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Research Improvements on a Visual Search Task

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Abstract: Based on the above summary of theoretical foundations, the present experiment builds on the work of previous study by developing hypotheses and designing relevant experiments to investigate and discuss the effects of four influential variables of visual search. The cited article "The Influence of Stimuli Valence, Extraversion, and Emotion Regulation on Visual Search Within Real-World Scenes" demonstrates that emotion regulation is closely related to the development of affective disorders. Therefore, emotion regulation therapy is used in clinical treatment. However, the factor of extroversion has not been validated in previous articles. Accordingly, the extroversion variable was changed to neuroticism in this article. In addition, in previous studies, real-world emotional scenarios, including positive, negative and neutral scenarios have been shown to affect visual search tasks. Similarly, the experimental approach of conducting a visual search for targets in real-world emotional scenes was used in this article. This study of the effects of neuroticism and emotional regulation on attention may have significant implications for providing more effective interventions for individuals with affective disorders.

Keywords: task difficulty, emotion regulation, visual search

1. Introduction

Neurobehavioral disorders comprise many behavioural disorders related to brain disorders or brain injury. Currently, these disorders are often not well addressed. The theory suggests that attentional resources are focused on task-relevant stimuli (concept-driven processing) and prominent stimuli (data-driven processing). Data-driven processing, also known as bottom-up processing, refers to conscious processing beginning with external stimuli. The role of external stimuli is emphasized, and external input information drives the processing. In contrast, concept-driven processing, or top-down processing, begins with general knowledge about the perceptual object and emphasizes the influence of prior knowledge and existing concepts on the organization and interpretation of new inputs. However, because our brain can only process a certain amount of information in a given time and space, attention is needed to filter information and better allocate cognitive resources to virtual objects. The emotional value of stimuli may impact attentional processing and selection, that is, emotional attention. Attention training techniques can be used to treat neurobehavioral disorders. Research has shown that attention training techniques impact emotion regulation and can help treat neurological disorders, which has tremendous clinical implications. This also provides firm support and help for the hypothesis of the current study. Attention training has received extensive attention

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in the field of emotion regulation, including cognitive reappraisal and expression suppression. Visual search is one of the training paradigms for attention, such as identifying a target object in a complex and distracting environment, and real-world emotional scenarios have previously been demonstrated to impact visual research tasks. Experimenters could detect emotional targets more accurately and quickly during the visual search. In addition, emotional distractors were more attention-grabbing than neutral distractors. These findings provide a better understanding of the impact of emotion regulation on an individual's ability to allocate attention in real-world scenarios [1-9].

In an experimental study conducted by Bendall et al. in 2022, participants were asked to seek neutral target letters embedded in negative, positive, and neutral real-world images. Results showed that targets in festive scenes were less accurate, while response times in negative scenes were slower. However, because the variables in the experimental design of Bendall et al. did not include task difficulty, and can not confirm whether task difficulty affects attention allocation and is influenced by emotion regulation. Accordingly, task difficulty was added as one of the experimental variables in the present experiment. It is worth noting that task difficulty is one of the three main factors influencing cognitive load acting on the task. As task difficulty increases, participants' accuracy rates are lower and cognitive load is higher [1, 10].

Regarding the other variable in this experiment-neuroticism, a more established and empirically validated domain of personality traits, people with higher levels of neuroticism have poorer responsiveness to the effects of environmental stress. Previous research has shown that neuroticism is positively associated with negative emotions and not with positive emotions and can lead to impaired personal performance and self-regulatory failure. Specifically, neuroticism is associated with emotion regulation. Cognitive reappraisal in emotion regulation strategies can change individuals' emotions by altering their perceptions. One study showed that patients with high levels of neuroticism had reduced cognitive appraisal function. In addition, expression suppression is another more commonly used emotion regulation strategy, like cognitive reappraisal, which acts on attention. Based on the above summary of theoretical foundations, the present experiment builds on the work of Bendall et al. by developing hypotheses and designing relevant experiments to investigate and discuss the effects of four influential variables of visual search, namely stimulus value, task difficulty, neuroticism, and emotion regulation on attention in real-world scenarios [11, 12].

2. Literature Review

2.1. Introduction of the Cited Article

The article "The Influence of Stimuli Valence, Extraversion, and Emotion Regulation on Visual Search Within Real-World Scenes" investigates how stimuli valence, extraversion, and emotion regulation affect visual search within real-world scenes. The authors predict that people who habitually use expression suppression in daily lives are more capable of suppressing the interference from the real-world scenes, resulting in identifying the target more accurately and faster. Other than that, they predicted that the individual difference characteristics of extraversion and emotion regulation showed interaction with stimulus value and that individuals with more extraversion, cognitive reappraisal and expression inhibition levels had improved performance in positive and negative experiments compared to neutral trials [1].

2.1.1. Methods and Results

Their study uses eye-tracking and self-report measures to examine the impact of these factors on visual search. Participants first administered questionnaires on the extroverted and usual use of two

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strategies for regulating emotions, cognitive reassessment and expression, followed by a visual research task in which target letters were embedded in real-world scenarios with different emotional values [2].

They investigated attention allocation in emotional and neutral real-world scenarios by asking participants to find target letters embedded in real-world positive, negative, and neutral images in visual search tasks. The authors hypothesize that variables including stimuli valence, extraversion, and emotion regulation would influence visual search and that these effects would be most potent for negative stimuli. The study involves 84 participants shown a series of photographs from real-world scenes. Participants are asked to search the images for a specific target object and to report when they found it. Their study manipulated the valence of the stimuli by presenting participants with either positive or negative images. It also measured participants' extraversion and emotion regulation levels using self-report measures. Experimental evidence shows that pictures from the real world impact visual search accuracy and response time. The study's results showed that stimuli valence significantly affected attention distribution. Participants could find the target object in the positive images faster than the target item in the negative pictures. This effect was powerful for participants who were low in extraversion. In addition, the results showed that emotion regulation impacted visual search. Participants who reported higher levels of emotion regulation were better at finding the target object in negative images than those who reported lower levels of emotion regulation. The authors suggest that these findings have implications for understanding how individuals process information in real-world environments. Specifically, the results suggest that the emotional content of their environment may influence individuals who are low in extraversion.

In contrast, those who are high in emotion regulation may be better able to focus their attention in emotionally challenging situations. Overall, the study provides new insights into how stimuli valence, extraversion, and emotion regulation affect visual search in real-world scenes. The findings suggest that differences in individuals' traits of extraversion and emotion regulation may be attributable to the fact that emotional values can significantly impact attention allocation. The study also highlights the potential importance of emotion regulation for individuals navigating challenging or emotionally arousing environments. One limitation of the study is that it relied on self-report measures to assess extraversion and emotion regulation, which may be subject to bias. Additionally, other emotional cues may affect visual search differently because the study only looked at the effects of positive and negative stimuli. Future studies could delve deeper into these topics and examine the neurological processes underpinning how emotional cues affect visual search.

2.1.2. The Limitation of Previous Research

Like all research studies, the cited article has some limitations. The experimental sample was undersized and not representative. Additionally, as the author indicated that the experiment did not include task difficulty, it is speculated that this may be because it influenced the effect of emotion regulation on behavioural performance, which is why task difficulty was added as one of the variables in a future experiment. A visual task employed in this study that requires less efficient processing than the task of detecting changes has been used in previous studies. It may not be enough to show an extraversion effect. This is because the characteristics of the adopted task are important considerations concerning the results of the cognitive task. Consequently, as another critical point of this article, one more conclusion that can be drawn from Bendall's article is that there is not enough experimental data and evidence in his article to confirm the previous hypothesis that extraversion affects attention [1].

The other controversial point is that in this study, it can be due to changes in arousal levels rather

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than changes in stimuli value that influence participants' attention. Because the arousal levels of the stimuli in the experiments were different when the stimuli were selected based on value, the arousal levels also varied. However, the effects of both value and arousal were investigated in other articles indicating that stimuli value but not arousal level is the main factor affecting attention to vision, so whether it was the arousal level of the stimuli that affected attention or the value of the stimuli is uncertain. Future work is needed to investigate the independent effects of value and arousal on visual search in real-world scenes.

2.2. Discussion

2.2.1. Improvement

The current prospective study is based on a previous article on the effects of stimulus valence, extroversion, and emotion regulation on visual search in real-world scenarios, which was already introduced at the beginning of this study. Based on the deficiencies in the previous article, this article will improve the deficiencies of the previous experiments. Changing the variable "extroversion"from the previous article to "neuroticism" and improving the task difficulty by increasing the stimuli letters' colour, such as blue, red, and green. The experiment will remain the emotional regulation as an independent variable. Additionally, these two studies use positive, negative and neutral pictures from the real world as the stimulus background [1].

2.2.2. Hypotheses and Predicted Results

Expected results included that stimulus value would affect attention allocation and vary depending on task difficulty, neuroticism, and chronic emotion regulation strategies. Although previous studies suggest similar findings that guide the current predictions, further experimental refinement is necessary for the current study. The potential findings and questions in the introduction are explained next, and several hypothetical results are obtained. The study has several hypotheses that are presented in the introduction part. Some of the confirmable results can be verified in the cited article.

Nevertheless, this experiment has not been implemented for now. So it follows that some of these results are hypothetical results. The discussion section will not provide a more detailed statement of these results.

In the simple task, the results have two aspects: accuracy and response time. Firstly, accuracy decreases in optimistic emotion scenarios, and response times increase in negative emotion scenarios. Both of Bendall's articles verify the reason for this comparative implementation. Moreover, from these results, we can see that attention varies according to the emotional valence of real-world scenes. And Positive pictures are more likely to interfere with our attention.

Additionally, the different influences of positive and negative stimuli on reaction time and accuracy indicate that emotional stimulus may impact attention processing style in various ways. Secondly, individuals who habitually use expressive suppression strategies can identify targets more accurately and quickly, supported by previous articles. Thirdly, individuals with lower neuroticism will behave better, and individuals with high levels of neuroticism will have longer response times and low accuracy rates. Maybe this predicted result may be confirmed by the characteristics of high neuroticism. On the one hand, individuals with high levels of neuroticism have lower emotional stability and are more vulnerable to some external factors, and are even more sensitive to negative stimuli. Individuals can be influenced more easily by pictures from real-world scenes than those with low-level neuroticism. This result may be controversial.

On the other hand, this may not be confirmed in the current experiment. However, there is an article as a basis for this in Neuroticism Focused Attention: Evidence from SSVEPs. Both

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neuroticism and extraversion have been shown to affect attention. However, in our main reference article, extraversion did not affect attention, so it is possible that the effect of neuroticism on attention could not be verified in this article as well. Finally, individuals with lower neuroticism who perform in both positive and negative situations would have been enhanced by increased cognitive reappraisal and expressive suppression after increased task difficulty compared to neutral experiments. However, the increased habitual expression suppression is beneficial for visual search tasks. From the results, Individuals with high levels of expressive suppression have shorter response times and higher accuracy rates. Furthermore, from the above results, we can conclude that the emotion regulation strategy helps individuals improve their cognitive function, especially visual attention. Also, successful emotion regulation could improve behavioural performance and neural activation during the experiment [1, 13].

In previous studies, these extroversions and emotion regulation did not interact with emotional stimulus valence because previously studied tasks may not have required sufficient attention resources to reveal this effect. There is also the possibility that the task's difficulty in the current experiment was not significant enough because there is no more detailed classification and matching of task difficulty in the current study, so it may not have produced results like the interaction. Then in this kind of circumstance, participants have longer response times and lower accuracy rates. The neuroticism, cognitive reappraisal, and expressive suppression interact with stimulus valence in a difficult task. Task difficulty has an impact on the effects of emotional conditions on behavioural performance as well as neural activation in cognitive control. Hence, in the multi-source interference task, the task difficulty impacts the influence of emotional stimulus on working memory performance.

2.2.3. Limitations and Future Improvement of This Study

This current experimental design certainly has some limitations as well. The arousal levels of the stimuli in this experiment differed, and there was no strict matching in arousal levels. Therefore, it is necessary to investigate the independent effects of arousal and value on visual search in a follow-up study. Furthermore, it is uncertain whether task difficulty is sufficient, and the task's difficulty may influence the effect of emotional conditions on behavioural performance. Accordingly, in the future, the experiment will be designed like Stroop tasks or emotional components of Stroop tasks.

3. Significance

The significance of the current study is that it provides a means to develop an understanding of the relationship between psychological and neurobiological mechanisms at work. More importantly, research on neuroticism and emotion regulation in the attention domain will contribute to clinical treatment research for affective disorders. Future studies can investigate brain structures associated with cognitive reappraisal and habitual use of expression inhibition and their functional activation. Emotion regulation processes are carried out by a complex network of interconnections between the amygdala, insula and cortico-subcortical circuits of the orbitofrontal cortex and anterior cingulate cortex, in addition to the prefrontal cortex, which is also indirectly involved in emotion regulation through its connection with the orbitofrontal cortex. So future studies may investigate the activation of these brain regions during the visual search task in real-world scenes. And it will be a great idea to change the visual search task to the Stroop task with the emotional component in the future study to see the differences in selected attention. Finally, another orientation for future research is to conduct longitudinal studies with the repeated observation of the effects of using emotional regulation strategies, which would help to understand the sequence of chronic use of cognitive

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reappraisal or expressive inhibition [14].

4. Conclusion

In summary, it can be concluded that this article is an improved design based on the article by Bendall et al. A visual search task containing real-world stimuli with different emotional values was used, demonstrating that positive and negative stimuli affect attention. The results assumed from the experiment can be confirmed. Firstly, in terms of accuracy, targets embedded in neutral scenes are more accurate than those embedded in positive scenes, but there is no difference between neutral and negative scenes. However, targets embedded in negative scenes were identified more accurately than in festive scenes. Regarding reaction time, targets embedded in neutral scenes will be recognized faster than targets embedded in negative scenes. Nevertheless, The reaction time to correctly identify the target in a neutral scene did not differ from that in a joyous scene. Additionally, those accustomed to expression suppression strategies can identify targets more accurately and quickly. Moreover, individuals with lower neuroticism will behave better, and individuals with high levels of neuroticism have longer response times and low accuracy rates, which could perhaps be confirmed in future experiments. Besides the above points, task difficulty impacts the effects of emotional conditions on behavioural performance and neural activation in cognitive control. Furthermore, from the above results, we can conclude that emotion regulation strategies help individuals improve their cognitive functions, especially visual attention. More importantly, research on neuroticism and emotion regulation in the attention domain will contribute to clinical treatment research for affective disorders.

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