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Receiver operating characteristic analysis of age-related changes in lineup performance

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ABSTRACT

In the basic face memory literature, support has been found for the *late maturation hypothesis*, which holds that face recognition ability is not fully developed until at least adolescence. Support for the late maturation hypothesis in the criminal lineup identification literature, however, has been equivocal because of the analytic approach that has been used to examine age-related changes in identification performance. Recently, receiver operator characteristic (ROC) analysis was applied for the first time in the adult eyewitness memory literature to examine whether memory sensitivity differs across different types of lineup tests. ROC analysis allows for the separation of memory sensitivity from response bias in the analysis of recognition data. Here, we have made the first ROC-based comparison of adults' and children's (5- and 6-year-olds and 9- and 10-year-olds) memory performance on lineups by reanalyzing data from Humphries, Holliday, and Flowe (2012). In line with the late maturation hypothesis, memory sensitivity was significantly greater for adults compared with young children. Memory sensitivity for older children was similar to that for adults. The results indicate that the late maturation hypothesis can be generalized to account for age-related performance differences on an eyewitness memory task. The implications for developmental eyewitness memory research are discussed.

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Introduction

Children are often the sole witness to a crime, and their identification evidence can play a pivotal role in criminal investigations (Pike, Brace, & Kynan, 2002; Pozzulo, 2007). Eyewitness identification evidence is obtained by showing the eyewitness a lineup of faces; a lineup is composed of a suspect and a number of fillers or persons known by the police to be innocent. If the suspect is the actual perpetrator, the lineup is target-present, whereas if the lineup does not contain a guilty suspect, the lineup is target-absent. The majority of research indicates that when the perpetrator is present, children as young as 5 years are just as likely as adults to make a correct identification decision (e.g., Goodman & Reed, 1986; Lindsay, Pozzulo, Craig, Lee, & Corber, 1997; Marin, Holmes, Guth, & Kovac, 1979; Parker & Carranza, 1989; Parker & Ryan, 1993; Pozzulo & Balfour, 2006; Pozzulo & Lindsay, 1998). In stark contrast, however, when shown a target-absent lineup (i.e., a lineup containing only innocent persons), children are significantly more likely than adults to incorrectly identify someone as the perpetrator (Beal, Schmitt, & Dekle, 1995; Davies, 1996; Dekle, Beal, Elliott, & Huneycutt, 1996; Parker & Carranza, 1989; Parker & Ryan, 1993; Pozzulo & Balfour, 2006; Pozzulo & Dempsey, 2006). By adolescence (10–14 years), some research indicates that identification accuracy in target-absent lineups reaches adult levels (Pozzulo & Lindsay, 1997; Pozzulo & Warren, 2003, Experiment 2; for reviews, see Havard, 2014; Pozzulo, 2007; Pozzulo & Lindsay, 1998).

Children may perform less accurately than adults on lineups because their memory sensitivity, or their ability to encode and/or detect the perpetrator in the lineup, is poorer. The *late maturation hypothesis* posits that children do not remember faces as accurately as adults because face processing ability does not fully develop until at least adolescence (see Carey & Diamond, 1977; Mondloch, Le Grand, & Maurer, 2002). Evidence from the basic face processing literature suggests that children's sensitivity may be poorer because they tend to engage in more feature-based processing rather than configural-based processing (Mondloch, Geldart, Maurer, & Le Grand, 2003; Mondloch et al., 2002; Schwarzer, 2000). The recognition of faces using configural information might not reach adult levels until adolescence (Bruce et al., 2000; Carey, Diamond, & Woods, 1980; Mondloch et al., 2002, 2003). Alternatively, age-related differences in memory sensitivity may arise because more basic memory mechanisms have not yet matured (see Crookes & McKone, 2009). In the eyewitness identification literature, some studies have concluded that the ability to accurately remember faces improves with age (Brigham, Van Verst, & Bothwell, 1986; Goodman & Reed, 1986; Karageorge & Zajac, 2011; Leippe, Romanczyk, & Manion, 1991).

Hypotheses about age-related differences in lineup decision strategies have also been put forward as an explanation for children's poorer identification performance. In particular, children appear to be more willing than adults to guess under conditions of uncertainty (Ceci & Bruck, 1993; Hughes & Grieve, 1980). In line with this, the positive identification rate for children is larger compared with adults (Lindsay et al., 1997; Parker & Carranza, 1989; Parker & Ryan, 1993; Pozzulo & Lindsay, 1998). Children may be just as able to encode and retrieve the perpetrator from memory as adults, but they may false alarm more often because they set a comparatively low response threshold (Lindsay et al., 1997; Parker & Carranza, 1989). Researchers have proposed that the mere presentation of a lineup may suggest to a child that the perpetrator is present in the lineup and, therefore, that a positive identification needs to be made (Ceci, Ross, & Toglia, 1987; Gross & Hayne, 1996). Children may also feel more social pressure to positively identify a face and feel greater reluctance to declare uncertainty compared with adults (Beal et al., 1995; King & Yuille, 1987; Ricci, Beal, & Dekle, 1996). Children may also be less aware of the consequences of making a false identification (Brewer, Weber, & Semmler, 2005; Dekle et al., 1996; Pozzulo & Lindsay, 1997; Spring, Saltzstein, & Peach, 2013). Other researchers have proposed that memory sensitivity and response bias differ with age. Namely, children may set a lower response threshold because they have a more difficult time in detecting the target from the lures (Leippe et al., 1991; Pozzulo & Dempsey, 2006; Pozzulo & Lindsay, 1998).

Taken together, there is much evidence that children and adults adopt different strategies during a lineup test. In the next section, we make the case that in order to adequately test the late maturation account, age-related differences in response thresholds (or response bias) need to be taken into