



# Development of face processing

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This article reviews the development of the face-processing system from birth, during infancy and through childhood, until it becomes the sophisticated system observed in adults. We begin by discussing the following major theoretical issues concerning the development of face expertise: (1) nature versus nurture or the role of experience in face processing, (2) level of processing (i.e., global, basic, subordinate, individual) and expertise, and (3) type of processing (i.e., holistic, configural, featural). This general overview will be followed by a closer examination of individual studies that investigate the development of face processing. These studies will include a review of (1) development of differential processing of faces and objects, (2) development of differential processing of faces of different species, (3) developmental changes in processing facial identity, and (4) developmental changes in the categorization of faces. Our review of the developmental literature reveals early competence in face-processing abilities with infants presenting a preference for face stimuli and facial discrimination using featural, configural, and holistic cues. This early competence is then later refined as evidenced by age-related changes throughout childhood. Some of the refinements are likely due to the development of general cognitive abilities, whereas some others may be face-specific. © 2011 John Wiley & Sons, Ltd. *WIREs Cogn Sci* 2011, 2: 666–675 DOI: 10.1002/wcs.146

## INTRODUCTION

Recognition of individuals at first sight is extremely important for social species such as human and nonhuman primates. An individual's decision to fight, flee, mate, cooperate, or seek protection often depends on the outcome of such recognition. If some species recognize individuals using olfaction or audition,<sup>1</sup> primates will primarily do it via their visual system, using faces. Although it is still controversial as to whether humans' superior face-processing abilities reflect an innate, specialized face-processing

mechanism, or a more general phenomenon of visual learning due to massive exposure to faces,<sup>2–5</sup> most researchers agree that (1) adults are experts in face processing and (2) adults' ability to process faces is tuned by their experience.

Faces are multidimensional visual stimuli, providing a broad range of information to an observer.<sup>6</sup> This information can be organized into two major categories: face traits and face states. Face traits refer to the visual information in the face that is relatively permanent and stable. These traits include: facedness (face or non-face), species (e.g., humans or dogs), gender (male or female), race (e.g., Chinese or Caucasian), aesthetics (attractive or unattractive), age (old or young), and identity (e.g., John or Mary). Face states refer to dynamic and transient facial cues. Face-state information is used to process speech (e.g., the McGurk effect), emotional expressions, attention, and intentions.<sup>7</sup> Exactly which components of the face-processing system are present at birth, which develop first, and at what stage the system becomes adult-like are still hotly debated topics. However, we will not talk about face states here.

Viewing a face triggers at least two automatic and fast processes: categorization of the stimulus

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# Development Of Face Processing

**Daniel F McAuley**



## **Development Of Face Processing:**

The Development of Face Processing in Infancy and Early Childhood Olivier Pascalis, Alan Slater, 2003 This book on face perception is one of the most researched areas in infancy and early childhood because of the enormous information that the face conveys to its viewer both in terms of the recognition of individuals and in the expressive information that faces convey. It remains a complex area but a number of theoretical issues have emerged which motivate much of the current research. This book describes many of these issues and also presents some empirical research findings to illustrate the ways in which researchers carry out their investigations.

*The Development of Face Processing* Gudrun Schwarzer, Helmut Leder, 2003 This book draws together for the first time the latest scientific findings from leading international researchers on how face recognition develops. It is only in recent years that methods acceptable in experimental psychology have been developed for studying this vital and unique process. While other publications have concentrated on computer modeling and of face processing and the like this one is unique in that it looks at fundamental and so far unanswered questions such as: What are the roots of and reasons for our ability to recognize faces? How much of this ability is learned and how much innate? By connecting studies on face processing in infancy with those on the development of face processing it thus bridges the gap between face processing research and visual perceptual development. Leading researchers from USA and Europe who have conducted pioneering work in these domains describe results and anticipate future inquiry covering topics such as: fundamental cognitive abilities in infancy; development of face processing from infancy to adulthood and the effects of expertise on face recognition.

**Handbook of Research on Face Processing** A.W. Young, H.D. Ellis, 2013-10-22 The high degree of scientific interest in face processing is readily understandable since people's faces provide such a wealth of social information. Moreover, investigations have produced evidence of highly precocious face processing abilities in infants and of neural mechanisms in adults that seem to be differentially involved in face perception. Such findings demonstrate that as one might expect the psychological importance of the face has clear biological underpinnings. There are also urgent practical reasons for wanting to understand face processing. The most extensively investigated of these involve forensic issues. Other applications include the development of automated recognition systems for security and other purposes and understanding and rehabilitating disorders and impairments linked to brain injuries and psychiatric conditions. Current studies of face processing are grouped in the volume into eleven topic areas. For each area the editors approached an acknowledged authority and commissioned a review chapter summarising the findings that have been made. These chapters were then circulated to other experts who were asked to write brief commentaries that developed theoretical or empirical points of importance to each area. In this way a balanced coverage of each topic is achieved. The book begins with a section examining the evidence suggesting that there may be something special about face processing. This is followed by consideration of the face as a visual pattern. Then there are four sections dealing with major uses of facial information followed by sections

discussing the development of face processing abilities and the neural mechanisms involved The last three sections of the book deal with topics for which there are important practical applications for the studies reported *The Role of Facial Movements in Face Processing and Its Development* Naiqi Xiao,2016 Our visual processing system is largely shaped by the environment in which we live Human faces as one of the most commonly seen stimuli exert unparalleled influence in our visual system and its development In the past half century researchers have extensively studied face processing which has greatly broadened our understandings of visual perception Most of these prior studies used static face images as experiment stimuli In the real world faces are mostly moving people smile talk and nod Prior studies reported unique contributions of facial movements in facilitating face recognition in infants and adults The underlying perceptual mechanisms for processing moving faces however are still unclear In particular our current understanding about face processing is limited to evidence from studies using static faces It is an open question as to whether our understanding about static face processing can help us understand face processing in the real world where faces are moving The current thesis specifically addresses this theoretically important question by examining the roles of facial movements in the development of face perception in infancy childhood adolescence and adulthood Results from Chapter 2 demonstrated that moving faces facilitated part based face processing in children adolescents and adults In the first year of life infants exhibited a left visual field bias in their face scanning pattern only for natural moving faces but not for artificial moving ones Chapter 3 Infants scanned moving faces differently from static ones Their scanning pattern for moving faces but not for static faces predicted their face discrimination performance Chapters 4 5 These studies consistently show crucial roles of facial movements in the development of face perception from infancy to adulthood My research has laid an important foundation for future studies to understand real world face processing and the underlying perceptual and neural mechanisms

**The Development of Face Perception & Facial Expression Processing** Nim Tottenham,2005 *Special Issue* ,2013 *Development of Face Processing in the Human Brain* Wei He,2014 *Handbook of Developmental Social Neuroscience* Michelle De Haan,Megan R. Gunnar,2009-04-02 Recent years have seen an explosion of research into the physiological and neural bases of social behavior This state of the science handbook is unique in approaching the topic from a developmental perspective Exploring the dynamic relationship between biology and social behavior from infancy through adolescence leading investigators discuss key processes in typical and atypical development Chapters address emotion motivation person perception interpersonal relationships developmental disorders and psychopathology The volume sheds light on how complex social abilities emerge from basic brain circuits whether there are elements of social behavior that are hard wired in the brain and the impact of early experiences Illustrations include 8 color plates

**On the Typical and Atypical Development of Face Processing and Recognition During the First Three Months of Life and in a Population of School-aged Children Born Prematurely** Marianne H. E. Rotsaert,2005 [On the Development of Face Processing in Early Life](#) ,2010 **Risk and**

## **Protective Factors Associated with Early Adversity and Development: Evidence from Human and Animal Research**

Rosario Montirosso, Livio Provenzi, Ed Tronick, 2020-02-13

## **Studies on the Structure & Development of Vertebrates**

Edwin Stephen Goodrich, 1930

Process Photogram, 1898

Perception, 2009

The Development of Face Processing

Deficits in Autism: A Meta-Analytic Review Demi Robinson, 2020

Abnormal visual scanning of faces in individuals with autism is a predictor and possible precursor to more prominent social communication deficits seen in autism Klin et al 2002 Sasson 2006 and it is one of the earliest symptoms Dawson et al 2005 The aim of the present meta analysis is to determine the degree and significance of differences in looking behaviors between infants at high and low risk of autism and to examine if these differences are affected by the type of social stimuli used High and low risk infants looking behaviors were compared when viewing static and dynamic stimuli and when participating in the still face paradigm Studies were included if they utilized infants birth to 12 months both at high risk and low risk for developing autism and used an eye tracker to measure duration of time looking at facial stimuli Twenty one studies met inclusion criteria The overall effect size of differences in looking behaviors for high and low risk infants was 0.03 95% 0.06 0.12 There were no significant effects of age gender or type of stimulus on infants looking behaviors While majority of studies found an effect in the difference of looking behaviors between infants at high and low risk the inconsistency of the combined results resulted in an overall nonsignificant effect size These findings indicate reduced eye contact may not be as reliable of a behavioral marker within the first year of life as previous research has indicated

## **The Development of Expert Face Processing** Angela Hayden, 2006

Developmental

Neurocognition B. De Boysson-Bardies, Scania de Schonen, Peter Jusczyk, Peter MacNeilage, John Morton, 1993-02-28 This volume contains the proceedings of a NATO Advanced Research Workshop ARW on the topic of Changes in Speech and Face Processing in Infancy A glimpse at Developmental Mechanisms of Cognition which was held in Carry Le Rouet France at the Vacanciel La Calanque from June 29 to July 3 1992 For many years developmental researchers have been systematically exploring what is concealed by the blooming and buzzing confusion as William James described the infant's world Much research has been carried out on the mechanisms by which organisms recognize and relate to their conspecifics in particular with respect to language acquisition and face recognition Given this background it seems worthwhile to compare not only the conceptual advances made in these two domains but also the methodological difficulties faced in each of them In both domains there is evidence of sophisticated abilities right from birth Similarly researchers in these domains have focused on whether the mechanisms underlying these early competences are modality specific object specific or otherwise

## **Transactions of the National Dental Association at the ...annual Session...** National Dental Association

(1897-1922), 1911

*Face Perception* Andy Young, Vicki Bruce, 2013-01-11

Human faces are unique biological structures that convey a complex variety of important social messages Even strangers can tell things from our faces our feelings our locus of attention something of what we are saying our age sex and ethnic group whether they find us attractive In recent

years there has been genuine progress in understanding how our brains derive all these different messages from faces and what can happen when one or other of the structures involved is damaged Face Perception provides an up to date integrative summary by two authors who have helped develop and shape the field over the past 30 years It encompasses topics as diverse as the visual information our brains can exploit when we look at faces whether prejudicial attitudes can affect how we see faces and how people with neurodevelopmental disorders see faces The material is digested and summarised in a way that is accessible to students within a structure that focuses on the different things we can do with faces It offers a compelling synthesis of behavioural neuropsychological and cognitive neuroscience approaches to develop a distinctive point of view of the area The book concludes by reviewing what is known about the development of face processing and re examines the question of what makes faces special Written in a clear and accessible style this is invaluable reading for all students and researchers interested in studying face perception and social cognition

**The Development of Visuospatial Attentional Orienting** Rina Schul, 2003 As our current understanding of the mechanisms of attentional orienting is based primarily on studies with adults I set out to track normal and abnormal development of visuospatial attentional orienting To that end I examined typically developing individuals and individuals with one of two developmental disorders Specific Language Impairment SLI or Williams Syndrome WS on one task assessing visual discrimination and another wherein accurate performance additionally requires attentional orienting The latter task patterned after Posner's cuing paradigm reveals patterns of attentional shift and disengagement and the benefits and costs of attentional orienting An initial study examined 200 typically developing children 7-17 yrs and 40 young adults 18-40 yrs and found gradual improvement from 7 to 18 years in a the speed and efficiency of attentional orienting and b the efficiency of disengaging attention and processing stimuli in unattended locations A second study examined 15 children 7-15 yrs with SLI Though known for their significant language problems in the absence of hearing impairment low nonverbal IQ social emotional disorder or frank neurological damage SLI individuals also exhibit less specific perceptual and motor deficits presumably due to generalized slowness in processing Since the covert movement of attention relies on rapid neurocognitive processes I expected this to be adversely affected in SLI While the SLI group displayed slowed visual processing and motor responses relative to age matched controls the speed of their visuospatial attentional orienting was normal A third study examined 16 individuals 16-47 yrs with WS who have the mental age of young children however with relative strengths in language and face processing and profound deficits in visuospatial processing Moreover as WS brains have anomalies primarily in dorsal posterior areas including the parietal cortex and cerebellum both implicated in attention I hypothesized that WS visuospatial attentional orienting might be impaired WS performance on the attention test was severely compromised although they did demonstrate use of attentional cues to direct their behavior Together my data illustrate age related changes in the efficiency and speed of components of visuospatial attentional orienting during the school age years These changes appear to be unaffected in SLI and arrested in

WS

## The Enigmatic Realm of **Development Of Face Processing**: Unleashing the Language is Inner Magic

In a fast-paced digital era where connections and knowledge intertwine, the enigmatic realm of language reveals its inherent magic. Its capacity to stir emotions, ignite contemplation, and catalyze profound transformations is nothing lacking extraordinary. Within the captivating pages of **Development Of Face Processing** a literary masterpiece penned by way of a renowned author, readers embark on a transformative journey, unlocking the secrets and untapped potential embedded within each word. In this evaluation, we shall explore the book's core themes, assess its distinct writing style, and delve into its lasting affect the hearts and minds of those that partake in its reading experience.

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