

Abstract of thesis entitled: Types of expert object perception abilities for faces, words, and musical notation

Submitted by FAN, Pu

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### Abstract

What are the number and types of the components underlying expert object perception abilities? This question concerns cognitive theorists who are interested in the structure of mind, and concerns educational psychologists who would like to know if the development of expert skills benefits from domain-general or domain-specific influences. Specifically, this study used a latent variable approach to model associations reflecting different types of object perception abilities within familiar categories of faces, English words, Chinese characters, and musical notes. Music reading Chinese-English bilinguals were recruited. For each category, three perceptual matching tasks were used as indicators. Variances common to the indicators were extracted by category factors, which were then associated with each other through different paths for competing theoretical models. One overarching factor of object perception for all categories was found. This one-factor model remained the best even when domain-specific experience and fluid intelligence were controlled. Perception abilities for an additional set of novel object categories were assessed using the same tasks, and the best-fitting model had two factors governing 2D objects and 3D objects respectively, whether controlling for general object perception experience and fluid intelligence or not. The different underlying structures between familiar and novel categories suggest that domain-general abilities, possibly including fine-grained discrimination, determined performance

variations when the level of expertise was high; and domain-specific abilities, such as skills specific for processing 2D and 3D objects, were more important when the level of expertise was low. The findings integrate previous accounts for domain-general and domain-specific object recognition mechanisms, and illustrate how domain-general and domain-specific abilities enjoy different levels of importance at different phases of expertise acquisition.

*Keywords:* expert visual perception, domain-general, domain-specificity, latent variable modelling

## 摘要

專家領域物件的視知覺能力 (expert object perception abilities) 包含多少底层组成部分, 各屬於什麼類型? 這個問題涉及對心智結構感興趣的認知理論家, 以及想知道專家技能的發展如何受領域一般性 (domain-general) 或領域特异性 (domain-specific) 能力影響的教育心理學家。具體而言, 本研究使用潛在變量法 (latent variable approach), 比較視知覺過程下熟悉領域 (面孔、英文單詞、漢字和音符) 之間不同的關聯模型。我們招募了熟識樂譜的中英雙語人士。每個領域類別有三個知覺配對任務作為測量指標 (indicator)。每個類別指標變量間的同方差 (common variance) 提取成為潛在的類別因子 (factor), 這些類別因子進而由不同的路徑相互關聯以形成不同的理論模型。我們發現所有類別的視知覺能力由同一個因子統領。即使在控制了特异領域的經驗和流體智力 (fluid intelligence) 後, 這個單因子模型仍然是最好的。另外, 我們還使用了相同的視知覺任務來測量一組陌生的領域類別。最佳擬合模型包含兩個因子, 分別掌管 2D 物件和 3D 物件。這個結果不受領域一般性經驗和流體智力影響。對比熟悉類別和陌生類別的不同內部結構, 我們提出: 當領域專業水平較高時, 領域一般性能力 (可能包括了細粒狀區分, fine-grained discrimination) 決定了任務水平變化; 而當領域專業水平較低時, 領域特異性能力 (如感知 2D 和 3D 物件的不同能力) 更重要。本研究結果整合了此前關於領域一般性和領域特異性物件再認 (object recognition) 機制的解釋, 並闡明了領域一般性和領域特異性能力如何在獲取專家技能的不同階段享有不同的重要性。

**關鍵詞:** 專家領域物件的視知覺能力, 領域一般性, 領域特异性, 潛在變量模式