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Effects of ancient and modern, avoidant and approach stimuli on visual search task reaction times

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Effects of Ancient and Modern, Avoidant and Approach Stimuli on Visual Search Task Reaction Times

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USE OF THESIS

Effects of Ancient and Modern, Avoidant and Approach Stimuli on Visual Search Task Reaction Times

Sanja Bojic

A Report Submitted in Partial Fulfilment of the Requirements for the Award of
Bachelor of Arts (Psychology) Honours, Faculty of Computing, Health and Science,
Edith Cowan University

Submitted (May, 2009)

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Abstract

Effects of Ancient and Modern, Avoidant and Approach Stimuli on Visual Search Task Reaction Times

The threat superiority effect refers to faster and more accurate detection of fearful stimuli. This has been explained as evidence for evolution, as ancient fearful stimuli are detected more quickly than modern fearful stimuli. The aim of this study was to investigate which of two alternate evolutionary explanations best explains the findings. Whereas Ohman and Mineka (2001) dealt only with avoidant responses, Lang suggested that stimuli may evoke either an avoidant (fearful) or approach response, associated with negative or positive valence, respectively. The experiment employed a same-different task where Age (ancient, modern), and Valence (approach, avoidant, neutral) were manipulated and presented to 37 (19 females and 18 males) participants. Participants were presented with slides of 9 images, and asked to determine whether all images come from the same category (for example they are all flowers) or a different category (there is a snake among the flowers) as quickly and as accurately as possible. Ancient approach (horses) and avoidant (snakes) stimuli were detected faster than the neutral stimuli (mushrooms), but both modern approach (pizzas) and modern neutral (clocks) stimuli were detected faster than avoidant (guns) stimuli. These findings are most consistent with the evolutionary explanation of Lang (1995). It is suggested that the disparate results in the literature may be due to confounds associated with stimulus similarity.

Keywords: Approach, avoidance, valence, threat, attention

Author: Sanja Bojic

Supervisor: Dr Ken Robinson

Submitted: October, 2009

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Examining the Interaction of Emotion and Attention Through an Evolutionary Psychological Perspective: Review of the Literature

(Literature Review)

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Edith Cowan University

Examining the Interaction of Emotion and Attention Through an Evolutionary Psychological Perspective: Review of the Literature

Abstract

The aim of this paper was to review the literature on the threat superiority effect and to compare and contrast two competing evolutionary psychological explanations. One group of researchers have focused on how fearful images capture our attention (Ohman, 2007; Ohman & Mineka, 2001; 2003); while another theory has focused on the effects that motivation has on attention, where motivation is defined in terms of appetitive and aversive stimuli (Lang, 1995). It was concluded that at the present time, Lang offers a better overall explanation of the results. This was because Ohman could not account for some of the recent findings that fearful and non fearful animals, as well as fruits were detected faster than plants and that there was no difference in detection times of modern and ancient fearful stimuli. Lang's explanation could account for these results, as fruits and non-fearful animals can be considered appetitive stimuli. Therefore, detecting appetitive and aversive stimuli faster than neutral ones is consistent with Lang's explanation. However, as the recent studies have certain confounds such as failing to control for valence and stimulus perceptual similarity across conditions, it was concluded that further research is needed, before rejecting Ohman's explanation. It was recommended that future studies should compare appetitive, aversive and neutral stimuli in a modern and ancient condition, whilst at the same time, controlling for valence and stimuli perceptual similarity across conditions.

Keywords: Approach, avoidance, threat, valence, fear module

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Submitted: May, 2009

Examining the Interaction of Emotion and Attention through an Evolutionary Psychological Perspective: Review of the Literature

There is growing interest in the relationship between emotion and attention. Experimental research in this area has been approached mainly from two evolutionary psychology perspectives. One group of researchers have focused on how fearful images capture our attention (Ohman & Mineka, 2001); while another group of researchers have focused on the effects that motivation has on attention, where motivation is defined in terms of approach and avoidance stimuli (Bradley & Lang, 2000; Hamm, Schupp & Weike, 2003; Lang, 1995; Lang, Bradley & Cuthbert, 1990; Lang, Bradley & Cuthbert, 1997). Although both theories stem from Darwin's (1876) evolutionary theory, the two competing evolutionary psychological explanations have developed independently, so different theories have been conceptualised to explain the effect emotion has on attention.

Darwin's (1876) theory of evolution proposed that all species slowly evolved from a common ancestor through a process called 'natural selection'. Natural selection was a way organisms best adapted to their environment ensured their survival by passing on their genes to the next generation. Darwin's theory of evolutionary selection holds that variation within species occurs randomly and that the survival or extinction of each organism is determined by that organism's ability to adapt to its environment.

Darwin's (1876) evolutionary theory was adopted to explain the phenomenon of fearful stimuli capturing our attention faster than non-fearful stimuli, and this broad result has become known as the threat superiority effect (Esteves, Dimberg & Ohman, 1994; Fox, Lester, Russo, Bowles, Pichler, & Dutton). The threat superiority effect was explained through Darwin's theory, because detecting threats in the environment faster would have ensured the organism's survival. Ohman and Mineka (2001; 2003) developed the model known as the evolved fear system (hereafter referred to as the 'fear module') that assists us in detecting fearful stimuli. It consists of four main features which include the selectivity of input, automatic activation, encapsulation and a dedicated neural apparatus. This means that the fear module is automatically activated by evolutionarily fearful stimuli, without the need for conscious awareness. Ohman and Mineka explain the threat superiority effect as being mediated by a survival trait that is passed from one generation to the next. Throughout evolution, threat could occur in the environment unpredictably and detecting threat quickly would have been a survival advantage.

There is an alternative evolutionary explanation based on affective states and motivated attention. Lang and colleagues (Bradley & Lang, 2000; Hamm et al., 2003; Lang, 1995; Lang et al., 1990; Lang et al., 1997) proposed that there are evolutionary associations between the appetitive and aversive systems and the emotional system. The dimensions of arousal and valence are the most important features for the activation of the appetitive and aversive systems that respond to primary reinforcers (Lang, 1995; Lang et al., 1990; Lang et al., 1997). The appetitive system is promoted by pleasant states through approach responses, while withdrawal responses are promoted by the unpleasant states driven by the aversive system. Arousal is defined as the level of activation within either system (Lang et al., 1990; Lang et al., 1992; Lang et al., 1997). Therefore, as both positive and negative valences are arousing and influence attention, it is argued that both aversive and appetitive stimuli are detected faster than neutral ones. While this view is consistent with Darwin's evolutionary theory, it differs from that of Ohman and Mineka (2001). Lang and colleagues predict that both aversive and appetitive stimuli would be detected faster than neutral ones, whereas Ohman and Mineka predict faster detection of fearful evolutionarily significant stimuli than neutral ones.

The aim of this paper is to review the literature in the area of emotion and attention, or more specifically the threat superiority effect. The review examines how the two competing interpretations of Darwin's (1959) evolutionary theory explain the threat superiority effect and recent findings in the literature on emotion. The two competing evolutionary psychological theories are Ohman and Mineka's (2001; 2003) fear module (including the updated version by Ohman, 2007), and Lang's (1995) theory of appetitive and aversive motivation.

This review includes consideration of some of the studies that reported the threat superiority effect with face stimuli. The focus of the paper then shifts to studies that have found that the threat superiority effect does not only apply to faces, but to other evolutionary significant stimuli. Next, the paper discusses some recent studies that have challenged the fear module, followed by a discussion of the potential confounding effects that stimulus perceptual similarity has on reaction times in visual search tasks. Finally, the paper outlines some of the gaps in the literature and provides recommendations on how this area of research may be improved.

Early Research

A critical study in this area was the Hansen and Hansen (1988) study, where the participants completed a same- different visual search task consisting of neutral, happy and angry faces. The visual search task required the participants to view the pictures and indicate whether they were all from the same (target-absent) or different (target-present) categories. This involved, for example, viewing a slide of nine images and determining whether they were from the same category of all happy faces, or from a different category, where there is one angry face among the happy faces. Hansen and Hansen found that an angry face was detected faster among a background of happy or neutral faces, than a happy or neutral face among a background of angry or neutral faces. Although this study was confounded by dark shading of the angry faces, which contributed to faster detection, their results sparked an interest in the area (Purcell, Stewart, & Skov, 1996). Once the stimulus confound was controlled, angry faces were still found to be detected faster than happy or neutral faces in a number of studies (Cohen, Eckhardt, & Schagat, 1998; Eastwood, Smilek & Merikle, 2001; Esteves, 1999; Fox, Lester, Russo, Bowles, Pichler & Dutton, 2000; Gilboa- Schechtman, Foa & Amir, 1999; Hadwin, Donnelly, French, Richards, Watts & Daley, 2003; Ohman, Lundqvist & Esteves, 2001). The faster detection of angry faces was interpreted as an anger superiority effect. Both Ohman and Mineka's (2001; 2003) and Lang's (1995) theoretical explanations are consistent with these results, as the first predicts that fearful stimuli are detected faster than neutral ones, while the second predicts that aversive stimuli are detected faster than neutral ones.

Threat Superiority Effect Does Not Only Apply to Faces

It was later observed that the threat superiority effect does not apply only to angry faces, but also to other evolutionarily significant threats. Ohman, Flykt, and Esteves (2001) presented participants with pictures from fearful (snakes and spiders) and non- fearful (flowers and mushrooms) categories. Snake and spider targets were presented among a flower and mushroom backgrounds and vice versa. A same or different task was used, where either fearful or non- fearful targets were presented together with pictures of fearful or non - fearful backgrounds. The difference between reaction times of fearful and non- fearful targets yielded a strong effect size ($\eta^2 = .94$). Participants were faster making 'different' decisions to fearful than to non-fearful targets.

Ohman et al. (2001) found that participants with a snake or spider phobia were able to make significantly faster 'different' decisions with the feared stimulus. Interestingly, they found that phobic participants were faster at finding the non-feared stimulus compared with control participants (hence, a snake phobic would make faster different decisions to snake targets in a flower background, but they would also make faster different decisions to spider targets in a flower background). They explained this seemingly inconsistent result by indicating that fear generalises in phobic individuals.

The results of Ohman et al. (2001) are consistent with the Hansen and Hansen (1988) study even though different stimuli were used, and have been explained by Ohman and Mineka (2001) as showing a preferential detection of fearful stimuli, which is expected given their evolutionary explanation. Fearful or avoidant stimuli capture our attention faster than neutral ones, but the evolutionary explanation also insists that faster detection of threat has significance for survival. These results are also consistent with Lang's (1995) explanation, as faster detection of fearful stimuli may be considered as faster detection of aversive stimuli.

All Animals are Detected Faster than Plants

The difference between the two theories emerged with new findings in the literature that challenged the evolutionary explanation of the threat superiority effect. Both theories predict that threatening animals are detected faster than neutral or non-fearful ones, however some studies have found that this is not the case. Tipples, Young, Quinlan, Broks and Ellis (2002) found that fearful animals (snakes, bears and snarling dogs) were detected faster among flowers and mushrooms than vice versa. They also found, however, that non-fearful animals (horses, cats and rabbits) were detected faster among flowers and mushrooms than vice versa. In their third experiment, they investigated whether faster detection of targets was due to the target image or the background, by keeping the background consistent (stones, grass, and bricks) while participants searched for plant, fearful and non- fearful animal targets. This was a target detection task and participants were told to search for a certain target among the background stimuli. In half of the trials the target was absent and in the other half, it was present. There was no significant difference in reaction time between fearful targets compared with non-fearful targets. Moreover, the effect of set size was larger in magnitude for plant targets ($\eta^2 = .84$), than for non - fearful ($\eta^2 = .68$) and fearful animals ($\eta^2 = .68$). These results could indicate a stimulus confound, where images of plants were less similar to their backgrounds compared with images used in the two animal conditions, and so was easier to detect.

In their fifth experiment, Tipples et al. (2002) considered fearful and non-fearful animals as one category which was compared with flowers (tulip, rose, and daffodil) and fruit (apple, peach, and orange) images, while the background stimuli remained non- living objects. Fearful and non- fearful animals, as well as fruit, were detected more quickly than flowers. Tipples et al. considered their results inconsistent with expectations of the fear module, as fearful animals were detected as quickly as non-fearful animals. Even though Ohman (2007) updated the fear module and explained that the fear generalises across all animals, it could not explain why fruit images were detected as quickly as fearful and non-fearful animals. The overall findings were interpreted as challenging the evolutionary threat explanation, as they were inconsistent with the expectation that fearful animals would be detected faster than non -fearful ones. These results were consistent with Lang (1995), as fruit were detected as fast as fearful and non- fearful animals. This is because fruit and some non-fearful animals are also appetitive, and according to Lang, appetitive and aversive stimuli are detected faster than neutral ones.

The reliability of these findings was demonstrated after replication by other studies. Lipp, Derakshan, Waters and Logies (2004) studied the reaction times associated with the detection of fearful stimuli (spiders and snakes)and non- fearful stimuli (cats and horses) in a background of either flowers or mushrooms. There were no significant differences in the reaction times associated with detecting fearful compared to non-fearful targets. Hence, fearful stimuli were not detected faster than non-fearful animal stimuli. In a follow-up experiment, Lipp et al. studied the reaction times for detection of non-fearful stimuli (cats and horses) with fearful stimuli (big cats and wolves), in a background of either flowers or mushrooms. There was no difference in reaction time found between fearful and non-fearful targets. The results of Lipp et al. are inconsistent with the original fear module (Ohman & Mineka, 2001; 2003), but they are consistent with the updated version of the fear module that argues that all animals are detected faster than neutral stimuli (Ohman, 2007). The findings are also consistent with Lang (1995).

Further support of this argument has been found by Lipp (2006), where participants completed three visual search tasks where they had to decide whether pictures were from the same category or a different category. Pictures of fearful (snake and spiders), predator (big cats and wolves) and non-fearful stimuli (horses and cats) were embedded among a flower or mushroom background. On target- absent trials, participants were quicker to respond to animal pictures regardless of their fear relevance compared with the flower or mushroom conditions. The results were significant and the effect size was moderate for target ($\eta^2 = .66$), trial type ($\eta^2 = .33$), background ($\eta^2 = .12$) and trial type and background interaction ($\eta^2 = .75$). Stronger effects of the target were observed in the predator task ($\eta^2 = .45$) when compared to the non-fearful animal tasks ($\eta^2 = .30$).These results indicated that animals, snakes and spiders were detected faster regardless of the fear relevance.

The findings that all animals and even fruit are detected faster than plants (Lipp, 2006; Lipp et al., 2004; Tipples et al., 2002), are not consistent with the fear module predictions (Ohman, 2007; Ohman & Mineka, 2001), as it was expected that fearful animals, snakes and spiders would be detected faster due to a survival advantage. The findings are consistent with the view that appetitive and aversive images are detected faster than neutral ones, as they are either a source of food or threat (Lang, 1995). Fruit is a ready source of food, as so it is appropriate from an evolutionary perspective for fruit images to be detected quickly. Hence, the explanation of Lang is also consistent with the Darwin's evolutionary theory (1876) as detecting all animals, snakes, spiders and fruit faster than plants would have served as a survival advantage.

Ohman (2007) has accommodated these seemingly conflicting results by extending the evolved fear module to include all animals, which are either a threat or a source of food to human respondents. Note that the fruit result is still incompatible with the fear module it cannot be categorised as an animal and it is not threatening, but it still has a superior detection. The faster detection of fruit is, however, compatible with Lang's (1995) aversive and appetitive motivational systems. The only difficulty with this explanation is that mushrooms can also serve as a source of food, although it might be argued that they are in the class of fungi, of which some are inedible, and even poisonous. Hence, it is possible that humans have not adapted to fungi stimuli from an evolutionary perspective.

Ancient Threat is not Detected Faster than Modern Threat

A perhaps stronger challenge to the fear module explanation (Ohman, 2007; Ohman & Mineka, 2001; 2003) was represented by studies investigating whether ancient fearful stimuli were detected faster than modern ones (Brosch & Sharma, 2005). The participants completed a visual search task where they had to decide whether all images were from the same or a different category. The ancient fearful stimuli were snakes and spiders, the non-fearful stimuli being flowers and mushrooms, while the modern fearful stimuli were guns and syringes, the non-fearful stimuli being cups and mobile phones. The results indicated that snakes and spiders were detected faster than flowers and mushrooms, which represents a replication of Ohman et al. (2001). Unexpectedly, given the fear module prediction, guns and syringes were detected faster than cups and mobile phones. Irrespective of epoch (ancient versus modern), longer reaction times were observed for fearful stimuli. Indeed, Brosch and Sharma reported that modern fearful stimuli were responded to more quickly than ancient fearful stimuli. The effect size for threat was large ($\eta_p^2 = .72$) and weak for age ($\eta_p^2 = .42$), while the interaction between age and threat was moderate ($\eta_p^2 = .55$). Overall, the strongest main effects were for threat ($\eta_p^2 = .91$) and lowest for age ($\eta_p^2 = .28$). These findings indicated that threat had stronger effects on reaction times than age or evolutionary significance of stimuli. They explained the results in terms of fearful images holding attention and suggested that modern stimuli were more threatening than their ancient counterparts. The results are inconsistent with the fear module (Ohman, 2007; Ohman & Mineka, 2001; 2003), as it predicted faster detection of only the ancient fearful stimuli, as those stimuli were evolutionarily significant. The modern stimuli were not evolutionarily significant as they were more recent, which provides less time for evolution to occur. The fact that the same results were replicated in the modern condition indicated that reaction times were not influenced by the age of the stimuli, as much as they were by their valence. It should be noted that although these results are inconsistent with the fear module (Ohman, 2007; Ohman & Mineka, 2001; 2003), the results were consistent with Lang (1995), as they indicated that there was a faster detection of aversive stimuli than neutral ones.

Similar findings to those of Brosch and Sharma (2005) were observed in Blanchette's (2006) study. She asked participants to complete a visual search task for ancient fearful (snakes and spiders), non-fearful (flowers and mushrooms), modern fearful (guns and knives) and non-fearful (clocks and toasters) stimuli. Blanchette replicated the results of Brosch and Sharma, in that she reported that fearful stimuli were detected faster than non-fearful stimuli. In fearful conditions, the reaction times were less affected by the size of the background and location of the target stimuli, than the non-fearful stimuli. The fearful targets were detected faster than non-fearful ones in the modern condition as well and it could be interpreted that threat superiority does not only apply to evolutionary images but also to those of the modern era. This finding questions the evolutionary explanation, as detection of modern fearful stimuli could not be influenced by natural selection.

In Experiment 2 (Blanchette, 2006), it was examined whether the fear extends to symbolic stimuli. Identical stimuli were used as in Experiment 1, except that they were cartoon drawings and toys instead of photographs. Again, fearful targets were detected faster than non-fearful targets for both ancient and modern threats. This suggested that the threat superiority effect is present regardless of whether the objects are modern or ancient, realistic or cartoons.

In Experiment 3 (Blanchette, 2006), more perceptually similar stimuli were used and animals were always presented with animals rather than plants. The new stimuli for the ancient fearful condition were lions and rats, and non-fearful stimuli were goldfish and rabbits, while in the modern fearful condition syringes and hand grenades and non-fearful balls and pens were used. Again there was faster detection of fearful than non-fearful images, in both modern and ancient conditions. Even when the fearful were similar to the non-fearful targets for example, pens and syringes, the participants were still quicker to find the fearful target. There was no difference in detecting modern and ancient fearful stimuli and when differences were found, they favoured modern and not the ancient (evolutionary) stimuli. The author concluded that learning leads to faster detection of modern fearful stimuli. It is still possible that this experiment was confounded. Ancient conditions consisted of lions and rats, but the non-fearful backgrounds were goldfish and rabbits. It may be more difficult to discriminate between these categories because one is aversive, the other appetitive. On the other hand, syringes and hand grenades are aversive, whereas it could be argued that balls and pens are neutral.

Another study that examined the specificity of the threat superiority effect and further supported previous findings, was conducted by Fox, Griggs, and Mouchlianitis (2007). In their Experiment 1, snakes, guns, flowers and mushrooms were used. The study found that there was a threat superiority effect, but also found that there was no difference between reaction times of modern and ancient fearful stimuli. These results were consistent with Blanchette's (2006) and Brosch and Sharma's (2005) findings. The combined weight of all three studies suggest that fear relevance is more important than the evolutionary origins of stimuli. However, as previous studies have used the same pictures as targets and backgrounds, it is possible that faster detection of fearful targets was really faster rejection of background images. In Experiment 2, different images were used as targets and different as backgrounds. The fearful (snakes and guns) and non-fearful (mushroom and toasters) targets were presented among backgrounds of flowers and electric kettles. It was found that fearful images were detected faster in both modern and ancient conditions and it was now known that this was due to detecting fearful targets faster rather than faster rejection of neutral backgrounds.

These results confirm previous findings that evolutionarily significant (ancient) stimuli are not detected more efficiently than modern stimuli, thereby challenging the evolutionary explanation of the threat superiority effect, in terms of the fear module (Ohman, 2007; Ohman & Mineka, 2001; 2003). The results still indicated that fearful stimuli were detected faster than the non-fearful stimuli, but this effect was observed for the modern condition as well, which is inconsistent with predictions derived from the fear module. The results are consistent with Lang's (1995) explanations, as it predicted faster detection of aversive stimuli in the ancient and modern condition compared to the neutral stimuli.

It is, however, important to note that when comparing the reaction times of detecting fearful and non-fearful targets, even though participants were faster for fearful targets in both conditions, the effect size was much stronger for evolutionarily significant conditions ($\eta_p^2 = .76$), compared to the modern conditions ($\eta_p^2 = .40$) (Fox, et al., 2007). In addition, the reaction times overall were faster for modern than ancient condition, with moderate effect size ($\eta_p^2 = .58$). These results indicate that there may have been a confound that contributed to these results, such as perceptually less complex stimuli used in the modern condition, which contributed to overall faster detection of modern stimuli, including fearful ones. From the examples of stimuli used in Blanchette's (2006) study, it can be observed that in the modern fearful condition, where images of pens and syringes were used, the pens were all oriented in the same direction, whilst the target (syringe) was oriented in the opposite direction and thus, may have stood out. This could have contributed to faster detection of modern fearful stimuli. This potential confound needs to be examined before rejecting the fear module explanation.

Which Theory Provides a More Complete Explanation?

The aim of this literature review was to distinguish which explanation best accounts for the results in this area of research. Starting from the first studies that found that threatening faces are detected faster than neutral ones (Cohen, Eckhardt, & Schagat, 1998; Eastwood, Smilek & Merikle, 2001; Esteves, 1999; Fox, Lester, Russo, Bowles, Pichler & Dutton, 2000; Gilboa-Schechtman, Foa & Amir, 1999; Hadwin, Donnelly, French, Richards, Watts & Daley, 2003; Hansen and Hansen, 1988; Ohman, Lundqvist & Esteves, 2001), both theories apply. The fear module explanation suggests that fearful stimuli would be detected faster (Ohman, 2007; Ohman & Mineka, 2001; 2003), while Lang's (1995) explanation also applies as avoidant stimuli were detected faster than neutral ones.

Then, examining the research that has found that snakes and spiders were detected faster than flowers and mushrooms (Ohman et al., 2001); once more, detecting threat faster was consistent with both Ohman's (2007) and with Lang's (1995) explanations. The differences between the two explanations emerged with findings that fearful and non - fearful animal stimuli were detected faster than neutral stimuli (Lipp, 2006; Lipp et al., 2004; Tipples et al, 2002). These findings were inconsistent with the fear module and have led Ohman (2007) to extend the fear module to include all animals. However, even so, the fear module cannot explain why fruit was also detected faster than mushrooms and flowers (Tipples et al., 2002). Lang's theory, on the other hand, can account for these results, as fruit and non-fearful animals can be interpreted as appetitive stimuli. Therefore faster detection of aversive and appetitive stimuli than neutral ones is consistent with this explanation.

The fear module was further challenged by the recent studies that have found that there is no difference between modern and ancient threatening stimuli (Blanchette, 2006; Brosch & Sharma, 2005; Fox et al., 2007). According to Ohman and Mineka (2001; 2003) faster detection of fearful stimuli when compared to the neutral stimuli was only expected in the ancient condition, as it consisted of evolutionarily significant stimuli such as snakes and spiders. Lang's (1995) explanation can account for these results as faster detection of aversive stimuli is expected regardless of their evolutionary significance. Hence, it appears that Lang's theory provides a more complete explanation of the findings in this area of research. However, it needs to be considered that Lang's explanation has not been challenged to the same extent, as studies have not compared aversive and appetitive stimuli in the modern and ancient conditions. Furthermore, the recent studies challenging the Ohman and Mineka's explanation have certain confounds, and further research is needed to clarify the results obtained.

Recommendation for Future Studies

After reviewing the recent literature on how emotion affects attention, it becomes apparent that studies such as Blanchette, (2006), Brosch and Sharma, (2005) and Fox et al., (2007), have not ensured that stimuli were as homogeneous and differed equally from the other conditions. This will need to be ensured in the future studies, to eliminate the possibility of the stimulus perceptual complexity, influencing the results obtained. It would be a significant contribution to this area of research to investigate whether reaction times would change if, for example, Blanchette's (2006) study was replicated but with stimulus perceptual confounds controlled for. The findings would help determine whether the data obtained were reliable, or whether the perceptual complexity of images selected had strong effects on reaction times and confounded the results obtained.

As it was evident that the fear module has been challenged by some of the recent results, it is necessary to focus on how Lang's (1995) evolutionary explanation accounts for the recent results. It can be argued that studies that have examined the differences between fearful and non-fearful stimuli reaction times, have at the same time compared aversive and neutral stimuli. For example, in Ohman et al. (2001), the fearful stimuli were snakes and spider, and according to International Affective Picture System (IAPS), they are also considered aversive stimuli (Lang et al., 1997; Lang, Bradley & Cuthbert, 2008). However, since it was not the aim of the authors to test Lang's explanation, it was not ensured that images were equally valenced or rated equally on approach, avoidance and neutrality in the modern and ancient conditions. Therefore, this is another possible confound in the recent studies that needs to be overcome in order to allow interpretation of the results.

Future studies should employ a visual search task, where negatively, positively and neutrally valenced images are compared with each other, in ancient and modern conditions. As the modern studies have not focused on valence it is necessary to control it across conditions in the future, to learn how it affects the reaction times in different conditions. In addition as certain combinations of stimuli are perceptually easier to detect, it is necessary that future studies carefully select images that are perceptually and in terms of valence similar in different conditions. Therefore, future research needs to directly compare both positively (appetitive) and negatively (aversive) valenced stimuli that vary in terms of evolutionary significance (ancient and modern).

Conclusion

The aim of this paper was to compare and contrast two competing evolutionary explanations, to find which provides a more complete justification of the recent findings of the threat superiority effect. One explanation was Ohman and Mineka's (2001; 2003) fear module, which predicted that evolutionarily significant fearful stimuli would be detected faster than non-fearful stimuli. The other was Lang's (1995) appetitive and aversive motivational explanation, which predicted that both appetitive and aversive stimuli would be detected faster than neutral ones in both the ancient and modern conditions, as this would have ensured survival advantage (Bradley & Lang, 2000; Hamm et al., 2003; Lang, 1995; Lang et al., 1990; 1997; 2008).

The research in this area began with studies finding that images of fearful faces were detected faster than neutral images and this finding has since been replicated with other evolutionarily significant fearful stimuli (Hansen & Hansen, 1988; Ohman et al., 2001). Initial studies have found that evolutionarily significant threats, such as snakes and spiders, were detected faster in visual search task than neutral stimuli such as flowers and mushrooms (Ohman et al., 2001). These findings have been accounted for by the evolved fear module (Ohman & Mineka, 2001), as well as Lang (1995).

However, the evolutionary explanation of the threat superiority effect has been challenged, as research inconsistent with the evolved fear module has emerged (Lipp, 2006; Lipp et al., 2004; Tipples et al., 2002). Tipples and his colleagues replicated the Ohman et al., (2001) study, but also extended it by comparing the reaction times of detecting non-fearful animals such as horses and rabbits with plants. This study found that all animals, whether fearful or non-fearful, were detected faster than plants. This finding has been replicated by a number of other studies including Lipp (2006) and Lipp et al., (2004) studies. The findings may be better explained by Lang's (1995) explanation, as appetitive and aversive stimuli were detected faster than neutral ones.

The inconsistent results of Lipp (2006), Lipp et al. (2004) and Tipples et al. (2002) led Ohman (2007) to update the evolved fear module to preference all animals, as they were either a threat or a source of food. However, the updated fear module still cannot account for the faster detection of fruit (Tipples et al. 2002). Lang (1995) on the other hand, could explain these findings, as fruit are appetitive stimuli.

More recently, the evolutionary explanation of the threat superiority effect has been further challenged by the findings of studies that compared the reaction times of ancient and modern fearful stimuli (Blanchette, 2006; Brosch & Sharma, 2005; Fox, et al., 2007). According to the evolutionary theory, threats that were common to all mammals should have evolved into faster detection times than modern threats. In other words, ancestral threats such as snakes and spiders should be detected faster than modern threats such as guns and syringes. The studies conducted by Brosch and Sharma (2005), Fox et al. (2007) and by Blanchette (2006) found that modern fearful were detected as efficiently as the ancient fearful, and that modern fearful stimuli were sometimes detected faster than ancient fearful stimuli. These results are inconsistent with the fear module, and it would seem that further modification to the theory might be required to explain these latter results. The findings were consistent with Lang's (1995) explanation, as detection of aversive stimuli over neutral ones is expected regardless of the evolutionary significance.

However before making any final conclusions about the fear module, it is necessary to ensure the reliability of the recent studies. Although modern stimuli were detected faster than ancient stimuli, there was a smaller effect size for the modern conditions when compared to the ancient conditions (Blanchette, 2006; Brosch & Sharma, 2005; Fox et al., 2007). Furthermore, certain issues with stimuli used were observed in Blanchette's study, such that modern fearful target stimuli were oriented in a way that made them stand out from the neutral background. Therefore, it is necessary to examine this area further and eliminate any possible confounds before modifying or rejecting the evolutionary explanation. In addition, Lang's explanation has not been challenged to the same extent as studies have only focused on the fearful or aversive stimuli, rather than the approach stimuli and this could be investigated in future studies.

The present review has argued that there were potential confounds in recent studies and recommended how future research could be improved. It was argued that a combined approach was necessary to examine how fear and valence interact to influence our attention, in the modern and ancient conditions. Future studies should employ a visual search task, where aversive, approach and neutral images are compared with each other, in evolutionary and modern conditions. In addition, perceptual similarity should be controlled. It is necessary to control for possible confounds before making any conclusions about the evolutionary explanation. Attending to those potential confounds will hopefully lead to exciting new discoveries about the interaction of emotion and attention whilst providing clarity to the discrepancies and questions raised in this comparison of existing studies in this area.

References

Blanchette, I. (2006). Snakes, spiders, guns, and syringes: How specific are evolutionary constraints on the detection of threatening stimuli? *The Quarterly Journal of Experimental Psychology, 59*, 1484-1504.

Bradley, M. M., & Lang, P. J. (2000). Measuring emotion: Behavior, feeling, and physiology. In R. D. Lane & L. Nadel (Eds.), *Cognitive neuroscience of emotion*. New York: Oxford University Press.

Brosch, T., & Sharma, D. (2005). The role of fear-relevant stimuli in visual search: A comparison of phylogenetic and ontogenetic stimuli. *Emotion, 5,* 360-364.

Cohen, D., Eckhardt, C., & Schagat, K. (1998). Attention allocation and habituation to anger- related stimuli during a visual search task. *Aggressive Behavior, 24*, 399 – 409.

Darwin, C. (1876). *The origin of species by means of natural selection, or the preservation of favoured races in the struggle for life*. London: John Murray. 6th ed, with additions and corrections. Retrieved on May 23, 2009, from http://darwin-online.org.uk/pdf/1876_Origin_F401.pdf

Duncan, J., & Humphreys, G. W. (1989). Visual search and stimulus similarity. *Psychological Review, 96*, 433– 458.

Esteves, F. (1999). Attentional bias to emotional facial expressions. *European Review of Applied Psychology, 49*, 91-97.

Esteves, F., Dimberg, U., & Ohman, A. (1994). Automatically elicited fear: Conditioned skin conductance responses to masked facial expressions. *Cognition & Emotion, 8*, 393–413.

Eastwood, J., Smilek, D., & Merikle, P. (2001). Differential attentional guidance by unattended faces expressing positive and negative emotion. *Perception and Psychophysics, 63*, 1004 – 1013.

Fox, E., Griggs, L., & Mouchlianitis, E. (2007). The detection of fear relevant stimuli: Are guns noticed as quickly as snakes? *Emotion, 7*, 691- 696.

Fox, E., Lester, V., Russo, R., Bowles, R., Pichler, A., & Dutton, K. (2000). Facial expressions of emotions: Are angry faces detected more efficiently? *Cognition & Emotion, 14,* 61- 92.

Gilboa-Schectman, E., Foa, E. B., & Amir, N. (1999). Attentional biases for facial expression in social phobia. *Cognition and Emotion, 13*, 305-318.

Hadwin, J. A., Donnelly, N., French, C. C., Richards, A., Watts, A., & Daley, D. (2003). The influence of children's self-report trait anxiety and depression on visual search for emotional faces. *Journal of Child Psychology & Psychiatry & Allied Disciplines, 44*, 432 – 444.

Hamm, A. O., Schupp, H., T., & Weike, A., I. (2003). Motivational organization of emotions: Autonomic changes, cortical responses, and reflex modulation. In R. J. Davidson, K. R. Scherer & H. H. Goldsmith (Eds.), *Handbook of affective science* (pp. 187-212). Oxford: Oxford University Press.

Hansen, C. H., & Hansen, R. D. (1988). Finding the face in the crowd: An anger superiority effect. *Journal of Personality and Social Psychology, 54*, 917–924.

Lang, P. J. (1995). The emotion probe: Studies of motivation and attention. *American Psychologist, 50,* 372–385.

Lang, P. J., Bradley, M. M., & Cuthbert, B., N. (1990). Emotion, attention, and the startle reflex. *Psychological Review, 97*, 377-395.

Lang, P. J., Bradley, M.M., & Cuthbert, B. N. (1997). International affective picture system: Technical manual and affective rating. NIMH Centre for the Study of Emotion and Attention.

Lang, P. J., Bradley, M.M., & Cuthbert, B. N. (2008). *International affective picture system (IAPS): Affective ratings of pictures and instruction manual.* Technical Report A-8. University of Florida, Gainesville, FL.

Lipp, O. V. (2006). Of snakes and flowers: Does preferential detection of pictures of fear-relevant animals in visual search reflect on fear-relevance? *Emotion 6*, 296 –308.

Lipp, O. V., Derakshan, N., Waters, A. M., & Logies, S. (2004). Snakes and cats in the flowerbed: Fast detection is not specific to pictures of fear-relevant animals. *Emotion, 4*, 233–250.

Martin, D. W. (2004). *Doing psychology experiments* (6th Ed). Wadsworth: Canada

Ohman, A., (2007). Has evolution primed humans to 'beware of the beast'? *Proceedings of the National Academy of Sciences of the Unites States of America (PNAS), 104*, 16396- 16397.

Ohman, A., Flykt, A., & Esteves, F. (2001). Emotion drives attention: Detecting the snake in the grass. *Journal of Experimental Psychology: General, 130*, 466-478.

Ohman, A., Lundqvist, D., & Esteves, F. (2001). The face in the crowd revisited: A threat advantage with schematic stimuli. *Journal of Personality and Social Psychology, 80*, 381-396.

Ohman, A., & Mineka, S. (2001). Fears, phobias, and preparedness: Toward an evolved module of fear and fear learning. *Psychological Review, 108*, 483- 522.

Ohman, A., & Mineka, S. (2003). The malicious serpent: Snakes as a prototypical stimulus for an evolved module of fear. *Current Directions in Psychological Science, 12*, 5-9.

Purcell, D. G., Stewart, A. L., & Skov, R. B. (1996). It takes a confounded face to pop out of a crowd. *Perception, 25*, 1091–1108.

Tipples, J., Young, A. W., Quinlan, P., & Ellis, A.W. (2002). Searching for threat. *Quarterly Journal of Experimental Psychology, 55A*, 1007-1026.

Appendix A

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Effects of Ancient and Modern, Avoidant and Approach Stimuli on Visual Search Task Reaction Times

(Research Report)

Sanja Bojic

Edith Cowan University

Abstract

Effects of Ancient and Modern, Avoidant and Approach Stimuli on Visual Search Task Reaction Times

The threat superiority effect refers to faster and more accurate detection of fearful stimuli. This has been explained as evidence for evolution, as ancient fearful stimuli are detected more quickly than modern fearful stimuli. The aim of this study was to investigate which of two alternate evolutionary explanations best explains the findings. Whereas Ohman and Mineka (2001) dealt only with avoidant responses, Lang suggested that stimuli may evoke either an avoidant (fearful) or approach response, associated with negative or positive valence, respectively. The experiment employed a same-different task where Age (ancient, modern), and Valence (approach, avoidant, neutral) were manipulated and presented to 37 (19 females and 18 males) participants. Participants were presented with slides of 9 images, and asked to determine whether all images come from the same category (for example they are all flowers) or a different category (there is a snake among the flowers) as quickly and as accurately as possible. Ancient approach (horses) and avoidant (snakes) stimuli were detected faster than the neutral stimuli (mushrooms), but both modern approach (pizzas) and modern neutral (clocks) stimuli were detected faster than avoidant (guns) stimuli. These findings are most consistent with the evolutionary explanation of Lang (1995). It is suggested that the disparate results in the literature may be due to confounds associated with stimulus similarity.

Keywords: Approach, avoidance, valence, threat, attention

Author: Sanja Bojic

Supervisor: Dr Ken Robinson

Submitted: October, 2009

Effects of Ancient and Modern, Avoidant and Approach Stimuli on Visual Search Task Reaction Times

There is growing interest in the relationship between emotion and attention. Experimental research in this area has been approached mainly from two evolutionary psychology perspectives, both based on Darwin's (1876) theory. Darwin's theory of evolution proposed that all species slowly evolved from a common ancestor through a process called 'natural selection'. Natural selection was a way an individual best adapted to their environment ensured their survival by passing on their genes to the next generation. One group of researchers have focused on how threatening images capture our attention and explained their observations in terms of an evolved fear module (Ohman & Mineka, 2001; 2003); while another group of researchers have focused on the effects that motivation has on attention, where motivation is defined in terms of approach and avoidance stimuli (Bradley & Lang, 2000; Hamm, Schupp, & Weike, 2003; Lang, 1995; Lang, Bradley & Cuthbert, 1990; Lang, Bradley & Cuthbert, 1997; 2008).

Fearful stimuli capture our attention faster than non-fearful stimuli, and this broad result has become known as the threat superiority effect (Esteves, Dimberg & Ohman, 1994; Fox, Lester, Russo, Bowles, Pichler, & Dutton, 2000). One of the critical studies in this area was conducted by Ohman, Flykt, and Esteves (2001), who presented participants with pictures from fearful (snakes and spiders) and non- fearful (flowers and mushrooms) categories. Nine images are presented in a 3 x 3 matrix, with a single snake or spider target being presented among eight flower or mushroom images and vice versa. Participants were asked whether all images came from the same category (for example they are all flowers) or a different category (there is a snake among the flowers) as quickly and as accurately as possible. The study found that participants were faster making 'different' decisions to fearful than non-fearful targets. The difference between reaction times of fearful and non- fearful targets was not only significant, but there was also a large effect size ($\eta^2 = .94$).

The results of Ohman et al. (2001) have been explained by Ohman and Mineka (2001) as showing a preferential detection of fearful stimuli, which is expected given their evolutionary explanation. Ohman and Mineka (2001; 2003) developed the model known as the evolved fear system (hereafter referred to as the 'fear module') that assists us in detecting fearful stimuli. It consists of four main features, which include the selectivity of input, automatic activation, encapsulation and a dedicated neural apparatus. This means that the fear module is automatically activated by evolutionarily fearful stimuli, without the need for conscious awareness. Ohman and Mineka explain the threat superiority effect as being mediated by a survival trait that is passed from one generation to the next. Throughout evolution, threat could occur in the environment unpredictably and detecting threat quickly would have been a survival advantage. Hence, fearful or avoidant stimuli capture our attention faster than neutral ones, but the evolutionary explanation predicts that faster detection of threat has survival significance. Hence, individuals within our species have evolved to enable faster detection of ancient avoidant stimuli.

There is an alternative evolutionary explanation based on affective states and motivated attention. It would appear that this explanation has never before been applied to explaining the threat superiority effect. Lang and colleagues (Bradley & Lang, 2000; Hamm et al., 2003; Lang, 1995; Lang et al., 1990; Lang et al., 1997) proposed that there are evolutionary associations between the approach and avoidant responses associated with emotion. The dimensions of arousal and valence are the most important features (Lang, 1995; Lang et al., 1990; Lang et al., 1997). As both positive and negative valences are arousing and influence attention, it is argued that both avoidance and approach stimuli are detected faster than neutral ones. While this view is consistent with

Darwin's evolutionary theory, it differs from that of Ohman and Mineka (2001). Lang and colleagues predict that both avoidant and approach stimuli would be detected faster than neutral ones, whereas Ohman and Mineka predict faster detection of fearful evolutionarily significant stimuli than neutral ones.

The difference between the two theories emerged with new findings that challenged the Ohman and Mineka's (2001; 2003) evolved fear module, but were consistent with Lang's (1995) explanation. Studies have compared the reaction times of fearful and non-fearful animal and neutral stimuli and have found that, indeed, fearful animals (such as snakes, bears and snarling dogs) were detected faster among flowers and mushrooms than vice versa. They found, however, that non-fearful animals (such as horses, cats and rabbits) were also detected faster in plant backgrounds than vice versa (Lipp, 2006; Lipp, Derakshan, Waters & Logies, 2004; Tipples, Young, Quinlan, Broks & Ellis, 2002). In their fifth experiment, Tipples et al. (2002) considered fearful and non-fearful animals as one category and compared responses with those of flowers (tulip, rose, and daffodil) and fruit (apple, peach, and orange) images, while the background stimuli were non- living objects. Fearful and non- fearful animals, as well as fruit, were detected more quickly than flowers.

These findings, that all animals and even fruit were detected faster than plants (Lipp, 2006; Lipp et al., 2004; Tipples et al., 2002), are not consistent with the fear module predictions (Ohman & Mineka, 2001), as it was expected that fearful animals, snakes and spiders would be detected faster due to a survival advantage. The findings are consistent with the view that approach and avoidant images are detected faster than neutral ones, as they are either a source of food or threat (Lang, 1995). For example, Tipples et al. (2002) found that both snakes (avoidant) and rabbits (approach) are detected faster than plants (neutrally valenced). The explanation of Lang is also consistent with the otherwise difficult to explain finding that fruit is detected as quickly as avoidant stimuli. Fruit is a ready source of food, as so it is appropriate from an evolutionarily perspective for images to be detected quickly.

Ohman (2007) has accommodated these seemingly conflicting results, by extending the evolved fear module to include all animals, which are either a threat or a source of food to human respondents. Note that the fruit result (Tipples et al., 2002) is still incompatible with the fear module, but is compatible with Lang's (1995) avoidant and approach explanation. The only difficulty is that mushrooms can also serve as a source of food, although it might be argued that they are in the class of fungus, of which some are inedible, and even poisonous. Hence, it is possible that humans have not adapted to fungi stimuli from an evolutionarily perspective.

A perhaps even stronger challenge to the fear module explanation (Ohman, 2007; Ohman & Mineka, 2001; 2003) is represented by studies investigating whether ancient fearful stimuli were detected faster than modern ones (Blanchette, 2006; Brosch & Sharma, 2005; Fox, Griggs & Mouchlianitis, 2007). Blanchette's (2006) study required that participants complete a visual search task for ancient fearful (snakes and spiders), non-fearful (flowers and mushrooms), modern fearful (guns and knives) and non-fearful (clocks and toasters) stimuli. It was found that fearful stimuli were detected faster than non-fearful stimuli. The fearful targets were detected faster than non-fearful ones in the modern condition as well and it can be interpreted that threat superiority does not only apply to evolutionary images, but also to those of the modern era. The finding that modern avoidant stimuli are detected as fast as the ancient ones, and when differences were observed they favoured the modern stimuli, has been replicated by other studies (Lipp, 2006; Lipp et al., 2007). This then questions the evolutionarily psychological explanation, as detection of modern fearful stimuli could not be influenced by natural selection. These results confirm previous findings that evolutionarily significant (ancient) stimuli are not detected more efficiently than modern stimuli, thereby challenging the fear module explanation of the threat superiority effect (Ohman, 2007; Ohman & Mineka, 2001). The results still indicated that fearful stimuli were detected faster than the non-fearful stimuli, but this effect was observed for the modern condition as well, which is inconsistent with predictions derived from the fear module.

One explanation for the inconsistent results of the recent studies is that the results obtained were due to differences in perceptual complexity of stimuli used in ancient and modern conditions. The results have indicated that participants were overall faster in detecting modern stimuli not just for the fearful but also for the non-fearful or neutral stimuli. Duncan and Humphreys' (1989) theory of search and visual attention suggests that the most important determinants of the speed to detect different stimuli lie in stimuli, target, background and background- target similarity in visual search task studies. The detection of the target image is faster if there is high similarity within the stimulus set, but low similarity across the stimulus set. Also, target images drawn from a homogeneous stimulus set are found faster than target images from the heterogeneous stimulus set. Similarly, homogeneous backgrounds are searched faster than heterogeneous backgrounds. This means that when stimuli from the same category, for example flowers, are all similar visually (e.g., roses and gardenias), they will be detected faster than if those stimuli include a wide variety of different flowers that do not look similar to each other (e.g., roses and kangaroo paw). Furthermore, target images that significantly differ from the background images are detected faster than target images that are very similar to the background. This seems logical, as when differences are large it is much easier to notice them than when stimuli are similar perceptually and have to be analysed in more detail to spot the differences, which increases reaction times. This appears to be one of the issues in the recent studies, as they have not ensured equal homogeneity between stimuli in modern and ancient conditions.

Overall, it appears that Lang's (1995) explanation can account better for the results obtained than the revised or original version of the fear module theory (Ohman, 2007; Ohman & Mineka, 2001; 2003). However it needs to be noted that Lang's explanation has never been tested in this research literature, as studies have never compared approach and avoidant stimuli in the modern and ancient conditions. Moreover, recent studies that have challenged Ohman's (2007) explanation may have certain confounds such as failing to control stimulus perceptual similarity and not ensuring the images were equally rated as neutral or avoidant in the modern and ancient conditions.

The present study used a visual search task study where avoidant, approach and neutral images were compared with each other, in ancient and modern conditions. Moreover, the study employed carefully selected images that are similar perceptually and in terms of valence, as it cannot be ruled out that faster detection of modern avoidant stimuli can be attributed to perceptual confounds.

The first hypothesis, based on the predictions of the fear module (Ohman, 2007) and Lang (1995), was that the reaction times associated with ancient approach and avoidant stimuli would be significantly faster and more accurate than those of ancient neutral. The second hypothesis was that modern avoidant and approach reaction times would be significantly faster and more accurate than the neutral ones. The third hypothesis was that ancient approach and avoidant stimuli would be detected faster than modern approach and avoidant stimuli.

Method

Research design

The study employed a within-subjects design with two independent variables, each varied on either two or three levels. Stimuli were manipulated on valence (approach, avoidance and neutral) and on age (ancient and modern). The dependent variables were reaction time, and number of errors made.

Participants

The participants were 40 students (20 males and 20 females) from Edith Cowan University, aged between 18 and 55 years. The results were analysed on the data obtained from 37 (18 male and 19 female) participants. Three participants were excluded from the analysis, as they obtained above 7% of incorrect responses, which was set as the criterion. The participation was voluntary and no monetary reward was offered. Ethics approval was obtained from the Edith Cowan University Research Ethics Committee. All participants reported they had normal or corrected-to-normal vision.

Materials and Stimuli

The materials used in this study were: a personal computer, SuperLab4.0 software, Microsoft PowerPoint 2007 software, a participant information sheet (Appendix A) and a written consent form (Appendix B).

Each visual stimulus contained nine images tiled on a 3x3 matrix on a single slide. Each image was selected from the International Affective Picture System (IAPS; Lang, Bradley & Cuthbert, 1997; 2008) augmented by photograph images obtained from the Internet. Each stimulus slide was constructed using Microsoft PowerPoint and saved as a separate picture file using jpg format. Each slide was then uploaded to SuperLab and organised into appropriate conditions. It was ensured that images selected from the Internet were similar to the examples for the IAPS manual, to avoid altering their valence ratings.

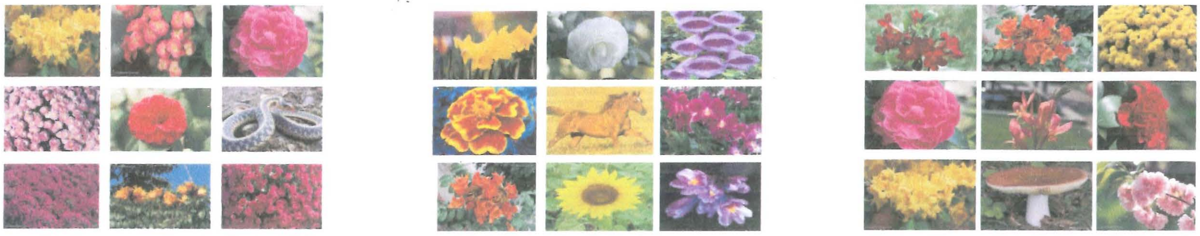
There were two age conditions (ancient and modern) and each had 3 levels of valence (approach, avoidance, or neutral). Target images in the ancient avoidance condition were images of snakes, while the modern avoidance condition, targets were images of guns. Target images in the ancient approach condition were images of horses, while those in the modern approach stimuli were images of pizzas. Finally, target images in the ancient neutral condition were images of mushrooms, while in the modern condition they were images of clocks. The neutral background in the ancient conditions was made up of flower images, while in the modern condition; the neutral background was made up of stapler images. The arrangement of stimuli is reported in Table 1.

Table 1. *Arrangement of Stimuli*

Ancient			Modern		
Valence:			Valence:		
Avoidant:	Approach:	Neutral:	Avoidant:	Approach:	Neutral:
snake	horse	mushroom	gun	pizza	clock
Background:			Background:		
flowers			staplers		

Each of the images used were rated equally on valence (avoidance and approach) and differed equally from the neutral images, according to mean ratings associated with the IAPS manual (Lang, Bradley & Cuthbert, 1997; 2008). The neutral images in ancient and modern conditions were rated between 5 and 6 on valence for example clocks were rated as 5.50 on valence, while mushrooms were rated as 5.12. In the approach

Figure 1. Examples of matrices in the ancient condition.



Target present avoidant Target present approach Target present neutral

Target absent avoidant Target absent approach Target absent neutral

Figure 2. Examples of matrices in the modern condition.

Target present avoidant Target present approach Target present neutral

Target absent avoidant Target absent approach Target absent neutral condition, horses were rated as 7.64 and similarly pizzas were rated as 7.10 on valence. In the avoidance condition, snakes were rated as 3.90 and guns as 3.19. Perceptual similarity of the image stimuli was partially controlled for by ensuring that there was no dark shading of target images.

Each part of the task contained 18 target- present and 18 target - absent slides, resulting in the total of 216 slides and since there was a repetition of the task, a grand total of 432 slides. All images were in colour and a total of 30 different pictures were used for each category. The practice task consisted of 43 slides, which together with the actual task added to a total of 500 slides. The practice task was designed in the same way as the test task and consisted of pictures of keys, cats, strawberries, syringes and spiders. A Latin square was utilized to control for order effects, which can occur in repeated measures designs (Martin, 2004). Examples of the ancient stimuli used are presented in Figure 1, while the examples of stimuli used in the modern condition are presented in Figure 2.

Procedure

Participants were presented with the information sheet and asked to sign the consent form. Before the experiment began, it was explained that all information was going to be kept confidential, that the participation was voluntary and should they feel uncomfortable at any time, they could terminate the experiment without any penalty or repercussion.

Participants completed a practice visual search task and were provided a chance to ask any further questions. Next, they were presented with the SuperLab presentations of the visual search task. The participants were asked to look at the pictures and answer a simple question as quickly as possible, as their reaction times (RTs) were recorded.

The instructions participants read on the screen stated: 'You will be presented with slides of 9 images. Your task is to determine whether all images come from the same category (for example they are all flowers) or a different category (there is a snake among the flowers) as quickly and as accurately as possible. Hold your finders on the 'z' and '/' keys on the keyboard. When all images are from the same category, press the 'z' key and when there is one image from a different category press the '/' key. When you are ready to begin, press the space bar. Thank you for participating in this study.' It took approximately 20 minutes to complete the task and the SuperLab recorded the participants' RTs and all accurate and inaccurate responses for each of the conditions.

Results

The data were analysed using Statistical Package for the Social Sciences (SPSS) for Windows, Version 17. The main analysis performed was a 2 (Age: Ancient, Modern) by 3 (Valence: Avoidant, Approach, Neutral), within-subject Analysis of Variance (ANOVA) for the reaction time data. Some of the data from the SPSS output is presented in Appendix D. The experimental software cumulated reaction time to respond to each slide, and so provided a total RT for each separate condition. As a result, it was not possible to derive RTs for accurate responses. To partially control for the influence of inaccurate RTs, the percentages of incorrect responses was calculated and any participants who reported a greater percentage than 7% of mistakes were excluded from the analysis. This resulted in exclusion of 3 participant's data who produced 12%, 15% and 20% inaccurate responses.

The assumption of normality was violated for the Modern Neutral condition, so the data was transformed using Arithmetic Ln technique. The transformed data were normally distributed as estimated by Shapiro- Wilk's test for all conditions. The assumption of homogeneity of variance was not violated, as the ratio of dividing the largest variance by the smallest variance was less than 3.

Mauchly's test indicated that the assumption of sphericity had been violated for Age $\chi^2(0) = 1.0$, $p<.05$,therefore degrees of freedom were corrected using Huynh-Feldt estimates of sphericity (Age $\varepsilon = 1.00$). Mauchly's test indicated that the assumption of sphericity had not been violated for Valance $\chi^2(2) = 1.00, p > .05$ and interaction between Age x Valence$\chi^2(2) = .96, p > .05$, therefore sphericity was assumed.

The differences between the means and main effects are summarised in Figure 3 and Table 2, respectively. The Estimated Marginal Means (transformed means) indicated that overall the reaction times were faster in the Ancient ($M = 4.43$ lnsec, $SD = .04$) than the Modern ($M = 4.48$ lnsec, $SD = .04$) condition, and this difference was significant, $F(1, 36) = 9.47, p < .01, \eta_p^2 = .21$.

The significant main effects of Valence $F(2, 35) = 37.84, p < .01, \eta_p^2 = .68$ were broken down and overall, Approach stimuli ($M = 4.37$ lnsec, $SD = .03$) were detected significantly faster than Neutral ($M = 4.48$ lnsec, $SD = .04$) or Avoidant stimuli ($M = 4.53$ lnsec, $SD = .04$). In addition, Neutral stimuli were also detected significantly faster than Avoidant stimuli. This would indicate that RTs for Avoidant stimuli were significantly slower than those in the Approach and Neutral stimuli, however this effect is a reflection of the slow RTs in the Modern Avoidant condition.

The main effect of Valence significantly influenced the RTs, $F(2, 72) = 37.55, p < .01, \eta_p^2 = .51$.The interaction between Age x Valence was also significant $F(2, 72) = 172.83, p < .01, \eta_p^2 = .83$.

As the interaction between Age and Valence was significant, and the SPSS is not equipped to perform post hoc tests on the repeated measures ANOVA, the Tukey's HSD pair wise comparison was conducted by hand. The critical value of the Studentized Range Statistic (q) for 6 ordered means and 72 df (MS error) at alpha .05, was found to be 4.16 (Howell, 2007, pp. 679). The critical Tukey's HSD value was calculated to be .06. It should be noted that the transformed data was used to calculate the Tukey's HSD as the original data was negatively skewed. The detailed working out is demonstrated in Appendix C and the differences between the means are presented in Table 3.

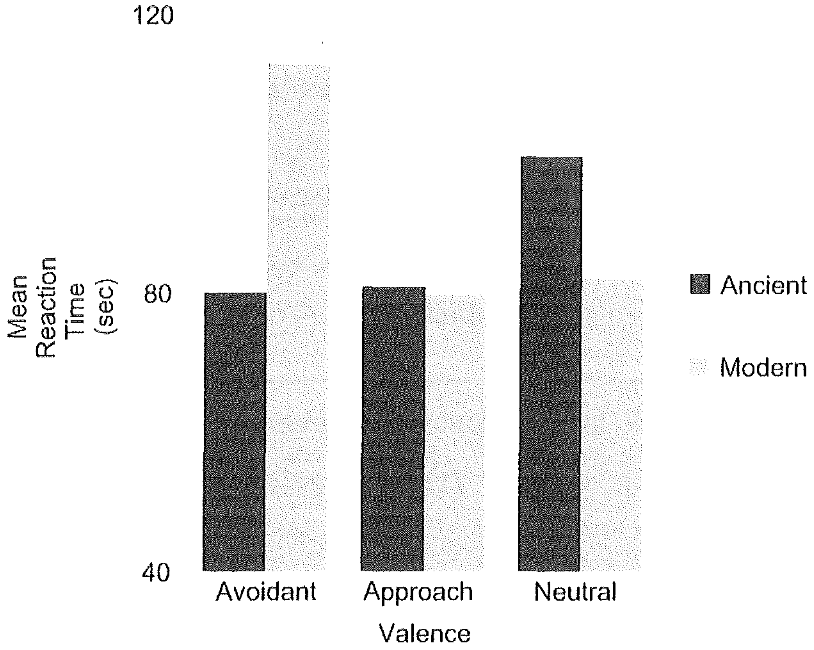


Figure 3. Differences between the mean reaction times observed for each condition as a function of age.

Table 2.

A Summary of the Repeated Measures ANOVA Within Subjects Table

Source	df	F-value	p-value	Partial η^2
Age	1, 36.12	9.47	< .01	.21*
Valence	2, 72	37.55	< .01	.51*
Age * Valence	2,72	172.83	< .01	.83

* Note. When modern avoidant condition was controlled for, the effect size for Age (η_p^2= .50) was stronger than the effect size for Valence (η_p^2 =. 47).

The Tukey's HSD pair wise comparison indicated there were significant differences in the RTs between: Ancient Avoidant and Ancient Neutral; Ancient

Approach and Ancient Neutral; Ancient Avoidant and Modern Avoidant; Modern Avoidant and Ancient Approach; Modern Avoidant and Ancient Neutral; Modern Approach and Ancient Neutral; Modern Approach and Modern Avoidant; Modern Neutral and Ancient Neutral and Modern Neutral and Modern Avoidant conditions. No other comparisons were significant.

Table 3.
Tukey'sHSD- The Differences Between the Means

	Condition Means					
	Ancient			Modern		
	Avoidant	Approach	Neutral	Avoidant	Approach	Neutral
Condition Means	(4.36)	(4.37)	(4.57)	(4.69)	(4.36)	(4.38)
Ancient Avoidant (4.36)	-	.01	.21*	.33*	.00	.02
Ancient Approach (4.37)	-	-	.20*	.32*	.01	.01
Ancient Neutral (4.57)	-	-	-	.15*	.21*	.19*
Modern Avoidant (4.69)	-	-	-	-	.33*	.31*
Modern Approach (4.36)	-	-	-	-	-	.02
Modern Neutral (4.38)	-	-	-	-	-	-

* Note.The differences are significant at alpha .05 and Tukey'sHSD critical of .06.

The significant differences in the RTs can be summarised in the following way: Ancient Avoidant were detected significantly faster than Ancient Neutral stimuli. Ancient Approach was also detected significantly faster than Ancient Neutral stimuli. There was no significant difference between Ancient Avoidant and Approach stimuli. Modern Approach stimuli were significantly faster than Modern Avoidant stimuli. Modern Neutral were also significantly faster than Avoidant stimuli. There was no significant difference between Modern Approach and Neutral stimuli. The Ancient Avoidant were detected significantly faster than Modern Avoidant stimuli. Modern

Neutral were detected significantly faster than Ancient Neutral stimuli. There was no significant difference between Ancient Approach and Modern Approach stimuli RTs.

As the Modern Avoidant condition had slower RTs when compared to all other conditions, it was suspected that this condition was causing the larger valence effect size than the age effect size. To investigate, a 2 (Age: Modern, Ancient) by 2 (Valence: Approach, Neutral) Repeated Measures ANOVA was conducted. As suspected there was now a stronger effect size of Age (η_p^2= .50) than Valence (η_p^2=. 47), when the Modern Avoidant condition was not included in the analysis.

Errors

The number of errors were added up for each person (n = 37) over each of the six conditions. The total percentages of inaccurate responses are shown in Table 4. The data were significantly different from normality for all five conditions as estimated by Shapiro- Wilk's test. In addition, the assumption of homogeneity of variance was violated in the data (dividing the largest variance by the smallest resulted in a ratio higher than 3). As most of the ANOVA assumptions were violated, a Friedman's non-parametric test was conducted.

The results indicated that there was a significant difference in the number of mistakes made in different conditions, $\chi^2(5) = 71.67, p<.01$. Post hoc analyses were performed by conducting the Wilcoxon signed-rank test. Nine comparisons were conducted so the alpha level was adjusted to .005. There were more mistakes made in the Ancient Neutral than Ancient Avoidant, z = -3.15, p< .005, r = -.30. More mistakes were made in Ancient Neutral than Ancient Approach, z = -3.50, p< .005, r = -.33. There were no differences in mistakes, between Ancient Approach and Avoidant stimuli, z = -.82, p> .005. More mistakes were made in Modern Avoidant than Modern Neutral, z = -4. 53, p< .005, r = -.43.There was no significant difference between number of inaccurate responses in Modern Neutral and Approach conditions. More mistakes were made in Modern Avoidant than Approach, $z = -5.01$, $p < .005$, $r = -.48$ andin Modern Avoidant than Ancient Avoidant condition, $z = -4.99$, $p < .005$, $r = -.33$. There was no significant difference in the number of mistakes made in Modern Approach and Ancient Approach $z = -35$, $p > .005$, or between Modern Neutral and Ancient Neutral conditions.

Table 4.

Total Percentages of Incorrect Responses for Each Condition

Ancient Avoidant	Ancient Approach	Ancient Neutral
2.33% (62)*	1.99% (53)*	4.23% (114)*
Modern Avoidant	Modern Approach	Modern Neutral
7.84% (209)*	2.21% (59)*	2.96% (79)*

*Note. The actual number of trials are shown in parentheses. The total number of trials for 37 participants was 2664.

Discussion

The Ancient Condition

The results supported the first hypothesis as ancient avoidant and approach stimuli were detected faster and more accurately than the ancient neutral stimuli. Participants detected evolutionarily significant stimuli faster and more accurately than neutral ones. These findings were consistent with Ohman et al. (2001) and with Ohman and Mineka's (2001; 2003) fear module. The results are also consistent with Lang's (1995) explanation as ancient avoidant (snake) stimuli were detected significantly faster and more accurately than the neutral (mushrooms) stimuli.

In addition, the results indicated that ancient approach stimuli were also detected significantly faster than the ancient neutral stimuli. This is consistent with Tipples et al.

(2002) findings that all animals are detected faster than plants, and also consistent with the weak version of Ohman's (2007) evolved fear module that holds that there is an evolutionarily advantage to all animals being detected faster. The findings are inconsistent with the strong version of the fear module (Ohman & Mineka, 2001; 2003), as approach conditions were not considered. These findings are also consistent with Lang's (1995) explanation as ancient approach (horse) stimuli were detected faster and more accurately than neutral (mushroom) stimuli.

There was no significant difference in reaction time or in error rate between the ancient avoidance and approach stimuli. The findings are consistent with Ohman (2007) as faster and more accurate detection of fearful and non-fearful animals, when compared to the neutral stimuli, was in agreement with the predictions of the fear module. Faster and more accurate detection of both approach and avoidant stimuli than neutral stimuli are consistent with Lang's (1995) explanation that both avoidant and approach stimuli are detected faster and more accurately than neutral ones, as evolved detection of these stimuli would have served as a survival advantage as they were either a threat or a source of food.

The Modern Condition

The second hypothesis that modern avoidant and approach stimuli would be detected faster than neutral stimuli, was only partially supported by the data. The avoidant stimuli produced the longest reaction times; they were detected significantly more slowly than other stimuli. That is, the modern approach and neutral stimuli were both detected significantly faster than modern avoidant stimuli. This result is inconsistent with recent studies that found that modern avoidant stimuli are detected just as fast as ancient avoidant stimuli and also faster than neutral stimuli (Blanchette, 2006; Brosch & Sharma, 2005; Fox et al., 2007).

Turning to the error data for modern stimuli, the results demonstrated that significantly more errors were made in the modern avoidant condition than the modern neutral or modern approach conditions. There was no significant difference in the number of errors in the modern neutral and approach conditions. These results show faster and more accurate detection of modern approach and neutral stimuli, when compared with the modern avoidant stimuli. Hence, detection of modern avoidant stimuli was significantly slower and less accurate when compared to the other modern conditions. Moreover, detection of modern avoidant stimuli was not only slower but also less accurate than detection of ancient avoidant stimuli. There was no difference in error rates between modern approach and ancient approach conditions, or between modern neutral and ancient neutral conditions.

These results may be interpreted in two ways. It can be argued that even though stimuli on the modern and ancient conditions were rated equally in terms of valence, that individual participants perceived the modern avoidant stimuli as much more negatively valenced or more threatening which contributed to the interference with the task. Previous studies have found that high negatively valenced images hold participants attention longer than neutral ones, which results in longer RTs for the avoidant condition (Schimmack, 2005; Verbruggen & De Houwer, 2007). Studies have found that in the Stroop task, it takes significantly longer to colour-name negatively valenced words, when compared to neutral or positive words (Martin, Williams & Clark, 1991; Pratto& John, 1991). Pratto and John (1991) had their participants complete a version of the Stroop task with images, where approach, avoidant or neutral image was covered in a colour and participants had to ignore the picture and name the colour on top of it. They found that avoidant (negatively valenced) images produced the most interference when compared to the neutral images. Therefore it is possible that individual participants perceived guns as highly negatively valenced and this resulted in interference with the current task. To test for this explanation, it would be necessary to ask participants after the experiment to rate the relative valence of all pictures used in the experiment.

Another explanation is that participants perceived the modern avoidant stimuli as less threatening or less negatively valenced than other stimuli. Therefore there was no threat negativity bias, or any superior detection of the modern avoidant stimuli. Also it is worthy of note that there was no difference between modern approach and neutral stimuli. The neutral stimulus was a clock, which was neutrally valenced according to IAPS (Lang, Bradley & Cuthbert, 1997; 2008). It could, for example, be speculated that as the participants were students, the clock pictures could have been perceived as avoidant stimuli, as they may have reminded them of time running out and having assignments due. The approach target stimulus was a pizza, it cannot be ruled out that the participants perceived a clock as an avoidant and a pizza an approach stimuli, in which case the results in the modern condition have replicated the results in the ancient condition, as there was a faster detection of stimuli that were perceived as avoidant. This possibility cannot be ruled out as studies examining valence in words, have found large individual differences in participants' perceptions of different stimuli due to personal experiences (Ito & Cacioppo, 2005). For some people one stimulus can be neutral, while for another person it may be perceived as highly negatively or even positively valenced. This conclusion, of course cannot be made without further investigation, as it is not known how the students perceived the stimuli used. To test this or the previous explanation described in the earlier paragraph, it would be necessary to check for individual valence ratings of the stimuli.

Which Explanation Provides a Better Account of the Results?

The results of the ancient condition are consistent with both Lang's (1995) and Ohman's (2007) explanations, while the results of the modern condition are ambiguous.

It can be argued that Ohman's explanation is supported as modern avoidant and approach stimuli are not evolutionarily significant and were not expected to be detected faster than modern neutral. The threat and approach superiority effect is only expected to have evolved to stimuli that were evolutionarily significant or present for a longer period throughout the evolution. Furthermore, it was found responses associated with ancient avoidant stimuli were faster and more accurate than those of modern avoidant stimuli. Since the modern avoidant stimuli such as guns, are more recent threats than snakes, the enhanced detection of the snake stimuli when compared to the guns, is consistent with Ohman's (2007) evolutionary explanation.

However, it can also be argued that the results in the modern condition support the Lang's (1995) explanation. The modern approach stimuli were detected just as quickly as the ancient approach stimuli. In other words participants were as efficient in detecting ancient approach stimuli such as horses, as they were detecting modern approach stimuli, such as pizzas. This indicated that there was a search advantage of the modern approach condition, which is consistent with Lang's and in turn inconsistent with Ohman's (2007) explanation, as superior detection of modern approach stimuli was expected. One explanation of these results is that perhaps ancient approach stimuli were not perceived as food, as they were horses. Perhaps different results would have been obtained if the target stimulus were an animal more likely to be associated with food such as a chicken or rabbit. Yet another possibility is that a modern approach stimulus such as pizza is perceived as fast food whereas a horse, although edible, represents considerable more work prior to eating. When fruit was compared to the neutral stimuli (plants) in the ancient conditions, it was found to be detected faster than the neutral stimuli (Tipples et al., 2002). Future researchers may wish to consider the use of fruit as ancient approach stimuli, and more easily accessible food similar to pizza as modern stimuli.

Overall, it is evident that neither Ohman's (2007) or Lang's (1995) explanations can entirely explain the RTs found in the modern condition. According to Lang's explanation, it was expected that both avoidant (guns) and approach (pizzas) stimuli would have been detected significantly faster than the neutral stimuli. However the results indicated that modern avoidant stimuli were detected significantly slower than the approach and neutral stimuli. In fact, there was no significant difference between modern approach and neutral stimuli. Similarly, Ohman could not account for superior detection of modern approach stimuli, which were as efficient as ancient approach and ancient avoidant stimuli.

The difficulty distinguishing which explanation best accounts for the RTs in the modern condition was further demonstrated in the ambiguity of the effect size of age and valence. It first appeared that although the effects of Age were significant ($\eta_p^2 = .21$), Valence accounted for more variance in the RTs across different conditions ($\eta_p^2 = .51$). These results would suggest that faster detection of certain stimuli was more influenced by their valence than their evolutionarily significance. However, it is important to remember that modern avoidant condition had much slower RTs when compared to other modern and other ancient conditions. When the results were analysed and the avoidant condition was excluded (only modern and ancient, approach and neutral conditions were compared), as suspected the effect size was now stronger for Age ($\eta_p^2 = .50$) than for Valence ($\eta_p^2 = .47$). This indicated that previously larger effects for valence were influenced by the much slower RTs in the modern avoidant condition. The results now appear to support Ohman's explanation, as age or evolutionarily significance had stronger effects on the RTs than valence. It must be noted that the results in the modern condition cannot be conclusively interpreted due to possible confounds associated with the modern avoidant condition.

A Possible Confound - Visual Pattern Matching

In the preliminary stages of the study, the stimuli used in Blanchette's (2006) study were replicated. In the modern avoidant condition the target was a syringe, embedded among the background of pens. It was found that the modern avoidant condition was detected much faster than neutral or approach conditions and this was attributed to the stimuli orientation as pens were oriented toward the right, and the syringe was oriented to the left. To avoid this confound, different stimuli were selected (staplers and guns) and it was also attempted to keep the common orientation of the stimuli, as much as possible. The controlling of the confound allowing easier detection of modern avoidant stimuli, may in itself, have resulted in a confound where modern avoidant stimuli were *harder* to detect. Hence, this may be the best explanation as the modern avoidant conditions produced the slowest RTs and highest error rates. Although these results were earlier interpreted as being consistent with the evolutionary hypothesis, it is possible that there were unintended influences of stimulus similarity. It is apparent that a follow-up experiment is needed, as changing the task difficulty between Blanchette and the present study, completely reversed the results obtained.

Further evidence in favour of perceptual influences is found when it is considered that the modern neutral condition had an apparent search advantage, as it was as fast and as accurate as the modern approach condition. It is not possible to ascertain whether this difference was observed because the stimuli were perceived as avoidant (the neutral stimuli were pictures of clocks) or because the task was easier, as the target differed in terms of physical similarity from the background. Moreover, modern neutral stimuli were detected faster than the ancient neutral stimuli, which was unexpected as both were control conditions and were rated equally on valence (Lang et al., 1997; 2008). The only difference between them, that could not be controlled for, was that in the ancient conditions mushrooms and flowers were more visually complex, while clocks and staplers were not. This further demonstrated how perceptual issues related to the stimuli used may affect the results in the visual search studies, such as the present study.

Recommendations for Future Studies

It is possible that visual pattern matching represents a further factor that needs to be more actively controlled in future experiments. For the present experiment, many participants spontaneously reported that they found the modern avoidant condition to be most difficult due to the high perceptual similarity of stimuli. The staplers and guns were much more perceptually similar than the neutral modern condition, which consisted of clocks and staplers. This could have been due to a larger difference between their shapes as one was rectangular and the other round, but also in terms of colours as clocks were lighter whereas staplers tended to be darker in terms of colour and background. In the modern avoidant condition, both the guns and the staplers appeared darker and being more similar, it possibly contributed to the longer RTs. A way that this may be controlled for is to ask participants to rate target and background pictures in terms of perceptual similarity following the experiment, for example using a five point Likert scale ranging from 1 (very difficult) to 5 (very easy).

The possibility that pattern matching is an important influence on RTs, has been investigated before. Duncan and Humphreys (1989) found that faster detection occurs when the background pictures are similar to each other but differ from the target image, and slower reaction times were observed when the background was more varied and also varied from the target image. It was found in previous studies that different results can be obtained by manipulating perceptual differences of the stimuli used. For example Lipp (2006) found that when different stimuli were used, faster RTs were observed in fear irrelevant conditions, but when more perceptually similar stimuli were used faster detection was observed in fear relevant conditions. In the present experiment an attempt was made to ensure that the stimuli selected for different conditions were rated equally on valence in the modern and ancient conditions and it was ensured that there were no perceptual confounds. In other words it was ensured that the difficulty of the task was similar across different conditions. A possible improvement would be to use schematic images, as this would allow greater control over stimuli.

The potential roles of both individual ratings of valence, and perceptual similarity need to be explored further in future studies. Future studies should evaluate stimuli in terms of individual valence rating and difficulty to detect the target image among different backgrounds. Such an experiment could then estimate the effect sizes due to these potentially confounding sources of variance, and provide for statistical control. It would then be necessary to replicate the current study, in other words to compare negatively, positively and neutrally valenced stimuli in a modern and ancient condition, with new stimuli so that the confounds of stimuli effects can be replicated. In this way the new results obtained can be attributed to the effects of the independent variables rather than the potential confounds.

Summary and Conclusion

The present study examined how two competing evolutionarily psychological explanations apply to the recent findings in the literature. Ohman and Mineka's (2001; 2003; Ohman, 2007) evolved fear module was compared and contrasted with Lang's (1995) motivational approach and avoidance explanation. While Ohman's explanation has been challenged by studies that have found no differences between modern avoidant and ancient avoidant stimuli, Lang's explanation has never been experimentally tested as previous studies have only focused on avoidant stimuli and ignored the approach stimuli.

The present study adopted the Blanchette (2006) design, extended it to include approach stimuli, while also providing for some control for perceptual similarity and valence of the stimuli. The results in the ancient condition were consistent with both Ohman's (2007) and Lang's (1995) explanations, as there was a faster and more accurate detection of approach (horses) and avoidant (snake) stimuli than neutral (mushrooms) stimuli.

The results in the modern condition were ambiguous as there was a faster and more accurate detection of approach (pizzas) and neutral (clocks) stimuli than avoidant (guns) stimuli. The results could be interpreted as the avoidant stimuli being perceived as much more threatening and causing interference with the task or not threatening enough to have a search advantage. The results were therefore only partially consistent with both Ohman's (2007) and Lang's (1995) explanations. The faster detection of ancient avoidant stimuli when compared to the modern avoidant stimuli was consistent with Ohman as faster detection of evolutionarily significant threats would have served as a survival advantage. However, the results also indicated that modern approach stimuli were detected as fast and as accurately as ancient approach or ancient avoidant stimuli. These findings are inconsistent with Ohman's but are consistent with Lang's explanation.

Further ambiguity of the results was observed in the effect sizes between age and valence. It first appeared that valence had a stronger effect on the RTs than age of the stimuli, but when the modern avoidant condition, which produced the slowest reaction times, was controlled for, the results indicated that age had stronger effects on the RTs than valence.

A possible confound that has influenced the RTs in the modern condition, could be the stimuli pattern matching. The results indicated that modern neutral stimuli were detected significantly faster than the ancient neutral stimuli. In addition, the modern avoidant condition was significantly slower than all other modern and ancient conditions. These results suggest that the modern condition RTs may have been influenced by stimuli perceptual difficulty.

It was concluded that future studies are necessary to clarify the inconsistent findings in the modern conditions, as both Lang (1995) and Ohman's (2007) theories could not entirely explain the current results. Although the present study introduced a greater number of controls such as, equal valence and perceptual difficulty of the task across different conditions, there is still a possibility that there was visual pattern matching confounds, as photographs were used. A recommendation for future studies was that the participants first evaluate stimuli on difficulty, and then valence ratings are collected for each of the participants to account for individual differences. These two additional measures should eliminate these potential confounds influencing the results obtained.

This was one of the first studies that compared approach and avoidant stimuli in modern and ancient conditions. It can be concluded that the present study provided both strong support for Ohman's (2007) and Lang's (1995) explanations in the ancient condition and partial support for both explanations in the modern condition. A spontaneous finding was that perceptual stimuli complexity and pattern matching can significantly influence the RTs. Hence, as this confound has not been controlled to the same extent in previous studies, it questions the reliability of previous findings. The present study is an important step towards discovering how emotion and attention interact. It is imperative that future studies in this area control perceptual confounds, as this would both clarify the inconsistent findings and contribute towards new discoveries in this area.

References

Blanchette, I. (2006). Snakes, spiders, guns, and syringes: How specific are evolutionary constraints on the detection of threatening stimuli? *The Quarterly Journal of Experimental Psychology, 59*, 1484-1504.

Bradley, M. M., & Lang, P. J. (2000). Measuring emotion: Behavior, feeling, and physiology. In R. D. Lane & L. Nadel (Eds.), *Cognitive neuroscience of emotion.* New York: Oxford University Press.

Brosch, T., & Sharma, D. (2005). The role of fear-relevant stimuli in visual search: A comparison of phylogenetic and ontogenetic stimuli. *Emotion, 5,* 360-364.

Darwin, C. (1876). *The origin of species by means of natural selection, or the preservation of favoured races in the struggle for life*. London: John Murray. Retrieved May 23, 2009, from http://darwin-online.org.uk/pdf/1876_Origin_F401.pdf

Duncan, J., & Humphreys, G. W. (1989). Visual search and stimulus similarity. *Psychological Review, 96*, 433– 458.

Esteves, F., Dimberg, U., & Ohman, A. (1994). Automatically elicited fear: Conditioned skin conductance responses to masked facial expressions. *Cognition & Emotion, 8*, 393–413.

Fox, E., Griggs, L., & Mouchlianitis, E. (2007). The detection of fear relevant stimuli: Are guns noticed as quickly as snakes? *Emotion, 7*, 691-696.

Fox, E., Lester, V., Russo, R., Bowles, R., Pichler, A., & Dutton, K. (2000). Facial expressions of emotions: Are angry faces detected more efficiently? *Cognition & Emotion, 14,* 61-92.

Hamm, A. O., Schupp, H., T., &Weike, A., I. (2003). Motivational organization of emotions: Autonomic changes, cortical responses, and reflex modulation. In R. J. Davidson, K. R. Scherer & H. H. Goldsmith (Eds.), *Handbook of affective science* (pp. 187-212). Oxford: Oxford University Press.

Howell, D.C. (2007). *Statistical methods for psychology* (6th Ed). Thomson Wadsworth: Belmont, CA.

Ito, T. A., & Cacioppo, J. T. (2005). Variations on a human universal: Individual differences in positivity offset and negativity bias. *Cognition and Emotion, 19,* 1- 26.

Lang, P. J. (1995). The emotion probe: Studies of motivation and attention. *American Psychologist, 50,* 372–385.

Lang, P. J., Bradley, M. M., & Cuthbert, B., N. (1990). Emotion, attention, and the startle reflex. *Psychological Review, 97,* 377-395.

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1997). Motivated attention: Affect, activation, and action. In P. J. Lang, R. F. Simons & M. T. Balaban (Eds.), Attention and orienting: sensory and motivational processes (pp. 97-135). Manhwah, New Jersey: Lawrence Erlbaun Associates Publishers.

Lang, P. J., Bradley, M.M., & Cuthbert, B.N. (2008). *International affective picture system (IAPS): Affective ratings of pictures and instruction manual.* Technical Report A-8. University of Florida, Gainesville, FL.

Lipp, O. V. (2006). Of snakes and flowers: Does preferential detection of pictures of fear-relevant animals in visual search reflect on fear-relevance? *Emotion 6,* 296 –308.

Lipp, O. V., Derakshan, N., Waters, A. M., & Logies, S. (2004). Snakes and cats in the flowerbed: Fast detection is not specific to pictures of fear-relevant animals. *Emotion, 4,* 233–250.

Martin, D. W. (2004). *Doing psychology experiments* (6th Ed). Wadsworth: Canada

Martin, M., Williams, R. M., & Clark, D. M.(1991). Does anxiety lead to selective processing of threat related information? *Behavioural Research and Therapy, 29*, 147-160.

Ohman, A., (2007). Has evolution primed humans to 'beware of the beast'? *Proceedings of the National Academy of Sciences of the Unites States of America (PNAS), 104*, 16396- 16397.

Ohman, A., Flykt, A., & Esteves, F. (2001). Emotion drives attention: Detecting the snake in the grass. *Journal of Experimental Psychology: General, 130*, 466-478.

Ohman, A., & Mineka, S. (2001). Fears, phobias, and preparedness: Toward an evolved module of fear and fear learning. *Psychological Review, 108*, 483- 522.

Ohman, A., & Mineka, S. (2003). The malicious serpent: Snakes as a prototypical stimulus for an evolved module of fear. *Current Directions in Psychological Science, 12*, 5-9.

Pratto, F., & John, O. P. (1991). Automatic vigilance: The attention-grabbing power of negative social information. *Journal of Personality and Social Psychology, 61*, 380 – 391.

Schimmack, U. (2005). Attentional interference effects of emotional pictures: Threat, negativity or arousal? *Emotion, 5*, 55- 66.

Tipples, J., Young, A. W., Quinlan, P., & Ellis, A.W. (2002). Searching for threat. *Quarterly Journal of Experimental Psychology, 55A*, 1007-1026.

Verbruggen, F., & De Houwer, J. (2007). Do emotional stimuli interfere with response inhibition? Evidence from the stop signal paradigm. *Cognition and Emotion, 21*, 391– 403.

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Appendix A

Participant Information Sheet

"Effects of Ancient and Modern, Avoidant and Approach Stimuli on Visual Search Task Reaction Times"

Your involvement in the study will require that you complete a visual search task, which should take approximately 20 minutes. You will see slides with pictures of plants, animals and objects, presented on the computer. You will be required to distinguish whether the pictures are from the same category (e.g., they are all flowers) or a different category (e. g., there is one animal among the flowers)? You will respond by clicking the 'z' key when all images are the same and the '/' key when they are different, on a standard computer keyboard. Your reaction times will be recorded, so the aim is to complete the task as quickly and as accurately as possible. You will be provided with a practice task before you begin the experiment and given a chance to ask any questions you may have.

Your participation is voluntary and you can terminate the experiment at any time. Your identity and the information provided will be kept confidential. I would be pleased to answer any questions that you may have.

If you wish to participate in the study please read and sign the consent form. Your participation is greatly appreciated.

It is possible that this study may be published. Should that be the case, then the deidentified data will be kept for five years following publication in a secure filing cabinet at the University. For further information you can contact me, my supervisor or an independent representative of Edith Cowan Universityon contact details provided below.

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Email: j.dandy@ecu.edu.au

Yours Sincerely,
Sanja Bojic

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Appendix B

Participant Informed Consent Form

Effects of Ancient and Modern, Avoidant and Approach Stimuli on Visual Search Task Reaction Times

I have read the information sheet provided, understand what the proposed research involves and have freely agreed to participate. I understand that the information I provide will be kept for five years in a secure on-campus environment. It was explained to me that my participation is voluntary and that I can withdraw at any time. I also give my permission for the data to be published. I understand that any personal information I provide will be kept confidential.

______________________	______________________
Signed: Research Participant	Signed: Researcher
______________________	______________________
Date:	Date:

____

Contact number or email address

Appendix C

Working- out Tukey's HSD by Hand

Tukeys's HSD = q (a;p;v) √ [MS error (residual) / n per group)]

a= .05; p (number of ordered means) = 6; v (df associated with MS error, from the SPSS output) = 72

Studentized Range Statistic (q) for 6 ordered means and 72 df (MS error) at alpha .05, was found to be 4.16 (Howell, 2007, pp. 679).

Tukey's HSD = 4.16 √ (0.008 / 37)

= 4.16 √0.00021622

=4.16 x 0.01470442

= **<u>0.06</u>** (if difference between the means in more than .06, it is significant)

Table demonstrates the differences between means

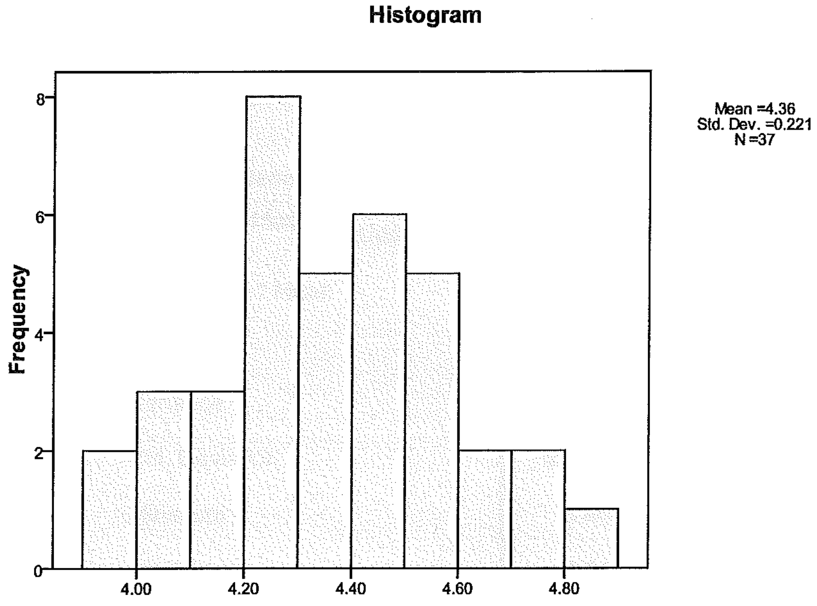
	Ancient Avoidant *M* = 4.36	Ancient Approach *M* = 4.37	Ancient Neutral *M* = 4.57	Modern Avoidant *M* = 4.69	Modern Approach *M* = 4.36	Modern Neutral *M* = 4.38
Ancient Avoidant *M* = 4.36		0.01	**0.21***	**0.33***	0.00	0.02
Ancient Approach *M* = 4.37			**0.20***	**0.32***	0.01	0.01
Ancient Neutral *M* = 4.57				**0.15***	**0.21***	**0.19***
Modern Avoidant *M* = 4.69					**0.33***	**0.31***
Modern Approach *M* = 4.36						0.02
Modern Neutral *M* = 4.38						

* Note. The difference between the two means is significant.
The means used in the calculation are the transformed means, because the original values were not normally distributed.

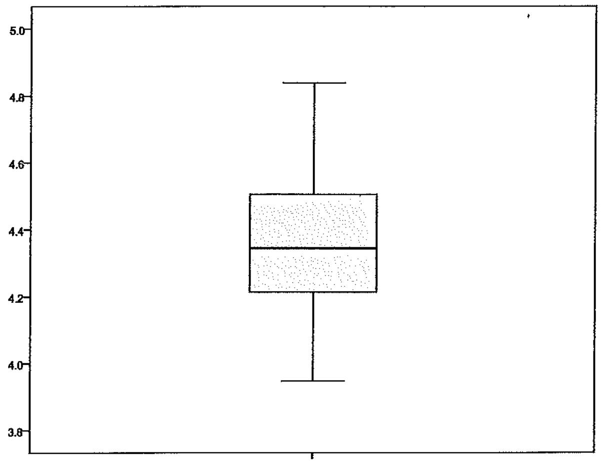
Appendix D

SPSS Output (Normality of the Transformed Means for Each Condition)

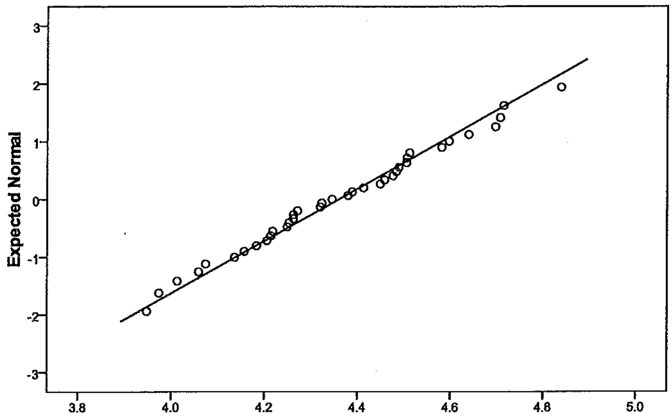
Ancient Avoidant



Transformed Ancient Avoidant



Transformed Ancient Avoidant



Normal Q-Q Plot of Transformed Ancient Avoidant

Descriptives			Statistic	Std. Error
Transformed Ancient Avoidant	Mean		4.3591	.03633
	95% Confidence Interval for Mean	Lower Bound	4.2854	
		Upper Bound	4.4327	
	5% Trimmed Mean		4.3578	
	Median		4.3442	
	Variance		.049	
	Std. Deviation		.22096	
	Minimum		3.95	
	Maximum		4.84	
	Range		.89	
	Interquartile Range		.30	
	Skewness		.112	.388
	Kurtosis		-.549	.759

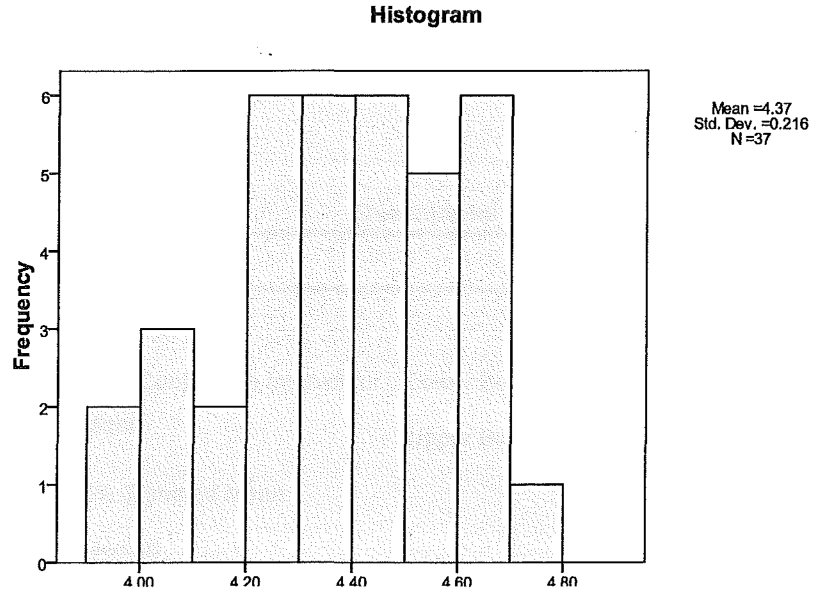
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Transformed Ancient Avoidant	.088	37	.200*	.984	37	.869

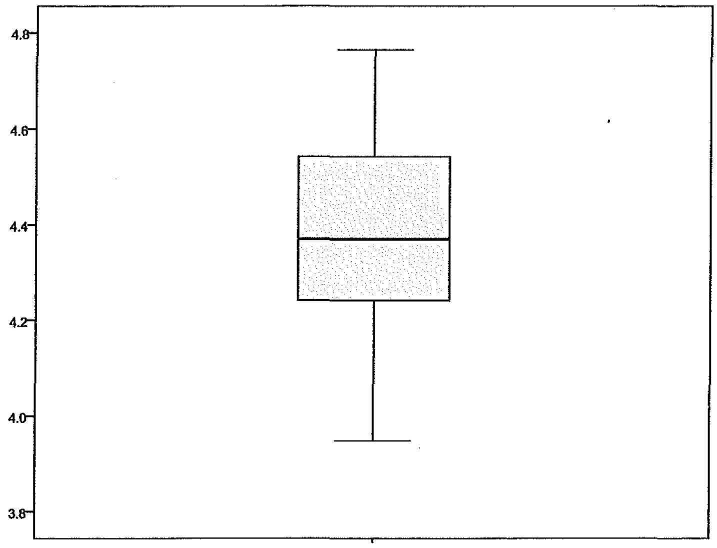
a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

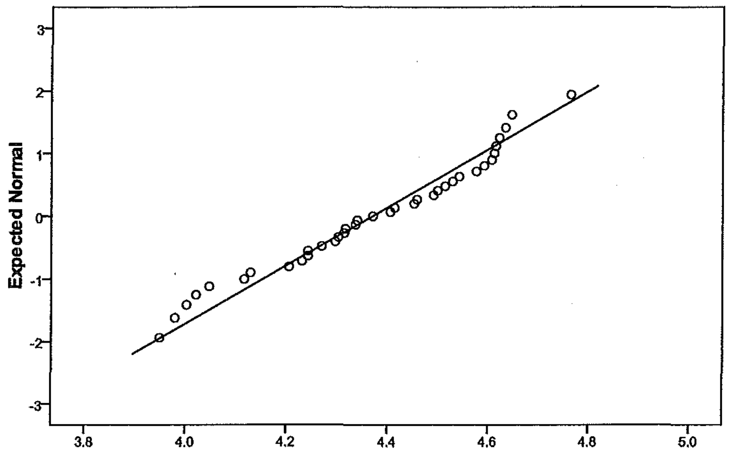
Ancient Approach Normality



Transformed Ancient Approach



Transformed Ancient Approach



Normal Q-Q Plot of Transformed Ancient Approach

Descriptives

			Statistic	Std. Error
Transformed Ancient Approach	Mean		4.3695	.03551
	95% Confidence Interval for Mean	Lower Bound	4.2975	
		Upper Bound	4.4415	
	5% Trimmed Mean		4.3732	
	Median		4.3698	
	Variance		.047	
	Std. Deviation		.21598	
	Minimum		3.95	
	Maximum		4.76	
	Range		.82	
	Interquartile Range		.32	
	Skewness		-.313	.388
	Kurtosis		-.788	.759

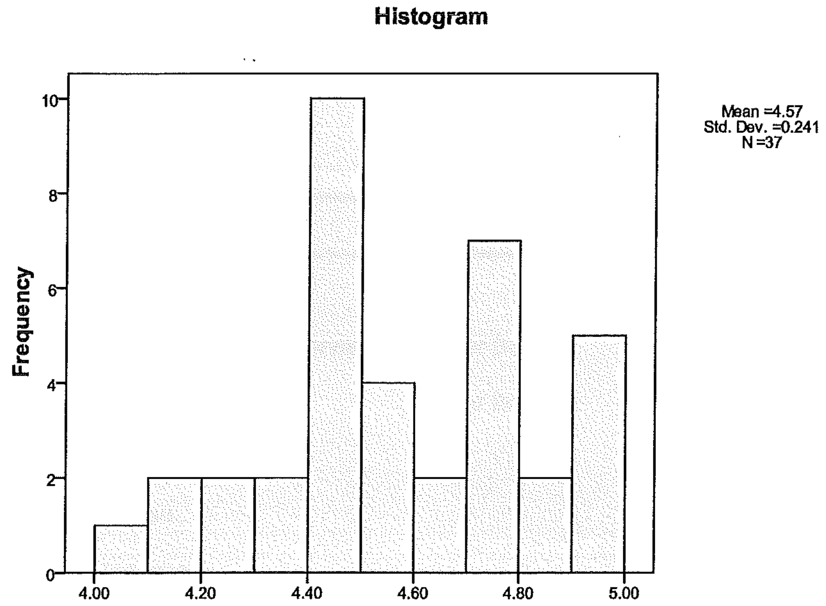
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Transformed Ancient Approach	.091	37	.200*	.961	37	.216

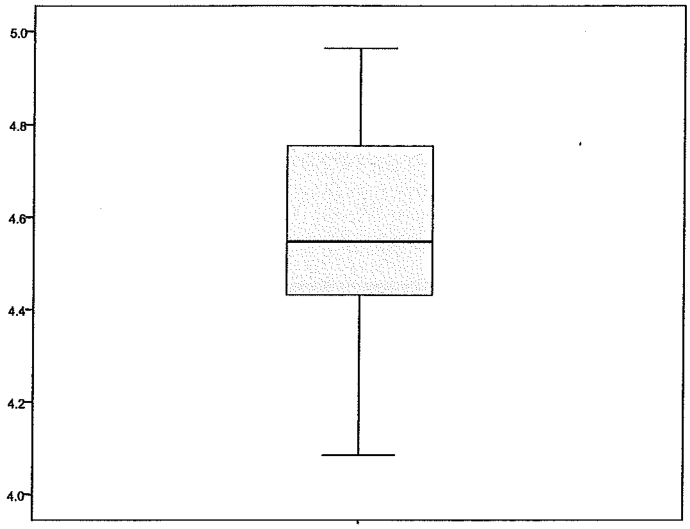
a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

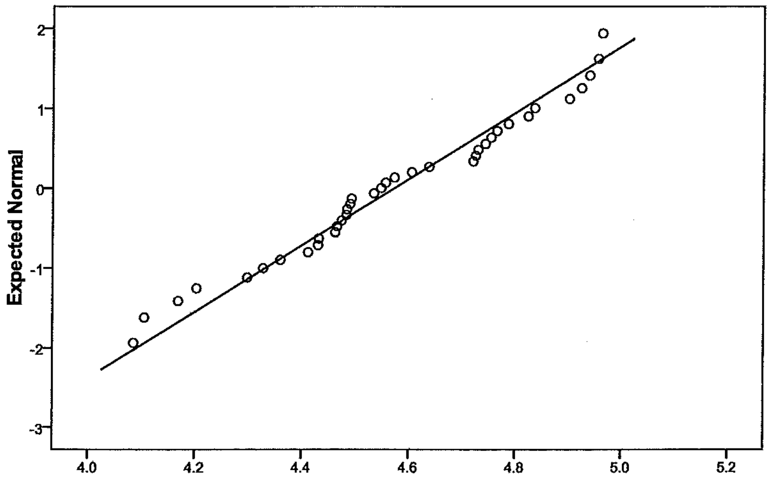
Ancient Neutral Normality



Transformed Ancient Neutral



Transformed Ancient Neutral



Normal Q-Q Plot of Transformed Ancient Neutral

Descriptives

			Statistic	Std. Error
Transformed Ancient Neutral	Mean		4.5728	.03959
	95% Confidence Interval for Mean	Lower Bound	4.4925	
		Upper Bound	4.6531	
	5% Trimmed Mean		4.5779	
	Median		4.5475	
	Variance		.058	
	Std. Deviation		.24082	
	Minimum		4.09	
	Maximum		4.96	
	Range		.88	
	Interquartile Range		.33	
	Skewness		-.166	.388
	Kurtosis		-.641	.759

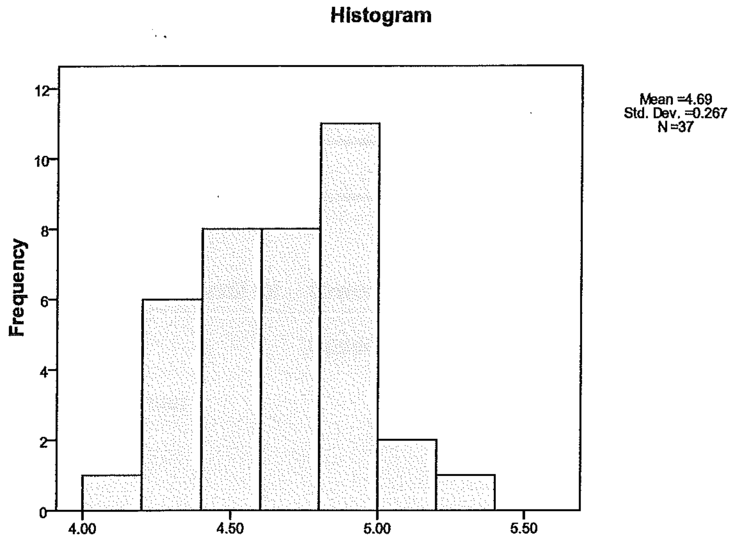
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Transformed Ancient Neutral	.109	37	.200*	.965	37	.297

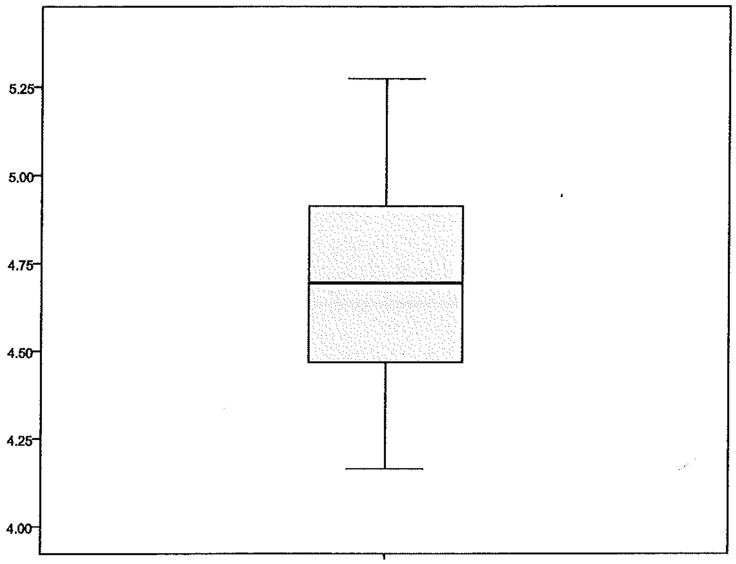
a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

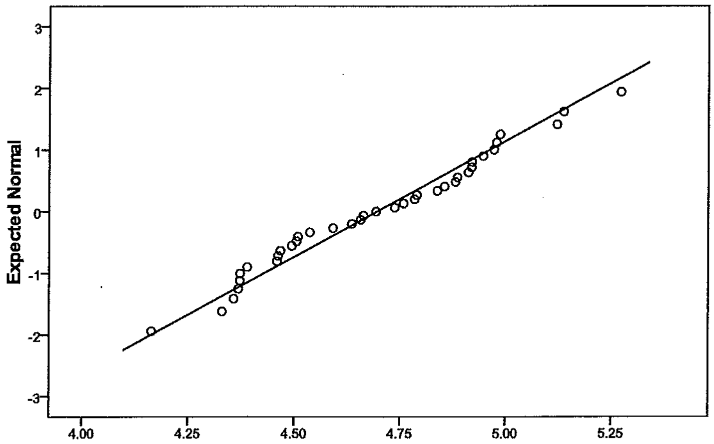
Modern Avoidant Normality



Transformed Modern Avoidant



Transformed Modern Avoidant



Normal Q-Q Plot of Transformed Modern Avoidant

Descriptives

			Statistic	Std. Error
Transformed Modern Avoidant	Mean		4.6950	.04382
	95% Confidence Interval for Mean	Lower Bound	4.6061	
		Upper Bound	4.7838	
	5% Trimmed Mean		4.6916	
	Median		4.6929	
	Variance		.071	
	Std. Deviation		.26657	
	Minimum		4.16	
	Maximum		5.27	
	Range		1.11	
	Interquartile Range		.45	
	Skewness		.099	.388
	Kurtosis		-.779	.759

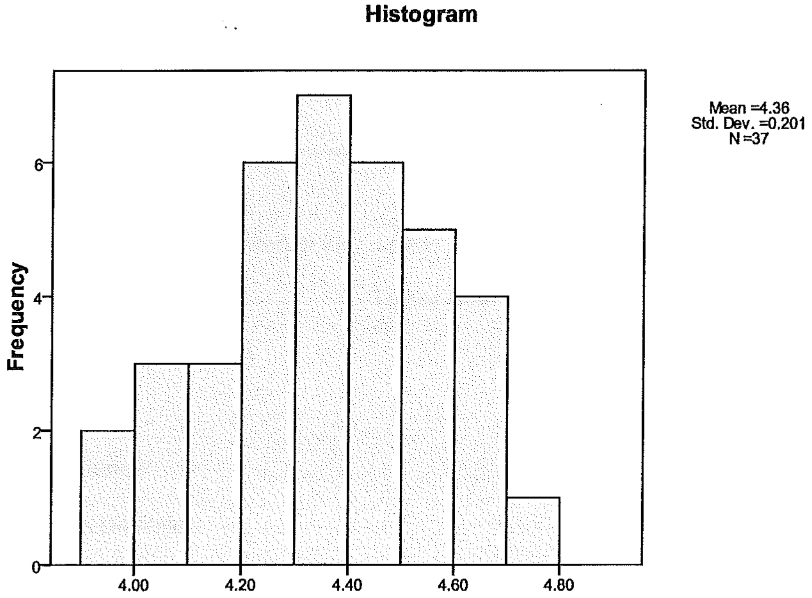
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Transformed Modern Avoidant	.110	37	.200*	.972	37	.459

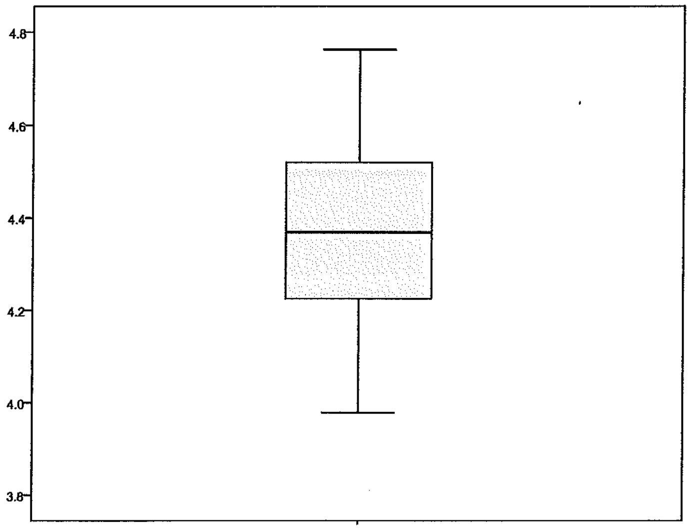
a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

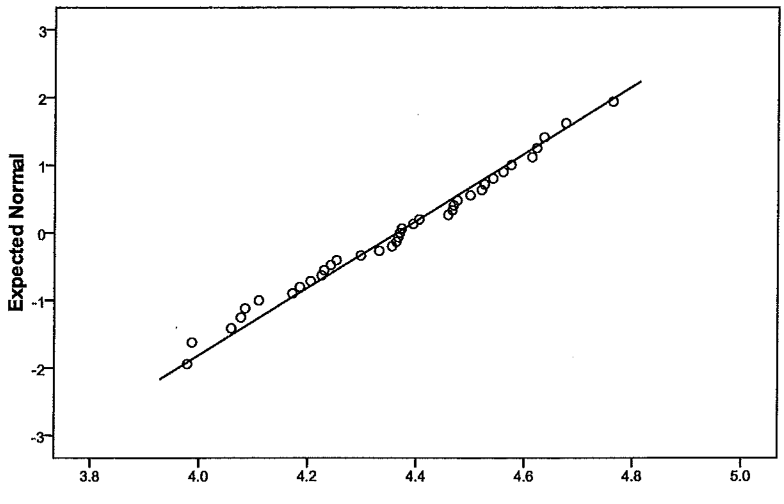
Modern Approach Normality



Transformed Modern Approach



Transformed Modern Approach



Normal Q-Q Plot of Transformed Modern Approach

Modern Approach Descriptives

			Statistic	Std. Error
Transformed Modern Approach	Mean		4.3633	.03308
	95% Confidence Interval for Mean	Lower Bound	4.2962	
		Upper Bound	4.4304	
	5% Trimmed Mean		4.3646	
	Median		4.3687	
	Variance		.040	
	Std. Deviation		.20121	
	Minimum		3.98	
	Maximum		4.76	
	Range		.78	
	Interquartile Range		.31	
	Skewness		-.147	.388
	Kurtosis		-.730	.759

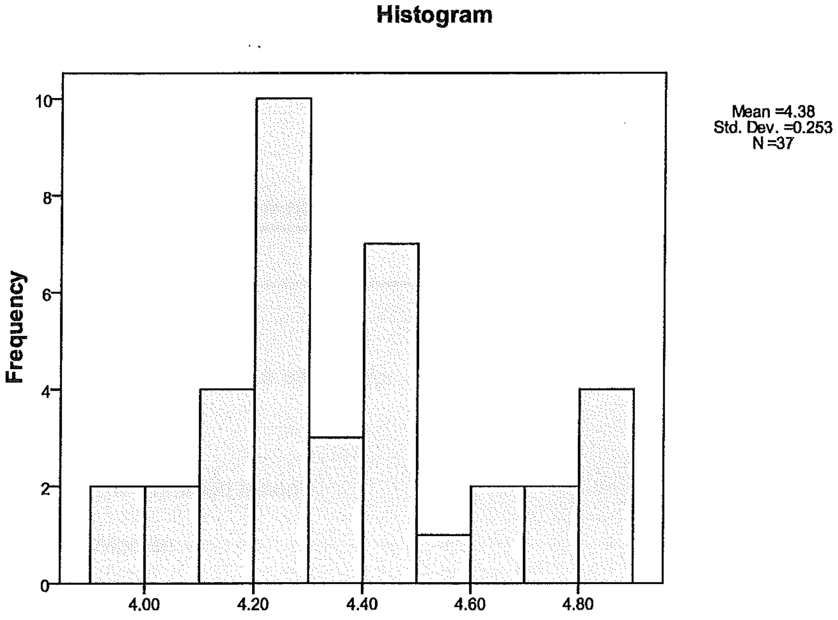
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Transformed Modern Approach	.086	37	.200*	.980	37	.715

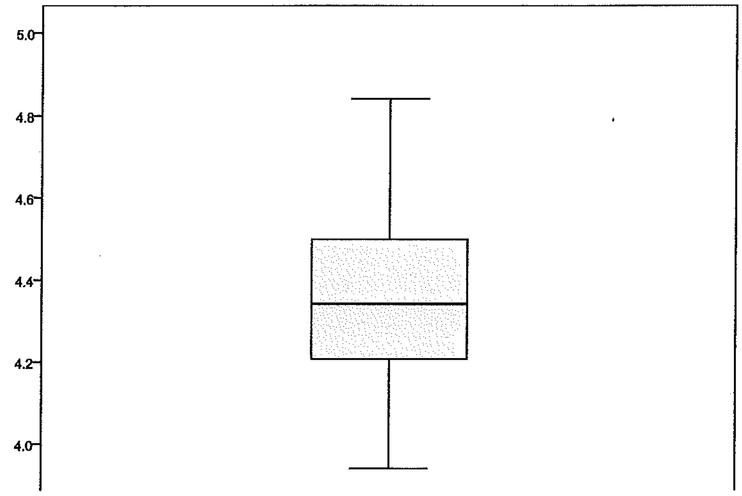
a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

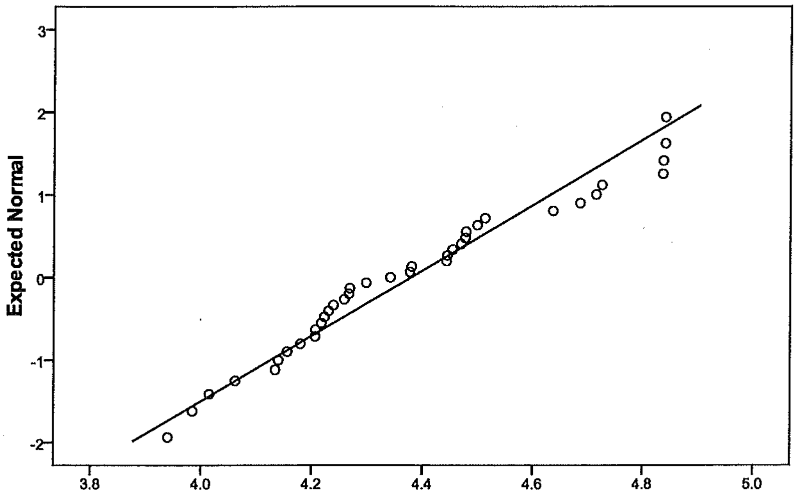
Modern Neutral Normality



Transformed Modern Neutral



Transformed Modern Neutral



Normal Q-Q Plot of Transformed Modern Neutral

Transformed Modern Neutral Descriptives

			Statistic	Std. Error
Transformed Modern Neutral	Mean		4.3789	.04156
	95% Confidence Interval for Mean	Lower Bound	4.2946	
		Upper Bound	4.4631	
	5% Trimmed Mean		4.3764	
	Median		4.3415	
	Variance		.064	
	Std. Deviation		.25280	
	Minimum		3.94	
	Maximum		4.84	
	Range		.90	
	Interquartile Range		.30	
	Skewness		.400	.388
	Kurtosis		-.659	.759

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Transformed Modern Neutral	.129	37	.126	.949	37	.087

a. Lilliefors Significance Correction

A Repeated Measures Analysis of Variance (ANOVA) on the Transformed Reaction Time data

Within-Subjects Factors

Measure:MEASURE_1

Age	Valence	Dependent Variable
1	1	Ancient Avoidant
	2	Ancient Approach
	3	Ancient Neutral
2	1	Modern Avoidant
	2	Modern Approach
	3	Modern Neutral

Descriptive Statistics

	Mean	Std. Deviation	N
Ancient Avoidant	4.3591	.22096	37
Ancient Approach	4.3695	.21598	37
Ancient Neutral	4.5728	.24082	37
Modern Avoidant	4.6950	.26657	37
Modern Approach	4.3633	.20121	37
Modern Neutral	4.3789	.25280	37

Mauchly's Test of Sphericity[b]

Measure:MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[a]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Age	1.000	.000	0	.	1.000	1.000	1.000
Valence	.996	.147	2	.929	.996	1.000	.500
Age * Valence	.955	1.624	2	.444	.957	1.000	.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

b. Design: Intercept
Within Subjects Design: Age + Valence + Age * Valence

Tests of Within- Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power^a
Age	Sphericity Assumed	.114	1	.114	9.471	.004	.208	9.471	.850
	Greenhouse-Geisser	.114	1.000	.114	9.471	.004	.208	9.471	.850
	Huynh-Feldt	.114	1.000	.114	9.471	.004	.208	9.471	.850
	Lower-bound	.114	1.000	.114	9.471	.004	.208	9.471	.850
Error (Age)	Sphericity Assumed	.432	36	.012					
	Greenhouse-Geisser	.432	36.000	.012					
	Huynh-Feldt	.432	36.000	.012					
	Lower-bound	.432	36.000	.012					
Valence	Sphericity Assumed	.996	2	.498	37.546	.000	.511	75.092	1.000
	Greenhouse-Geisser	.996	1.992	.500	37.546	.000	.511	74.778	1.000
	Huynh-Feldt	.996	2.000	.498	37.546	.000	.511	75.092	1.000
	Lower-bound	.996	1.000	.996	37.546	.000	.511	37.546	1.000
Error (Valence)	Sphericity Assumed	.955	72	.013					
	Greenhouse-Geisser	.955	71.699	.013					
	Huynh-Feldt	.955	72.000	.013					
	Lower-bound	.955	36.000	.027					
Age * Valence	Sphericity Assumed	2.670	2	1.335	172.832	.000	.828	345.665	1.000
	Greenhouse-Geisser	2.670	1.913	1.396	172.832	.000	.828	330.675	1.000
	Huynh-Feldt	2.670	2.000	1.335	172.832	.000	.828	345.665	1.000
	Lower-bound	2.670	1.000	2.670	172.832	.000	.828	172.832	1.000
Error (Age* Valence)	Sphericity Assumed	.556	72	.008					
	Greenhouse-Geisser	.556	68.878	.008					
	Huynh-Feldt	.556	72.000	.008					
	Lower-bound	.556	36.000	.015					

a. Computed using alpha = .05

Table of Between Subjects Effects

Measure:MEASURE_1

Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Intercept	4408.857	1	4408.857	16035.310	.000	.998	16035.310	1.000
Error	9.898	36	.275					

a. Computed using alpha = .05

Estimated Marginal Means

1. Grand Mean

Measure:MEASURE_1

Mean	Std. Error	95% Confidence Interval	
		Lower Bound	Upper Bound
4.456	.035	4.385	4.528

2. Age

Estimates

Measure:MEASURE_1

Age	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	4.434	.035	4.363	4.504
2	4.479	.037	4.404	4.554

Pairwise Comparisons

Measure:MEASURE_1

(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	-.045*	.015	.004	-.075	-.015
2	1	.045*	.015	.004	.015	.075

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Pillai's trace	.208	9.471[a]	1.000	36.000	.004	.208	9.471	.850
Wilks' lambda	.792	9.471[a]	1.000	36.000	.004	.208	9.471	.850
Hotelling's trace	.263	9.471[a]	1.000	36.000	.004	.208	9.471	.850
Roy's largest root	.263	9.471[a]	1.000	36.000	.004	.208	9.471	.850

Each F tests the multivariate effect of Age. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

b. Computed using alpha = .05

3. Valence

Estimates

Measure:MEASURE_1

Valence	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	4.527	.038	4.449	4.605
2	4.366	.033	4.300	4.433
3	4.476	.039	4.397	4.555

Pairwise comparisons

Measure:MEASURE_1

(I) Valence	(J) Valence	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	.161*	.018	.000	.114	.207
	3	.051*	.019	.031	.004	.099
2	1	-.161*	.018	.000	-.207	-.114
	3	-.109*	.019	.000	-.158	-.060
3	1	-.051*	.019	.031	-.099	-.004
	2	.109*	.019	.000	.060	.158

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Pillai's trace	.684	37.839[a]	2.000	35.000	.000	.684	75.677	1.000
Wilks' lambda	.316	37.839[a]	2.000	35.000	.000	.684	75.677	1.000
Hotelling's trace	2.162	37.839[a]	2.000	35.000	.000	.684	75.677	1.000
Roy's largest root	2.162	37.839[a]	2.000	35.000	.000	.684	75.677	1.000

Each F tests the multivariate effect of Valence. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

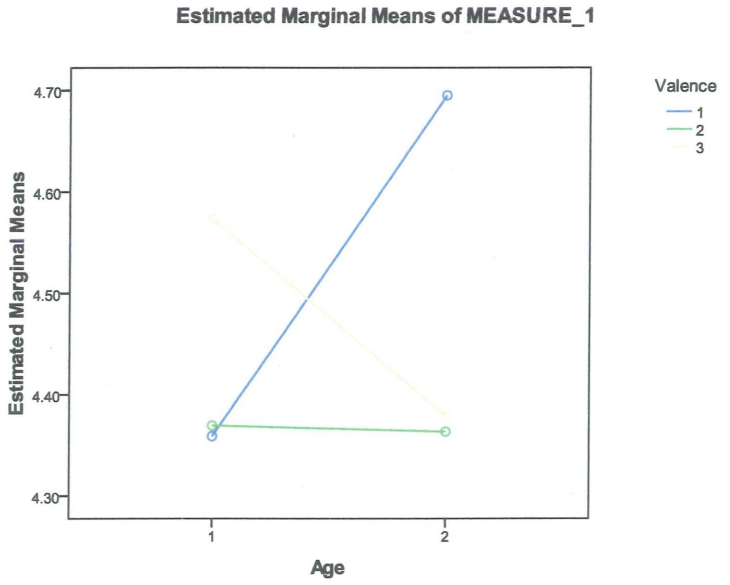
a. Exact statistic

b. Computed using alpha = .05

4. Age * Valence

Measure:MEASURE_1

Age	Valence	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1	1	4.359	.036	4.285	4.433
	2	4.370	.036	4.298	4.442
	3	4.573	.040	4.493	4.653
2	1	4.695	.044	4.606	4.784
	2	4.363	.033	4.296	4.430
	3	4.379	.042	4.295	4.463



SPSS Output Analysis of Inaccurate Responses

NPar Tests

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Mistakes Ancient Avoidant	37	1.68	1.701	0	6
Mistakes Ancient Approach	37	1.43	1.537	0	6
Mistakes Ancient Neutral	37	3.08	2.139	0	10
Mistakes Modern Avoidant	37	5.65	3.155	0	15
Mistakes Modern Approach	37	1.59	1.518	0	7
Mistakes Modern Neutral	37	2.14	1.735	0	8

Friedman Test

Ranks

	Mean Rank
Mistakes Ancient Avoidant	2.82
Mistakes Ancient Approach	2.50
Mistakes Ancient Neutral	4.09
Mistakes Modern Avoidant	5.47
Mistakes Modern Approach	2.77
Mistakes Modern Neutral	3.34

Test Statistics[a]

N	37
Chi-Square	71.672
df	5
Asymp. Sig.	.000

a. Friedman Test

Post hock on the Inaccurate Responses Data (Non- Parametric Test)

Wilcoxon Signed Ranks Test

Ranks

		N	Mean Rank	Sum of Ranks
Mistakes Ancient Neutral – Mistakes Ancient Avoidant	Negative Ranks	8[a]	14.38	115.00
	Positive Ranks	26[b]	18.46	480.00
	Ties	3[c]		
	Total	37		
Mistakes Ancient Neutral – Mistakes Ancient Approach	Negative Ranks	7[d]	11.21	78.50
	Positive Ranks	25[e]	17.98	449.50
	Ties	5[f]		
	Total	37		
Mistakes Ancient Approach – Mistakes Ancient Avoidant	Negative Ranks	16[g]	13.91	222.50
	Positive Ranks	11[h]	14.14	155.50
	Ties	10[i]		
	Total	37		
Mistakes Modern Neutral – Mistakes Modern Avoidant	Negative Ranks	30[j]	17.77	533.00
	Positive Ranks	3[k]	9.33	28.00
	Ties	4[l]		
	Total	37		
Mistakes Modern Neutral – Mistakes Modern Approach	Negative Ranks	10[m]	12.00	120.00
	Positive Ranks	17[n]	15.18	258.00
	Ties	10[o]		
	Total	37		
Mistakes Modern Approach – Mistakes Modern Avoidant	Negative Ranks	34[p]	20.07	682.50
	Positive Ranks	3[q]	6.83	20.50
	Ties	0[r]		
	Total	37		
Mistakes Modern Avoidant – Mistakes Ancient Avoidant	Negative Ranks	3[s]	5.50	16.50
	Positive Ranks	33[t]	19.68	649.50
	Ties	1[u]		
	Total	37		
Mistakes Modern Approach –	Negative Ranks	11[v]	13.64	150.00

	Positive Ranks	14[w]	12.50	175.00
	Ties	12[x]		
	Total	37		
Mistakes Modern Neutral – Mistakes Ancient Neutral	Negative Ranks	22[y]	15.50	341.00
	Positive Ranks	8[z]	15.50	124.00
	Ties	7[aa]		
	Total	37		

a. Mistakes Ancient Neutral < Mistakes Ancient Avoidant
b. Mistakes Ancient Neutral > Mistakes Ancient Avoidant
c. Mistakes Ancient Neutral = Mistakes Ancient Avoidant
d. Mistakes Ancient Neutral < Mistakes Ancient Approach
e. Mistakes Ancient Neutral > Mistakes Ancient Approach
f. Mistakes Ancient Neutral = Mistakes Ancient Approach
g. Mistakes Ancient Approach < Mistakes Ancient Avoidant
h. Mistakes Ancient Approach > Mistakes Ancient Avoidant
i. Mistakes Ancient Approach = Mistakes Ancient Avoidant
j. Mistakes Modern Neutral < Mistakes Modern Avoidant
k. Mistakes Modern Neutral > Mistakes Modern Avoidant
l. Mistakes Modern Neutral = Mistakes Modern Avoidant
m. Mistakes Modern Neutral < Mistakes Modern Approach
n. Mistakes Modern Neutral > Mistakes Modern Approach
o. Mistakes Modern Neutral = Mistakes Modern Approach
p. Mistakes Modern Approach < Mistakes Modern Avoidant
q. Mistakes Modern Approach > Mistakes Modern Avoidant
r. Mistakes Modern Approach = Mistakes Modern Avoidant
s. Mistakes Modern Avoidant < Mistakes Ancient Avoidant
t. Mistakes Modern Avoidant > Mistakes Ancient Avoidant
u. Mistakes Modern Avoidant = Mistakes Ancient Avoidant
v. Mistakes Modern Approach < Mistakes Ancient Approach
w. Mistakes Modern Approach > Mistakes Ancient Approach
x. Mistakes Modern Approach = Mistakes Ancient Approach
y. Mistakes Modern Neutral < Mistakes Ancient Neutral
z. Mistakes Modern Neutral > Mistakes Ancient Neutral
aa. Mistakes Modern Neutral = Mistakes Ancient Neutral

	Mistakes Ancient Neutral - Mistakes Ancient Avoidant	Mistakes Ancient Neutral - Mistakes Ancient Approach	Mistakes Ancient Approach - Mistakes Ancient Avoidant	Mistakes Modern Neutral - Mistakes Modern Avoidant	Mistakes Modern Neutral - Mistakes Modern Approach	Mistakes Modern Approach - Mistakes Modern Avoidant	Mistakes Modern Avoidant - Mistakes Ancient Avoidant	Mistakes Modern Approach - Mistakes Ancient Approach	Mistakes Modern Neutral - Mistakes Ancient Neutral
Z	-3.151[a]	-3.497[a]	-.817[b]	-4.525[b]	-1.679[a]	-5.009[b]	-4.986[a]	-.346[a]	-2.251[b]
Asymp. Sig. (2-tailed)	.002	.000	.414	.000	.093	.000	.000	.730	.024

a. Based on negative ranks.

b. Based on positive ranks.

c. Wilcoxon Signed Ranks Test

SPSS Output –Repeated Measures ANOVA (Avoidant Condition was Excluded)

Within-Subjects Factors

Measure:MEASURE_1

Age	Valence	Dependent Variable
1	1	Transformed Ancient Approach
	2	Transformed Ancient Neutral
2	1	Transformed Modern Approach
	2	Transformed Modern Neutral

Descriptive Statistics

	Mean	Std. Deviation	N
Transformed Ancient Approach	4.3695	.21598	37
Transformed Ancient Neutral	4.5728	.24082	37
Transformed Modern Approach	4.3633	.20121	37
Transformed Modern Neutral	4.3789	.25280	37

Mauchly's Test of Sphericity[b]

Measure:MEASURE_1

					Epsilon[a]		
Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Age	1.000	.000	0	.	1.000	1.000	1.000
Valence	1.000	.000	0	.	1.000	1.000	1.000
Age * Valence	1.000	.000	0	.	1.000	1.000	1.000

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

b. Design: Intercept

Within Subjects Design: Age + Valence + Age * Valence

Tests of Within-Subjects Effects

Measure:MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Age	Sphericity Assumed	.371	1	.371	36.481	.000	.503	36.481	1.000
	Greenhouse-Geisser	.371	1.000	.371	36.481	.000	.503	36.481	1.000

	Huynh-Feldt	.371	1.000	.371	36.481	.000	.503	36.481	1.000
	Lower-bound	.371	1.000	.371	36.481	.000	.503	36.481	1.000
Error (Age)	Sphericity Assumed	.366	36	.010					
	Greenhouse-Geisser	.366	36.000	.010					
	Huynh-Feldt	.366	36.000	.010					
	Lower-bound	.366	36.000	.010					
Valence	Sphericity Assumed	.443	1	.443	31.523	.000	.467	31.523	1.000
	Greenhouse-Geisser	.443	1.000	.443	31.523	.000	.467	31.523	1.000
	Huynh-Feldt	.443	1.000	.443	31.523	.000	.467	31.523	1.000
	Lower-bound	.443	1.000	.443	31.523	.000	.467	31.523	1.000
Error (Valence)	Sphericity Assumed	.506	36	.014					
	Greenhouse-Geisser	.506	36.000	.014					
	Huynh-Feldt	.506	36.000	.014					
	Lower-bound	.506	36.000	.014					
Age * Valence	Sphericity Assumed	.326	1	.326	51.666	.000	.589	51.666	1.000
	Greenhouse-Geisser	.326	1.000	.326	51.666	.000	.589	51.666	1.000
	Huynh-Feldt	.326	1.000	.326	51.666	.000	.589	51.666	1.000
	Lower-bound	.326	1.000	.326	51.666	.000	.589	51.666	1.000
Error (Age*Valence)	Sphericity Assumed	.227	36	.006					
	Greenhouse-Geisser	.227	36.000	.006					
	Huynh-Feldt	.227	36.000	.006					
	Lower-bound	.227	36.000	.006					

a. Computed using alpha = .05

SPSS Output –Repeated Measures ANOVA (Avoidant condition was excluded)

Pairwise Comparisons

Measure:MEASURE_1

(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	.100*	.017	.000	.066	.134
2	1	-.100*	.017	.000	-.134	-.066

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni.

Pairwise Comparisons

Measure:MEASURE_1

(I) Valence	(J) Valence	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	-.109*	.019	.000	-.149	-.070
2	1	.109*	.019	.000	.070	.149

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni.

Appendix E

Guidelines for Contributions by Authors

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