Exploring the impact of higher level linguistic representations on nonword repetition performance

Gathercole’s (2006) comprehensive and interesting Keynote Article on the nature of the relations between nonword repetition and word learning highlights the complex number of interacting factors that affect this relation through development. In this Commentary we focus on the impact of higher level cognition, particularly linguistic representations on lower level functions such as attention and processing, as well as higher level functions such as memory. In addition, we note the importance of distinguishing children with specific language impairment (SLI) who do and do not have phonological deficit when testing for memory impairments. We argue that further detailed investigations are warranted at the linguistic levels of cognitive processing alongside memory tasks that tap different components of language and nonlinguistic memory. Such studies would help tease apart the complex, and probably bidirectional relations between attention, memory, and linguistic representations. Moreover, we propose that this investigative strategy crucially needs to take a longitudinal developmental perspective if we are to understand the developmental trajectory.
Gathercole (2006) pertinently notes the effect of phonological representation on nonword repetition, that is, “the capacity to store nonwords is influenced by (among other things) prior factors affecting the initial construction of the phonological representation.” Yet, the precise nature of this relationship has yet to be fully explored. To do this, a theoretical framework of phonology as well as memory (the latter Gathercole provides) is needed. One such phonological framework within the generative phonology tradition is “prosodic theory” (Harris, 1994). Prosodic theory can be used to understand both normal acquisition and the nature of the phonological deficits found in children with SLI. We argue that such a framework is needed if we are going to elucidate the relations between memory, phonological representations (in typical and atypical development), dependent relations between them, and their effect on nonword repetition. Empirical support for such dependency between memory and phonology and other levels of linguistic representation are evident in the literature.

The impact of higher level cognitive functions (e.g., phonology, morphology, and syntax) on memory as well as on lower level perception and attention is illustrated by the many EEG event-related potential (ERP) studies investigating the neural correlates elicited in nonattended auditory odd-ball paradigms (Naätänen et al., 1997; Pulvermüller, Shtyrov, Kujala, & Naätänen, 2004). Such tasks elicit a component known as the “mismatch-negativity” (MMN), which is a negatively going wave at around 200–250 ms after a rare (odd-ball) event. This component is considered to reflect memory traces of auditory events, and is clearly affected by the nature of the phonological, syntactic, morphological, and semantic materials. Surprisingly, in the developmental literature, relatively little attention has been paid to these findings, which illustrate the complex nature of memory.

However, more than a decade ago, van der Lely and Howard (1993), raised the possibility that the prosodic structure of the nonword could have an effect on nonword repetition in children. Van der Lely and Howard (1993) found that not all children with SLI have short-term memory problems. Investigating a group of typically developing children and children with grammatical (G-)SLI we found that when the phonological structure of the to be remembered nonwords was simple, children were able to remember as many words as their language matched peers. Thus, the prosodic structure of certain words could make them difficult to repeat.

The prosodic structure of a word has two aspects. One governs how individual consonants and vowels are grouped into syllables (syllabic structures). The other governs relations of stress prominence between neighboring syllables (metrical structure). In an attempt to understand the phonological deficit in children with SLI, we set about devising a nonword repetition procedure that would take into account the prosodic complexity of a nonword, rather than the amount or length of the to be repeated nonword. Complexity was determined through the number of “marked parameters” (syllable and/or metrical). So-called “marked parameters” are not attested in all languages, and are acquired later than unmarked parameters. This allowed us to investigate how phonological complexity influences performance using a nonword repetition task. The resulting Test of Phonological Structure (van der Lely & Harris, 1999), allows a thorough examination of phonological abilities by systematically varying the prosodic complexity of a word. The procedure consists of 96 nonwords that have been constructed using five binary
phonological parameters, chosen because they establish the major typological outlines of syllable and metrical structure in English.

In a recent study (Gallon, Harris, & van der Lely, 2006) a group of participants with G-SLI (ages 12–20 years) and two groups of typically developing children (ages 4–8 years) were studied. Our results revealed a significant difference in the pattern of performance for children with G-SLI compared to typically developing younger children. We also found that the prosodic complexity of a word impacts on performance: the greater the number of marked prosodic structures, the greater the decrease in performance. This effect was apparent even on monosyllabic and disyllabic nonwords. Of particular note is that unfooted (unstressed) syllables at the metrical level cause problems for the children at the syllable level of the prosodic hierarchy, even in these short disyllabic words (Gallon et al., 2006; Gallon et al., 2006; Marshall, Ebbels, Harris, & van der Lely, 2002).

Our finding reveal that although short-term memory is likely to affect nonword repetition accuracy it cannot provide a full account of the performance we saw in these one and two syllable nonwords. These nonwords should not present a problem in terms of repetition accuracy but yet when we increased the prosodic complexity either through the marked syllabic structure or metrical stress pattern, performance for the participants with G-SLI deteriorated.

In addition to the impact of phonological structure, morphology can also be seen to impact on the repetition of nonwords in the tasks carried out by Gathercole and colleagues. Archibald and Gathercole (2006) report performance on nonword repetition in comparison to that of serial recall using the same phonological segments. In the nonword repetition task the nonword, for example, feimoychee has to be repeated, although in the serial recall task the nonword is broken into monosyllabic nonwords, and these have to be repeated: fei . . . moy . . . chee. Note that each syllable was stressed in both tasks. Archibald and Gathercole found a difference in performance between the two tasks with the nonword repetition task being harder. This led the authors to conclude that an “unidentified skill” specific to nonword repetition is involved. We propose that rather than their being an “unidentified skill” involved, the prosodic nature of the two tasks differ and can perhaps explain their results. Phonologically, such words could have a prosodic hierarchical structure with three, footed syllables, all with strong stress within one word. Whereas stressed monosyllabic (one footed syllable) words are frequently found in English (dog, cat, bee), stressed three-syllable words would be highly unusual and, indeed, rare. Thus, repeating such a nonword would be more akin to repeating a morphological compound such as, “nap”kin-“ring,” “wal”nut- “tree,” or “pho”to-“frame.” Thus, based on a typology of SLI, whereby different deficits in the components of language (e.g., syntax, morphology, phonology, lexicon) in different children determine the nature of the deficit (van der Lely, 2005), this leads to the prediction that for those children with morphological deficit, such nonwords would be particularly problematic to repeat. It is of note also that nonwords in the Children’s Test of Nonword Repetition also contain derivational and morphological forms (-er, -ity, -ic, -ing). Once again, we would predict that nonwords containing such morphological forms would disadvantage any child with morphological deficit in comparison to typically developing children.
In sum, we consider that it is vitally important to take into account, control, and/or manipulate the prosodic complexity, as well as other levels of linguistic representations, that might be tapped when designing materials in nonword repetition tasks. Incorporating these factors into nonword repetition procedures would facilitate our understanding of memory and the acquisition of language components and their interrelations through development. Furthermore, it would help us identify and distinguish children with memory deficits from those with deficits in language components. Such differential diagnosis is crucial to further our understanding of SLI and provide appropriate remediation for their deficits.

REFERENCES

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Manipulating the characteristics of words and nonwords to better understand word learning

The work of Susan Gathercole and others on nonword repetition has increased general interest in the relationship between memory and language, and has provided a fertile theoretical framework for researchers to explore how the language system makes use of the phonological loop, a component in Baddeley’s (1986) working memory model. Gathercole (2006) integrated a number of findings from a variety of research methodologies and populations to support this theoretical framework. She also discussed how this framework might be applied to increase