The impact of physical spaces on divergent and convergent problem-solving performance

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Abstract: What consequences does the embodied and situative nature of cognition have for problem solving? Research on situative and embodied cognition has shown that certain aspects of attention and perception are attuned to physical characteristics and settings (Bhalla & Proffitt, 1999). Further, some recent research has suggested that the cognitive and neural substrates of search processes in semantic memory are shared with search/foraging processes in the world, and that search constraints in the physical environment can shape search patterns in both physical foraging and in semantic memory (Hills et al., 2008, 2012). In a series of studies, we explore whether and how this might have consequences for search processes in problem solving. Specifically, we examine whether and how performance on divergent (requiring many alternative solutions) and convergent (requiring a single "best" solution) problem-solving tasks differs depending on the size of the physical environment in which the problem solver is situated. We reasoned that larger rooms afford broader physical movements and search, and might therefore similarly activate a broader search in semantic memory during divergent problem solving. Participants solved divergent (alternative uses, visual invention task) and convergent problems (letter series extrapolation task, remote associates test) in either a small space (small room) or large space (large hall). Across a range of problem solving performance indicators (e.g., fluency, novelty, quality), we found that performance on divergent tasks was slightly but reliably higher in the larger space, compared to the smaller space. However, we found no such variation on convergent task performance across the two types of environments. These findings suggest that problem-solving processes (specifically divergent search in semantic memory) may be influenced by constraints and affordances in one's physical environment.