Deviant processing of audiovisual stimuli in aphasia

Dörte Hessler, Roel Jonkers and Roelien Bastiaanse

Center for Language and Cognition, University of Groningen

Science of Aphasia, August 28th 2010

Introduction I

Speech perception is a multimodal process:

- using auditory and visual input (Rosenblum, 2008)
- in which seeing the speaker influences comprehension:
  - in noisy environments (Sumby & Pollack, 1954)
  - in cognitively demanding contexts (Reisberg et al., 1987)
  - in aphasia (e.g. Shindo et al., 1991)

Introduction II

Another proof for multimodality:

The McGurk effect

- discovered by McGurk & MacDonald (1976)
- dubbing of non-matching auditory and visual information
- auditory /ba/ and visual /ga/
- perception: fusion of both (/da/)

Introduction III

The McGurk effect in aphasia

- Campbell et al. (1990)
  - first note on the McGurk effect in aphasia
  - investigated 1 aphasic subject
  - this subjects shows normal McGurk effect for words and consonants
- Klitsch (2008)
  - compared aphasic listeners with age-matched non-brain-damaged subjects
  - offline task: choice between 3 possibilities
  - answer patterns did not differ between groups

Introduction IV

The aims of the current study are

- to gain more information on the processing
- therefore combining offline scores with online reactiontimes
- to find out whether there really is no difference between aphasic and healthy processing

Participants

3 aphasic subjects

	Gender	Age	Type of aphasia	months post onset
WB	male	57 years	Wernicke	148
EK	male	48 years	Anomic	16
JH	female	51 years	Mixed	44

All suffered from deficit in the auditory analysis of speech!

14 non-brain-damaged control subjects

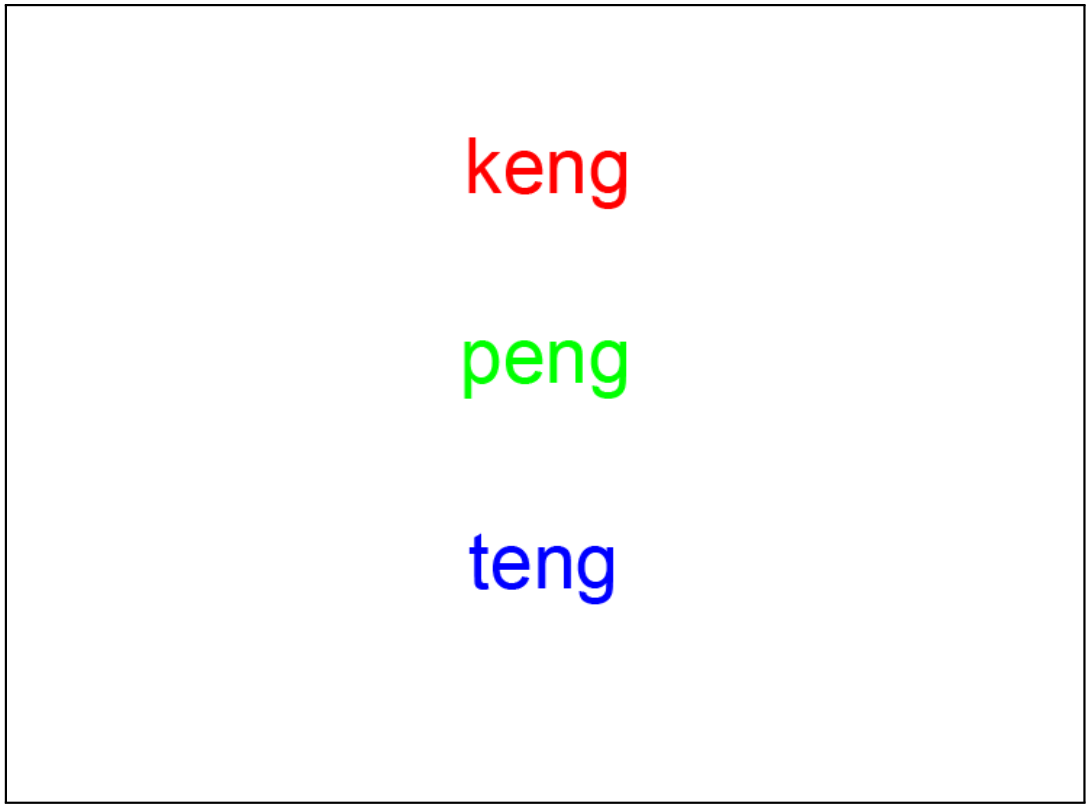
- same age range
- 7 male & 7 female

Task

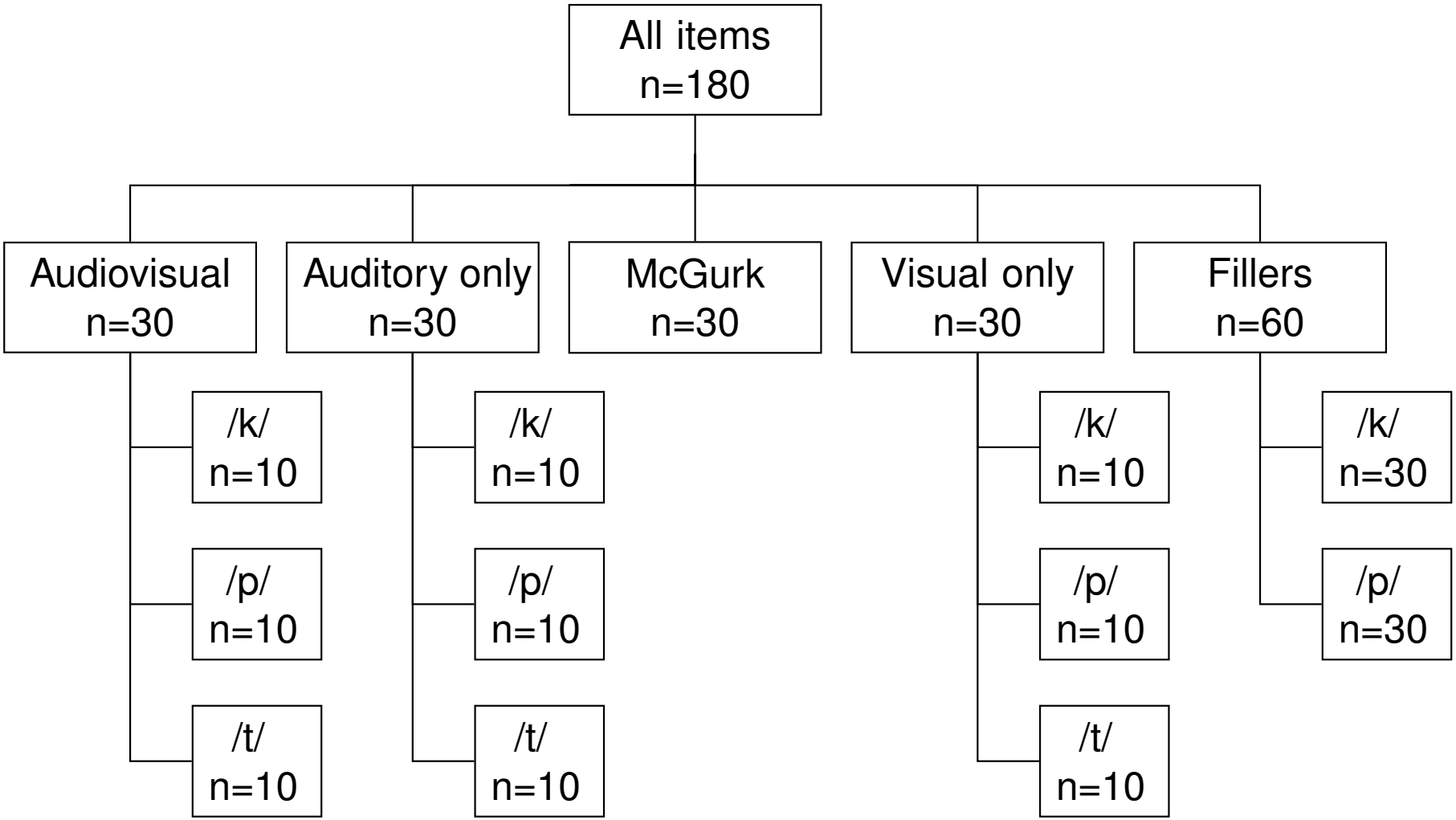
- presentation of video

Task

- presentation of video
- 3 answer choices
- starting with
  - /k/ (red, on top)
  - /p/ (green, in the middle)
  - /t/ (blue, on the bottom)



Material


All items
n=180
Audiovisual
n=30
Auditory only
n=30
McGurk
n=30
Visual only
n=30
Fillers
n=60
/k/
n=10
/p/
n=10
/t/
n=10
/k/
n=10
/p/
n=10
/t/
n=10
/k/
n=10
/p/
n=10
/t/
n=10
/k/
n=30
/p/
n=30

Procedure

- Identification Task:
  - video of speaker pronouncing syllable
  - pick one out of three written choices
- Presented in three conditions:
  - auditory only
  - audiovisual
  - McGurk (see example of procedure)
- Recording of answer pattern and reactiontime

Procedure - Example

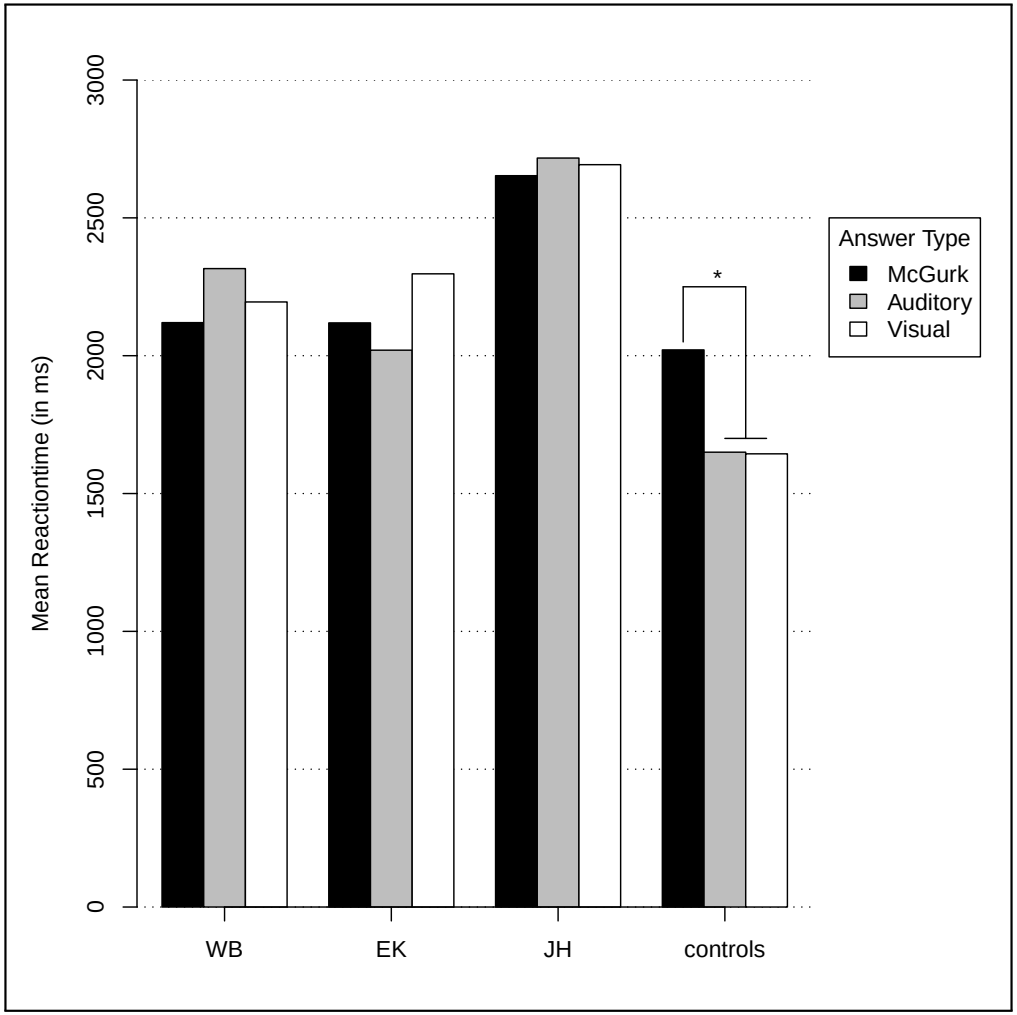
Results I

Initials	Auditory Only		Audiovisual		McGurk (per answer type)					
					McGurk (/t/)		Auditory (/p/)		Visual (/k/)	
	correct	RT	correct	RT	Amount	RT	Amount	RT	Amount	RT
WB	53%	2176ms	73%	1674ms	50%	1989ms	23%	2316ms	27%	2195ms
EK	59%	2718ms	76%	2516ms	18%	1912ms	46%	2061ms	36%	2297ms
JH	55%	2755ms	89%	2353ms	39%	2565ms	39%	2718ms	22%	2693ms
Controls (mean)	99%	1462ms	100%	1422ms	22%	2021ms	33%	1650ms	45%	1644ms

Results and reactiontimes for the three conditions

- Visual only condition: worse than AO for each participant

Results II



Reactiontime per answertype
$*$: Mann-Whitney-U Test, p<.05

Results - Summary I

- Aphasic subjects perform worse in AO and AV condition than nbd-controls
- Aphasic subjects answer slower in all three conditions
- Aphasic subjects show improved performance in AV condition compared with AO condition
- Faster reactiontimes on AV than AO for aphasic subjects

Results - Summary II

Analyses within McGurk condition:

- Occurence of answertype:
  - non-brain-damaged controls: visual > auditory > fusion
  - aphasic subjects: no significant difference for either subject
- Reactiontimes in respect to answertype:
  - non-brain-damaged controls: sign. increase when fusion-response
  - aphasic subjects: no influence of answertype

Discussion I

In this study we therefore find

- qualitative differences in AV-processing
- in form of slowed down reactiontimes on fusion responses for ndb-controls but not aphasic subjects

Why is there a slowdown for healthy but not for aphasic listeners?

Discussion - Proposal

Reactiontimes on fusion percepts

- Nbd-controls slower on fusion than other responses...
  - ... because of additional resources needed!
  - Despite fusion they access unimodal information (Soto-Faraco & Alsius, 2007, 2009)
  - Accessing unimodal information prior to fusion could be the factor that slows down!
- Aphasic subjects might rely solely on automatic multimodal processing without access to unimodal information!
- Therefore no slowdown would occur!

Discussion - Outlook

Future work

This study: not recorded whether there was access to unimodal information!

Therefore hypothesis needs to be tested in future research!

Questions & Comments

Thank you for your attention!

d.a.hessler@rug.nl
http://doerte.eu/

Error analysis: WB

AO

	target		
answer	/k/	/p/	/t/
/k/	3	0	1
/p/	3	4	0
/t/	4	6	9

AV

	target		
answer	/k/	/p/	/t/
/k/	5	1	0
/p/	0	7	0
/t/	5	2	10

Error analysis: EK

AO

	target		
answer	/k/	/p/	/t/
/k/	6	3	2
/p/	3	6	3
/t/	1	0	5

AV

	target		
answer	/k/	/p/	/t/
/k/	8	0	4
/p/	0	9	1
/t/	1	1	5

Error analysis: JH

AO

	target		
answer	/k/	/p/	/t/
/k/	6	2	2
/p/	2	6	4
/t/	1	2	4

AV

	target		
answer	/k/	/p/	/t/
/k/	7	0	0
/p/	1	10	1
/t/	1	0	8

Error analysis

	AO			AV		
	WB	EK	JH	WB	EK	JH
total	14	12	13	8	7	3
/k/	7	4	3	5	1	2
/p/	6	3	4	3	1	0
/t/	1	5	6	0	5	1

Amount of errors

Error analysis II

	AO			AV		
	WB	EK	JH	WB	EK	JH
total	14	12	13	8	7	3
/k/	1	5	4	1	4	0
/p/	3	6	6	0	1	2
/t/	10	1	3	7	2	1

Phoneme chosen when incorrect