Developing auditory comprehension subtests of the Russian Aphasia Test

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Russian Aphasia Test (RAT)

- Addresses the lack of quantitative psychometrically valid and reliable language assessment tests in Russian.
- Integrates neuropsychological and psychometric traditions.
- Includes four language domains: auditory comprehension, oral production, reading, and writing.
- Assesses specific levels of linguistic processing in each domain.
- Aims to specify the type and severity of linguistic deficits in individuals with different aphasia profiles.

Auditory comprehension subtests

- **Phonological** – Minimal pair discrimination
- **Lexical** – Lexical decision
- **Lexical-semantic** – Single-word comprehension
- **Syntactic** – Comprehension of sentences
- **Discourse** – Comprehension of oral stories

Two stages in development: 1) piloting a large item set; 2) standardization of a refined item pool on a large sample of individuals with aphasia and healthy controls.

First stage – we provide preliminary data from individuals with and without aphasia on these subtests.

MINIMAL PAIR DISCRIMINATION

Judgment of whether pairs of nonwords (n=100) and words (n=72) are different or the same.

Manipulated factors:

- Phonological features (e.g., manner (*man-ban*) and place (*tin-pin*) of articulation, VOT (*pun-bun*), palatalization);
- Syllabic structure (CV, CVC, CCVC, CVCC, CCVCC);
- Word position (onset, offset, transformation);
- Frequency and imageability (for words).

Participants

- Aphasia: 12 (M_{age} = 45.25)
- Controls: 20 (M_{age} = 53.7)

Results

- No significant differences between groups. Lack of sensitivity?
- Nonwords are more difficult to discriminate for both groups (controls p = .001; aphasia p = .013).
- Factors impacting performance: syllabic structure and position, phoneme manner (control: palatalization, aphasia: VOT) .
- Discrimination of nonwords correlates with a standardized test of language comprehension (*rho* = .756, p = .007).

	Control %	Aphasia %
Nonwords	94.25	89.45
Words	97.85	95.72

LEXICAL DECISION

Classify stimuli as word or nonword (n=120).

Manipulated factors:

- Lexical frequency: high and low;
- Word length: 2 and 3 syllable;
- Degree of similarity of non-words to real words.

Participants

- Aphasia: 12 (M_{age} = 45.25)
- Controls: 20 (M_{age} = 52.15)

Results

- Significant differences between groups (*p < .05, **p < .001).
- Classification of nonwords is particularly difficult for individuals with aphasia.
- Performance on the lexical decision task correlates with discrimination of nonwords (*rho* = .61, p = .046).

	Length	Type	Control %	Aphasia %
Nonwords	**2**	**Similar**	**98.3***	**92.2**
		Not similar	99.7	98.9
	3	**Similar**	**97.7****	**89.4**
		Not similar	99.3	100
Words	**2**	**High frequency**	99.7	98.9
		Low frequency	99.7	97.8
	3	**High frequency**	100	100
		Low frequency	**99.7***	**97.8**
Overall			**99.3****	**96.9**

SINGLE-WORD COMPREHENSION

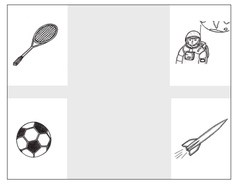
- Word to picture matching for objects (n=67) and actions (n=68).
- Visual array of 4 pictures (target, phonological , semantic, unrelated foils).
- Items were selected based on high naming and image agreement. Images and words taken from standardized databases (Verbs: www.neuroling.ru; Nouns: www.nounobject.ru)

Participants

- Aphasia: 30 for noun comprehension and 45 for verb comprehension (M_{age} = 45.4)
- Controls: 30 (M_{age} = 44.2)

Results

- Significant differences between groups (**p < .001).
- Comprehension of verbs worse than nouns for both groups.



raketa ('rocket') **– target**
raketka ('racket') – phonological foil
kosmonavt ('astronaut') – semantic foil
myach ('ball') – unrelated foil

tsvesti ('to bloom') **– target**
gresti ('to row') – phonological foil
sazhat' ('to plant') – semantic foil
vycherpyvat' ('to scoop') – unrelated foil

	Nouns		Verbs	
Type of answer %	**Control %**	**Aphasia %**	**Control %**	**Aphasia %**
Correct answers	**100 (0)****	**92 (13)**	**99 (0.9)****	**86 (12)**
Phonological error	0 (0)	2.5 (4)	0.1 (0.4)	2.5 (4)
Semantic error	0 (0)	5 (7)	0.4 (0.8)	9 (7)
Irrelevant error	0 (0)	0.75 (3)	0.05 (0.27)	1.8 (3)

COMPREHENSION OF SENTENCES

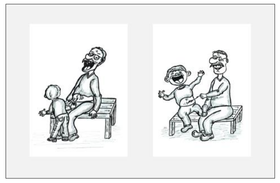
- Sentence to picture matching for various syntactic constructions (n=68): SVO, OVS, subject relative, object relative, prepositional phrases.
- Intransitive and transitive verbs.
- Reversible and non-reversible sentences.
- Each visual array consists of 2 pictures.
- High-frequency lexical items used.
- Short sentences, no additional descriptors.

Participants

- Aphasia: 20 (M_{age} = 49.9)
- Controls: 20 (M_{age} = 51.55)

Results

- Significant differences between groups: overall and in reversible and non-canonical constructions, as well as prepositional phrases (*p < .05, **p < .001).
- Overall sentence comprehension score correlates with language comprehension score from a standardized language test (*rho* = .625, p = .004).



Where is grandpa, who is tickled by the boy
(Object relative clause – transitive, reversible)

Type of construction	Type of verb	n	Control %	Aphasia %
Active canonical SVO	**Intransitive**	4	100	93.8
	Transitive, non-reversible	4	100	96.3
	Transitive, reversible	8	**99.4****	**80**
Active non-canonical OVS	**Transitive, non-reversible**	4	**100***	**90**
	Transitive, reversible	8	**93.8****	**68.1**
Subject relative clause (≈ subject cleft)	**Intransitive**	4	100	100
	Transitive, non-reversible	4	100	96.3
	Transitive, reversible	8	**100****	**83.1**
Object relative clause (≈ object cleft)	**Transitive, non-reversible**	4	100	93.8
	Transitive, reversible	8	**98.8****	**71.9**
Prepositional	**Non-reversible**	4	**100***	**85**
	Reversible	8	**99.4****	**63.1**
Overall		68	**98.97****	**81.62**

COMPREHENSION OF ORAL STORIES

- Comprehension of two orally presented stories: the 'Book' story and the 'Cat' story.
  - Length: 151/150 words and 22 sentences. Average length of sentences: 6.8 words.
  - Lexical complexity: 1-3rd grade level text. Average frequency of lexical items: 175.8/164.7.
  - Syntactic complexity: 29/30 clauses and 1.3 clauses per sentence.
- Comprehension indexed by response accuracy to a set of 16 yes-no questions on explicit/implicit and main/detail story content.

Participants

- Aphasia: 10 (M_{age} = 51.9)
- Controls: 20 (M_{age} = 48.7)

Results

- Significant differences between groups only for the 'Book' story (*p < .05).
- Implicit information and details are more difficult for aphasia than controls.
- Overall the 'Cat' story is more difficult for the control group (p < .02).
- Details are more difficult than the main storyline in the 'Cat' story for both groups.

Story	Type	Control	Aphasia
Book	**Explicit**	93.8	77.5
	Implicit	**97.5***	**75.0**
	Main	96.3	80.0
	Detail	**95.0***	**72.5**
	Overall	**95.6***	**76.3**
Cat	**Explicit**	92.5	90.0
	Implicit	88.8	87.5
	Main	98.8	97.5
	Detail	82.5	80.0
	Overall	90.6	88.8

NEXT STAGE

Maximize validity and reliability of each subtest by removing "poor" items:

- Remove items that were answered erroneously by two or more healthy participants;
- Retain items with good corrected-item-total correlation;
- Ensure varying item difficulty based on performance of individuals with aphasia;
- Ensure that each influential psychometric property is represented by a wide range of values.

Standardize the refined and shortened set of items for each subtest in a large control and clinical sample (n=100).

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