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Twenty-four-month-olds' nonverbal memory for expected and unexpected versions of familiar events

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ABSTRACT

Very little is known regarding whether scripted knowledge affects memory in infancy. By means of the elicited imitation paradigm we examined whether 24-month-olds' (N = 112) differentially re-enacted expected and unexpected 4th steps of two highly familiar and of two less familiar 5-step events immediately as well as across a two-week retention interval. The results revealed that overall the infants re-enacted fewer unexpected 4th steps (relative to expected 4th steps) of the events as they had been demonstrated to the infants, and that the infants re-enacted fewer 4th steps (expected and unexpected) at the delayed recall test as they had been demonstrated. However, although the degree of familiarity of the events influenced the total number of actions (re)-enacted, familiarity did not affect how often the infants re-enacted the crucial 4th steps as they had been demonstrated. The results are discussed in relation to the prevailing theories of scripted knowledge in infancy.

1. Introduction

The term scripted knowledge or simply *scripts* was introduced by Shank and Abelson (1977). Scripts refer to abstract knowledge structures reflecting the understanding of the temporal and causal sequences of familiar action sequences. As adults we have scripts for numerous familiar events typically experienced in everyday life, such as visiting a restaurant, getting ready to go to work, or celebrating a child's birthday. Scripts help us to free cognitive capacity for other tasks, to interpret experiences, and to predict what may or may not happen in similar future events (Dahl, Sonne, Kingo, & Krøjgaard, 2013).

From a developmental perspective where scripts at times are referred to as general event representations (GERs, Hudson & Mayhew, 2009) we are interested in when and how scripts are learned, and how they may affect memory. In the present study we focused on the latter aspect, that is, how scripted knowledge may affect memory. More specifically, we examined how 24-month-olds re-enacted expected and unexpected incidents of highly familiar and less familiar events by means of the elicited imitation paradigm employing an immediate as well as a (two-week) delayed test. We define *unexpected* incidents as incidents that unambiguously violate the typical course of a particular event. We distinguish between highly familiar and less familiar events by means of the infants' baseline performance: Without motor instruction infants should produce reliably more target actions for the highly familiar events relative to the less familiar events. When considering

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infants we use the term 'events', because before having actually tested the infants we do not know whether the events qualify as genuine scripts (i.e., abstract knowledge structures reflecting the understanding of the temporal and causal sequences of familiar action sequences) – whereas they almost certainly would for adults.

Young children's recall of expected and unexpected versions of scripted events has been investigated in the verbal domain, while infants' nonverbal re-enactments of highly familiar and less familiar events have been examined by means of the elicited imitation paradigm. To the best of our knowledge, no one has previously examined memory of unexpected versions of highly familiar and less familiar events in nonverbal infants. In the following we briefly outline the two lines of research we set out to combine, that is, verbally proficient children's recall of scripted events, and infants' recall of familiar events.

1.1. Verbally proficient children's recall of scripted events

Groundbreaking research conducted by Katherine Nelson and her colleagues revealed that even three-year-olds possessed stable, ordered event representations of familiar events when asked to verbally report "what happens" in typically encountered events such as going to McDonalds, having lunch at daycare, or having dinner at home (e.g., Nelson 1978, 1979; Nelson & Gruendel, 1981, 1986). These findings were in sharp contrast to the then prevailing view that young children's event memories were unorganized and idiosyncratic (e.g., Piaget & Inhelder, 1973). Although the amount of information reported when asked about "what happens" in a typical event increases as the child grows older, several studies have shown that even young children tend to report the events in a generalized and temporally structured manner (Fivush, 1984; Hudson & Nelson, 1986; Nelson & Gruendel, 1981, 1986). A robust finding is that when young children have multiple experiences with similar events, their event representations become generalized and they have difficulty remembering details of a specific episode of a recurrent event (Hudson, 1990; Hudson, Fivush, & Kuebli, 1992; Kuebli & Fivush, 1994). For example, Hudson and Nelson (1983) examined preschoolers' and first graders' use of scripts in story recall and found that even though first graders recalled unexpected or discrepant information to a greater extent than did preschoolers, both age groups often falsely reported scripted story information indicating that their recall was influenced by their scripted knowledge.

These findings are consistent with the assumption provided by both the event-schema theory (Hudson et al., 1992) and the fuzzy-trace theory (Brainerd & Reyna, 2001; Brainerd, Reyna, Wright, & Mojardin, 2003) suggesting that as a function of repeated experiences young children's memory tends to improve for what usually happens in an event, whereas their recall of specific (including unusual) details decreases (e.g., Hudson & Nelson 1983). According to the fuzzy-trace theory both children and adults develop two fundamentally different types of memory representations: a gist trace which is fuzzy and imprecise, yet represents information concerning common features from across the experienced scripted events, and a verbatim trace representing the factual details associated with the event (Brainerd & Reyna, 2001; Brainerd, Reyna, & Kneer, 1995). The assumption is that as time passes, the gist traces are easier to access compared to the verbatim traces which are more fragile and rapidly forgotten (Brainerd & Reyna, 2001; Brainerd et al., 2003). Note that this account may explain why young children across delays tend to recall a 'single' episode of familiar events according to the script and not necessarily how the specific episode occurred.

Meanwhile, some studies have revealed that when a particular episode deviates substantially from what usually happens in a familiar event, young children (like older children and adults) seem to remember the atypical information better than information which is in accordance with their script knowledge (Davidson & Hoe, 1993; Hudson, 1990). Furthermore, several studies with preschoolers (e.g., Fivush, Gray, & Fromhoff, 1988; Nelson, 1988) have shown that novel events occurring only once tend to remain relatively distinct in memory. These findings are in accordance with the body of research demonstrating the role of *distinctiveness* on memory (e.g., Hunt & Worthen, 2006). According to this literature, a distinctive event is well remembered because it is surprising, salient, bizarre, or novel, attracting considerable attention leading to enhanced memory (Hunt, 2006). Thus, a distinctive event tends to resemble a given category of events while at the same time violating what usually happens in this given event category – in short: a distinctive event is often considered to be an unexpected exemplar of a recurrent event. However, as emphasized by Howe (2006) even though the role of distinctiveness in memory is well documented in adults and older children, we do not know whether this effect can also be translated to memory in young children and infants. In fact, prior research on how infants recall unexpected incidents of familiar events is almost absent. In the following we review this literature.

1.2. Infants' re-enactment of familiar events

Using the elicited imitation paradigm, a number of studies, most notably by Bauer and her colleagues, have demonstrated ordered recall of both familiar and novel events by 11–36-month-olds (Bauer & Mandler, 1989, 1992; Bauer & Shore, 1987; Bauer & Thal, 1990; Bauer & Travis, 1993; O'Connell & Gerard, 1985). In these studies the familiar events were typically chosen among events that one would consider highly salient and frequently encountered in the lives of infants (e.g., being put to bed, having a bath, or having breakfast).

Although, familiarity tended to facilitate ordered recall, infants also recalled novel events after only a single experience (Bauer & Mandler, 1989; Bauer & Thal, 1990). Some studies have revealed that changing the expected order of the event components disturbed the infants' recall (e.g. Fivush & Mandler, 1985; O'Connell & Gerard, 1985). For example, O'Connell