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## Influence of emotional facial expressions on 3–5-year-olds' face recognition

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### ABSTRACT

Three experiments examined 3- and 5-year-olds' recognition of faces in constant and varied emotional expressions. Children were asked to identify repeatedly presented target faces, distinguishing them from distractor faces, during an immediate recognition test and during delayed assessments after 10 min and one week. Emotional facial expression remained neutral (Experiment 1) or varied between immediate and delayed tests: from neutral to smile and anger (Experiment 2), from smile to neutral and anger (Experiment 3, condition 1), or from anger to neutral and smile (Experiment 3, condition 2). In all experiments, immediate face recognition was not influenced by emotional expression for either age group. Delayed face recognition was most accurate for faces in identical emotional expression. For 5-year-olds, delayed face recognition (with varied emotional expression) was not influenced by which emotional expression had been displayed during the immediate recognition test. Among 3-year-olds, accuracy decreased when facial expressions varied from neutral to smile and anger but was constant when facial expressions varied from anger or smile to neutral, smile or anger. Three-year-olds' recognition was facilitated when faces initially displayed smile or anger expressions, but this was not the case for 5-year-olds. Results thus indicate a developmental progression in face identity recognition with varied emotional expressions between ages 3 and 5.

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## 1. Introduction

Young children are able to recognize faces and assess their familiarity (Brace et al., 2001; Bruce, Campbell, Doherty-Sneddon, Import, Langton, 2000). Recognition of facial identity, however, is only one of several crucial face processing skills. When assessing facial familiarity, one must simultaneously process social information such as emotional expression, and the question arises how young children cope with varying emotional expressions while recognizing facial identity. Until now, most studies of younger children's ability to generalize identity across varying emotional expressions have focused on immediate recognition of an unfamiliar face presented once. These investigations have shown mixed results, from recognition at chance level in 3-year-olds (Ellis, 1992) and 6–8-year-olds (Mondloch, Geldart, Maurer, & Le Grand, 2003) to significant face recognition ability in 3–5-year-olds (Bruce et al., 2000; Norbeck, 1981). The present study investigated the influence of emotional expressions on both immediate face recognition in identical emotional expressions and delayed recognition across different emotions. In particular, we examined the extent to which smile, anger and neutral facial expressions influence immediate recognition of target faces and whether variations in emotional expressions influence face recognition after delays of 10 min and one week.

### 1.1. *Models of processing identity and social information from faces*

The interrelation of the processing of identity and the processing of emotional expression has received substantial attention in adult face recognition research (Baudouin, Gilibert, Sansone, & Tiberghien, 2000; Bruce & Young, 1986; D'Argembeau, Van der Linden, Comblain, & Etienne, 2003; Ganel & Goshen-Gottstein, 2004; Haxby, Hoffman, & Gobbini, 2000; Schweinberger & Soukup, 1998; Vuilleumier & Pourtois, 2007). Bruce and Young (1986) postulate a face processing model in which specialized modules for the processing of face identity, emotional expression, and other social information operate independently. Initial visual encoding of an unfamiliar face is assumed to result in viewer-centered descriptions, so-called face recognition units, which form the basis for analyses of emotional expression (Bruce & Young, 1986). Haxby, Hoffman and Gobbini (2000, 2002) broadly define two brain systems for face processing, with one system responsible for analyzing invariant but changeable visual aspects underlying face identity recognition, and the other responsible for processing non-visual aspects such as emotions or speech. Unlike Bruce and Young (1986) Haxby et al. (2000, 2002) assume that the different system components interact and modulate each other, resulting in a percept composed of identity and of changeable visual and non-visual facial aspects.

Both of these models were proposed for adults, and whether they can be applied to children or predict the extent to which emotional expression influences children's recognition of facial identity is unknown. We next summarize studies of children's ability to recognize facial identity with constant and varying emotional expressions.

### 1.2. *Children's ability to recognize facial identity*

Immediate facial recognition for faces that do not vary in emotional expression is well documented in infancy and in children aged 5–6 and older. Even newborns recognize familiar and unfamiliar faces (Pascalis & de Schonen, 1994; Turati, Cassia, Simion, & Leo, 2006), and face recognition develops rapidly toward the end of the first year (de Haan, Johnson, Maurer, & Perrett, 2001; de Schonen & Mathivet, 1990; Nelson, 2003; Quinn, Yahr, Kuhn, Slater, & Pascalis, 2002). Numerous studies have shown a significant increase in face recognition between ages 5 and 12, and therefore indicate slow maturation of face processing skills (Bruce et al., 2000; Carey, 1992; Carey, Diamond, & Woods, 1980; Chung & Thompson, 1995; Diamond & Carey, 1977; Ellis & Flin, 1990; Freire & Lee, 2001; Mondloch, Le Grand, & Maurer, 2002). However, Crookes and McKone (2009) argue that improved recognition performance can be fully explained by general cognitive development rather than by face-specific perceptual development.

Development of face recognition ability during early childhood has received less attention. Only minimal face recognition abilities have been attributed to children under the age of 5 (Carey, 1992; Ellis, 1992). However, recent investigations contradict these results. Brace et al. (2001) studied face

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