

Research Project

Spatial scaling in children and adults: The role of perceptual modality, visual experience, and cognitive style

Third-party funded project

Project title Spatial scaling in children and adults: The role of perceptual modality, visual experience, and cognitive style

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Spatial scaling is an essential spatial skill that is involved in a number of daily activities, from interpreting small-scaled maps of a building to understanding the large-scaled model of a cell. This ability is a crucial prerequisite for several science disciplines and involves an understanding how distances in two different-sized spaces relate to each other. Given this importance, it seems timely to increase our knowledge about the mental processes involved in spatial scaling; however, several methodological preconditions have to be fulfilled to systematically investigate this skill. As of today, only few studies have addressed these constraints and revealed heterogenous findings. In the present project, we will incorporate these methodological preconditions and qualify previous research by investigating the cognitive processes involved when scaling up (e.g., when interpreting a small-scaled map) and scaling down (e.g., when understanding a large-scaled cell-model), which will probe the flexibility of the scaling process. Furthermore, we aim to extend our knowledge about scaling in the visual domain to the haptic domain and examine in which ways scaling differs between these perceptual modalities. These questions will be investigated in samples of children aged 6, 7, and 8 years as well as adults, which will enable to detect developmental continuity of spatial-scaling abilities in general and effects of perceptual modalities and scaling directions in particular. Using a state-of-the-art methodology, in each of these experiments, children and adults will be presented with two embossed graphics. One graphic will include a convex target location (i.e., the map) and the other one will be empty (i.e., the referent space). Sizes of the maps will differ in accordance to different scaling factors and directions whereas the referent space will be constant in size. Participants will be instructed to visually, haptically, or bimodally explore the map and to remember the target location. Immediately afterwards, they will be asked to indicate the same location in the referent space from memory. The tactile exploration of maps and scaling of spatial information will be additionally investigated in a sample of blind individuals who did collect a varying extent of visual experience in their previous life (congenitally blind and late blind individuals). Investigating the influence of visual experience on spatial-scaling abilities will inform debates discussing whether humans need visual input to generate and transform mental object representations. Furthermore, our results will inform interventions designed to improve blind individuals' usage of embossed graphics. As a final goal, we aim to investigate associations between spatial-scaling abilities and cognitive style, which is a general heuristic how individuals perceive, structure, and remember information. Investigating this relationship will help to understand how trait-like spatial-scaling abilities differ as a function of state-like cognitive styles, which will be central for creating effective training studies and will inform theoretical frameworks.

Findings from the proposed studies will make an important contribution to various interdisciplinary fields such as psychology, philosophy, educational sciences, and computer sciences.

Keywords spatial scaling, visual domain, tactile domain, cognitive style, blindness, cognitive development, mental transformation

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