Evaluation of Treatment for Word Sound Deafness in Aphasia – A single case study

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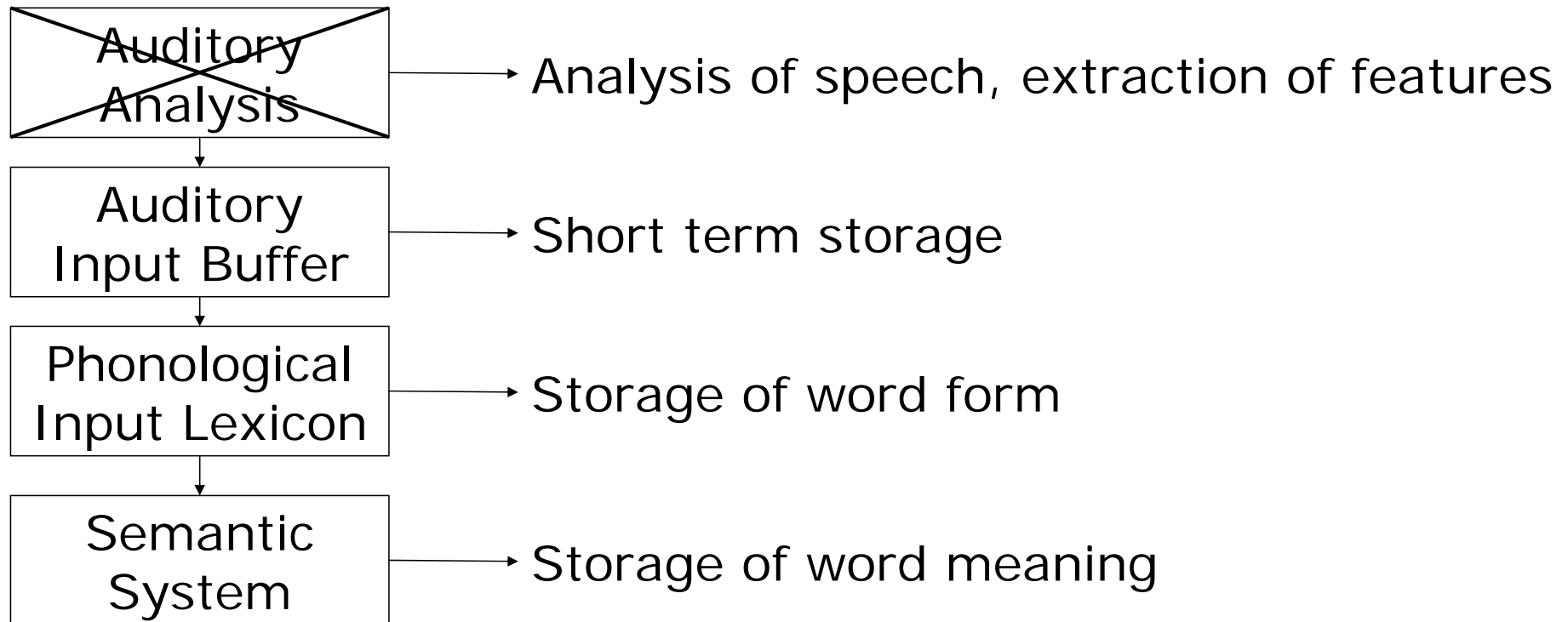[2] Department of Linguistics, University of Potsdam

Background

> Word Sound Deafness (WSD):

- Breakdown of the auditory analysis of speech, while the ability to perceive, discriminate or identify non-speech sounds remains preserved

- First mentioned by Kussmaul (1877)

- Few published studies on treatment

Background

> Auditory comprehension within cognitive neuropsychological models (e.g. Howard & Franklin, 1988):

~~Auditory Analysis~~	→ Analysis of speech, extraction of features
Auditory Input Buffer	→ Short term storage
Phonological Input Lexicon	→ Storage of word form
Semantic System	→ Storage of word meaning

Background

> A phoneme consists of 3 distinctive features:
> - Place of articulation (/ta/ - /pa/)
> - Manner of articulation (/ta/ - /sa/)
> - Voicing (/ta/ - /da/)

> Phonemes are distinguished by minimally 1 and maximally all 3 features (/ta/ - /va/)

Background

> In WSD:

- The greater the difference between phonemes, the easier to discriminate (Auerbach et al., 1982)

- Supporting factors:
  - Lip-reading (Buchman et al., 1986; Shindo et al., 1991)
  - Context (Buchman et al., 1986; Saffran et al., 1976)
  - Slowed speech (Albert et al., 1972; Buchman et al., 1986)

Background

> Systematic treatment studies WSD:

- Morris et al. (1996)
    - Partially replicated by current study
    - Treatment successful

- Maneta et al. (2001)
    - Partial replication of Morris et al. (1996)
    - Treatment not successful

Aim/Hypotheses

> Aim: add support to Morris et al.'s (1996) finding that systematic treatment of WSD is efficient

> Hypotheses:

- Improvement of:
  - Trained material
  - Similar, but untrained material
  - Related tasks
- 1=2=3 distinctive features (after treatment)
- Persistency of improvements

Methods

>Participant MTR:

- Female
- Right handed
- 75 years
- 11 month post onset (haemorrhage in left basal ganglia)
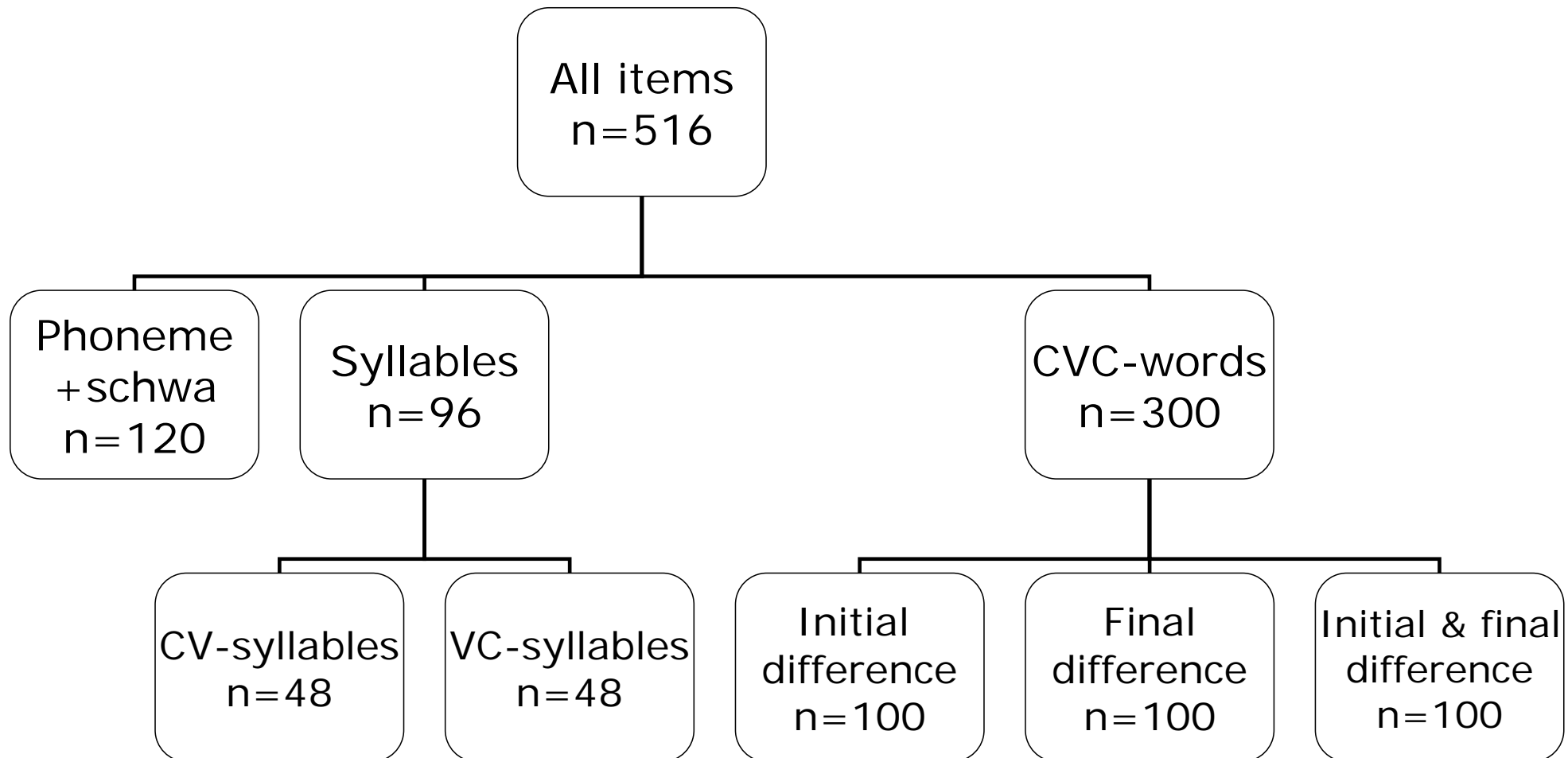- No neuropsychological deficits
- Global aphasia

Methods

>Neurolinguistic assessment with Lemo (De Bleser et al., 2004):

- Deficit in auditory analysis
- No deficit in the phonological input lexicon
- Severe deficit in the semantic system
- Damage to phonological output system
- Severe reading problems

Methods

Design: ABA with 5 assessment points:

BL1	BL1′	BL1′′		post	follow-up

Baseline assessments	Treatment sessions	Following treatment	8 weeks after post
At least 7 days in-between	3-4 days in-between		

Pre-treatment: stable performance on all tasks:
- Auditory discrimination tasks
- Control tasks (LeMo tasks: written synonym decision, internal reading: rhyme decision & written word-picture matching)

Methods

Items used in treatment study: ½ trained, ½ untrained:

Methods

> Procedure:
  - 7 tasks:
    - (1) Grapheme-phoneme matching
    - (2) Phoneme discrimination
    - (3) Word-picture matching
    - (4) Word-word matching
    - (5) Word-picture verification
    - (6) Word-word verification
    - (7) Syllable discrimination

Methods

>Each task:

- Trained and untrained items
- Items differing in 3, 2 & 1 distinctive features

>Material balanced for

- Position of difference (CVC-items)
- Lexical frequency (words)

Methods

> Each task: Start with maximal difference (3 distinctive features) & lip-reading possible

- 5 correct responses → no lip-reading
- 90% correct (without lip-reading) → 2 distinctive features (with lip-reading) …

> Full cessation: 90% correct in all tasks (1 distinctive feature without lip-reading) in 2 subsequent sessions or after 16th session

Results

> Cut-off reached after 13 sessions

> Duration of intervention: 7 weeks

> Duration of intervention session: 50-60 min.

> Control tasks (written synonym decision, internal reading: rhyme decision & written word-picture matching) stable before and after treatment

(McNemar, 2-tailed, $p > .05$)

Results

> Influence of amount of distinctive features differentiating pairs:
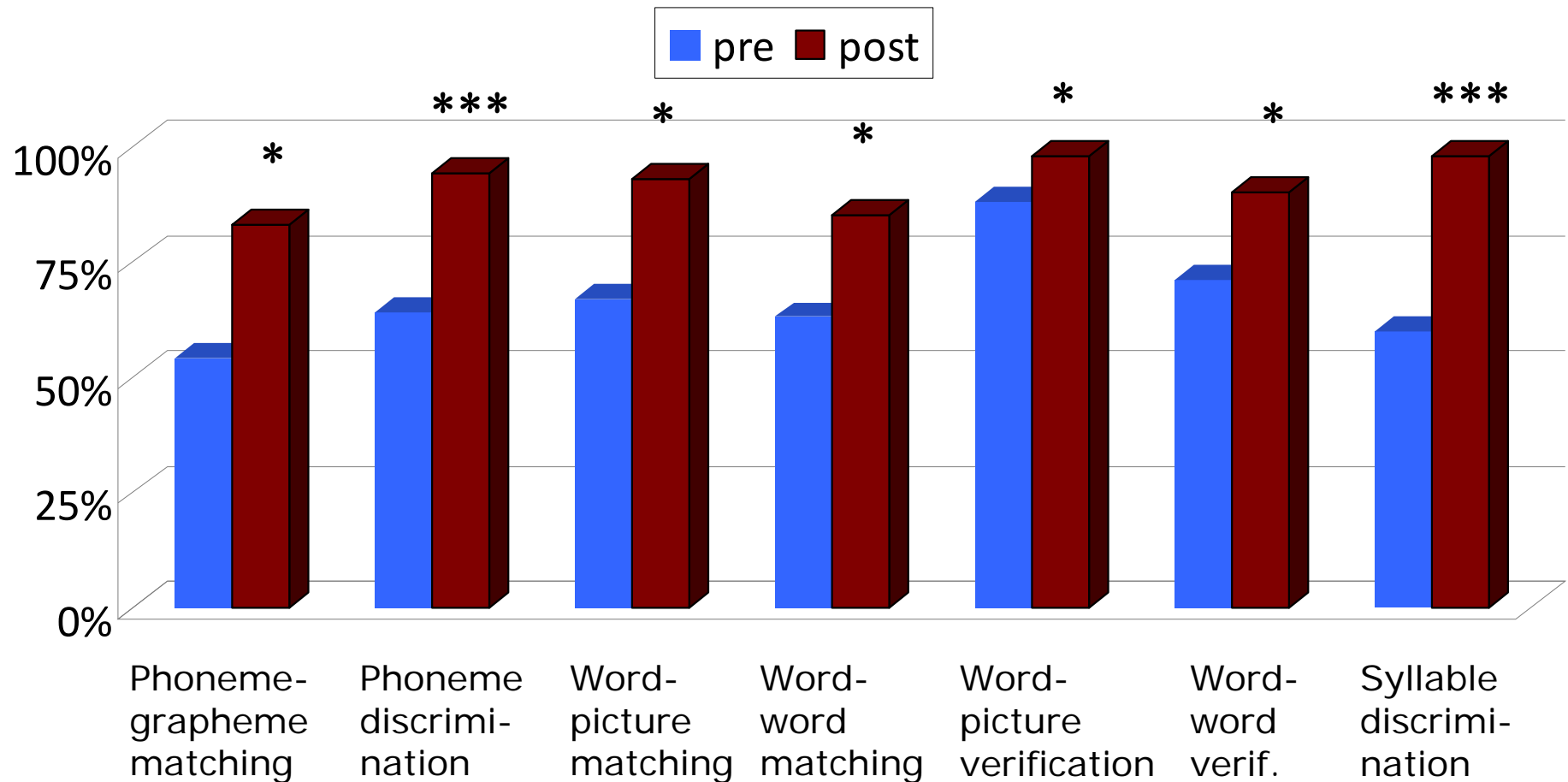
- Before treatment:

    $3 = 2 >^* 1$

- After treatment:
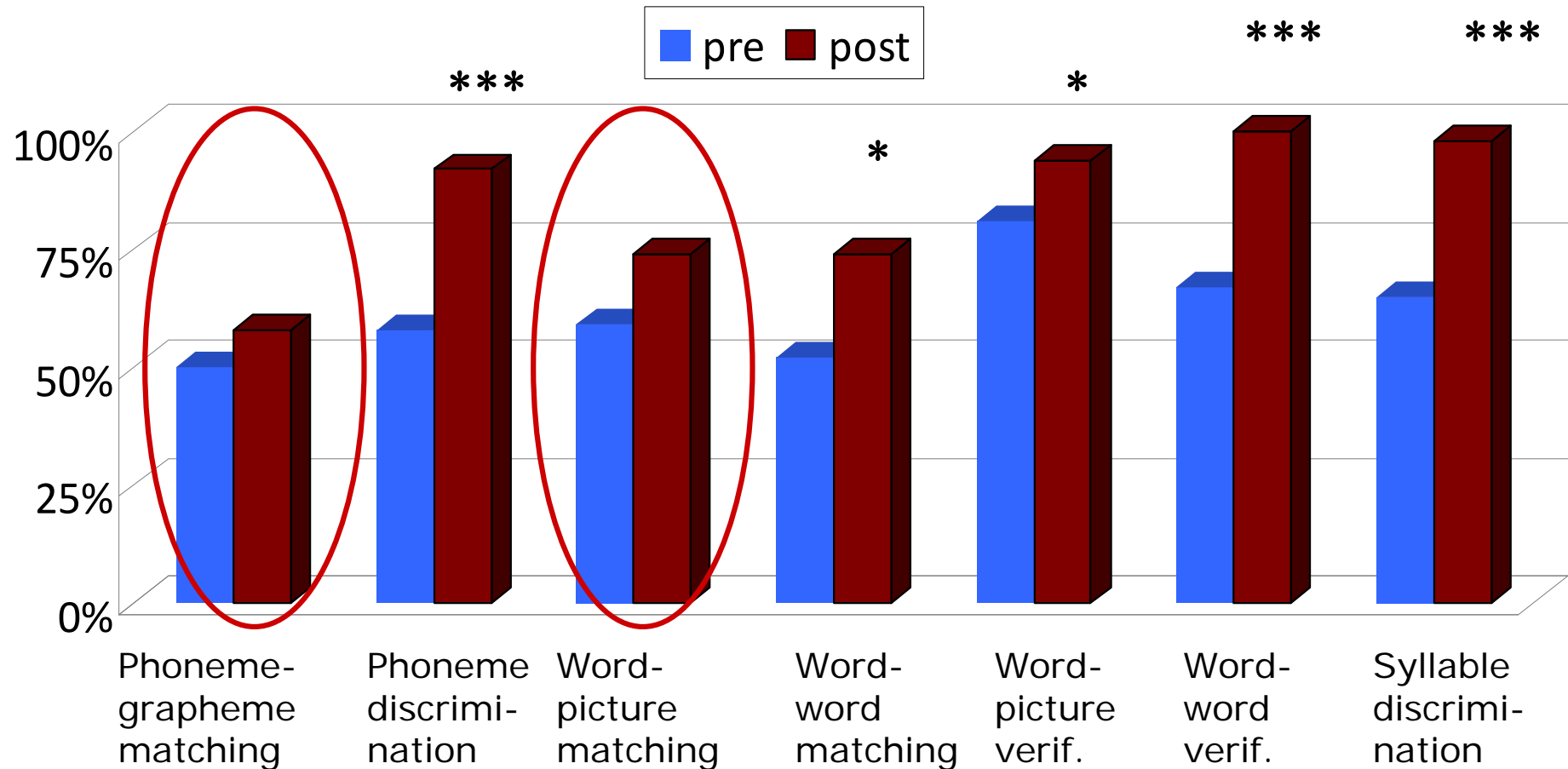
    $3 = 2 = 1$

*: Fisher exact (1-tailed): $p < .05$

Results: Trained material

*: p≤.05; **: p<.01; ***: p<.001 (McNemar exact, 1-tailed)

Results: Untrained material

*: p≤.05; **: p<.01; ***: p<.001 (McNemar exact, 1-tailed)

Results

> Related Tasks:
- Significant improvement for:
  - LeMo nonword discrimination (p<.001)
  - LeMo word discrimination (p<.001)
  - Maximal Pairs Screening (p<.001)

- No significant changes for:
  - LeMo aud. lexical decision
  - LeMo repetition of nonwords
  - LeMo repetition of words
  - LeMo aud. word-picture matching
  - LeMo aud. synonymy judgement

(McNemar exact, 1-tailed)

Results

>Follow-up testing:

- Control tasks stable

- Trained material: no sign. differences to post-treatment except for phoneme-grapheme matching

- Untrained material: no sign. differences to post-treatment

- Related tasks: no sign. differences to post-treatment

(McNemar exact, 2-tailed)

Reminder

>Participant suffered from multiple problems:
- Deficit in auditory analysis
- Severe deficit in the semantic system
- Damage to phonological output system
- Severe reading problems

Discussion

>Improvement for trained items as expected

>Untrained Items: improvement only for 5/7 tasks:

- Phoneme-grapheme matching → reading limitations
- Word-picture matching → semantic deficit

Discussion

>Related tasks:

- Discrimination tasks improved as expected

- Aud. lexical decision → ceiling pre-treatment
- Repetition → damage to output phonology
- Aud. Word-picture matching/synonymy judgment → semantic deficit

Discussion

> Results resemble Morris et al.'s (1996) results

> Maneta et al. (2001) however did not find improvement:

- Participant more impaired, unable to fulfill discrimination tasks

- Only tasks in treatment not involving same/different judgments

Discussion

>Treatment is applicable in clinical setting

>Treatment was effective!

>Further question:

- Is there a task more crucial than others or is the variety most important?

Thank you for your attention

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