BACKGROUND

• Rehearsal, the silent repetition of words, improves memory.
• Adults use rehearsal with little effort[1]. However, children consume attentional resources when rehearsing[2]. Also, inefficient rehearsal is likely related to memory deficits observed in children with atypical language development[3].
• Neither normal variation in rehearsal developmental nor how rehearsal becomes an attention-free process is understood because the conventional behavioral assessments of rehearsal:
  1. are more effective for group comparisons than for understanding individual variation, and
  2. require specific stimuli or impose unnatural task demands, making it difficult to assess rehearsal use across situations.

PURPOSE

LONG-TERM GOAL: Identify individual children’s memory weaknesses and create personalized interventions to encourage strategy use for improving memory.

PROBLEM: Current techniques for identifying the use of memory strategies are insufficient for application in children, especially young children and children with atypical language.

CURRENT AIM: Assess the validity and reliability of using surface electromyography (sEMG) as a measure of children’s rehearsal strategies.

PARTICIPANTS

EXP 1: 39 children in each of three age groups. Children must:
• Be 7.5, 8.5, or 9.5 years old
• Live in a home in which English is the primary language
• Be free of known developmental, cognitive, or neurological diagnoses
• Pass hearing and vision screenings.
EXP 2: Five children in each age group will return for reliability testing.

PROCEDURE

Six adaptive span tasks and an articulation rate measure, together, can be used to calculate rehearsal in the four conventional ways described elsewhere. All lists start with 2 items and get progressively longer until participant errs out.

CONVENTIONAL BEHAVIORAL MEASURES

<table>
<thead>
<tr>
<th>ARTICULATION RATE</th>
<th>WORD LENGTH EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Used as a proxy for rehearsal speed.</td>
<td>• Short words (e.g. fork, bell, clock, door) are better remembered than long words (ambulance, kangaroo, butterfly, umbrella)[1].</td>
</tr>
<tr>
<td>• Can be used across situations (e.g. calculated separately for different languages in bilingual participants).</td>
<td>• Group level articulation rate means are correlated with mean memory span[1].</td>
</tr>
<tr>
<td>• Correlations are not consistently observed within smaller age-ranges.</td>
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</tr>
</tbody>
</table>

PHONOLOGICAL SIMILARITY EFFECT

• Similar sounding words (e.g. bat, bag, mat, man) are harder to remember in order than different sounding words (e.g. fork, bell, clock, door)[1].

LONG-TERM GOAL: Identify individual children’s memory weaknesses and create personalized interventions to encourage strategy use for improving memory.

EXPECTED OUTCOMES

EXP 1:
(1) sEMG activity will correlate with each of the four conventionally acquired rehearsal estimates
(2) Correlations will be weakest in the 7.5-year-old age group as younger participants are likely not consistent in their use of rehearsal across tasks
(3) Within all age groups, but particularly the 7.5 year-old, articulation rate should have the weakest correlation with the other measures. articulation rate is only a proxy for rehearsal speed if the participant actually rehearse. A child who does not rehearse should have a low proportionalized score on the other three tasks; yet there is no reason to presume that non-rehearsers would have the slowest articulation rates.

EXP 2:
(1) Although reliability has never been quantified in the four conventional measures, the associated effects have been well replicated in the adult literature. Therefore, we would expect all of the measures to be reliable.
(2) We expect proportionalized scores to be at least as reliable as subtraction scores.

STATISTICAL APPROACH

EXP 1: Calculate the correlations between sEMG activity and the four conventional rehearsal measures:
• Articulation rate with sEMG during auditory digit span.
• Word Length effect with sEMG during 1-syllable words.
• Phonological Similarity Effect with sEMG during dissimilar words.
• Articulatory Suppression with sEMG during digits in silence

EXP 2: Assess whether the proportionalized scoring procedure[2] is more reliable than simple subtraction by comparing scores at Time 1 and Time 2 using the concordance correlation coefficient.

REFERENCES


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