

THE RELEVANCE OF A NONWORD REPETITION TASK TO ASSESS DOWN'S SYNDROME SUBJECTS VERBAL SHORT-TERM MEMORY.

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INTRODUCTION:

The verbal short-term memory span is usually measured by word span or digit span. Another way to measure short-term memory abilities is to use a nonword repetition task.

- Gathercole et al. (1991) study of the relationship between lexical knowledge and nonword repetition.

→ three hypothesis in order to explain this relationship:

(1) children repeat less long nonwords than short nonwords (mnestic hypothesis);

(2) children repeat more “wordlike nonwords” than “non-wordlike nonwords” (linguistic hypothesis);

(3) the length of the nonwords and their wordlikeness both influence the quality of the repetition.

→ Gathercole et al. (1991) results with young normally developing children seem to confirm this last hypothesis.

- How is the quality of nonword repetition in Down’s syndrome subjects according to the degree of wordlikeness and to the length ?

- Do Down's syndrome subjects obtain the same results than normally developing children ?

→ Is nonword repetition influenced both by the length and the degree of wordlikeness?

→ Does correct nonword repetition decrease as the nonword length increases and is this phenomenon independent of the nonword consonantic complexity and degree of wordlikeness ?

→ Do our results confirm the hypothesis according to which nonwords are temporarily stored in the phonological short-term memory system ? As this system has a limited capacity, do subjects recall more short nonwords than long nonwords ?

- In conclusion, is nonword repetition a reliable task allowing to assess phonological short-term memory in Down’s syndrome as well as in normally developing children.

EXPERIMENT:

SUBJECTS: 43 Down's syndrome subjects → CA: 6;10 years-old to 42;10 years-old (mean: 19;8 years-old).

MA: 3;2 years-old to 7;8 years-old (mean 4;4 years-old).

→ 9 children: CA: 6;10 years-old to 11;3 years-old (mean: 9;2 years-old).

MA: 3;2 years-old to 3;7 years-old (mean 3;5 years-old).

→ 13 adolescents: CA: 14;5 years-old to 21;8 years-old (mean: 18;5 years-old).

MA: 3;6 years-old to 7;8 years-old (mean 5;1 years old).

→ 14 adults: CA: 22;3 years-old to 42;10 years-old (mean: 28;8 years-old).

MA: 3;3 years-old to 5;11 years-old (mean 4;8 years old).

TASKS ° Nonword repetition (see Gathercole, Willis, Emslie & Baddeley, 1991, for the original task).

- Length variation: 4 sub-groups of 10 non words (1, 2, 3 and 4 syllables).

- Articulatory complexity variation: 20 nonwords contain a single consonant and 20 contain a consonant cluster (5 single consonant and 5 consonant cluster in each sub-group length).

→ *40 nonwords.*

RESULTS:

Repetition performance:

1) Whole group: mean 16.81 nonwords correctly repeated (range: 3 to 36).

2) Children: mean 11.00 nonwords correctly repeated (standard deviation: 2.52).

3) Adolescents: mean 18.71 nonwords correctly repeated (standard deviation: 10.21).

4] Adults: mean 18.64 nonwords correctly repeated (standard deviation: 11.39).

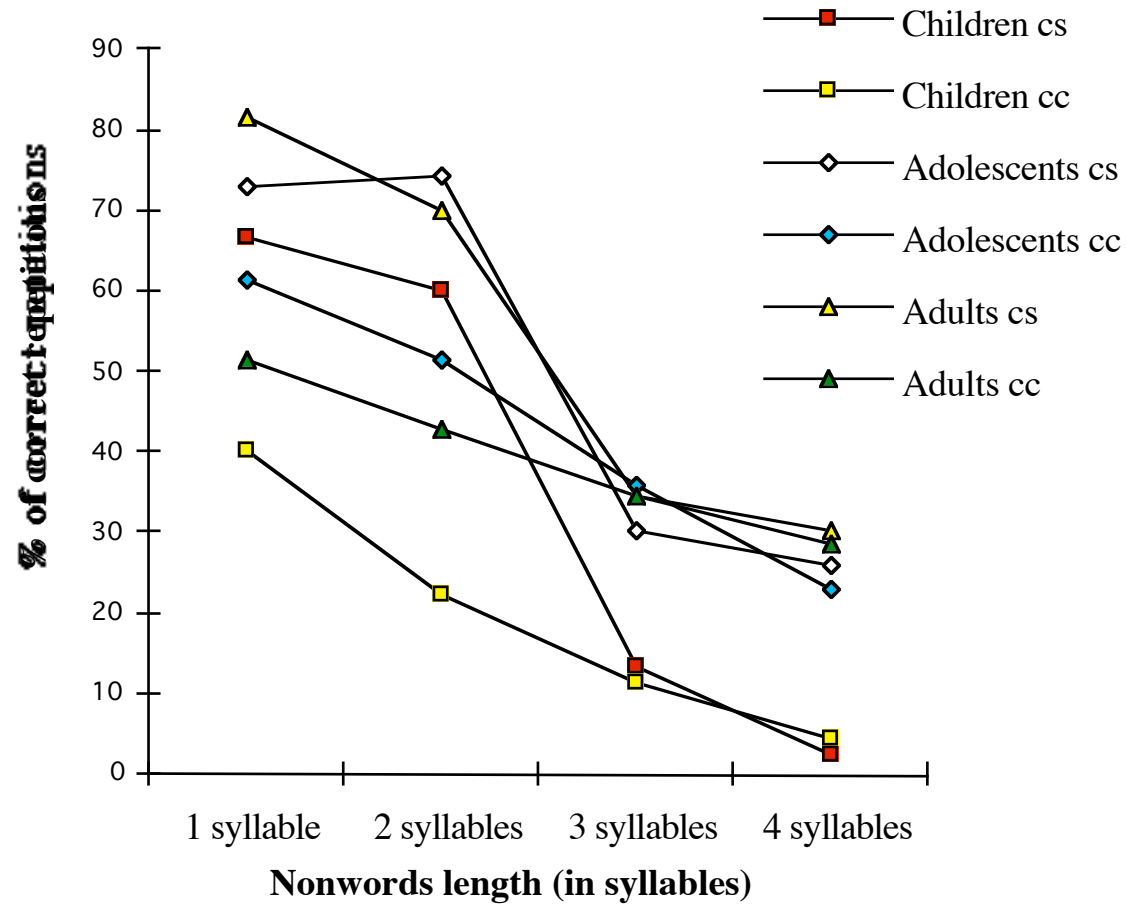
Correlation analysis:

1] Significant correlation between MA and nonword repetition performance ($r = 0.67$, $p < 0.0001$).

2] No significant correlation between CA and nonword repetition performance.

Influence of the phonological short-term memory factor: nonword length

Figure 1: Percentage of correct repetition in the three sub-groups of DS subjects according to the nonword length and the articulatory complexity (sc = single consonant, cc = consonant cluster).



- 1] Subjects repeat more short nonwords than long nonwords.
- 2] Subjects repeat more nonwords containing 1 or 2 syllables and single consonants than other nonwords.

Two ways ANOVA:

- Dependent variable: percentage of correct repetition
- 1st independent variable: nonword length (3 levels: 1, 2, 3 or 4 syllables)

- 2nd independent variable: consonantic complexity (2 levels: single consonant, consonant cluster).

→ **Significant effect of the variable "nonword length":** $F(3,32) = 22.66, p < 0.0001$

Table 1: Mean percentages of correct repetitions according to the nonword length (standard deviation).

Length: 1 syllable	63.51 % (17.20)
Length: 2 syllables	55.14 % (19.16)
Length: 3 syllables	38.38 % (12.95)
Length: 4 syllables	21.08 % (13.59)

→ Newman-Keuls a posteriori test:

- 1 syllable nonwords > 3 and 4 syllables non-words
- 2 syllables nonwords > 3 and 4 syllables non-words
- No significant differences between means: 1 and 2 syllables nonwords / 3 and 4 syllables nonwords.

→ **Significant effect of the variable "consonantic complexity":** $F(1,32) = 8.35, p < 0.01$

- 48.24 % (sd: 27.65) of simple nonwords correctly repeated (containing single consonants)
- 35.81 % (sd:17.25) of complex nonwords correctly repeated (containing consonant clusters)

→ **Significant interaction between the variable "nonword length" and the variable "consonantic complexity":**

$F(3,32) = 3.00, p < 0.05$

Table 2: Mean percentages of correct repetitions according to the nonword length and the consonantic complexity.
(standard deviation).

	Complexity: single consonants	Complexity: consonant clusters
Length: 1 syllable	74.59 % (11.87)	52.43 % (14.75)
Length: 2 syllables	69.19 (16.28)	41.08 % (8.20)
Length: 3 syllables	27.57 % (5.86)	19.19 % (18.47)
Length: 4 syllables	21.62 % (18.82)	20.54 % (7.78)

→ Newman-Keuls a posteriori test:

- Nonwords of a definite length but of different consonantic complexity:

- * 1 and 2 syllables nonwords with single consonants > 1 and 2 syllables nonwords with consonantic clusters (respectively $p < 0.05$ and $p < 0.01$).
- * no significant difference in the percentage of correct repetition of 3 and 4 syllables nonwords containing single consonants or consonant clusters.

- Nonwords of a definite consonantic complexity but of length:

- * no significant differences in the percentage of correct repetitions of 1 and 2 syllables nonwords.
- * no significant differences in the percentage of correct repetitions of 3 and 4 syllables nonwords.
- * 1 and 2 syllables nonwords > 3 and 4 syllables nonword ($p < 0.01$).

Influence of the linguistic factor: nonwords wordlikeness

In the previous analysis, we see that the quality of nonword repetition is influenced by the nonwords length but one cannot exclude that the quality of nonword repetition is also influenced by the subject's lexical knowledge.

→ phonological forms can be stored in the phonological memory and representations coming from the lexicon can also be added in the phonological memory

→ The percentage of correct repetitions can be influenced both by a phonological memory factor (nonwords length)

and by a linguistic factor (nonwords wordlikness).

Table 3: Correlations between the percentage of correct repetitions, nonwords length and nonwords wordlikness.

		Length	Wordlikness
% of correct repetitions	Whole group	- 0.74 **	0.71 **
	Children	- 0.68 **	0.65 **
	Adolescents	- 0.70 **	0.65 **
	Adults	- 0.68 **	0.66 **

- The percentage of correct repetitions increases with the degree of the nonwords wordlikness
- The percentage of correct repetition decreases as the nonwords length increases.

What is the real percentage of the variance of the correct repetitions explained by the nonwords wordlikness ?

--> partial correlations:

- Once the part variance explained by the nonwords length is taken off of the model, we see that the nonwords wordlikness still explains 39.69 % of the variance of the correct repetition (children: 32.04 %, adolescents: 26.94 % and adults: 33.87 %).
- The influence of the nonwords wordlikness on the percentage of correct repetitions is not only due to the fact that the longer the nonwords are, the less wordlike they are.

CONCLUSION AND DISCUSSION:

- 1] The percentage of correct repetitions is influenced by the nonwords length → the shorter nonwords are, the best they are repeated.*
 - 2] The percentage of correct repetitions is also influence by the degree of wordlikness of the nonwords → the more the nonwords sound like a real word, the best they are repeated.*
 - 3] The significant effect of the nonwords length is not depend ant of the degree of the nonwords wordlikness.*
- These results seem to confirm the hypothesis according to which nonwords are temporally stored in the phonological short-term memory system. As this system is limited (in time and capacity), the shorter the nonwords are, the best they are recalled.**
 - Nonword repetition is a reliable task allowing to assess phonological short-term memory in DS as well as in normally developing children.**
 - Furthermore, it seems that the phonological short-term memory system functioning is similar in DS subjects and in normally developing children.**