. In contrast, for high SS participants, arousal ratings were found to decline after only 5 exposures. Consequently, because the arousal intensity of the health warning images was initially maintained (up to 5 exposures), liking ratings were able to initially increase. However, as mentioned above, because arousal ratings began to decline at 5 exposures (i.e., the health warning images became less extreme and stimulating), this is presumably why liking ratings of high SS participants were found to significantly decline and return to baseline levels, thereby reflecting the form of an inverted U-shaped function.

A difference in liking ratings between low and high SS participants was presumably found in the positive high arousal IAPS condition and the negative high arousal health warning condition because repeated exposure also resulted in a change in the arousal intensity of the respective stimuli. And, this change in arousal intensity either moved further away from or closer to the OLA required for the low and high SSs, thereby explaining why low SS and not high SS participants demonstrated a mere exposure effect in the positive high arousal condition and also why the opposite was true for the negative high arousal health warning condition. However, in light of the possibility that SS failed to moderate the exposure-liking relationship for the negative high arousal IAPS condition because of the lack of personal relevance to low SS participants (see Chapter 3, section 3.3.3.2, p. 126), it would seem that the relationship between stimulus arousal, SS and the consequent effect on liking only applies when the content depicted has a high probability of occurring or being experienced.
5.2 Theoretical Implications

The findings of the current research have highlighted the important role of stimulus arousal and stimulus discriminability in the mere exposure effect, with significant exposure effects only occurring in high arousal experimental conditions wherein the stimuli were more similar to each other. As mentioned in Chapter 2, section 2.1.1.2 (p. 15), Zajonc et al. (1972) explained the effect of stimulus discriminability on the mere exposure effect in terms of the response competition hypothesis. In short, this theory posits that when an individual encounters a novel stimulus, the degree of similarity this stimulus has with a previously encountered stimulus will determine the intensity and the number of generalized responses that are activated at the time of the first exposure. The greater the similarity, the greater the number of responses that are elicited which in turn, leads to greater response competition; an adverse state. Subsequent exposure to the stimulus is believed to eliminate some of the responses which therefore, will reduce the response competition. Consequently, liking toward the stimulus is increased. However, while Zajonc et al., (1972) used the response competition hypothesis to explain why weaker exposure effects were obtained for easily discriminable paintings, it is unlikely that this is an adequate explanation of the underlying mechanism of stimulus discriminability. This is because this theory appears to assume that negative affect and positive affect are dependent upon one another which, as identified by Watson and Clark (1997) is not the case (refer Chapter 2, section 2.1.4.1.2, p. 52). Rather, negative affect and positive affect are believed to be orthogonal constructs and as such, “variations in positive and negative affect are independent of one another” (Watson & Clark, 1997, p. 270).

An alternative explanation for why stimulus discriminability can limit the occurrence of a mere exposure effect, especially in the case of the current research wherein emotional stimuli were used, relates to participant preferences. Specifically, because participants were exposed to more meaningful images which, in the low arousal conditions (including neutral) were more distinct from one another, it is highly plausible that personal preferences were able to resonate. For example, in the positive low arousal condition, the image depicting a misty paddock wherein horses were grazing may have been more personally relevant to a participant in comparison to the image of baby elephants because it conveyed memories of the participant’s childhood. As a
consequence, regardless of how many times the participant was exposed to this image, higher liking ratings may have been ascribed because of this personal attachment. Thus, it is plausible that in these conditions, the familiarity that is typically generated by repeated exposure as a source of affect is overridden by the participant’s personal attachment to the stimulus content.

In conditions where the effect of stimulus discriminability were attenuated, the findings of the current research extended upon the mere exposure literature by providing clarification of the effect of repeated exposure to high arousal stimuli; a variable that has been often overlooked in past research. In addition, the findings also highlighted the need to take SS into account when using such stimuli and thus, also extended upon the lack of mere exposure research exploring the impact of SS on the exposure-affect relationship. As described above, it is plausible that SS was found to moderate the exposure-liking relationship to the majority of high arousal stimuli (that were relatable and thus perceived as likely to occur or be experienced) because repeated exposure also changed the arousal intensity of these stimuli. Subsequently, this change in arousal intensity either moved further away from or closer to the OLA presumably required for the low and high SS participants in the current research. This possibility is akin to that described by Berlyne (1966) when proposing the arousal model of exposure effects (see Chapter 2, section 2.2.1, p. 62). In short, this model posits that individuals seek to establish a moderate level of arousal, and when deviances from this moderate level of arousal occur, negative or unpleasant emotions are experienced which subsequently, lead to a decline in affect towards the stimulus associated with this over-or-under arousal. Thus, the findings of the current research provided some indirect support for this model of the mere exposure effect which has been discarded in previous literature (refer Bornstein, 1989, for a review). However, given that this study was novel in that high arousal stimuli were investigated (a stimulus type that has been overlooked in previous mere exposure research) and that it also explored the impact of SS to stimuli that were truly emotional, the merit of this arousal model of exposure effects should be reassessed.

Furthermore, through the use of post-hoc tests which were rarely reported in the previous mere exposure literature (see Chapter 2, section 2.1.2.1, p. 36), clarity as to exactly when changes in affect ratings of highly arousing stimuli occurred from baseline...
(i.e., stimuli shown in test phase only) as a result of exposure was also gained. These tests were particularly important in Experiment 3B wherein the health warning images were utilised because by establishing when changes in affect, particularly the degree of unpleasantness (valence) and excitability (arousal) significantly occurred from the participants’ first exposure, this simultaneously highlighted a change in the effectiveness of these warnings. Even though a decrease in participant valence and arousal ratings was found, which is consistent with the notion of “wear out” or “message fatigue” (i.e., when the health warnings become familiar and their potency in conveying the health message decreases; Shanahan & Elliott, 2009), and also with the theory of affective habituation (refer Chapter 2, section 2.1.3.1, p. 45), the findings regarding the rate of this decline are disturbing. Specifically, in contrast to low SS participants who perceived the warnings to be less unpleasant (or pleasant) and more calming (less arousing) at 20 exposures, this occurred for high SS participants after only five exposures. Thus, given the participants’ perception of the emotional content (i.e., level of valence and arousal) was used a measure of effectiveness in Experiment 3B because the health warning images are believed to determine the strength of the warnings’ emotional impact (Hammond, 2011; Chapter 4, section 4.1), these findings indicated that the effectiveness of the health warning images is short lived. This was particularly pertinent for high SS participants in the current study who, according to Zuckerman and colleagues (1990), are more likely to engage in the behaviour that the warnings are targeted to eliminate.

Also of great concern was the finding that liking ratings of the health warning images increased for high SS participants. As stated in Chapter 4, section 4.1 (p. 132), the implementation of the graphic warnings relied upon the effect of repeated of exposure to convey a quit message every time a person reaches for a cigarette (Department of Health, 2012). Thus, the finding that liking ratings increased for high SS participants, at least initially, is counterproductive to the reasons why health warning images exist, namely to deter or motivate people not to smoke. Again, this is particularly problematic because, as mentioned above, high SS individuals are more likely to smoke cigarettes in comparison to their low SS counterparts (Zuckerman et al., 1990) for whom a mere exposure effect was not found.
Guided by the findings of the low arousal conditions of this thesis and the possible role that stimulus discriminability played in limiting the occurrence of a mere exposure effect, it is recommended that to prevent liking ratings of high SS individuals from increasing, health warning images should become more discriminable from one another and thus, not solely depict the health consequences of smoking. For example, the financial costs associated with smoking and the effect that smoking has on significant others are additional adverse consequences that could be focused upon, allowing for more variability in the content which is depicted. In addition, given that valence and arousal ratings of the health warning images decreased and thus, were consistent with the theory of affective habituation, it is also recommended to use images that are not extremely emotionally intense. This is in line with the finding that affective habituation (i.e., the degree with which affective reactions reduce in intensity during repeated exposure) is a direct function of how extreme the stimuli are to begin with (Dijksterhuis & Smith, 2002). Thus, if the stimuli were moderately extreme, it is likely that affective reactions (i.e., perceived degree of unpleasantness and excitability) to the health warning images would not reduce as quickly and therefore retain their effectiveness for a longer period of time. This would be particularly beneficial for high SS individuals whose affective reactions to the health warning images are likely to decrease at a rapid rate. While this rationale was supported by the findings of the current research, it is inconsistent with the suggestions made by Palmgreen and colleagues (1991), who proposed that advertising messages aimed at high SS individuals should contain “high-sensation-value”. Such messages are believed to possess emotionally powerful, physically arousing, and/or graphic content in order to match the arousal need (i.e., sensation need) of high SS individuals. Interestingly however, while this idea has been applied to the development of anti-marijuana public service announcements targeting high SS adolescents, and has produced promising results (refer Palmgreen, Donohew, Lorch, Hoyle, & Stephenson, 2001, for a review), it was also shown to be ineffective with tobacco campaigns.

Lastly, given that the valence and arousal ratings of high SS participants decreased at 5 exposures, this finding also suggests that the current rotational periods are not adequate. That is, because two sets of seven health warnings are only rotated every 12 months (within Australia, and even less frequently in other countries such as Thailand; Institute for Global Tobacco Control, 2013) (refer Chapter 4, section 4.1, p. 186).
135), it is extremely probable that a regular smoker (one who is high on SS) would encounter the same health warning image more than 5 times within one year, or more realistically, even within one day. Thus, to prevent “wear out” or “message fatigue”, cigarette health warning images may need to be updated and refreshed more regularly in order to sustain their intended salience and impact. Importantly, the finding of the current study that the emotional impact of the health warnings images began to wane at 5 exposures (for high SS participants) could be used to aid such a reform.

5.3 Suggestions for Future Studies

The findings of the current study provided insight into the effect of repeated exposure to high arousal stimuli. However, no such insights were gained for low arousal stimuli (including neutral), because stimulus discriminability presumably prevented the mere exposure effect from occurring. In addition, even though significant exposure effects were obtained for high arousal stimuli, the current research was unable to fully ascertain the role that stimulus valence and arousal play in the exposure-affect relationship because of the possible effects of stimulus discriminability being intertwined. As mentioned in Chapter 3, section 3.3.3.2 (p. 123), selection of similar IAPS images in the high arousal conditions of Experiment 2 was an unavoidable constraint of the IAPS database. That is, in contrast to low arousal conditions where there was a vast variety of real-world objects, scenes, etc. to choose among, there was far less variety when trying to obtain high arousal conditions. The selection of images was further restricted in the current research by only using images in each experimental condition (i.e., negative and positive low arousal and negative and positive high arousal) that were matched on valence and arousal intensity. Again, given the aim of this thesis was to establish the effect of repeated exposure to emotional stimuli, it was deemed highly important to finely control the valence and arousal intensity of the stimuli utilised. This was done in the hope of isolating the relative contributions of each in the exposure-affect relationship, and would also have allowed for accurate comparisons of the effect of repeated exposure between experimental conditions to occur. Another unavoidable constraint of the IAPS is that it was not possible to select images from the same semantic category (that were again matched in valence and arousal) to denote all experimental groups.
To overcome the abovementioned problems that were encountered, future research could replicate the current research utilizing different emotional stimuli. One way a different stimulus set could be achieved is by selecting a category of similar images that are representative of objects/scenes encountered in the real-world, and digitally editing the physical attributes of these images to make them positive (low and high in arousal) and negative (low and high in arousal). However, before this new database of images could be used in a mere exposure experiment, numerous pre-tests, using a different group of participants to those involved in the test study, would need to be conducted. Not only would this ensure that the images are in fact perceived as emotional, but it will also allow for standardised ratings of valence and arousal to be obtained which, as mentioned in Chapter 2, section 2.1.1.3.1 (p. 30), is why the IAPS has been proven to be of great benefit. Specifically, these ratings allow for superior experimental control in the selection of inherently emotional stimuli. If such a database of newly designed images could be achieved, then this would enable future research to take place to separate the roles of stimulus valence, stimulus arousal, and stimulus discriminability in the mere exposure effect to meaningful, real-world stimuli. However, when creating such a database, researchers would need to be mindful of stimulus prototypicality, or the extent to which the images are seen as “typical” or “novel” exemplars of its category. Importantly, stimulus prototypicality has been found to influence the occurrence of a mere exposure effect (Bornstein, 1989), and is also reported to play a significant role in participant preferences for meaningful stimuli (Halberstadt & Rhodes, 2003). Thus, a wide variety of stimuli differing in their degree of prototypicality should be included.

Another aspect of the current research that could be modified and incorporated into the experimental design of future studies relates to the way in which arousal was measured. In all experiments of this thesis, arousal was measured subjectively by a 9-point Likert scale that was anchored, 1 = I feel extremely calm to 9 = I feel extremely excited. Importantly, this arousal scale was used in order to be consistent with work of Lang et al. (2008) when creating the standardised ratings of arousal for the IAPS images. However, there is also research to suggest that more objective measures can provide a deeper insight into an individuals’ arousal state (e.g., Chamberlain & Broderick, 2007). Thus, one such measure that could be employed in future mere exposure research using emotional stimuli is Event-Related Potentials (ERP’s).
Importantly, this electrophysiological technique has been used in an abundance of previous studies using emotional stimuli, particularly the IAPS (e.g., Briggs & Martin, 2009; Britton et al., 2005; Deiss et al., 2008; Keil et al., 2003; Schupp et al., 2004), and has also been used in research exploring the relationship between SS and emotional processing (e.g., Zheng et al., 2011). ERP’s are often used in studies using emotional stimuli because the dimensions of valence and arousal have been reliably related to ERP components, with valence mainly modulating early ERP components and arousal mainly modulating later ERP components (e.g., Gianotti et al., 2008; Olofsson, Nordin, Sequeira, & Polich, 2008).

The findings of the current study have revealed the importance of taking stimulus arousal into account when exploring the mere exposure effect. Specifically, it is likely to have played a key role in why SS moderated the exposure-liking relationship for the high arousal stimuli (described above), and also in the effectiveness of the health warning images that has vital implications for the current tobacco reform policies. Thus, future studies employing alternative objective measures of arousal would be of great benefit to further delve the effects of stimulus arousal in the mere exposure effect.

5.4 Conclusion

This research offered significant contributions to the mere exposure effect literature. By using stimuli for which standardised ratings of valence and arousal had been reliably established, the effect of repeated exposure on affect ratings of emotional stimuli could (at long last) be investigated, and the impact of SS on the exposure-affect relationship to such stimuli could be explored. The reasons for using emotional stimuli differing in valence and arousal in the current research were three-fold: to correct the limitation of past mere exposure studies in the use of stimuli that were not truly affectively valenced; to address the gap in the mere exposure literature concerning the role of stimulus arousal in the exposure-affect relationship; and to add to the robustness of the mere exposure effect as a real-world phenomenon. The findings revealed that liking ratings of negative and positive high arousal stimuli increased with repeated exposure. Thus, a mere exposure effect which is normally obtained with neutral, meaningless stimuli also occurred with both unpleasant and pleasant high arousal stimuli that are representative of objects and scenes encountered in the real-world.
However, there was also compelling evidence to suggest that the exposure-liking relationship for the majority of the high arousal stimuli was not the same for low and high SS participants. Thus, the need to take SS into account when exploring the effect of repeated exposure to highly arousing stimuli was clearly highlighted. An integrated explanation of the effect of SS on the mere exposure effect was offered. This suggested that the changes in the arousal intensity of the stimuli that also occur as a result of repeated exposure can impact upon the OLA of low and high SS individuals. If the OLA of the SS individual is not maintained (i.e., if they are over-or-under aroused), then liking ratings cannot increase. However, it was also suggested that this account of findings was limited to conditions wherein the stimulus content is personally relatable (i.e., has a high likelihood that it will be experienced or encountered).

Even though no mere exposure effects were found for the low arousal stimuli (including neutral), these non-significant findings did unexpectedly suggest that the limiting effect of stimulus discriminability on the exposure-affect relationship, which has typically been found for paintings, is more influential than previously reported. A logical yet novel account of the underlying mechanism of stimulus discriminability, particularly when using emotional stimuli, was proposed which highlighted the probability that when stimuli are distinct from one another, personal preferences can override the attitude-enhancing effect of repeated exposure. Future research is needed to disentangle the presumed effect of stimulus discriminability on the mere exposure effect to real-world, meaningful stimuli.

Not only did the current research establish the effect of repeated exposure to high arousal emotional stimuli that are generally encountered in the real-world, but also to high arousal stimuli that have a profound societal purpose. That is, the cigarette health warning images that are intentionally designed to be highly adverse and confronting to portray the severe health consequences of smoking. The finding that a mere exposure effect occurred for high SS participants; a cohort that are more likely to smoke than low SS participants, together with the finding that valence and arousal ratings of these warnings decreased quite rapidly, seriously calls into question the effectiveness of such warnings. Can repeated exposure to the health warning images be relied upon to evoke deterrence? Do the health warnings sustain their emotional salience and intended impact on high SS individuals after prolonged exposure? Are the current
annual rotational periods adequate to prevent “wear out”? The findings of the current research suggest not. Clearly, future research needs to be undertaken to investigate more efficient ways of combating the smoking epidemic, particularly aimed at high SS individuals, given that it claims the lives of billions yearly. Therefore, the current research begins to answer previously under addressed empirical questions, some of which have implications that are far reaching. As a result, new and vital avenues of research have come to light, particularly in regards to the ways the current tobacco control policies can better communicate the detrimental effects of smoking.
Chapter 6
References


Appendix A: Copy of Ethics Approval for Each Experiment
Appendix A1: Copy of Ethics Approval for Experiments 1, 2 (Chapter 3), and 3B (Test Study; Chapter 4)

SUHREC Project 2011/053 Prof. Allan Whitfield, Design/ Ms Nicole Aimers
Approved Duration: 09/05/2011 To 09/06/2014 [Adjusted]

I refer to the ethical review of the above project protocol undertaken on behalf of Swinburne's Human Research Ethics Committee (SUHREC) by SUHREC Subcommittee (SHESC2) at a meeting held on 8 April 2011. Your response to the review as e-mailed on 20 April 2011 was put to a nominated SHESC2 delegate for consideration.

I am pleased to advise that, as submitted to date, the project has approval to proceed in line with standard on-going ethics clearance conditions here outlined.

- All human research activity undertaken under Swinburne auspices must conform to Swinburne and external regulatory standards, including the National Statement on Ethical Conduct in Human Research and with respect to secure data use, retention and disposal.

- The named Swinburne Chief Investigator/Supervisor remains responsible for any personnel appointed to or associated with the project being made aware of ethics clearance conditions, including research and consent procedures or instruments approved. Any change in chief investigator/supervisor requires timely notification and SUHREC endorsement.

- The above project has been approved as submitted for ethical review by or on behalf of SUHREC. Amendments to approved procedures or instruments ordinarily require prior ethical appraisal/ clearance. SUHREC must be notified immediately or as soon as possible thereafter of (a) any serious or unexpected adverse effects on participants and any redress measures; (b) proposed changes in protocols; and (c) unforeseen events which might affect continued ethical acceptability of the project.

- At a minimum, an annual report on the progress of the project is required as well as at the conclusion (or abandonment) of the project.

- A duly authorised external or internal audit of the project may be undertaken at any time.
Appendix A2: Copy of Ethics Approval for Experiment 3A
(Pilot Study; Chapter 4)

SUHREC Project 2011/053 Prof. Allan Whitfield, Design/ Ms Nicole Aimers
Approved Duration: 09/05/2011 To 09/06/2014 [Adjusted]
Project Modification: August 2011, February 2012

I refer to your e-mail of 13 December 2011 which included an Annual Report that outlined a requested modification to the protocol by the addition of a further task. The request and the documentation were put to a delegate of the relevant SUHREC Subcommittee (SHESC2) for consideration. Among the attachments to the above request was a health warnings booklet which contained very confronting images. Given the extent of the confronting nature of the images the request was referred to SUHREC for consideration. In the meantime, revisions to the statements in the Consent Information Statement (CIS) concerning the images were requested by the SHESC2 delegate and the revised CIS was received on 20 January 2012.

SUHREC considered the request at its meeting held 3 February 2012 and approved the revised CIS however, requested further amplification of the warning notice and formatting to draw attention to the text. The further revised CIS received on 17 February 2012 was reviewed by the SHESC2 delegate.

I am pleased to advise that, as submitted to date, the modified project/protocol may continue in line with standard ethics clearance conditions previously communicated and reprinted below.
Appendix B: List of IAPS Images Used in Experiments 1 and 2 (Chapter 3)
Appendix Table B1: List of IAPS Images Used in Experiment 1 (Chapter 3).

Table B1

The IAPS Images used in the Neutral Image Group

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<th>Arousal</th>
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$N = 7$
Appendix Tables B2-B5: List of IAPS Images Used in Experiment 2 (Chapter 3)

Table B2

*The IAPS Images used in the Negative Low Arousal Image Group*

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$N = 7$
Table B3

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<th>Arousal M</th>
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*The IAPS Images used in the Negative High Arousal Image Group*

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*N = 7*
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*The IAPS Images used in the Positive High Arousal Image Group*

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$N = 7$
Appendix C: Questionnaire Used in Experiments 1, 2, and 3B
(Chapters 3 and 4)
Note: Unlike Experiments 1 and 2, participants involved in Experiment 3B (Test Study; Chapter 4) were also asked if they had travelled to Malaysia and/or Thailand in the past 12 months in the “background information about you” section of this questionnaire (refer section 4.3.1.3.2, p. 154).

The Mere Exposure Effect: Application to Emotionally-Laden Stimuli.

**Background information about you**

This information is required so that we can gain a general description of the people who participate in the study.

Please tick or make a mark in the box that most appropriately answers the question.

1. What is your gender? Male [ ] Female [ ]

2. What is your age? _________________ years

3. What is your place of birth? Australia [ ] New Zealand [ ]

   UK [ ] Asia [ ]

   Europe [ ] Other [ ]

4. Is English your first language? Yes [ ] No [ ]

4 (a). If no, please specify what your first language is_____________________________
5. What is the highest educational level you have achieved?

Primary [ ]    Some secondary [ ]    Secondary completed [ ]
Trade qualification [ ]    Tertiary level [ ]    Postgraduate [ ]

5 (a). If your highest education level achieved was ‘tertiary level’ or ‘postgraduate’, please indicate your study discipline
__________________________________________________________________________________

6. Do you have normal or corrected to normal vision?    Yes [ ]    No [ ]

7. Are you colour blind?    Yes [ ]    No [ ]    Unsure [ ]

Please continue onto the next page of the questionnaire
Directions: Each of the items below contains two choices A and B. Please indicate which of the choices most describes your likes or the way you feel. In some cases you may find items in which both choices describes your likes or feelings. Please choose the one which better describes your likes or feelings. In some cases you may find items in which you do not like either choice. In these cases mark the choice you dislike least. Do not leave any items blank. It is important you respond to all items with only one choice, A or B. We are interested only in your likes and feelings, not in how others feel about these things or how one is supposed to feel. There are no right or wrong answers as in other kinds of tests. Be frank and give your honest appraisal of yourself.

1. A. I like "wild" uninhibited parties.
   B. I prefer quiet parties with good conversation.

2. A. There are some movies I enjoy seeing a second or even a third time.
   B. I can't stand watching a movie that I've seen before.

3. A. I often wish I could be a mountain climber.
   B. I can't understand people who risk their necks climbing mountains.

4. A. I dislike all body odours.
   B. I like some of the earthy body smells.

5. A. I get bored seeing the same old faces.
   B. I like the comfortable familiarity of everyday friends.

6. A. I like to explore a strange city or section of town by myself, even if it means getting lost.
   B. I prefer a guide when I am in a place I don't know well.

7. A. I dislike people who do or say things just to shock or upset others.
   B. When you can predict almost everything a person will do and say he or she must be a bore.

8. A. I usually don't enjoy a movie or play where I can predict what will happen in advance.
   B. I don't mind watching a movie or play where I can predict what will happen in advance.

9. A. I have tried marijuana or would like to.
   B. I would never smoke marijuana.

10. A. I would not like to try any drug which might produce strange and dangerous effects on me.
    B. I would like to try some of the drugs that produce hallucinations.

11. A. A sensible person avoids activities that are dangerous.
    B. I sometimes like to do things that are a little frightening.

12. A. I dislike "swingers" (people who are uninhibited and free about sex).
    B. I enjoy the company of real "swingers".

13. A. I find that stimulants make me uncomfortable.
    B. I often like to get high (drinking liquor or smoking marijuana).
14. A. I like to try new foods that I have never tasted before.
    B. I order the dishes with which I am familiar so as to avoid disappointment and unpleasantness.

15. A. I enjoy looking at home movies, videos, or travel slides.
    B. Looking at someone's home movies, videos, or travel slides bores me tremendously.

16. A. I would like to take up the sport of water skiing.
    B. I would not like to take up water skiing.

17. A. I would like to try surfboard riding.
    B. I would not like to try surfboard riding.

18. A. I would like to take off on a trip with no pre-planned or definite routes, or timetable.
    B. When I go on a trip I like to plan my route and timetable fairly carefully.

19. A. I prefer the "down to earth" kinds of people as friends.
    B. I would like to make friends in some of the "far-out" groups like artists or " punks".

20. A. I would not like to learn to fly an airplane.
    B. I would like to learn to fly an airplane.

21. A. I prefer the surface of the water to the depths.
    B. I would like to go scuba diving.

22. A. I would like to meet some persons who are homosexual (men or women).
    B. I stay away from anyone I suspect of being "gay" or "lesbian."

23. A. I would like to try parachute jumping.
    B. I would never want to try jumping out of a plane, with or without a parachute.

24. A. I prefer friends who are excitingly unpredictable.
    B. I prefer friends who are reliable and predictable.

25. A. I am not interested in experience for its own sake.
    B. I like to have new and exciting experiences and sensations even if they are a little frightening, unconventional, or illegal.

26. A. The essence of good art is in its clarity, symmetry of form, and harmony of colours.
    B. I often find beauty in the "clashing" colours and irregular forms of modern paintings.

27. A. I enjoy spending time in the familiar surroundings of home.
    B. I get very restless if I have to stay around home for any length of time.

28. A. I like to dive off the high board.
    B. I don't like the feeling I get standing on the high board (or I don't go near it at all).

29. A. I like to date persons who are physically exciting.
    B. I like to date persons who share my values.
30. A. Heavy drinking usually ruins a party because some people get loud and boisterous. 
   B. Keeping the drinks full is the key to a good party.

31. A. The worst social sin is to be rude. 
   B. The worst social sin is to be a bore.

32. A. A person should have considerable sexual experience before marriage. 
   B. It's better if two married persons begin their sexual experience with each other.

33. A. Even if I had the money, I would not care to associate with flighty rich persons in the "jet set." 
   B. I could conceive of myself seeking pleasures around the world with the "jet set."

34. A. I like people who are sharp and witty even if they do sometimes insult others. 
   B. I dislike people who have their fun at the expense of hurting the feelings of others.

35. A. There is altogether too much portrayal of sex in movies. 
   B. I enjoy watching many of the "sexy" scenes in movies.

36. A. I feel best after taking a couple of drinks. 
   B. Something is wrong with people who need liquor to feel good.

37. A. People should dress according to some standard of taste, neatness, and style. 
   B. People should dress in individual ways even if the effects are sometimes strange.

38. A. Sailing long distances in small sailing crafts is foolhardy. 
   B. I would like to sail a long distance in a small but seaworthy sailing craft.

39. A. I have no patience with dull or boring persons. 
   B. I find something interesting in almost every person I talk to.

40. A. Skiing down a mountain slope is a good way to end up on crutches. 
   B. I think I would enjoy the sensations of skiing very fast down a high mountain slope.


*End of questionnaire. Thank you very much for your time*
Appendix D: Assumption Checking of Data Obtained Within Experiments 1, 2, and 3B (Chapters 3 and 4)
Appendix D1: Assumption Checking for Experiment 1

(Chapter 3)

The assumption of linearity was checked by producing a scatterplot of the residuals against the fitted values for liking (Field, 2013). Examination of this plot revealed no evidence of a non-linear relationship. Next, the assumption of normality was checked by producing a normal probability plot, also of the residuals, for low and high sensation seekers separately. Examination of these plots indicated that the residuals were satisfactorily normally distributed at each level of SS. Please note that if the sample size of the current study was smaller (i.e., less than 30), additional normality checks relating to the distribution of the parameter estimates would have been conducted. However, because of the central limit theorem which states that, for large sample sizes (i.e., 30 or more), normality can be assumed regardless of the shape of the sampling data (Field), only the residuals of the model were focused upon. Mauchly’s test indicated that the assumption of sphericity had been met, $\chi^2(20) = 11.88, p = .943$, therefore degrees of freedom didn’t need to be corrected using other estimates of sphericity. In addition, Levene’s test indicated that the variances were homogeneous for all levels of the repeated measures factor (i.e., exposure frequency). Thus, the assumption of homogeneity of variance was also met.
Appendix D2: Assumption Checking for Experiment 2  
(Chapter 3)

Before participant liking, valence and arousal ratings were analysed using separate mixed design ANOVAs, the correlations between these three dependent variables were checked. When collapsing across the frequency levels, findings revealed that there was no relationship between the mean arousal and liking ratings ($r = 0.01, n = 186, p = .845$). However, there was a weak linear relationship between the mean arousal and valence ratings ($r = 0.18, n = 186, p = .013$) and a moderate to strong linear relationship between the mean liking and valence ratings ($r = 0.74, n = 186, p < .001$). Given that the latter was approaching 0.8, the profile plots displaying the relationship between liking and frequency and also between valence and frequency were examined. Upon inspection, the frequency-affect relationships were far from identical. Therefore, because the effect of repeated exposure appeared to be different for each construct and the correlation of $r = .74$, although high, was not high enough to make one of these dependent variables redundant (Tabachnick & Fidell, 2007) separate models for liking and valence were still conducted.

The assumption of linearity was checked by producing three scatterplots. The first scatterplot displayed the residuals of the liking model against the fitted values for liking, the second displaying the residuals of the valence model against the fitted values for valence and the third displaying the residuals of the arousal model against the fitted values for arousal (Field, 2013). Examination of these plots revealed no evidence of a non-linear relationship for any model. Next, the assumption of normality was checked by producing a normal probability plot, also of the residuals, for low and high sensation seekers separately, within each image group. Examination of these plots indicated that the residuals were satisfactorily normally distributed at each level of SS, within each image group, and for each model. Please note that if the sample size of the current study was substantially smaller (i.e., less than 30), additional normality checks relating to the distribution of the parameter estimates for each model would have been conducted. However, because of the central limit theorem which states that, for large sample sizes (i.e., 30 or more), normality can be assumed regardless of the shape of the sampling data (Field), only the residuals of the models were focused upon. Please also note that
before the total SS scores (obtained by the study questionnaire) were subjected to a median split, these total scores were normally distributed.

Mauchly’s test indicated that the assumption of sphericity had been violated for the liking ($\chi^2(20) = 72.18, p = <.001$), and arousal ($\chi^2(20) = 35.62, p = .017$) data. Therefore, the degrees of freedom in the liking and arousal datasets were corrected using Greenhouse-Geisser estimates of sphericity. However, for the valence data, Mauchly’s test indicated that the assumption of sphericity had been met ($\chi^2(20) = 18.58, p = .550$). Therefore, the degrees of freedom didn’t need to be corrected using other estimates of sphericity. In addition, Levene’s test indicated that the assumption of homogeneity of variance had also been violated for the liking, valence and arousal data. However, because Levene’s test is often significant (i.e., indicating a violation) in large sample sizes (Field, 2013), the scatterplots of the residuals for liking, valence and arousal at each frequency level against the respective fitted values for liking, pleasantness and arousal were produced. Examination of these plots revealed no evidence of non-constant variance. Given this, no attempts were made to transform the liking, valence or arousal data and the assumption of homogeneity of variance was deemed to be met.
Appendix D3: Assumption Checking for Experiment 3B

(Chapter 4)

Similar to Experiment 2, before participant liking, valence and arousal ratings were analysed using separate mixed design ANOVAs, the correlations between these three dependent variables were checked. When collapsing across the frequency levels, findings revealed that there was a moderate linear relationship between the mean liking and valence responses ($r = 0.61$, $n = 47$, $p = <.001$), between the mean arousal and liking responses ($r = -0.55$, $n = 47$, $p = <.001$) and between the mean arousal and valence responses ($r = -0.63$, $n = 47$, $p = <.001$). Similar to Experiment 2, because all of the Pearson’s correlation coefficients were moderate and not above 0.8, separate models for liking, valence and arousal were able to be conducted.

Similar to Experiment 2, the assumption of linearity was checked by producing three scatterplots. The first scatterplot displayed the residuals of the liking model against the fitted values for liking, the second displaying the residuals of the valence model against the fitted values for valence and the third displaying the residuals of the arousal model against the fitted values for arousal (Field, 2013). Examination of these plots revealed no evidence of a non-linear relationship for any model. Next, the assumption of normality was checked by producing a normal probability plot, also of the residuals, for low and high sensation seekers separately. Examination of these plots indicated that the residuals were satisfactorily normally distributed at each level of SS for each model. Please note that if the sample size of the current study was substantially smaller (i.e., less than 30), additional normality checks relating to the distribution of the parameter estimates for each model would have been conducted. However, because of the central limit theorem which states that, for large sample sizes (i.e., 30 or more), we can assume normality regardless of the shape of the sampling data (Field), only the residuals of the models were focused upon. Please also note that before the total SS scores (obtained by the study questionnaire) were subjected to a median split, these total scores were normally distributed.

Mauchly’s test indicated that the assumption of sphericity had been violated for the liking ($\chi^2(20) = 186.58$, $p = <.001$), valence ($\chi^2(20) = 225.54$, $p = <.001$), and arousal ($\chi^2(20) = 192.89$, $p = <.001$) data. Therefore, the degrees of freedom in these respective
datasets were corrected using Greenhouse-Geisser estimates of sphericity. However, for the liking and valence data, the assumption of homogeneity of variance had been met as Levene’s test indicated that the variances were homogeneous for all levels of the repeated measures factor (i.e., exposure frequency) within each respective dataset. In contrast, for the arousal data, Levene’s test indicated that the assumption of homogeneity of variance had been violated. However, because Levene’s test is often significant (i.e., indicating a violation) in large sample sizes (Field, 2013), the scatterplots of the residuals for arousal at each frequency level against the fitted values for arousal were produced. Examination of these plots revealed no evidence of non-constant variance. Given this, no attempts were made to transform the data and the assumption of homogeneity of variance was deemed to be met.
Appendix E: Non-Significant Findings of Experiment 1
(Chapter 3)
Table E1

*Overall Means (M), Standard Errors (SE), and 95% Confidence Intervals of Low and High SS Liking Ratings for Neutral IAPS Images*

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Appendix F: All Pairwise Comparisons Conducted in
Experiment 2 (Chapter 3)
Table F1

Pairwise Differences in Liking Ratings for Positive High Arousal IAPS Images between Each Frequency Level for Both Low and High SS Groups

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Pairwise Differences in Liking Ratings for Positive High Arousal IAPS Images between Each Frequency Level for Both Low and High SS Groups

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Table F1 (Continued)

*Pairwise Differences in Liking Ratings for Positive High Arousal IAPS Images between Each Frequency Level for Both Low and High SS Groups*

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*Note. SE = standard error; CI = confidence interval; LB = lower bound; UB = upper bound*

*$^*$ Adjustment for multiple comparisons: Bonferroni

*$p < .05$
Table F2

Pairwise Differences in Liking Ratings for Negative High Arousal IAPS Images between Each Frequency Level

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Table F2 (Continued)

Pairwise Differences in Liking Ratings for Negative High Arousal IAPS Images between Each Frequency Level

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Note. SE = standard error; CI = confidence interval; LB = lower bound; UB = upper bound

^ Adjustment for multiple comparisons: Bonferroni

*p < .05
Table F3

Pairwise Differences in Arousal Ratings for Positive High Arousal IAPS Images between Each Frequency Level

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### Table F3 (Continued)

**Pairwise Differences in Liking Ratings for Negative High Arousal IAPS Images between Each Frequency Level**

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**Note.** SE = standard error; CI = confidence interval; LB = lower bound; UB = upper bound

^ Adjustment for multiple comparisons: Bonferroni

*p < .05
Table F4

Pairwise Differences in Arousal Ratings for Negative High Arousal IAPS Images between Each Frequency Level

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<th>(J) Frequency</th>
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<th>p^</th>
<th>95% CI for Difference</th>
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Table F4 (Continued)

Pairwise Differences in Liking Ratings for Negative High Arousal IAPS Images between Each Frequency Level

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<th>(J)Frequency</th>
<th>Mean Difference (I-J)</th>
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<th>p^</th>
<th>95% CI for Difference</th>
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<td>.115</td>
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<td>-1.12 0.41</td>
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</tr>
<tr>
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<td>-0.04</td>
<td>0.17</td>
<td>1.000</td>
<td>-0.58 0.49</td>
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</tbody>
</table>

Note. SE = standard error; CI = confidence interval; LB = lower bound; UB = upper bound

^ Adjustment for multiple comparisons: Bonferroni
*p <.05
Appendix G: Non-Significant Findings of Experiment 2
(Chapter 3)
Table G1

*Overall Means (M) and Standard Deviations (SD) of Liking Ratings for Positive High Arousal IAPS Images Across the Frequency Levels*

<table>
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<td>2.28</td>
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<tr>
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<td>2.34</td>
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<td>1.84</td>
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<td>1.98</td>
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*N= 47*
Table G2

*Means (M) and Standard Deviations (SD) of Low and High SS Liking Ratings for Negative High Arousal IAPS Images Across the Frequency Levels*

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<td>Low</td>
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<td>High</td>
<td>4.83</td>
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<td>1.10</td>
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<td>1.84</td>
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Table G3

Means (M) and Standard Deviations (SD) of SS and Overall Liking Ratings for Positive Low Arousal IAPS Images Across the Frequency Levels

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<td>1.60</td>
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Table G4

*Overall Means (M), Standard Errors (SE), and 95% Confidence Intervals of Low and High SS Liking Ratings for Positive Low Arousal IAPS Images*

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Table G5

Means (M) and Standard Deviations (SD) of SS and Overall Liking Ratings for Negative Low Arousal IAPS Images Across the Frequency Levels

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Table G6

Means (M) and Standard Deviations (SD) of SS and Overall Valence Ratings for Each IAPS Image Group Across the Frequency Levels

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Table G7 (Continued)

*Means (M) and Standard Deviations (SD) of SS and Overall Arousal Ratings for Each IAPS Image Group Across the Frequency Levels*

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<thead>
<tr>
<th>Frequency</th>
<th>Image Group</th>
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Table G7 (Continued)

Means (M) and Standard Deviations (SD) of SS and Overall Arousal Ratings for Each IAPS Image Group Across the Frequency Levels

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<th>Frequency</th>
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<th>SD</th>
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</table>
Appendix H: Timeline of Australian Anti-Smoking Advertisements and Tobacco Control Policies (Chapter 4)
Table H1

*Timeline of Australian Anti-Smoking Advertisements and Tobacco Control Policies between 1971 and 2005*

<table>
<thead>
<tr>
<th>Year</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971</td>
<td>The Director of the Cancer Council, Dr. Nigel Gray, produced more than 20 television commercials which were 30 seconds in length, black and white and most had a funny twist. Actors Fred Parslowe, Miriam Karlin and Sir Macfarlane Burnet also featured in television advertisements on lung cancer and teenage smoking.</td>
</tr>
<tr>
<td>1972</td>
<td>The phase-out of cigarette advertising on radio and television began in Australia.</td>
</tr>
<tr>
<td>1973</td>
<td>The first health warning on cigarette packets was introduced in Australia 'Smoking is a health hazard'.</td>
</tr>
<tr>
<td>1975</td>
<td>Smoking was banned on Victorian metropolitan buses.</td>
</tr>
<tr>
<td>1976</td>
<td>Advertising of tobacco was banned on radio and television in Australia.</td>
</tr>
<tr>
<td>1985</td>
<td>Quit was established in Victoria. Quit's first advertising campaign featured the now famous 'Sponge' television commercial, plus 'Heart' and 'I Quit'. A three-minute message from Daryl Somers featured on the Quitline. In three months there were approximately 80,000 calls. Post-campaign research included the 1985 household surveys, which was the first of many giving us vital information about smokers' awareness, knowledge and intention to quit.</td>
</tr>
<tr>
<td>1986</td>
<td>After research showing that few smokers knew about emphysema and that stress and weight gain were barriers to quitting, the 'Stairs' and 'Mirrors' adverts were produced. Phasing out of smoking in federal workplaces began.</td>
</tr>
<tr>
<td>1987</td>
<td>Data were released on the number of smoking-related deaths in every local government area across the state. The Victorian Tobacco Act was passed, phasing out cinema and outdoor advertising, outlawing the sale of 'kiddie packs' of 15 cigarettes, increasing penalties on sales to children and directly using tobacco tax revenue in the establishment of VicHealth. The cigarette packet warning was replaced by four rotating warnings.</td>
</tr>
</tbody>
</table>
### Timeline of Australian Anti-Smoking Advertisements and Tobacco Control Policies between 1971 and 2005

<table>
<thead>
<tr>
<th>Year</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>Quit's budget tripled. As the only health agency with any experience with sponsorship, the new VicHealth leant heavily on Quit to take on sponsorships. These included basketball, hockey, netball, football, surfing and tennis. During this year we produced 11 television commercials.</td>
</tr>
<tr>
<td>1989</td>
<td>The Federal Government banned smoking on domestic airlines. Under various provisions of the Tobacco Act 1987, tobacco advertising was also removed from taxis, delivery vehicles and billboards.</td>
</tr>
<tr>
<td>1990</td>
<td>At the beginning of this year, not one cigarette advertisement was to be seen on the outside of milk bars and convenience stores. The Federal Government banned all tobacco advertising in the print media in Australia.</td>
</tr>
<tr>
<td>1991</td>
<td>The Federal Court found that passive smoking causes lung cancer, asthma attacks and respiratory disease in young children. By the end of 1991 only a handful of Victorian sports continued to advertise cigarettes. Prominent Quit signs adorned the scoreboards and ground perimeters at the Melbourne Cricket Ground and at Waverley, Princes and Olympic Parks.</td>
</tr>
<tr>
<td>1992</td>
<td>The Federal Government announced its intention to end all remaining forms of outdoor tobacco advertising and other promotions. The legislation was supported by all the major parties. The ministers for health introduced labelling regulations requiring cigarette manufacturers to clearly spell out the health implications of tar, nicotine and carbon monoxide and explain fully the health risks associated with smoking. The state tobacco license fee was increased to 75% of the wholesale value of tobacco sold. Quit Victoria activated the Quitline 131 848 telephone number.</td>
</tr>
<tr>
<td>1993</td>
<td>Cigarette promotion was phased out progressively under the Tobacco Act of 1987. The transdermal nicotine patch became available for sale in Australia. The Tobacco Act (Amendment) 1993 came into effect, increasing the age for sale of cigarettes in Victoria from 16 to 18 years.</td>
</tr>
<tr>
<td>1994</td>
<td>The ACT introduced the first smoke free public places legislation in Australia.</td>
</tr>
<tr>
<td>1995</td>
<td>New black on white warnings with a description on the back of the pack appeared on tobacco packs.</td>
</tr>
</tbody>
</table>
Table H1 (Continued)

*Timeline of Australian Anti-Smoking Advertisements and Tobacco Control Policies between 1971 and 2005*

<table>
<thead>
<tr>
<th>Year</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>The new Commonwealth Minister for Health and Aged Care convened the Ministerial Tobacco Advisory Group, and asked them to develop a major national campaign aimed at reducing smoking in Australia. Other states and territories agree to use the 131 848 telephone number and the national Quitline began.</td>
</tr>
<tr>
<td>1997</td>
<td>The National Tobacco Campaign launched a series of television commercials, “Every Cigarette is Doing You Damage - Lung, Tumour and Artery”. These ads generated a significant increase in quitting intentions and doubled calls to the Quitline.</td>
</tr>
<tr>
<td>1998</td>
<td>The National Tobacco Campaign produced and launched another two television commercials: Stroke and Call for Help. The Melbourne Cricket Ground went completely smoke free.</td>
</tr>
<tr>
<td>1999</td>
<td>The Commonwealth implemented tax by stick rather than by weight, increasing the price of large packets in particular.</td>
</tr>
<tr>
<td>2000</td>
<td>The National Tobacco Campaign produced and launched the final of the “Every Cigarette is Doing You Damage series of television commercials - Tar, Lung and Eye.</td>
</tr>
<tr>
<td>2001</td>
<td>Quit Victoria and Quit SA produced and launched a new advertising campaign, focusing on parents, for a nationally available media campaign. This followed the successful National Tobacco Campaign and was timed to continue the momentum while providing a new direction. The new campaign shifted focus from 'what every cigarette does to you' to 'the influence your smoking has on others - especially the ones you love'. The Federal Government announced the phase-out of tobacco sponsorship of internationally significant events by 2006. With the Victorian government, we launched a campaign to encourage parents to stop smoking. Smoke free dining was introduced in Victoria and Tasmania. Smoke free shopping centres were introduced in Victoria.</td>
</tr>
<tr>
<td>2002</td>
<td>Smoke free gambling was introduced in Victorian hotels and clubs. Licensed venues with more than one room must provide a smoke free alternative. The Federal Government began a review of health warnings and considered graphic pictorial warnings.</td>
</tr>
</tbody>
</table>
Table H1 (Continued)

Timeline of Australian Anti-Smoking Advertisements and Tobacco Control Policies between 1971 and 2005

<table>
<thead>
<tr>
<th>Year</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>Ten television commercials were produced to refresh and broaden the appeal of the Quitline as a service for smokers.</td>
</tr>
<tr>
<td>2004</td>
<td>The Federal Government announced plans to introduce picture-based warnings on tobacco products. It also ratified the global Framework Convention on Tobacco Control and was developing a new national tobacco strategy effective from mid-2004. The Victorian Government announced plans for all workplaces, including bars, to be smoke free. The Government also announced plans for bans on tobacco industry buzz marketing.</td>
</tr>
<tr>
<td>2005</td>
<td>Victorian Parliament approves laws to ban smoking in workplaces (from 2006) and bars (2007). Quit in Victoria marks its 20th anniversary. Smoking rates in Victoria have approximately halved over the life of the organization. The Bubble wrap / emphysema television and radio campaign is launched. The campaign is picked up by all other states and territories.</td>
</tr>
</tbody>
</table>

*Note.* Table adapted from the Cancer Council Victoria (2014).
Appendix I: Image Rating Booklet Used in Experiment 3A
(Chapter 4)
Introduction to the project
The current exercise is being conducted to satisfy the requirements of the student researcher’s PhD candidature. We are looking for volunteers to participate in an exercise which is linked to a larger study of the “mere exposure effect”. The “mere exposure effect” examines preference ratings for previously encountered stimuli.

Purpose of the exercise and the larger study
The purpose of this exercise is to establish standardised valence (i.e., the degree of attraction or aversion that an individual feels toward an object) and arousal ratings for foreign health warnings found on cigarette packets outside of Australia. This exercise is linked to a larger study which aims to investigate how pre-exposure to these foreign health warnings affects the way in which people make subsequent affective judgments.

What participation will involve
We are looking for male and female volunteers of at least 18 years of age to participate in this exercise. Return of a signed consent form will signal your willingness to participate. The exercise can be completed at any convenient time and location but will require your full concentration. The exercise will take approximately five minutes to complete and involves looking at eleven foreign health warnings found on cigarette packets in Malaysia and Thailand. Please note that the official text linked to each health warning is not written in English. However, underneath each health warning the English version has been provided. Please also note that the images you will see are real life photographs of the effects of smoking (e.g., cancer) and are very confronting. It’s important to be aware that the images you will see may be distressing to some.

For each health warning, your task will be to indicate how unpleasant or pleasant and how calm or exciting each image is according to 9-point rating scales.

Participant rights and interests – Risks & Benefits/Contingencies/Back-up Support
This is a great opportunity to participate in psychological research which will contribute and possibly further advance the mere exposure literature. However, should you wish to participate, there is a chance that you may experience a high degree of discomfort when viewing the health warnings. Should this occur and you would like to discuss these feelings with a counsellor, please contact: Swinburne Psychology Clinic (low-cost counselling) (Ph: 9214 8653) or Lifeline (Ph: 13 11 14).
Participant rights and interests – Free Consent/Withdrawal from Participation
It is important to understand that your participation in this exercise is entirely voluntary. You are free to withdraw consent and participation at any stage during the exercise without question or explanation.

Participant rights and interests – Privacy & Confidentiality
All responses are strictly confidential and material received will only be viewed by the researchers and then stored securely at Swinburne University of Technology. Your responses to this exercise are completely anonymous and confidential. The group data will be published in the student researcher’s PhD thesis and may also be presented at conferences and/or in journal publications.

Please consider the purposes and time commitment of this study before you decide whether or not to participate. This exercise and the larger study conforms to the principles set out in the Swinburne University of Technology Policy on Research Ethics and the NHMRC guidelines as specified in the National Statement on Ethical Conduct in Human Research (2007). This exercise has been approved by or on behalf of Swinburne’s Human Research Ethics Committee (SUHREC).

If you have any questions about the project, or wish to participate please contact:

Nicole Aimers                      Phone: 0413 514 484
Student Researcher          Email: naimers@groupwise.swin.edu.au

If you would prefer to talk to the project supervisor, please contact:

Professor Allan Whitfield      Phone: (03) 9214 6900
Primary Supervisor           Email: awhitfield@groupwise.swin.edu.au

If you have any concerns or complaints about the conduct of this project you can contact:

Research Ethics Officer, Swinburne Research (H68),
Swinburne University of Technology
PO Box 218, HAWTHORN
VIC 3122.
Ph: (03) 9214 5218 or +61 3 9214 5218
Email: resethics@swin.edu.au
PROJECT CONSENT FORM

Project Title: The Mere Exposure Effect: Application to Emotionally-Laden Stimuli

Principal Investigators: Ms Nicole Aimers and Professor Allan Whitfield
Associated Investigators: Dr. Clementine Thurgood

1. I consent to participate in the project named above. I have been provided a copy of the project consent information statement to which this consent form relates and any questions I have asked have been answered to my satisfaction.

2. In relation to this project, please circle your response to the following:
   a. I agree to complete two rating scales asking me about my valence and arousal judgment of health warnings found on cigarette packets  Yes  No
   b. I agree to complete a short questionnaire  Yes  No

3. I acknowledge that:
   (a) my participation is voluntary and that I am free to withdraw from the project at any time without explanation;
   (b) the Swinburne project is for the purpose of research and not for profit;
   (c) any identifiable information about me which is gathered in the course of and as the result of my participating in this project will be (i) collected and retained for the purpose of this project and (ii) accessed and analysed by the researcher(s) for the purpose of conducting this project;
   (d) my anonymity is preserved and I will not be identified in publications or otherwise without my express written consent.

By signing this document I agree to participate in this project.

Name of Participant:  

__________________________________________________________

Signature & Date:  

__________________________________________________________
Questions about you

1. What is your gender?  Male □  Female □

2. What is your age? _________________ years

3. What is your place of birth?  Australia □  New Zealand □  UK □  Asia □  Europe □  Other □

4. Is English your first language?  Yes □  No □

4 (a). If no, please specify what your first language is____________________

5. What is the highest educational level you have achieved?
Primary □  Some secondary □  Secondary completed □
Trade qualification □  Tertiary level □  Postgraduate □

6 (a). If your highest education level achieved was ‘tertiary level’ or ‘postgraduate’, please indicate your study discipline

________________________________________
7. Do you have normal or corrected to normal vision? Yes ☐ No ☐

8. Are you colour blind? Yes ☐ No ☐ Unsure ☐
Image Rating Instructions
Please rate the attached 11 images for pleasantness and arousal.

The rating scale for pleasantness looks like this:

To what extent do you find the image to be unpleasant or pleasant?

1 2 3 4 5 6 7 8 9
Extremely Unpleasant Neutral/ Unsure Extremely Pleasant

If you feel completely unhappy, annoyed, dissatisfied, despondent, or dejected when viewing the image, please circle number 1 (extremely unpleasant). If you feel completely happy, pleased, satisfied, content or hopeful when viewing the image, please circle number 9 (extremely pleasant).

The rating scale for arousal looks like this:

To what extent do you find the image to be arousing?

1 2 3 4 5 6 7 8 9
I Feel Extremely Calm Neutral/ Unsure I Feel Extremely Excited

If you feel completely relaxed, calm, sluggish, dull, sleepy or unaroused when viewing the image, please circle number 1 (I feel extremely calm). If you feel completely stimulated, excited, frenzied, jittery, wide-awake or aroused when viewing the image, please circle number 9 (I feel extremely excited).
To what extent do you find the image to be unpleasant or pleasant?

1  2  3  4  5  6  7  8  9
Extremely Unpleasant  Neutral/Unsure  Extremely Pleasant

To what extent do you find the image to be arousing?

1  2  3  4  5  6  7  8  9
I Feel Extremely Calm  Neutral/Unsure  I Feel Extremely Excited

Cigarette Causes Lung Cancer
Smoking Causes your Breath to Smell

To what extent do you find the image to be unpleasant or pleasant?

1  2  3  4  5  6  7  8  9
Extremely Unpleasant  Neutral/ Unsure  Extremely Pleasant

To what extent do you find the image to be arousing?

1  2  3  4  5  6  7  8  9
I Feel Extremely Calm  Neutral/ Unsure  I Feel Extremely Excited
Smoking Causes Stroke

To what extent do you find the image to be unpleasant or pleasant?

1 2 3 4 5 6 7 8 9
Extremely Unpleasant Neutral/ Unsure Extremely Pleasant

To what extent do you find the image to be arousing?

1 2 3 4 5 6 7 8 9
I Feel Extremely Calm Neutral/ Unsure I Feel Extremely Excited
Smoking Causes Fatal Emphysema

To what extent do you find the image to be unpleasant or pleasant?

1 2 3 4 5 6 7 8 9

Extremely Unpleasant Neutral/Unsure Extremely Pleasant

To what extent do you find the image to be arousing?

1 2 3 4 5 6 7 8 9

I Feel Extremely Calm Neutral/Unsure I Feel Extremely Excited
To what extent do you find the image to be arousing?

1 2 3 4 5 6 7 8 9
I Feel Extremely Calm     Neutral/ Unsure     I Feel Extremely Excited

To what extent do you find the image to be unpleasant or pleasant?

1 2 3 4 5 6 7 8 9
Extremely Unpleasant     Neutral/ Unsure     Extremely Pleasant

Cigarette Causes Mouth Cancer
To what extent do you find the image to be arousing?

1 2 3 4 5 6 7 8 9
I Feel Extremely Calm
Neutral/Unsure
I Feel Extremely Excited

To what extent do you find the image to be unpleasant or pleasant?

1 2 3 4 5 6 7 8 9
Extremely Unpleasant
Neutral/Unsure
Extremely Pleasant
Cigarette Causes Gangrene

To what extent do you find the image to be unpleasant or pleasant?

1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9
---|---|---|---|---|---|---|---|---
Extremely Unpleasant | Neutral/Unsure | Extremely Pleasant

To what extent do you find the image to be arousing?

1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9
---|---|---|---|---|---|---|---|---
I Feel Extremely Calm | Neutral/Unsure | I Feel Extremely Excited
Cigarette Smoke Causes 10 Types of Cancer

To what extent do you find the image to be arousing?

1 2 3 4 5 6 7 8 9
I Feel Extremely Calm Neutral/Unsure I Feel Extremely Excited

To what extent do you find the image to be unpleasant or pleasant?

1 2 3 4 5 6 7 8 9
Extremely Unpleasant Neutral/Unsure Extremely Pleasant
Cigarette Causes Miscarriage

To what extent do you find the image to be arousing?

To what extent do you find the image to be unpleasant or pleasant?
Smoking Causes Oral Cancer

To what extent do you find the image to be arousing?

I Feel Extremely Calm | Neutral/Unsure | I Feel Extremely Excited

To what extent do you find the image to be unpleasant or pleasant?

Extremely Unpleasant | Neutral/Unsure | Extremely Pleasant
To what extent do you find the image to be unpleasant or pleasant?

[Scale from 1 to 9: Extremely Unpleasant to Extremely Pleasant]

To what extent do you find the image to be arousing?

[Scale from 1 to 9: I Feel Extremely Calm to I Feel Extremely Excited]

Cigarette Causes Neck Cancer
Appendix J: All Pairwise Comparisons Conducted in Experiment 3B (Chapter 4)
Table J1

**Pairwise Differences in Liking Ratings for Health Warning Images between Each Frequency Level for Both Low and High SS Groups**

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Pairwise Differences in Liking Ratings for Health Warning Images between Each Frequency Level for Both Low and High SS Groups

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Note. SE = standard error; CI = confidence interval; LB = lower bound; UB = upper bound

^ Adjustment for multiple comparisons: Bonferroni

*p <.05
Table J2
Pairwise Differences in Valence Ratings for Health Warning Images between Each Frequency Level for Both Low and High SS Groups

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Pairwise Differences in Valence Ratings for Positive High Arousal IAPS Images
between Each Frequency Level for Both Low and High SS Groups

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Table J2 (Continued)

Pairwise Differences in Valence Ratings for Positive High Arousal IAPS Images
between Each Frequency Level for Both Low and High SS Groups

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Pairwise Differences in Valence Ratings for Positive High Arousal IAPS Images between Each Frequency Level for Both Low and High SS Groups

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Note. SE = standard error; CI = confidence interval; LB = lower bound; UB = upper bound

^ Adjustment for multiple comparisons: Bonferroni
*p < .05
Table J3

Pairwise Differences in Arousal Ratings for Health Warning Images between Each Frequency Level for Both Low and High SS Groups

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Pairwise Differences in Arousal Ratings for Health Warning Images between Each Frequency Level for Both Low and High SS Groups

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**Pairwise Differences in Arousal Ratings for Health Warning Images between Each Frequency Level for Both Low and High SS Groups**

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<td>-3.84</td>
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<td>.011</td>
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<td>0.21</td>
<td>.981</td>
<td>.981</td>
<td>-1.10</td>
</tr>
</tbody>
</table>

*Note. SE = standard error; CI = confidence interval; LB = lower bound; UB = upper bound

^ Adjustment for multiple comparisons: Bonferroni

*p < .05