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A timing-specific memory distortion effect in young children

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Abstract

It has been suggested that there are systematic distortions in children's memory for temporal durations, such that children's memory is not just less accurate than that of adults but qualitatively different. Experiment 1 replicated the memory distortion effect by demonstrating developmental change in the tendency to confuse a reference duration with one that is shorter rather than longer than it. When the long-term memory demands of the task were reduced by providing reminders of the reference duration on every trial, there were no such qualitative changes in error patterns (Experiment 2). Further evidence for developmental changes in memory distortion was found in the temporal generalization task of Experiment 3, in which stimuli were spaced logarithmically rather than linearly. In Experiment 4, a similar distortion pattern was absent in a task in which children made judgments about the pitch rather than the duration of stimuli, suggesting the effect may be specific to time estimation.

Keywords: Time estimation; Time perception; Memory; Temporal generalization

Introduction

The development of temporal processing seems likely to underpin growth in a variety of cognitive and linguistic abilities. Developmental improvements in time

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estimation over childhood have been documented consistently in a large number of studies, using a wide variety of tasks (e.g., Arlin, 1986; Droit-Volet, 1999; Friedman, 1977; Pouthas & Jacquet, 1987; for review, see Block, Zakay, & Hancock, 1999).

That temporal abilities should improve with development is unsurprising. However, recent research has suggested that young children's memory for temporal durations is not just less accurate than that of older children and adults, but is instead qualitatively different. More specifically, it has been proposed that there is a developmental change in the extent to which durations are remembered as being shorter than they really are (Droit-Volet, Clement, & Wearden, 2001; McCormack, Brown, Maylor, Darby, & Green, 1999). Such a claim is of general theoretical interest for at least two reasons. First, the observation of a qualitative change rather than mere quantitative change requires specific explanation. Second, the possibility that there is memory distortion is specific to the temporal domain points to the possibility of developmental dissociations between development of memory for temporal and non-temporal quantities. This research addresses two key questions: Is the observed memory distortion specific to temporal memory? And is the effect best conceived of as memorial or perceptual in nature?

Recent attempts to examine the development of time estimation have been carried out within the framework of Scalar Expectancy Theory (Droit-Volet, 2002; Droit-Volet & Wearden, 2001; McCormack et al., 1999), the most widely applied theory of human and animal timing (Gibbon, 1977; Gibbon, Church, & Meck, 1984; for review, see Wearden, 2001). Such studies have used *duration identification* tasks, in which participants are pre-exposed to one or more reference durations at the start of the task. At test, participants are required to judge the similarity of test durations to the reference duration(s) they encountered earlier.

According to Scalar Expectancy Theory, three types of processes are involved in such tasks. First, internal clock processes time the presented durations and generate representations of them that are passed to working memory. Second, long-term memory processes are responsible for storing and maintaining representations of the pre-exposed reference durations. Third, responses at test are based on the outcome of decision processes that compare representations of the reference durations with just-presented test durations. These processes are typically captured mathematically in scalar timing models (e.g., McCormack et al., 1999; Wearden, 1991, 1999; Wearden, Wearden, & Rabbitt, 1997). A key advantage of carrying out developmental studies of timing within the Scalar Expectancy Theory framework is that such formal models enable developmental changes to be pinpointed in particular components of the processing stages. Specifically, developmental differences can be interpreted in terms of changes in one or more of the parameters specified in such models.

For present purposes, we highlight two important parameters. These parameters correspond to two different ways in which time estimation abilities may develop. On the one hand, there could be developmental changes in the amount of noise or variability associated with one or more of the processing stages. A developmental decrease in the amount of noise would lead to increases in overall levels of performance on duration identification tasks, but would not usually be associated with striking developmental changes in the patterns of errors that are produced on