

Rationale

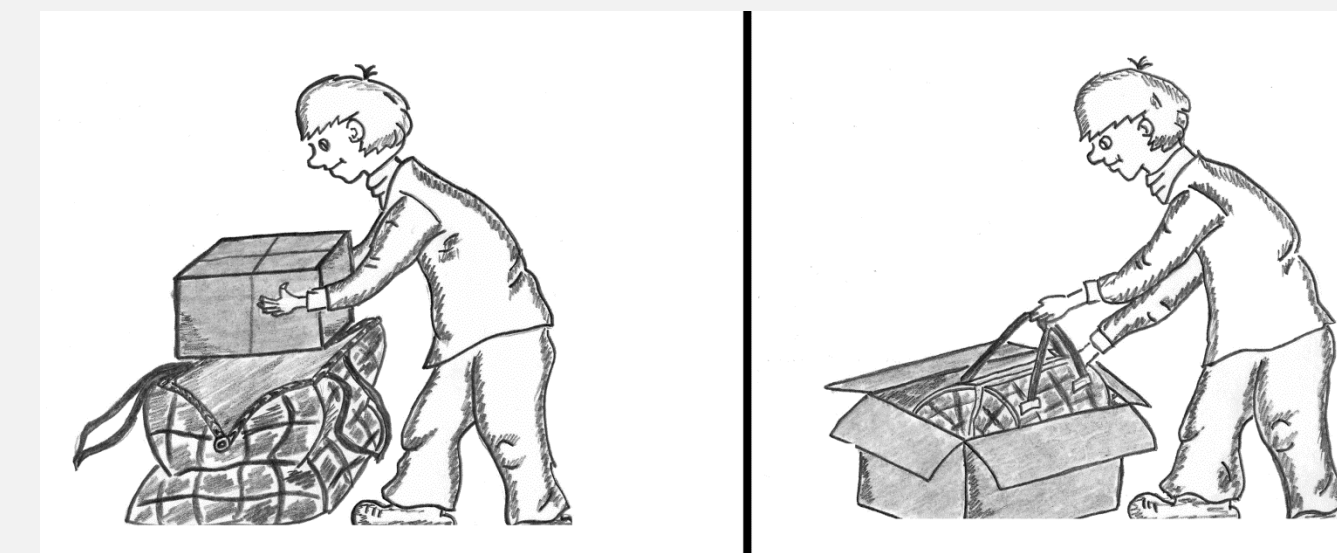
- Impairments in spatial processing may show themselves not only in gnosis and praxis, but also in the language domain
- Interpretation of reversible constructions (e.g. *put the box on the barrel* or *point to the pencil with the key*), is problematic in aphasic individuals (Luria, 1947; Goodglass, 1993)

- Luria (1947) considered this linguistic deficit a characteristic feature of so-called semantic aphasia and explained it and related spatial disorders by a common spatial neuropsychological factor grounded in the temporal-parietal-occipital regions of the brain
- Half a century ago Luria hypothesized that individuals with semantic aphasia overuse sensorimotor stereotypes reflecting the temporal order of interactions with objects during action implementation and map them on the surface word order of a sentence: correct with "take the box, put it on the barrel", but wrong with "take the pencil, point to the key with it"
- In the present study, for the first time, it has been experimentally tested if difficulties in extracting spatial relations from a linguistic form and a strategy to rely on basic sensorimotor stereotypes are specific to individuals with semantic aphasia

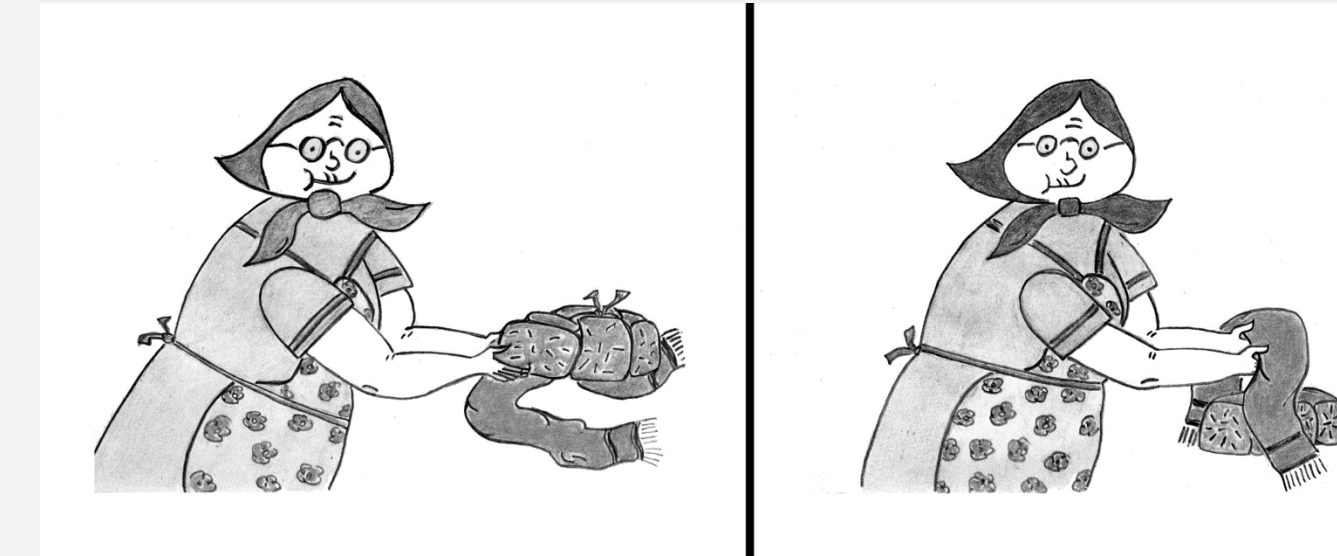
Procedure

- Sentence-picture matching
- E-prime presentation

The boy is putting the bag in the box



The grandmother is covering the scarf with the hat



Participants

- Six individuals with semantic aphasia (3 female; mean age 48 years; mean post onset time 19 months)
- 12 people with sensory (Wernicke) aphasia (6 female; mean age 48.5 years; mean post onset time 17 months)
- 12 people with motor (Broca) aphasia (6 female; mean age 47.4 years; mean post onset time 27.6 months)
- 12 non-brain-damaged individuals (9 female; mean age 47 years)
- All native speakers of Russian

Materials

- 12 prepositional and 12 instrumental **reversible** constructions were tested in two conditions: direct word order and inverted word order

Prepositional constructions with direct word order (1) naturally mapped on a sensorimotor stereotype ("take the bag, put it in the box"), while those with inverted word order (2) did not

Instrumental constructions represented a clear dissociation: only when being inverted (6) they followed a sensorimotor stereotype ("take the hat, cover the scarf with it"), while their direct word order counterparts (5) did not

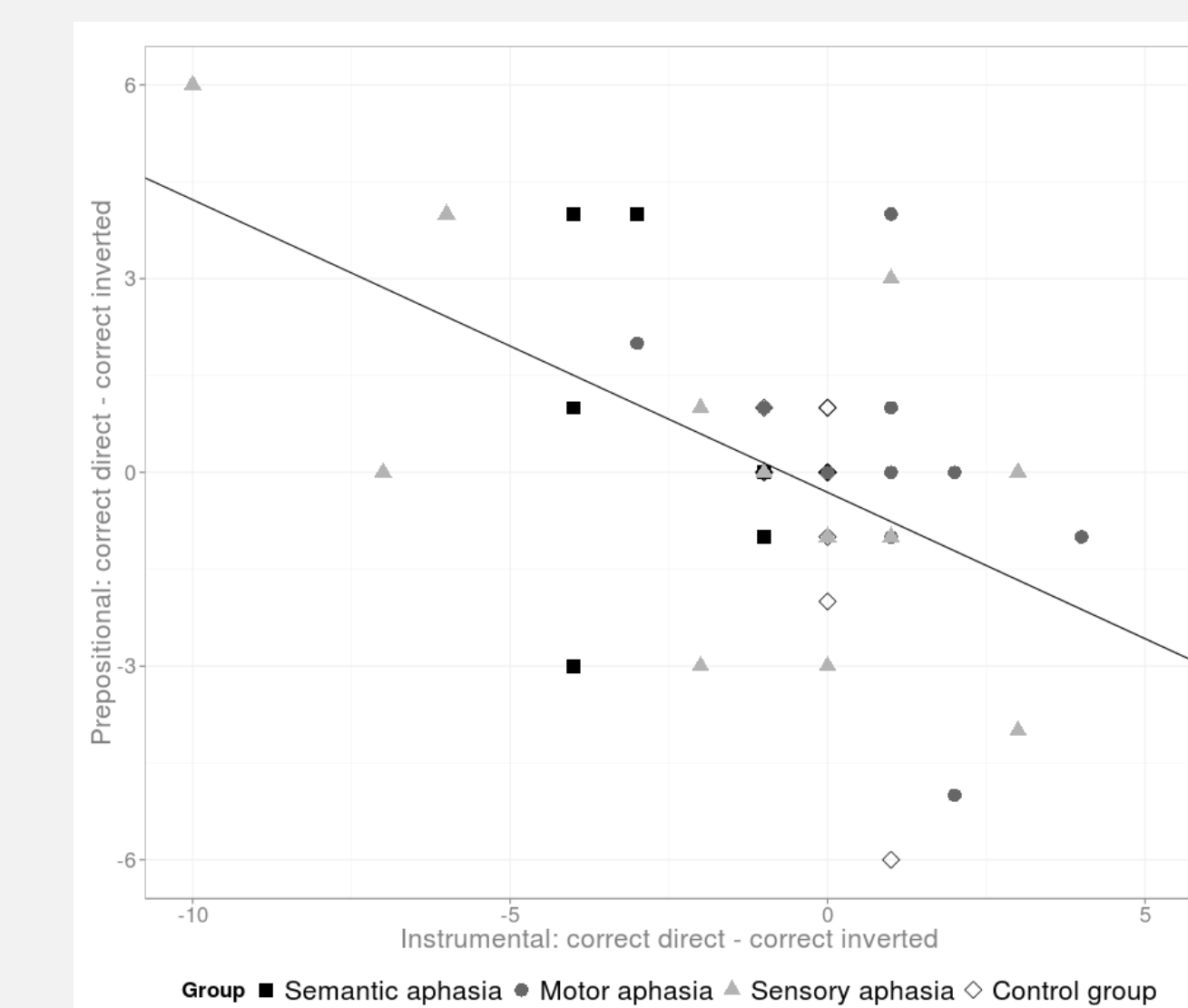
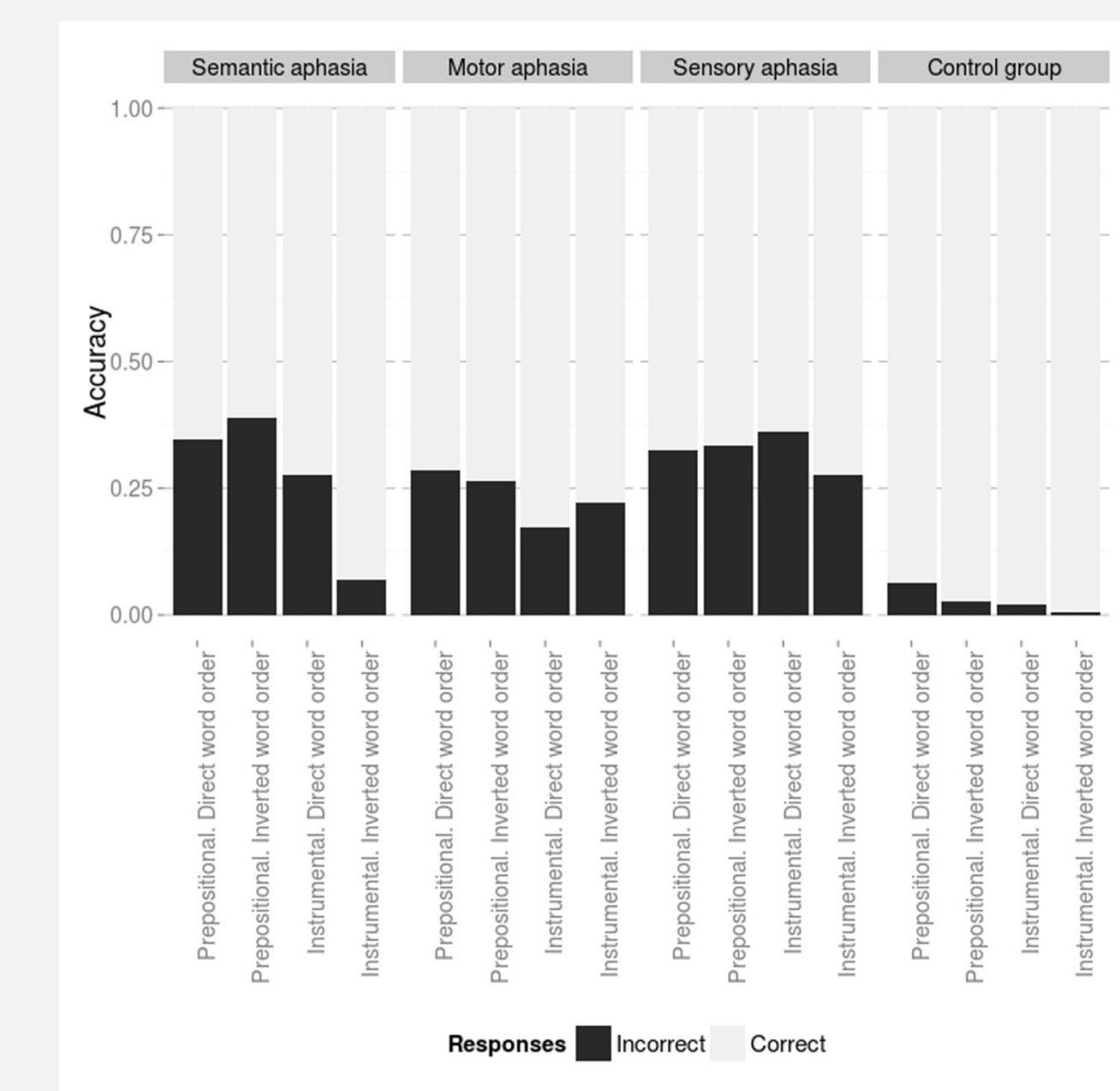
- 12 prepositional (3, 4) and 12 instrumental (7, 8) **irreversible** constructions, each again with direct and inverted word order options, were used to identify baseline performance in the clinical groups

		Direct Word Order	Inverted Word Order
Prep.	reversible	(1) Malchik kladet boy-NOM to put-PRES sumku v korobku bag-ACC in box-ACC 'The boy is putting the bag in the box'	(2) Malchik kladet boy-NOM to put-PRES v korobku sumku in box-ACC bag-ACC 'The boy is putting in the box the bag'
	irreversible	(3) Malchik kladet boy-NOM to put-PRES jabloko v sumku apple-ACC in bag-ACC 'The boy is putting the apple in the bag'	(4) Malchik kladet boy-NOM to put-PRES v sumku jabloko in bag-ACC apple-ACC 'The boy is putting in the bag the apple'
Instr.	reversible	(5) Babushka nakryvaet grandmother-NOM to cover-PRES sharf shapkoj scarf-ACC hat-INSTR 'The grandmother is covering the scarf with the hat'	(6) Babushka nakryvaet grandmother-NOM to cover-PRES shapkoj sharf hat-INSTR scarf-ACC 'The grandmother is covering with the hat the scarf'
	irreversible	(7) Babushka nakryvaet grandmother-NOM to cover-PRES telefon shlapoj telephone-ACC hat-INSTR 'The grandmother is covering the telephone with the hat'	(8) Babushka nakryvaet grandmother-NOM to cover-PRES shlapoj telefon hat-INSTR telephone-ACC 'The grandmother is covering with the hat the telephone'

Results and Discussion

- Effect of reversibility: in all groups of participants there were more correct responses to irreversible sentences than to reversible ones ($p < 0.001$ for all comparisons)
- Interaction of Construction type and Word order in the semantic group: *instrumental constructions elicited fewer correct responses when the word order was direct compared to the inverted word order ($p < 0.001$) in the prepositional constructions, no significant difference was found between the two word orders; but only when the word order was direct accuracy significantly differed from chance ($p < 0.01$)*

- In other groups of participants no such interaction was found
- Two additional measures were computed: the difference between the number of correct responses to the direct and inverted prepositional constructions, and the difference between the number of correct responses to the direct and inverted instrumental constructions
- A negative correlation between the two scores was found ($S = 17332$, $\rho = -0.40$, $p < 0.01$).



The findings confirm the importance of situational context and pragmatics for linguistic processing. First, if knowledge of the real world supports the unique interpretation of grammatical markers, it enhances processing in all tested cohorts of participants. Second, people with semantic aphasia consistently use sensorimotor stereotypes to compensate for their linguistic deficits. However, since this was also found in some participants with other aphasia types and in healthy people, such a sensorimotor strategy might depend on the intactness and overuse of left premotor regions suggested to be critical for motor and symbolic sequential processing (Luria, 1947).