

The influence of phonetic features on aphasic speech perception

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October 1st, 2009

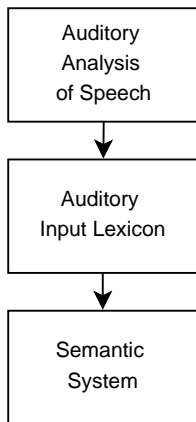
Background I

Speech perception is a multimodal process:

- using auditory **and** visual input (Rosenblum, 2008)
- in which seeing the speaker facilitates comprehension
 - in a noisy environment (Sumbly & Pollack, 1954)
 - with demanding contents (Reisberg et al., 1987)
 - in aphasia (Shindo et al., 1991)

Background II

Auditory perception in neuropsychological models:



Background III

The phonetic features

- place of articulation (/t/ vs. /p/)
- manner of articulation (/t/ vs. /s/)
- voicing (/t/ vs. /d/)

influence the perception of speech:

- smaller differences (1 feature) more difficult to detect than bigger ones for English aphasic listeners (Blumstein et al., 1977)

Background IV

Features seem differently affected in Dutch aphasia (Klitsch, 2008)

- place of articulation seemed most affected
- but: material used (PALPA, Dutch Version) not designed to investigate that difference:
 - voicing contrasts occurred initially
 - other contrasts finally or in metathesis
- Csépe et al. (2001) found for Hungarian that *voicing* was most affected

Aims

The current study investigates:

- whether Dutch aphasic subjects can also detect wider distinctions more easily than narrow ones
- which phonetic features are most vulnerable (if manipulated in the same position)
- the influence of lip-reading on (aphasic) perception of speech

Methods I: Procedure

Nonword discrimination task:

- videos of speaker articulating 2 syllables
- decision whether both were same or different
- button press to answer

3 conditions of presentation:

- auditory only (AO)
- visual only (VO)
- audiovisual (AV)

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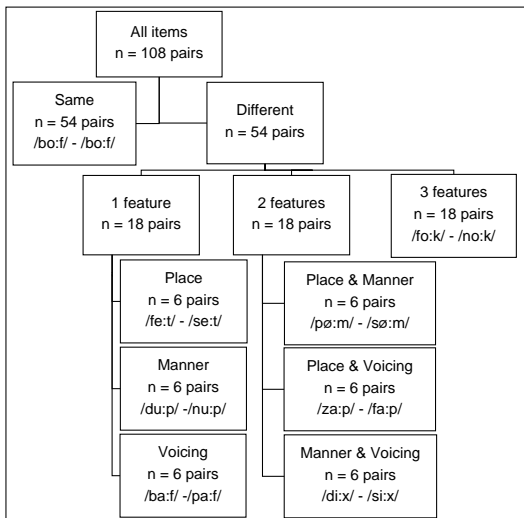
- auditory only (AO)
- visual only (VO)
- audiovisual (AV)

Methods II: Material

phonologically possible but non-existing CVC-syllables

- fixed place of difference (initial)
- amount and type of features differing within a pair controlled

Methods II: Material



Methods III: Participants

All participants:

- Dutch, right-handed, with normal hearing and (corrected to) normal vision

⇒ 14 non-brain-damaged controls

⇒ 6 aphasic subjects

Methods III: Participants

Initials	Age	Gender	Type of Aphasia	Months post onset	PALPA Nonword Discrimination
WB	57	male	Wernicke	148	56/72
BB	64	male	Global	5	53/72
EK	48	male	Amnesic	16	58/72
TB	47	female	Global	8	68/72
JH	51	female	Mixed	44	66/72
MB	47	female	Global	4	64/72

Results

Control Subjects:

- scored at ceiling in AO and AV conditions
- VO worse than AO or AV (Wilcoxon: $p < 0.01$)
 - concerning mainly *voicing* and *manner*

Aphasic Subjects:

- worse than controls in all 3 conditions (Mann-Whitney-U: $p < .001$)
- performance differed between the 3 conditions (Friedman: $p < .01$):
 - AV better than AO and VO (Wilcoxon: $p < .05$)
 - AO better than VO (Wilcoxon: $p < .05$)

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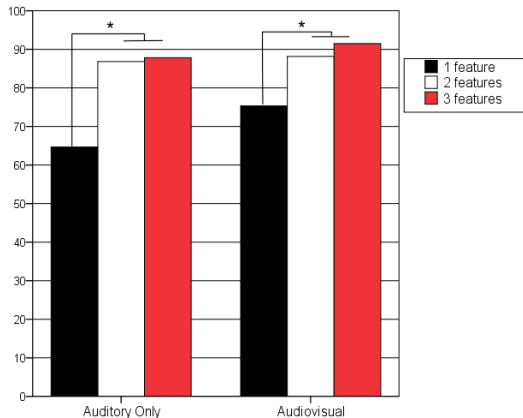
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 - AO better than VO (Wilcoxon: $p < .05$)

Results

Condition	Controls (avg. correct)	Aphasic subj. (avg. correct)	Z-Score	p-value
Auditory only condition	99%	87%	-3.521	p < .001
Audiovisual condition	99%	90%	-3.545	p < .001
Visual only condition	83%	63%	-3.387	p < .001

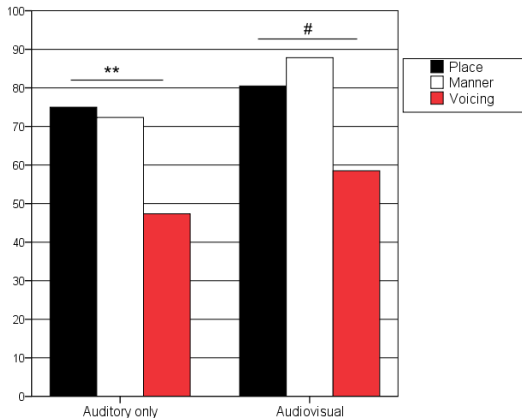
Results



- in both, AO and AV condition:
 - number of features matters
 - least correct responses for 1 feature

Statistic analyses with Wilcoxon, 2-tailed: *: $p < .05$

Results



- type of feature analysis (*place vs. manner vs. voicing*):
 - significant influence for the AO condition
 - a trend for the AV condition
- ⇒ contrasts in *voicing* were most difficult

Statistic analyses with Friedman Anova: **:p<.01; #:p=.094

Discussion

- additional lip-reading improves performance
 - replicating results of e.g. Shindo et al. (1991)
- most difficulties occur with small differences
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- contrary to Klitsch (2008) → but: difference in materials
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Differences between *place of articulation* and *voicing*:

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Questions & Comments

Thank you for your attention!

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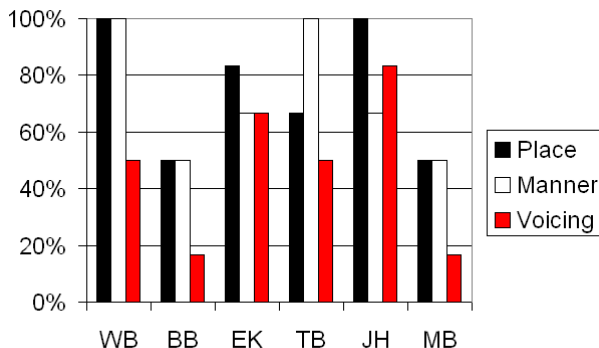
Appendix Ia

Individual Results:

Initials	Auditory only			Audiovisual		
	Place	Manner	Voicing	Place	Manner	Voicing
WB (Wernicke)	100%	100%	50%	83%	100%	67%
BB (Global)	50%	50%	17%	67%	60%	17%
EK (Amnesic)	83%	67%	67%	83%	100%	17%
TB (Global)	67%	100%	50%	100%	100%	83%
JH (Mixed)	100%	67%	83%	100%	100%	67%
MB (Global)	50%	50%	17%	50%	67%	100%

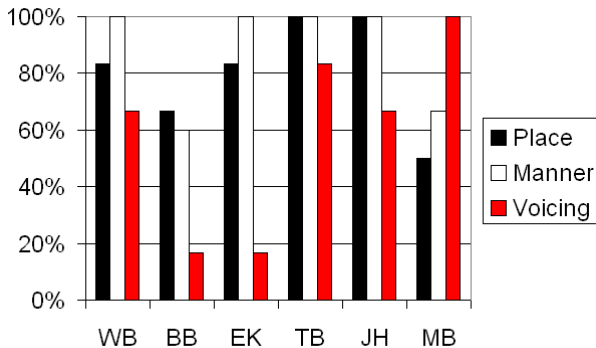
Appendix Ib

Individual Results (Auditory only condition):



Appendix Ic

Individual Results (Audiovisual condition):



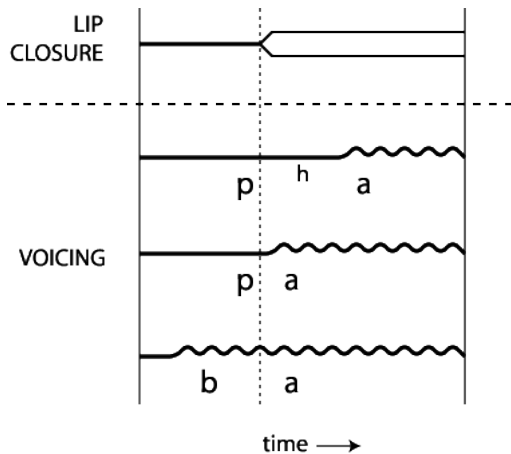
Appendix II

Performance of aphasic listeners in 'different' condition:

Condition	Same (avg. correct)	Different (avg. correct)
Auditory only condition	94%	80%
Audiovisual condition	94%	85%
Visual only condition	78%	48%

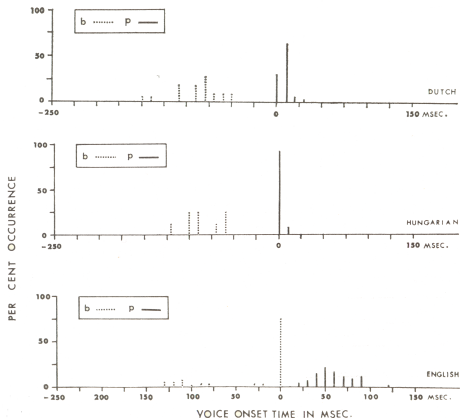
Appendix IIIa

Distinctions in Voicing:



Appendix IIIb

Voicing Distinctions in Dutch, Hungarian and English¹:



¹taken from Lisker & Abramson (1964)