中文摘要

在問題解決歷程中，提示被認為可引導解題者的注意力，有助於提取解題相關資訊。本研究目的以眼球追蹤技術探討立體空間問題中「提示與否和解題者答對與否」在圖文訊息的認知歷程，因而將解題者類型分為無提示答對、無提示答錯、有提示答對與有提示答錯四類。本研究將立體空間問題解決歷程分為解題歷程與作答歷程，並且針對解題歷程提出三階段「立體空間問題解決模式」：定義問題、圖文整合與解出問題。參與者為 68 位大學生，本研究以 R 統計軟體分析，結果顯示：定義問題階段由首次凝視時間可知，無提示答對者以文字區訊息為主。圖文整合階段由凝視回合數可知，四類解題者以圖形區為主，透過來回進出文字區與圖形區以整合圖文訊息。解出問題階段根據總凝視時間比率與總凝視次數可知，無提示答對者在圖文比重無顯著差異，其他三者則以圖形區訊息為主。因此，「無提示答對者」在文字區的首次凝視時間較久，亦即在文字區界定問題時間較久，但比「有提示答對者」在圖形區的總凝數次數及時間比率較少，顯示有提示答對者受提示影響，投入圖形區的認知處理較多。未來研究可探討「回饋與否」對解題歷程的影響，針對答錯者提供回饋以釐清問題。此外，亦可考量解題者的先備知識，進一步探討專家與生手解題策略的差異。

關鍵字：眼動型態、問題解決歷程、立體空間問題解決模式、提示、解題者表現類型

Abstract

During the problem solving process, cues are used to guide the solvers' attention, helping to retrieve information related to the solution. Little is known, however, about how the involved mental processes unfold. The present study begins by proposing a "model for solving three-dimensional space problems" (STSP), consisting of the following stages: define the problem, integrate text and diagram, and solve the problem. The present study analyzes the problem solving process for a three-dimensional space problem with eye movement monitoring, and investigates the effectiveness of cues related to the text and diagram information for successful and unsuccessful problem-solvers. Sixty-eight undergraduates were recruited as participants and classified into four groups: successful problem solvers in the non-cues (SNC); unsuccessful problem solvers with non-cues (USNC); successful problem solvers with cues (SC), and unsuccessful problem solvers with cues (USC). The problem solving process was divided into two stages: the solving stage and the answering stage. Eye movement data for the four groups was analyzed for the two stages. The statistical software R was used to analyze the data. Turning to the results, in the stage of 'defining the problem', first past gaze duration data indicated that the SNC group relied on textual information. In the stage 'integration of text and diagram' stage, run counts revealed that all four groups relied on both textual and diagram information, shifting their view back and forth and combining the information in the text and diagram areas; in the stage of 'solving the problem', the percentage of total viewing duration and total fixation count showed that the SNC group equally used the information in both area but the remaining three groups mainly used the information in the diagram area. In conclusion, the SNC group had longer first past gaze duration in the text area and spent more time defining the problem; but the SNC group had a lower total fixation count and lower percentage of total viewing duration than the SC group in the diagram area, suggesting that for the performance of the SC group, cues influenced them to invest more cognitive processes in the diagram area. Future studies might find it worthwhile to investigate the effects of feedback on performance. In particular, it would be useful to see whether and how feedback helps less successful solvers to clarify the problem. Future research might also explore the influence of prior knowledge and discuss the differences between expert and novice strategies.

Keywords: eye movements, problem solving processing, the model of solving three-dimensional space problems (STSP), cue, successful and unsuccessful problem-solvers