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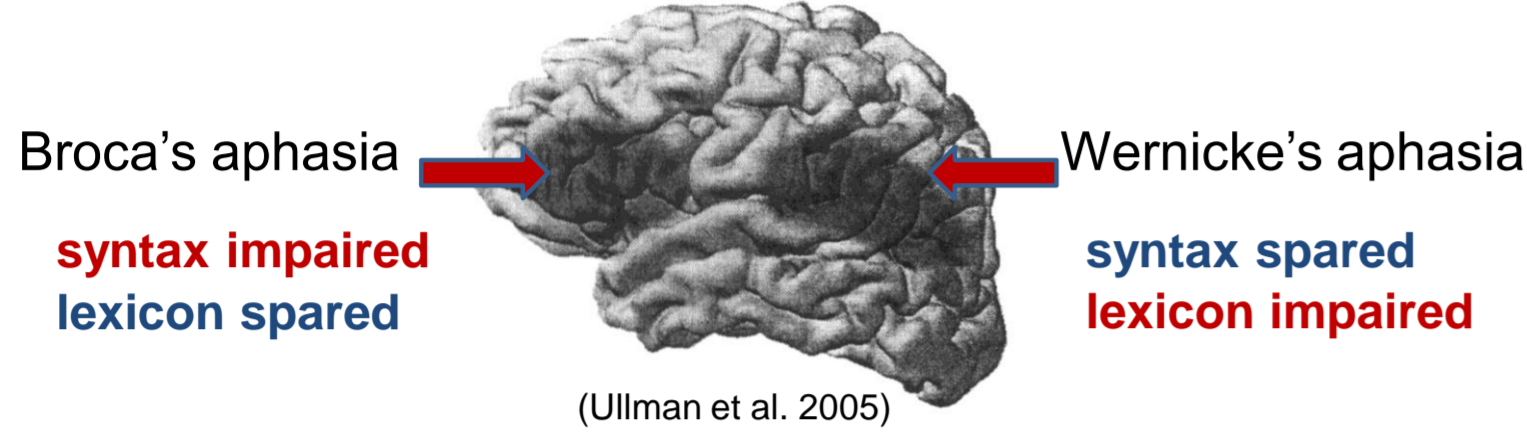FACULTEIT LETTEREN EN WIJSBEGEERTE

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Syntactic Deficits in German Wernicke's and Broca's aphasics

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Syntactic deficits in aphasia

❖ focus: **Broca's aphasia** (cf. Penke 1998, Grodzinsky 2000)
  • core symptom is agrammatism: reduced syntactic complexity, lack of functional elements
  • assumption: **syntactic disorder**

❖ less attention: **Wernicke's aphasia** (cf. Edwards 2005)
  • core symptom is paragrammatism: fluent speech, semantic and phonological paraphasias, sentence blends
  • assumption: **lexical disorder**

Broca's aphasia — Wernicke's aphasia

syntax impaired — syntax spared
lexicon spared — **lexicon impaired**

(Ullman et al. 2005)

Syntactic deficits in aphasia

❖ But there is evidence for impaired syntactic structures in Wernicke's subjects similar to Broca's aphasics
  • difficulties in production of complex sentences
    ✓ avoidance of complex sentences
    ✓ overrepresentation of simple, canonical SVO sentences
    (e.g. Niemi & Laine 1997, Martin & Blossom-Stach 1986, Bates et al. 1987)
  • errors in comprehension
    ✓ better performance for canonical sentences SVO sentences compared to non-canonical OVS sentences (e.g. Balogh & Grodzinsky 2000, Edwards 2005)

Research Questions:
✓ Are the syntactic abilities of Wernicke's subjects intact?
✓ Are there differences between Wernicke's and Broca's aphasics with respect to syntactic abilities?

?

Method

Structured tasks testing the production and comprehension of *wh*-questions in groups of 9 German Wernicke's and Broca's aphasics

Subjects	Wernicke's	Broca's*	Control*
age range	55-80	53-68	50-70
sex	6m, 3f	5m, 4f	5m, 5f
etiology	CVA	CVA	-
diagnosis by standard aphasic test (AAT)	yes	yes	-
N - elicitation task	6	7	10
N - repetition task	8	8	10
N - comprehension task	8	9	10

*data presented in Neuhaus & Penke (2008)

Production tasks

I.   **Elicitation**
Subjects were asked to transform a given main clause presented on a card into a *wh*-question. 54 *wh*-argument questions were tested .

Subject condition
n=16

Jemand füttert den Jungen. (*Somebody feeds the boy.*)
Klaus fragt:_____? (*Klaus asks_____?*)
target: **Wer** füttert den Jungen? (***Who** feeds the boy?*)

Object condition
n=26

Petra hat jemanden gesehen. (*Petra has seen somebody.*)
target: **Wen** hast Du gesehen? (***Whom** have you seen?*)

Adjunct condition
n=12

Petra hat den Roman letzte Woche gelesen.
(*Petra read the novel last week.*)
target: **Wann** hat Petra den Roman gelesen?
(***When** did Petra read the novel?*)

Production tasks

II. **Repetition**
Subjects were asked to repeat *wh*-questions as accurately as possible.
  wh-subject questions: n = 10
  wh-object questions: n = 10
  wh-adjunct questions: n = 10

Example
Wer repariert den Computer?
(*Who repairs the computer?*)

Control for sentence complexity and memory effects in production and comprehension tasks
  • sentence length: *wh*-argument questions: 4-6 words (matched between conditions), *wh*-adjunct questions: 5-7 words
  • lexical frequency*: frequent nouns and verbs :
    – mean verb lemma frequency: elicitation Ø 620, repetition Ø 1042, comprehension Ø 368   *acc. to CELEX data base (Baayen et al. 1993)
    – constant NPs in *wh*-argument questions of elicitation task (*Petra/jemand/er*) and *wh*-question comprehension (*man/woman*), mean lemma frequency for object or adverbial phrases in *wh*-adjunct questions in elicitation Ø 1116, for noun phrases in repetition Ø 376

Comprehension task: Picture pointing

Method: Presentation of little scenarios depicting a semantically reversible action. Person A and C are of the same sex.

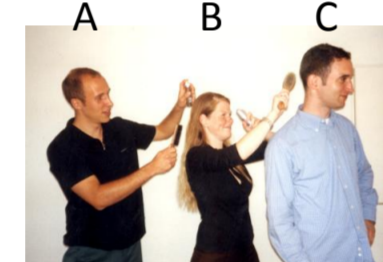Example: A man brushes a woman who in turn brushes a man.
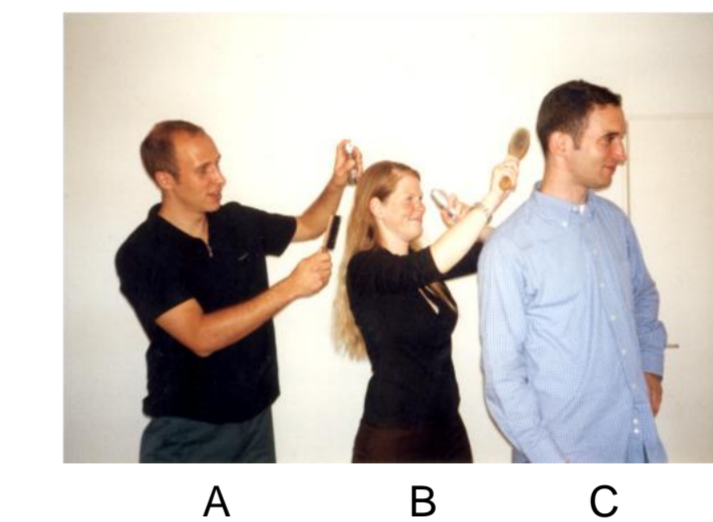
Subjects were asked a visually and auditorily presented *wh*-argument-question, e.g.:

Wer bürstet den Mann?
(***Who** is brushing the man?)

A   B   C

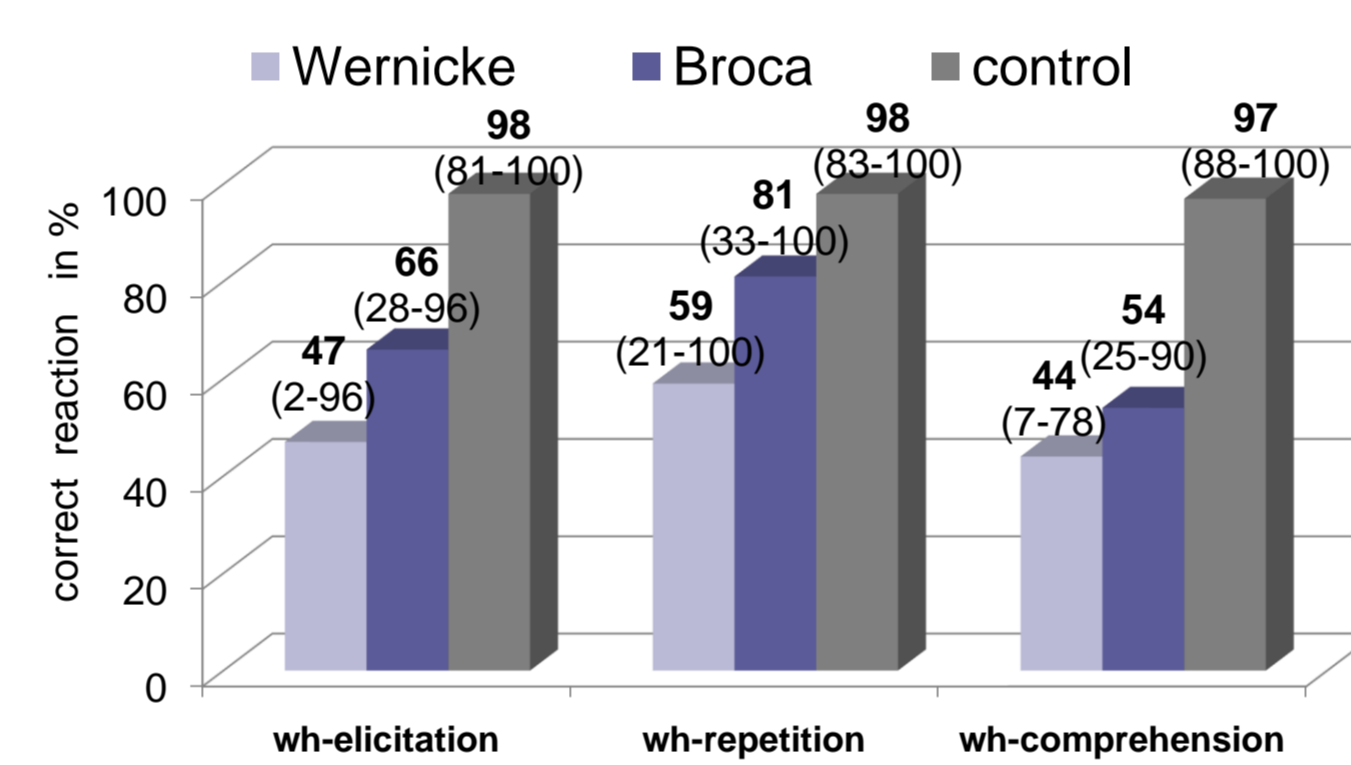Subjects were asked to point to the corresponding person in the picture (in this case, B).

Material

30 *wh*-subject questions
30 *wh*-object questions

60 pictures

A B C

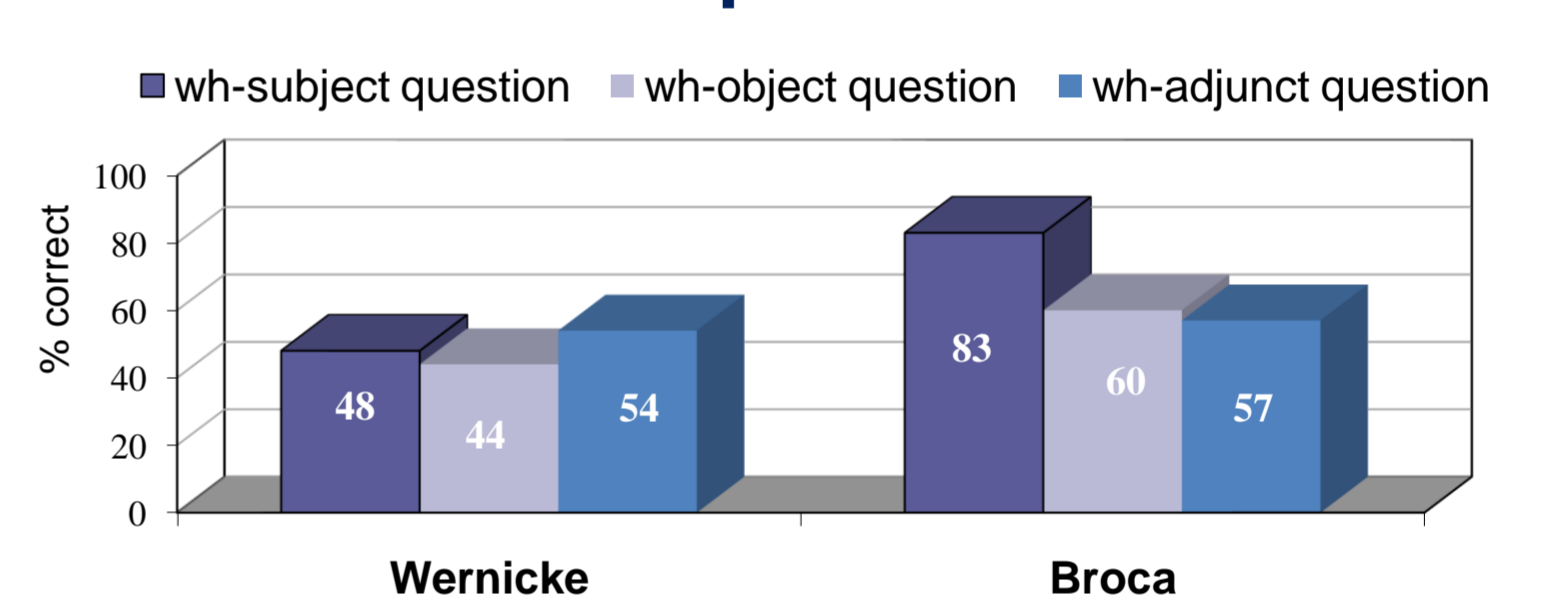| Question type	N	Example	Target reaction
who-subject	20	**Wer** bürstet den Mann/die Frau? (*Who is brushing the man/the woman?*)	person B/A
which N-subject	10	**Welcher Mann** bürstet die Frau? (*Which man is brushing the woman?*)	person A
who-object	20	**Wen** bürstet der Mann/die Frau? (*Who is the man/the woman brushing?*)	person B/C
which N-object	10	**Welchen Mann** bürstet die Frau? (*Which man is the woman brushing?*)	person C

Subjects were expected to point to A, B and C 20 times each.

Overall results of subtests

Wernicke | Broca | control

wh-elicitation: 47 (2-96), 66 (28-96), 98 (81-100)
wh-repetition: 59 (21-100), 81 (33-100), 98 (83-100)
wh-comprehension: 44 (7-78), 54 (25-90), 97 (88-100)

correct reaction in %

❖ Wernicke's subjects: weaker overall results than Broca's, but differences are not significant (MWU, *p* > .05).
❖ Best results achieved by persons with a mild form of aphasia

Results of *wh*-question elicitation

wh-subject question | wh-object question | wh-adjunct question
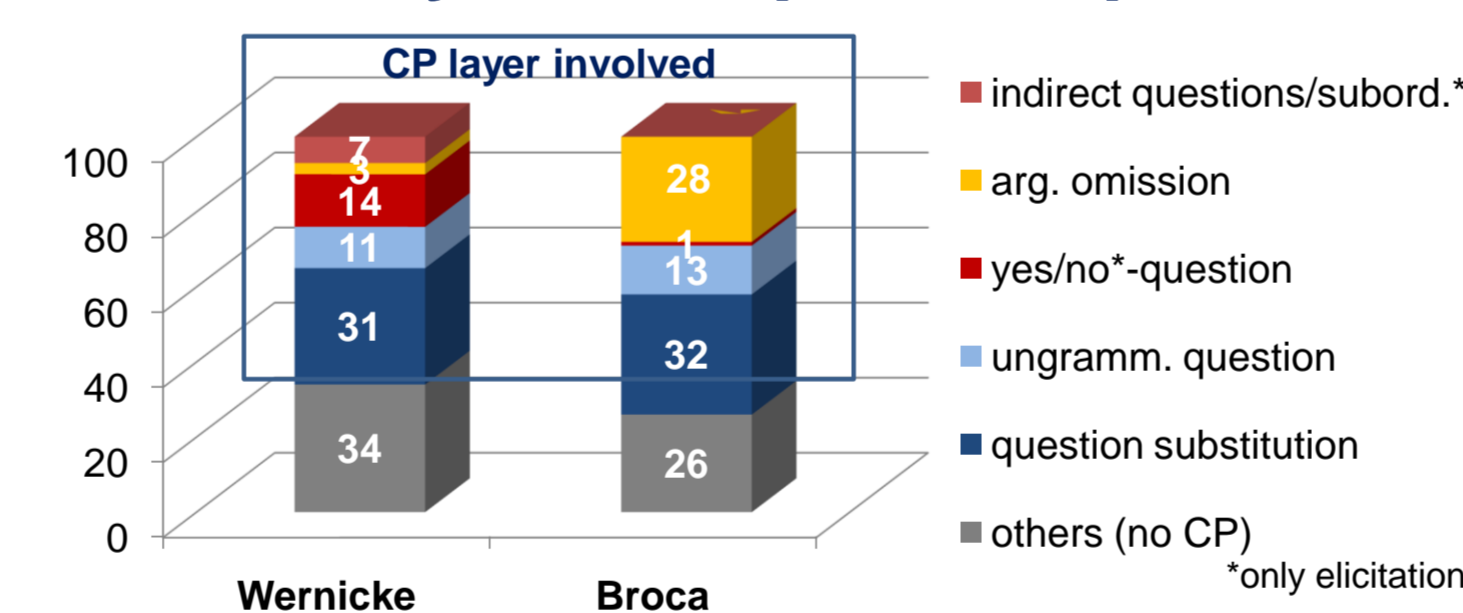
Wernicke: 48, 44, 54
Broca: 83, 60, 57

% correct

❖ Subject-object-asymmetry: *wh*-object questions are more difficult to produce than *wh*-subject questions
  • group effect only for Broca's subjects (Wilc., *p* =.06).
  • significant effects at individual level (*p* < .05): one of 6 Wernicke's (LR) and 3 of 7 Broca's subjects (PB, WR, GB)

Results of *wh*-question repetition

wh-subject question | wh-object question | wh-adjunct question

Wernicke: 81, 39, 57
Broca: 98, 73, 73

% correct
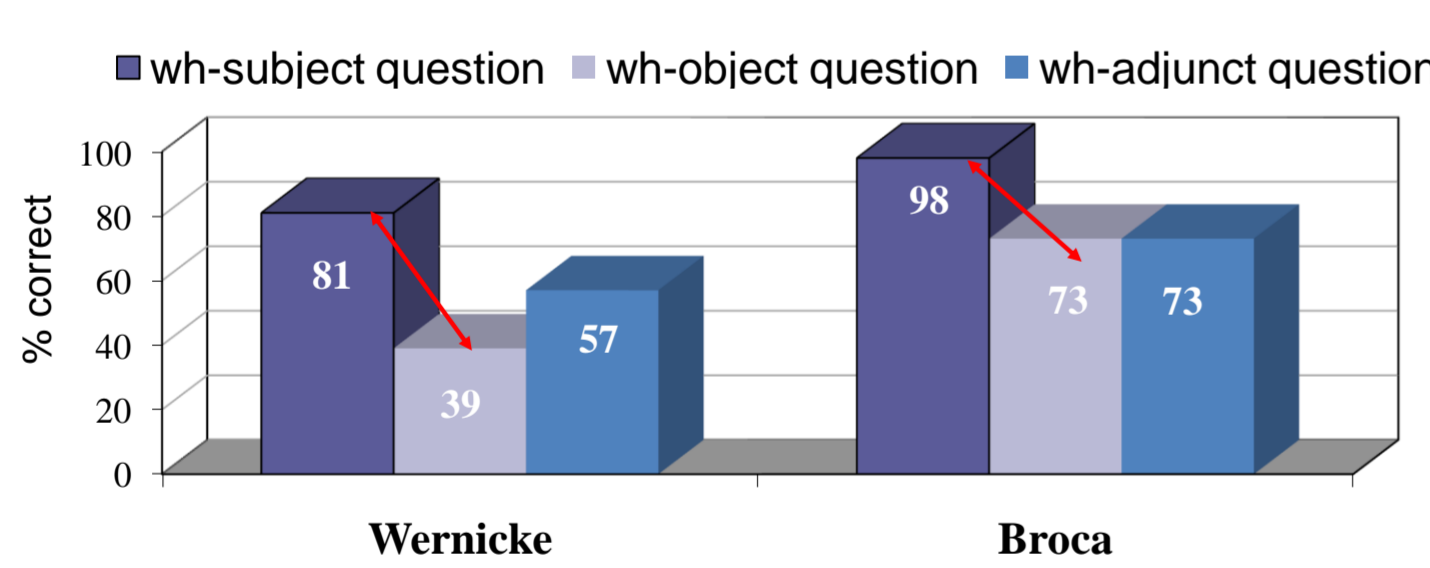
❖ Subject-object-asymmetry: *wh*-object questions are more difficult to repeat than *wh*-subject questions.
  • significant group effect for Broca's subjects and also for Wernicke's subjects (Wilc., each *p* =.03)
  • significant effects at individual level (*p* < .05): 4 of 8 Wernicke's subjects (ER, KW, GK, AS) and 2 of 8 Broca's subjects (PB, WW)

Error analysis *wh*-question production

CP layer involved

indirect questions/subord.* | arg. omission | yes/no*-question | ungramm. question | question substitution | others (no CP)

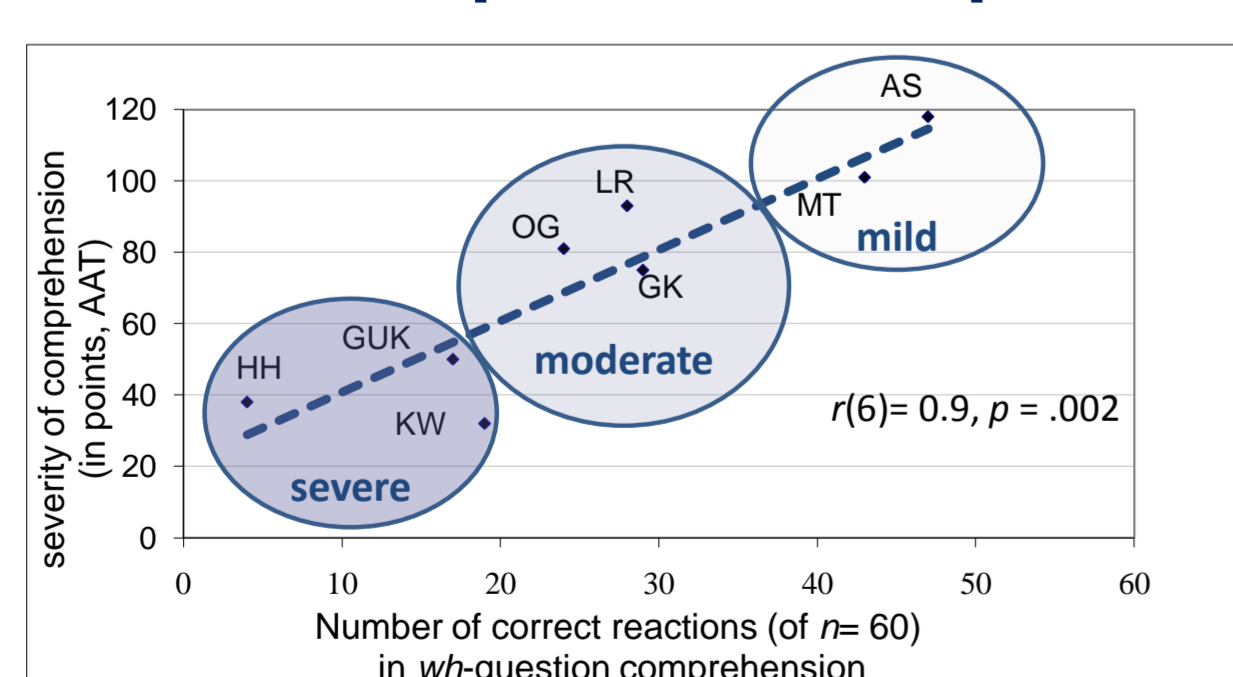Wernicke: 7, 14, 11, 31, 34
Broca: 28, 13, 32, 26

*only elicitation

❖ Most errors: complete CP-structures with *wh*-word, finite verb and subject and/or object (Wernicke: 66%, Broca: 74%)
❖ similarities: ⅓ of errors: correct questions with incorrect *wh*-word, mostly substitutions by *wh*-subject questions
❖ differences: Wernicke: more *yes/no* questions, Broca: more questions with argument omissions

Results of *wh*-question comprehension

wh-subject question | wh-object question

Wernicke: 47, 41
Broca: 64, 44

correct in %
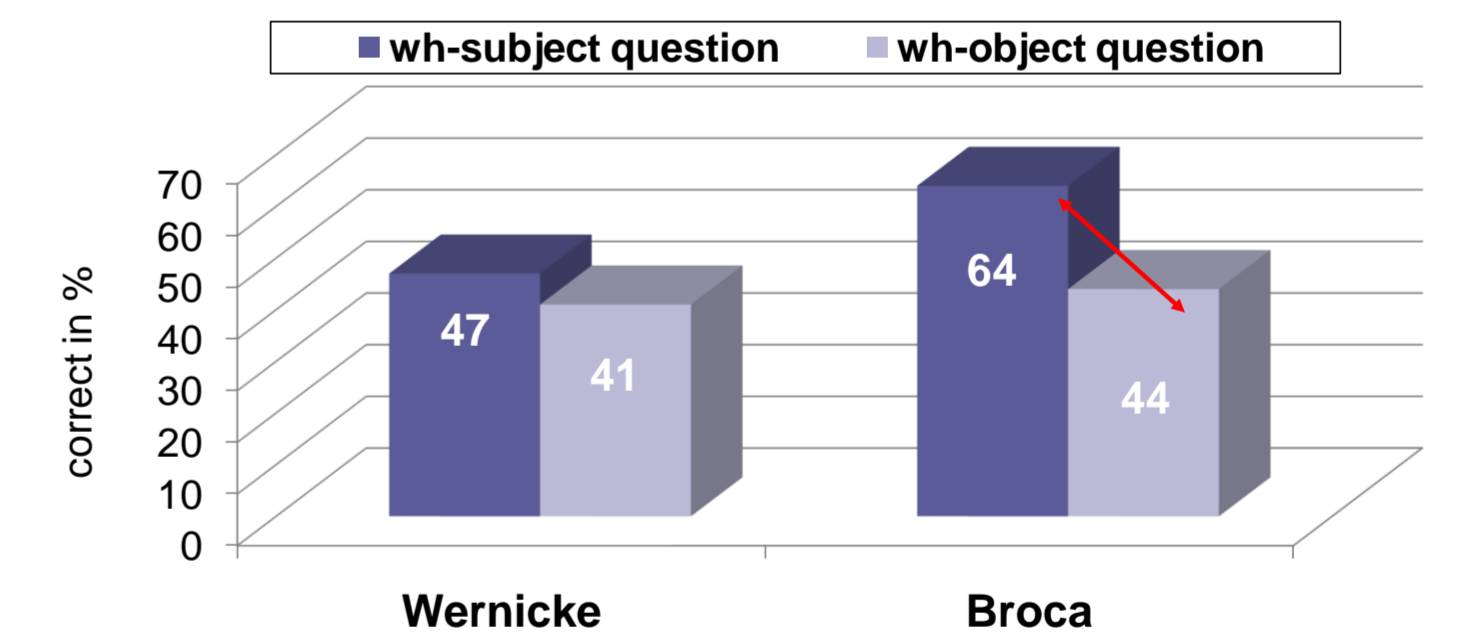
❖ Subject-object-asymmetry as in production:
  • significant group effect for Broca's subjects (Wilc., *p* =.04)
  • significant effects at individual level (*p* < .05): 2 of 9 Wernicke's subjects (GK, AS) and 2 of 8 Broca's subjects (ES, IK)

Results of *wh*-question comprehension

severity of comprehension (in points, AAT)
Number of correct reactions (of n= 60) in wh-question comprehension

AS, MT, LR, OG, GK (mild)
GUK, HH (moderate)
KW (severe)

r(6)= 0.9, *p* = .002

❖ Significant correlation between test results and severity of comprehension deficits (AAT)

Summary

➤ Both Broca's and Wernicke's aphasics have difficulties in producing and understanding *wh*-questions correctly.
➤ No significant group differences in overall results between Broca's and Wernicke's aphasics
➤ Similar reaction patterns between the 2 aphasic groups
  • qualitatively similar error types in *wh*-question production
  • canonicity effects in both subject groups
    ✓ the production and/or comprehension of non-canonical *wh*-object questions results in more errors than canonical *wh*-subject questions; missing group effects in Wernicke's aphasics are due to floor effects
    ✓ canonical *wh*-subject questions replace other question types

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Conclusion

➤ There is evidence for a syntactic deficit in Wernicke's aphasia
➤ This deficit is related to argument movement: complex structures involving object fronting are more vulnerable.

Nature of the deficit: Competence or processing deficit?
➤ results indicate a **processing deficit**
  aphasic performance is dependent on various factors:
  • task demands (e.g. elicitation worse than repetition)
  • severity of disorder (correlation between severity of aphasic disorder and test results)
  • structural complexity (more costly syntactic operations are more vulnerable)
  • individual factors (e.g. attention span, situational factors, lexical deficits...)

The processing deficit in Wernicke's aphasia

structural complexity
e.g. syntactic movement, trace-antecedent distance, position of landing site in syntactic tee...

lexical access

processing costs

situational factors

task, modality

linguistic processing capacity

integration of syntactic deficit theories

performance

impairment

production   comprehension

Broca's aphasia — **Wernicke's aphasia**

(Ullman et al. 2005)

syntax impaired ⟷ syntax spared
lexicon spared ⟷ **lexicon impaired**

The assumed dissociation is not valid!