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Infants' sensitivity to rhyme in songs

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ABSTRACT

Children's songs often contain rhyming words at phrase endings. In this study, we investigated whether infants can already recognize this phonological pattern in songs. Earlier studies using lists of spoken words were equivocal on infants' spontaneous processing of rhymes (Hayes et al., 2000; Jusczyk et al., 1999). Songs, however, constitute an ecologically valid rhyming stimulus, which could allow for spontaneous processing of this phonological pattern in infants. Novel children's songs with rhyming and non-rhyming lyrics using pseudo-words were presented to 35 9-month-old Dutch infants using the Headturn Preference Procedure. Infants on average listened longer to the non-rhyming songs, with around half of the infants however exhibiting a preference for the rhyming songs. These results highlight that infants have the processing abilities to benefit from their natural rhyming input for the development of their phonological abilities.

1. Introduction

Infants' daily routines are often accompanied by songs and nursery rhymes. Caregivers recite nursery rhymes during playtime and sing lullabies to soothe their child or to entertain him/her, e.g. while driving or during a diaper change (Trehub et al., 1997). Songs and nursery rhymes clearly serve a social-emotional function. The body of research on phonological processing of rhymes in toddlers and kindergartners is quite extensive, but only rarely makes use of ecologically valid stimuli such as songs and nursery rhymes. The central question in this study is whether 9-month-old infants exploit songs and rhymes to spontaneously process phonological patterns of their native language.

A very frequent phonological phenomenon in songs and nursery rhymes is the occurrence of rhymes at phrase endings. A phrase-final rhyme is a sound pattern that is repeated at the end of verses or phrases (Fabb, 1999). In Western children's songs, rhymes typically include the last stressed syllable and, if applicable, the following unstressed syllables. The unit of repetition in phrase-final rhymes typically is a whole word, excluding the word-onset (e.g. Stallworthy, 1996).

Previous research investigating the effect of rhyme on linguistic processing in children mostly focused on kindergartners and has shown clear benefits of rhymes in word learning and phonological processing tasks. For example, 2- to 4-year-olds benefit from rhyming stories when learning new words, as they are better able to learn a novel word if it rhymes with the phrase-final word of the previous verse (Read, 2014). Children in the same age range also benefit from listening to rhyming stories, as opposed to prose stories, before completing a rhyme/alliteration detection task (D. S. Hayes, 2001). These effects might be attributed to the increased

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predictability of the phonological content of a rhyming story (Cook, 1997; Rubin, 1995). This higher predictability of phonological content might in turn increase phonological sensitivity, as is evident from the results of the rhyme/alliteration detection task (Hayes, 2001). Similar conclusions can be drawn from a study with 6-year-olds (Sheingold & Foundas, 1978). After having listened to a story in rhyme or prose, children were asked to recall details of the story. Children were equally successful in that task, regardless of whether they had heard a rhyming or non-rhyming story. However, the children were more successful in sorting the events of rhyming stories into ordered sequences than those of non-rhyming stories. The authors hypothesized that the rhyming verse couplets were helpful to reconstruct the order of content appearing in the story, due to the predictability of the phonological form of rhyming words. Thus, toddlers and preschoolers already make use of rhymes to predict upcoming linguistic input and to memorize the content of a story.

A crucial component of rhyme sensitivity is the ability to recognize that rhyming words are different from repetitions of identical words: children have to be able to recognize that e.g. /bear/ and /pear/ share phonological material, but differ in their onset consonants. This is an important ability, as it has been suggested that the awareness of such subtle phonological differences has important implications for later literacy development (De Cara & Goswami, 2002; Goswami et al., 2002). Infants as young as 11 and 18 months of age are already sensitive to small changes to onset consonants (2009, Swingley, 2005). Additionally, 2-year-old children are able to identify the target in a set of rhyming items as soon as they hear the non-overlapping onset consonant (Swingley, Pinto, & Fernald, 1999). Upon acquisition of novel words, 14-month-olds are able to recognize subtle phonological differences between highly similar items, such as /din/ and /bin/ (Yoshida, Fennell, Swingley, & Werker, 2009). Moreover, infants as young as 16 months are even able to group such rhyming words apart from another set of words that also overlaps in phonological material but do not rhyme (e.g. /dib/ and /gib/ vs. /deb/) (Flocchia, Nazzi, Delle Luche, Poltrock, & Goslin, 2014). At the start of their second year of life infants thus already possess impressive phonological processing abilities that allow them to differentiate between and acquire rhyming single words.

However, there is only sparse evidence for rhyme processing in infants younger than one year of age and none of the studies in question used ecologically valid stimuli that nursery rhymes or songs provide. In one study that used a variant of the Headturn Preference Procedure (Kemler Nelson, Jusczyk, & Mandel, 1995), 9-month-old American-English infants did not show a higher sensitivity for CVC word lists that rhymed as compared to CVC word lists that did not (e.g. *bad, pad, lad* (shared -VC) vs. *vip, zut, mog* (no phonological overlap), Jusczyk, Goodman, & Baumann, 1999, experiment 1). However, infants in the same study and using the same procedure were sensitive to the mirror image of rhymes, that is phonological overlap at the beginning of the syllable (shared CV-, experiment 2) and overlapping syllable onsets (shared C-, experiment 3). Another study did find sensitivity to rhyming versus non-rhyming single words in 2-year-old English toddlers, but did not find evidence for this ability in 8.5-month-old infants (Braze, McRoberts, & Mc Donough, 2011). Within this study, both toddlers and infants were tested using the same visual fixation paradigm. While the toddlers looked significantly longer when hearing rhyming versus non-rhyming words, no significant looking time differences were found for infants tested on the same set of words. Infants thus recognize repetition of intra-syllabic units at word onsets in lists of single words, but do not spontaneously display such recognition for rhyming single words.

As a counterpoint to the absence of a spontaneous discrimination between rhyming and non-rhyming stimuli reported in the work by Jusczyk et al. (1999) and Braze et al. (2011), two other studies with 7-to-13-month-old English infants found that they were able to detect changes from one rhyme pattern to another under specific circumstances (Hayes, Slater, & Brown, 2000; Hayes, Slater, & Longmore, 2009). These infants were able to detect a change from one rhyme (e.g., *bad, dad, fad*) to another (*beg, deg, feg*) in a Conditioned Headturn Preference Procedure (Werker, Polka, & Pegg, 1997), suggesting that they are sensitive to the shared rhymes between words. Crucially, infants in both studies by Hayes and colleagues were trained to respond to a change in rhyme rather than showing a spontaneous reaction as assessed in an unconditioned Headturn Preference Procedure. Moreover, due to the elaborate training required for this paradigm, only a subset of the tested infants actually contributed analyzable trials. This gives rise to the possibility that the early rhyme sensitivity observed in this study only holds for rather mature infants that might differ substantially from a set of average infants. The study nevertheless provides a first indication infants can potentially process rhymes at an early age under certain circumstances.

Taken together, the evidence so far suggests that infants do not have a spontaneous preference for rhyming or non-rhyming word lists (Jusczyk et al., 1999), indicating that they are not able to differentiate between rhyme and non-rhyme. However, they can be trained to react to a change in rhyme in lists of words (Hayes et al., 2000, 2009). Although a specific sensitivity to rhymes is clearly present early in life, these results do not shed light on the question whether infants can and do spontaneously use this sensitivity when they encounter rhymes in their daily lives.

A context that may facilitate infants' spontaneous (instead of trained) processing of rhymes is song. Songs contain rhymes within a solid scaffold of melody and rhythm, which caregivers express through various multi-modal cues (Bergeson & Trehub, 2002; Delavenne, Gratier, & Devouche, 2013; Falk & Kello, 2017; Longhi, 2009; Nakata & Trehub, 2011). These structural cues potentially enable infants to attend longer to infant-directed song compared to infant-directed speech (e.g. Costa-Giomi, 2014). In fact, research has repeatedly identified infant-directed singing as a tool for infant arousal regulation (e.g. Trehub & Nakata, 2002). Prolonged attention to song might subsequently enable infants to extract information from song that is otherwise inaccessible to them. Yet, there are very few studies exploring infants' linguistic processing abilities in song, and none focused on the processing of rhyme. Two studies showed that infants can detect a change in the order of a string of syllables only when the syllable string is sung on a melody, but not when the string is spoken (Lebedeva & Kuhl, 2010; Thiessen & Saffran, 2009). Both studies used the Headturn Preference Procedure, with infants from 6 to 8 months old (Thiessen & Saffran, 2009) and 11 months old (Lebedeva & Kuhl, 2010). These studies provide evidence that infants actively encode the phonological content of songs, an important prerequisite to detect rhymes at phrase endings in songs.

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