Visuospatial Skills and the Workforce

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Abstract. Visuospatial cognitive skills are increasingly recognized as critical in many areas of both formal and informal learning, but far less research has looked at their role in the workforce. We know, for example, that strong visuospatial skills in high school are predictive of STEM occupations, but we know less about how these skills are actually deployed in the workplace, and also the extent to which these skills might also be important in various non-STEM occupational pathways. In this paper, we review the current context for these questions, including identifying occupations for which these research questions are actively being explored, as well as areas that urgently call for more research.

Keywords: Visual reasoning · Spatial skills · Cognitive assessments · Employment · Job matching.

1 Introduction

The skills that make up visuospatial cognitive processing allow us to perceive, encode, retain, and mentally act on visual and spatial information, including interacting with external diagrams and visualizations as well as using internal mental imagery [16]. Growing bodies of research are finding links between visuospatial skills and learning outcomes across various STEM disciplines [4], and similar patterns are found in STEM occupational contexts [10]. There is less research examining links between visuospatial skills and non-STEM occupations, though we expect these connections to be just as important.

For example, O*NET is a comprehensive database sponsored and maintained by the United States Department of Labor that defines occupations and provides information about job titles, tasks, abilities, skills, etc. The information on O*NET is based largely on survey responses provided by incumbents as well as occupational experts and analysts. While many of the listed occupations have not been the focus of detailed cognitive research, O*NET results do highlight the key roles that visuospatial skills are thought to play in many occupations in both STEM and non-STEM areas.

In this paper, we present a brief synthesis of research on visuospatial skills and their potential role in job matching and related areas of adult education and assessment. Contributions of our paper include: (1) a brief survey of research on visuospatial skills in non-STEM occupations; (2) a description of current industry-based tools for job matching that rely on assessing visuospatial skills; and (3) key challenges for cognitive science research in this area.

2 Two Mini-Reviews: Non-STEM Occupations and Commercial Talent Matching

Many pockets of studies have looked at the role of visuospatial skills in non-STEM occupational contexts, including: **carpentry** [5], **air traffic control** [12, 2], **architecture** [3], **x-ray baggage screening** [15], **art** [13], **sports refereeing** [9], **apparel design** [1], **policing** [8, 14], **construction** [17, 11]; **product design** [7], and **data entry** [6].

Next, we briefly review talent matching companies that use cognitive assessment tools to support industry hiring practices. Information about each talent matching company was gathered through what is presented on their websites and not through direct examination of their assessment materials.

Criteria Corp reports use by over 4,500 organizations. While their assessment targets important skills, such as problem-solving and critical thinking, their website description is missing a distinct visuospatial assessment. However, the company acknowledge that spatial reasoning is a component of their overall cognitive aptitude test, i.e., through the manipulation of shapes and recognition of spatial patterns. *Pymetrics*, which reports use by more than 60 large companies, includes numerical and logical reasoning measures, but does not reference visuospatial reasoning or any specific test of it on their website. *SHL* offers, among a very large battery of multiple cognitive and other assessments, a 25-minute Spatial Ability test that claims to support a wide range of occupations; this "wide range" is primarily exemplified in STEM-related jobs. *Berke* directly references visuospatial ability on their website and has a detailed acknowledgment of the importance of spatial visualization beyond STEM domains. *TestGorilla* offers a short test on spatial reasoning specifically targeted at STEM-related jobs.

3 Discussion and Future Work

We have presented a brief but multi-faceted case for the importance of research on visuospatial cognitive skills in occupational settings. Key takeaways include:

1) While there is growing research on visuospatial skills in professional STEM occupations and educational pathways, this research urgently needs to be expanded to include non-STEM and non-professional occupations.

2) Specific occupations are finding success in integrating visuospatial cognitive assessments into their occupation-specific screening and hiring practices, but we found less in the way of generalizable approaches.

3) Commercial talent matching products that incorporate visuospatial skills assessments have appeared on the market and seem to be widely used, but these products have not (as far as we know) been evaluated in controlled experiments.

4) Finally, more careful analysis is needed of links between performance on laboratory tasks and on tasks that more closely match real-world demands.

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