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Developmental Review 24 (2004) 33–73

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DEVELOPMENTAL  
REVIEW

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# Infant memory development: Implications for childhood amnesia<sup>☆</sup>

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Received 28 August 2003

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## Abstract

When asked to recall their earliest personal memories, most children and adults have virtually no recollection of their infancy or early childhood. This phenomenon is commonly referred to as childhood amnesia. The fate of our earliest memories has puzzled psychologists for over 50 years, particularly in light of the importance of early experience in human development. Empirical research has shown that infants can both learn and remember very early in development, making the ultimate fate of early memories even more mysterious. The theoretical explanation of childhood amnesia outlined here relies on age-related changes in encoding, retention, and retrieval that occur during infancy and early childhood. Data obtained using a host of different memory tasks support the conclusion that quantitative changes in these basic memory processes can account for the decline of childhood amnesia during the third or fourth year of life. © 2003 Elsevier Inc. All rights reserved.

*Keywords:* Memory; Memory development; Childhood amnesia; Infants

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## Historical perspective

The first three years of a child's life are characterized by a remarkable degree of physical, social, emotional, and cognitive change. At no other time is the rate of

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<sup>☆</sup> Portions of the data presented in this paper were supported by Marsden Grants UOO609, UOO014, and UOO040 from the Royal Society of New Zealand. I thank Carolyn Rovee-Collier, Byron Campbell, and Norman E. Spear for their unwavering mentorship over the past 20 years. I also thank my students at the University of Otago for their hard work and enthusiasm. Without them, this paper would not have been possible.

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development so rapid or so dramatic. Historically, most theorists have placed special emphasis on infant experience, arguing that events that occur early in life have a greater and more lasting impact than the same events or experiences encountered during adulthood. The relative importance of early experience was the cornerstone of Freudian theory and was also reflected in a number of subsequent theories of social and emotional development (for review, see Ainsworth & Bowlby, 1991). Early empirical research on infants who were raised in partial or total social isolation clearly demonstrated the profound effects of early social experience on subsequent development (Harlow, Harlow, & Suomi, 1971; Skeels, 1966).

Recent advances in neuroscience have shown that early experiences also play a fundamental role in brain development. At birth, the human infant brain weighs approximately 350 grams but it more than quadruples its size by the time of adulthood. Most of the neurons that make up the human brain are present at the time of birth; the fourfold change in weight is due primarily to an increase in the connections between the neurons. These connections are established very rapidly during infancy and are contingent, at least in part, upon experience (Greenough, Black, & Wallace, 1987). Although both deprivation and enrichment influence the structure and function of the mammalian brain throughout the lifespan (Black & Greenough, 1998; Winocur, 1998), these experiences may be particularly important early in development when the brain is initially taking shape (Kolb, Forgie, Gibb, Gorny, & Rowntree, 1998; Perry, 1997; Wickelgren, 1999).

In light of the pervasive effects of infant experience on both behavioral and neural development, it is somewhat perplexing that most adults have little or no recollection of these early, formative experiences. Freud coined the term *infantile or childhood amnesia* to describe the inability of adults to remember events from their infancy and early childhood. He originally identified the phenomenon by asking his patients to describe their earliest personal memories in the context of therapy. On the basis of these patient reports, Freud argued that the period of childhood amnesia extended into the 6th or 8th year of life (1953). Subsequent normative studies of adults' earliest memories have shown that Freud may have overestimated the period of childhood amnesia. There is now a general consensus that adults' earliest autobiographical memories are for events that occurred when they were approximately 3 to 4 years of age or even slightly younger (e.g., MacDonald, Uesiliana, & Hayne, 2000; Mullen, 1994; Usher & Neisser, 1993). Although this empirical research has forced us to revise Freud's estimates of the boundary for childhood amnesia, it has not eliminated the phenomenon *per se*. The fact remains that much, if not all, of our infancy is inaccessible to recall later in development.

There have been numerous attempts to identify the mechanism(s) responsible for childhood amnesia. Freud's notion of repression has been largely discounted. Recent theories of childhood amnesia have been couched in cognitive, rather than psychoanalytic, terms. Current explanations for childhood amnesia include neurologically based transitions from one memory system to another (Bachevalier, 1990), age-related changes in children's self concept (Howe, 2003; Howe & Courage, 1993, 1997a) and theory-of-mind (Perner & Ruffman, 1995), or the development of language and conversational skills (Nelson, 1993).

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