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Perspective taking: Spatial reasoning and projective geometry in the early years

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Spatial skills are seen as increasingly important in STEM fields. For more than two decades, the push for STEM (Science, Technology, Engineering, Mathematics) skills worldwide has brought particular attention to spatial reasoning and the role it plays in each of the domains as well as across STEM areas. Yet while spatial reasoning underlies all STEM domains, arguably, it is mathematics that enables examination and communication of spatial concepts. Within mathematics then, geometry provides a site to study and support young children's spatial reasoning.

In this paper we revisit Piaget and his colleagues' theoretical perspective regarding children's development of geometry concepts, focusing on projective geometry in that theory, and in particular, as it involves the relationships between objects and images and their mappings or projections onto other surfaces. We outline three critiques of Piaget and Inhelder's (1967) theory of topological primacy: 1) Children's conceptions of space may not follow the order of topological ideas then projective and Euclidean concepts; 2) The overemphasis on identifying logical errors in Piagetian theory precludes examination of projective concepts not fully fledged or articulated and perhaps altogether different; and 3) While children's geometric conceptions of space may not be direct reproductions of their sensorimotor perceptions of the environment, it is also unlikely that their representations are purely logical operational systems.

Following this, we situate the three criticisms within more current literature which emphasizes spatial reasoning as a dynamically emergent, ever-changing, and irreducibly whole. We identify complementary perspectives for how researchers might observe anew, the ways young children reason spatially in projective geometry. As such, we offer alternative sightlines for theoretical and pedagogical reconceptualisation.

References

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