Abstract of thesis entitled:

Restoring Cognitive Resources by Visual Images of Nature – Evidence from Behavioral and Neurophysiological Study

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ABSTRACT

Attention Restoration Theory (ART) proposes that interaction with nature can provide a restorative experience (Kaplan, 1995; 2001). The theoretical foundation of ART is based on past research findings with reference to William James's suggestions that attention can be separated into two distinct components: directed attention and involuntary attention (James, 1892). Prolonged focus by directed attention leads to mental fatigue. ART suggests that spending time in nature or simply looking at natural scenes would invoke one's involuntary attention and replenish one's directed attention capacity, while viewing urban scenes would lead to the opposite result. In the present study, we first replicated the existing findings on the effect of viewing images of nature on attention restoration with the Attention Network Task (ANT; Fan, et al., 2002; 2005). Secondly, we explored whether cognitive flexibility, a hallmark of human cognition referring to the ability to pursue multiple goals or tasks

simultaneously, can benefit from interaction with nature. Finally, we measured the neurophysiological changes in the brain during the process of viewing images of nature versus urban scenes by EEG power spectrum analysis, and compared the changes in N1 and P3 ERP components for ANT before and after viewing the images of nature and urban scenes. The results of the present study showed viewing images of nature would not only benefit attention function but also cognitive flexibility. In addition, EEG power spectrum analysis suggested that viewing images of nature is a restorative experience while viewing images of urban scenes increases the participant's level of mental fatigue. ERP analysis was not in line with our hypothesis, and it suggests that the improvement in executive attention may not simply be related to more readily available mental resources that have been replenished after viewing images of nature. In conclusion, the present study provided support to ART and extends the current findings on the benefits of viewing images of nature with neurophysiological evidence. On the other hand, it reveals the limitations of ART and the need for further investigation to provide a more comprehensive understanding of the benefits of nature to human cognitive functions.

摘要

注意力修復理論 (Attention Restoration Theory; ART)提出，接觸自然環境能為人們提供恢復性體驗(Kaplan, 1995; 2001)。ART 的理論基礎可以追溯到 William James 對注意系統的劃分，他認為注意可以分為主動注意 (directed attention) 和非自主注意 (involuntary attention) (James, 1892)。長時間的主動注意會導致精神疲勞。ART 認為，享受自然時光，甚至僅僅觀看自然場景，能夠激發非自主注意並恢復主動注意的能力；但觀看非自然的城市景象則產生相反的效果。以往研究致力於尋找支持 ART 的證據。本研究中，我們首先使用注意網路任務 (Attention Network Task; ANT; Fan et al., 2002; 2005) 重複以往發現，驗證觀看自然場景圖像對注意力恢復的作用。進一步，我們探索了接觸自然場景能否提高認知靈活性，即同時執行多目標或任務的認知能力。最後，我們考察行為變化背後的神經生理差異。我們分析了觀看自然場景和城市場景過程中大腦的 EEG 頻譜變化，並比較了觀看自然場景和城市場景前後表徵 ANT 任務的 ERP N1 和 P3 成分的差異。結果顯示，觀看自然場景不僅能夠促進注意和執行功能，還能提高認知靈活性。並且，EEG 頻譜分析結果為 ART 提供了進一步證據，驗證了觀看自然場景能恢復注意力而觀看城市場景會提高被試的心理疲憊。然而，ERP 分析結果與假設不一致，提示我們自然場景對注意執行功能的恢復作用有更複雜的機制，不能簡單歸結為自然場景對心理資源的補充。綜上所述，本研究為 ART 提供了進一步支持，並且將自然場景對注意力恢復作用的證據延伸到神經生理學

機制上，將理論、行為效應和神經機制結合。本研究同時也揭示了 ART 的局限

性，自然場景對人認知功能的恢復作用需要進一步研究來提供更全面的解釋。