

Chapter 3

Hemispheric Processing of Facial Emotion Recognition and Development in Children

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ABSTRACT

This chapter examines facial emotion recognition, a vital skill for social interaction and emotional development, from evolutionary, developmental, and neurological perspectives. It explores how children's ability to recognize emotions develops through social experiences, brain maturation, and lateralization. Key milestones, such as the shift from featural to holistic facial processing and sensitivity to emotional intensity, are discussed alongside insights into the right hemisphere's dominance in emotion recognition. The chapter also highlights sex differences, the role of the corpus callosum in hemispheric integration, and how these factors shape developmental trajectories. Drawing on behavioral and electrophysiological studies, it connects neural and cognitive processes with emotion recognition, showing evidence for gradual neural specialization. Finally, it bridges theory to practice by proposing applications in interventions for neurodevelopmental conditions, educational strategies, and the development of emotion recognition technologies.

INTRODUCTION

Facial emotion recognition plays a foundational and critical role in human social communication, enabling individuals to interpret and respond to others' emotional states effectively, supporting the development of interpersonal competence (Zupan & Eskritt, 2024). The ability to decode facial expressions contributes to socioemotional learning, empathy, and the regulation of social behavior across development (Decety & Holvoet, 2021). Importantly, deficits in this skill are consistently linked to social difficulties in both neurotypical and neurodiverse populations, including individuals with autism spectrum disorder (ASD) and attention deficit hyperactivity disorder (ADHD) (Uljarevic & Hamilton, 2013). From an early age, infants rely on facial cues to infer the emotional intentions of caregivers, shaping attachment and affective bonding (Montague & Walker-Andrews, 2001). Research shows that even very young infants

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exhibit attentional preferences toward emotional facial expressions, especially those of caregivers (Xie et al., 2024). However, the development of emotion recognition is not uniform and can be influenced by a complex interplay of neural maturation, cognitive strategies, cultural norms, and social experiences (Herba & Phillips, 2004). Furthermore, recent findings emphasize that disruptions in emotion recognition are not limited to clinical psychopathologies such as psychopathy, but are also prevalent in neurodevelopmental conditions. For example, individuals with ASD often show reduced accuracy in recognizing the emotions of fear or sadness, while children with ADHD may struggle to attend to emotionally salient facial cues (Uljarevic & Hamilton, 2013). These findings underscore the growing need to understand how emotion recognition abilities develop in both typical and atypical populations, so that the interventions aimed at enhancing social competence are informed by the literature (Weissman et al., 2024).

This chapter will explore the developmental trajectory of facial emotion recognition, focusing on the influence of hemispheric lateralization, and contextual factors. It also addresses how these mechanisms operate in neurodiverse populations, highlighting both typical and atypical pathways to emotion recognition ability.

THEORETICAL ACCOUNTS OF EMOTION RECOGNITION

Understanding facial emotion recognition requires consideration of relevant theoretical frameworks that explain it, its mechanisms, and its observed variability. Traditionally, discussions have unfolded around the theories of universal, basic emotions and the constructivist perspectives.

Basic Emotions Theory

One of the most influential theories of emotions is Ekman's Basic Emotions Theory, which proposes that a set of basic emotions—happiness, sadness, fear, anger, disgust, and surprise—are evolutionarily adapted emotions, each associated with distinct and universally recognised facial expressions (Ekman, 2003). Cross-cultural studies, including early work by Ekman and Friesen (1971), demonstrated consistent recognition of these expressions across different populations. These findings have been supported by meta-analyses (Elflein & Ambady, 2002), although more recent cross-cultural studies have noted variations in emotional display and interpretation depending on context (Crivelli & Fridlund, 2018).

Dimensional Models

In contrast, dimensional models conceptualize emotions as existing along a continuous dimensions space, most notably valence (positive to negative) and arousal (high to low intensity) rather than as discrete categories (Russell, 2003). Neuroscientific evidence supports this view, indicating that the brain tends to respond to general emotional attributes—such as valence or intensity—rather than to specific, labelled emotion categories (Palomero-Gallagher & Amunts, 2022). Large-scale machine learning studies, such as those using the AffectNet database, further validate the predictive power of valence and arousal dimensions in emotion recognition from facial cues (Mollahosseini et al., 2017). Their research demonstrated that deep learning models trained on over one million facial images could reliably predict the affective dimensions of valence and arousal. For example, these models can distinguish between high-arousal, negative expressions like anger and low-arousal, positive ones like contentment. However,

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