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SHORT REPORT

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Perceiving gaze from head and eye rotations: An integrative challenge for children and adults

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Abstract

Gaze is an emergent visual feature. A person's gaze direction is perceived not just based on the rotation of their eyes, but also their head. At least among adults, this integrative process appears to be flexible such that one feature can be weighted more heavily than the other depending on the circumstances. Yet it is unclear how this weighting might vary across individuals or across development. When children engage emergent gaze, do they prioritize cues from the head and eyes similarly to adults? Is the perception of gaze among individuals with autism spectrum disorder (ASD) emergent, or is it reliant on a single feature? Sixty adults (*M* = 29.86 years-of-age), thirty-seven typically developing children and adolescents (*M* = 9.3 years-of-age; range = 7–15), and eighteen children with ASD (*M* = 9.72 years-of-age; range = 7–15) viewed faces with leftward, rightward, or direct head rotations in conjunction with leftward or rightward pupil rotations, and then indicated whether the face was looking leftward or rightward. All individuals, across development and ASD status, used head rotation to infer gaze direction, albeit with some individual differences. However, the use of pupil rotation was heavily dependent on age. Finally, children with ASD used pupil rotation significantly less than typically developing (TD) children when inferring gaze direction, even after accounting for age. Our approach provides a novel framework for understanding individual and group differences in gaze as it is actually perceived—as an emergent feature. Furthermore, this study begins to address an important gap in ASD literature, taking the first look at emergent gaze perception in this population.

KEYWORDS
ASD, autism spectrum disorder, development, eye gaze, gaze perception, Wollaston

1 | INTRODUCTION

To discriminate another person's gaze, the visual system utilizes information from the entire face, not just the eyes (Cline, 1967; Kluttz, Mayes, West, & Kerby, 2009; Murayama & Endo, 1984; Otsuka, Mareschal, Calder, & Clifford, 2014; Wollaston, 1824). Perceived gaze is thus an emergent visual feature, and can vary depending on how the rotation of the eyes, the head, and other facial features are integrated. For example, different head rotations can make identical eye gazes appear to be directed at different points in space, or make two different eye gazes appear identical (Sweeny & Whitney, 2017). It is only by focusing on gaze at this emergent level that people may

