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MOTIVATION

- Acoustic cues used for **prosodic phrasing** (as realized by amplitude modulation, pitch contour, rhythmic information) can **determine** the syntactic structure and hence sentence interpretation. **Proper interpretation** of prosodic cues is thus important for communication.
- A noise masker with an **amplitude modulated envelope** is **beneficial** for speech recognition due to 'glimpsing' (e.g., Cooke 2006; Wagener et al., 2006). However, fluctuating (compared to stationary) noise can be more **detrimental** on a cognitive level because it is more difficult to "tune out" or segregate (e.g., Francart et al., 2011).
- It is unclear whether the "prosodic benefit" of speech perception observed in stationary noise (e.g., Carroll, 2013) will also hold for a **fluctuating noise masker**: A **rhythmic disruption** may affect general speech perception in relatively "natural" listening conditions where the masker is not stationary (e.g., entrainment, stream segregation mechanisms).

PREVIOUS FINDINGS

The prosodic benefit in stationary noise

Carroll, 2013

- (To what degree) Does stationary noise affect supra-segmental information as opposed to segmental information in sentence processing?

Material

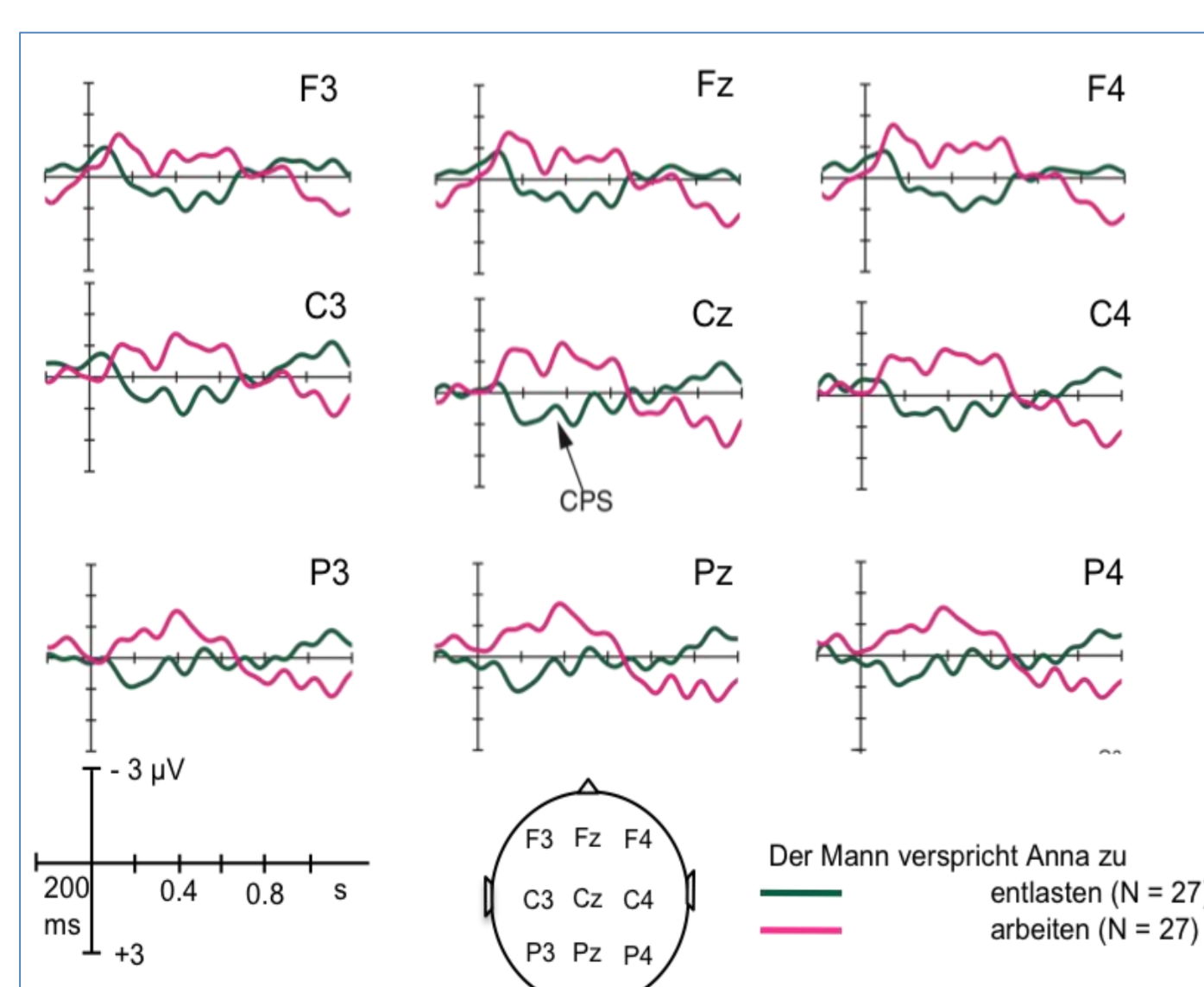
A	[Der Mann verspricht] _{IPB1} [Anna zu entlasten] _{IPB2} ... The man promises to call Anna ...
B	[Der Mann verspricht Anna] _{IPB1} [zu arbeiten] _{IPB2} ... The man promises Anna to work...
Continuation	... und das Büro zu putzen. ... and to clean the office.

Method: Event-Related Potentials

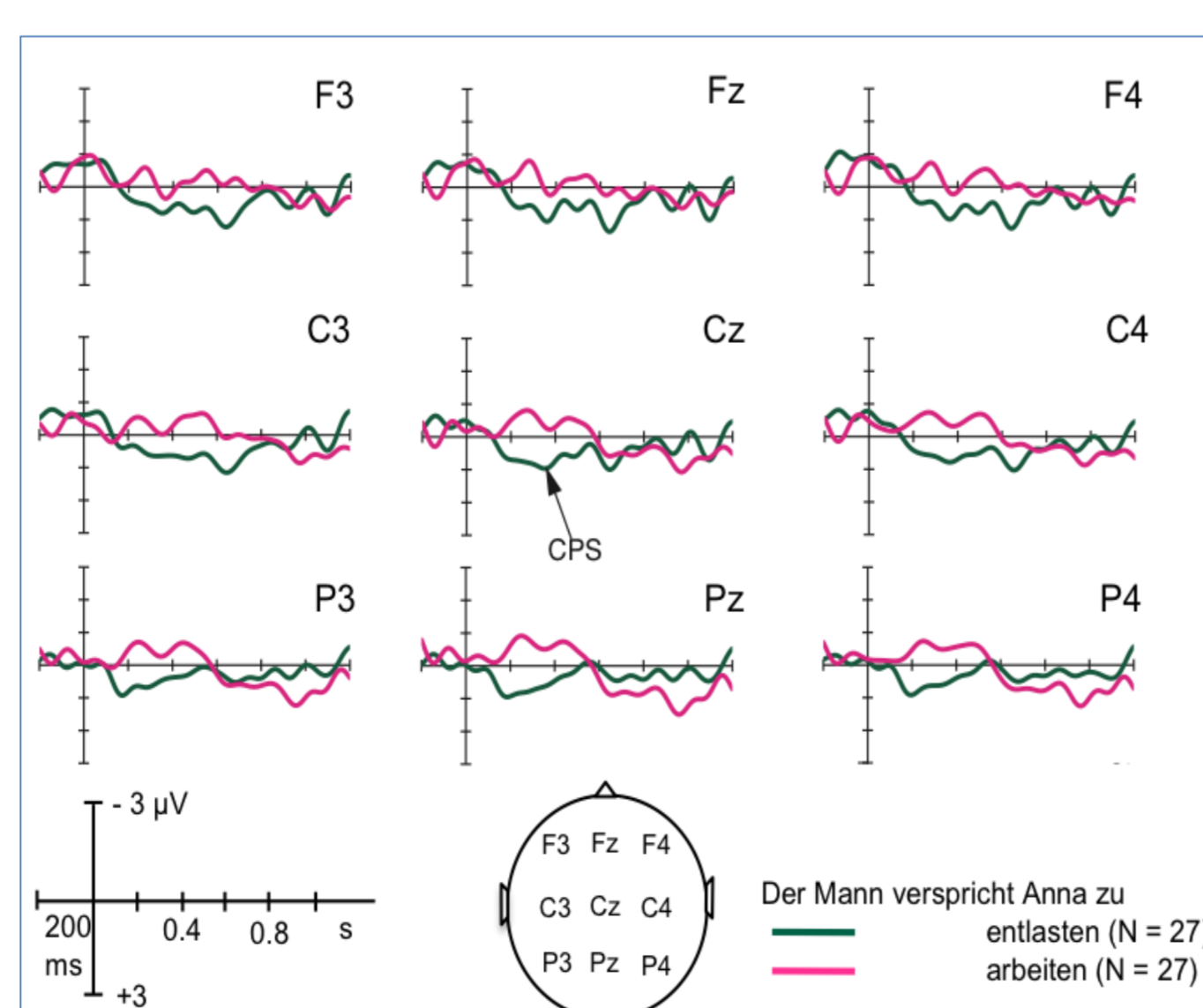
- Closure Positive Shift (Steinhauer et al., 1999) as prosodic ERP component
- 27 Ag/AgCl electrodes (10/20 system)
- Off-line word recall task
- Participants:** 27 young right-handed listeners (ø 23.1 yrs, 15♀ 14♂), normal hearing
- Manipulation:**
 - Clear speech, 70 dB SPL
 - Speech in stationary speech shaped noise, -3 dB SNR

Results

IPB1 in clear speech



IPB1 in stationary speech shaped noise



- Prosodic (supra-segmental) information still usable in stationary noise
- Reduced effect size, possibly due to larger individual differences (listening effort?)
- NO distinction between rhythmic and pitch-related influences

CURRENT STUDY

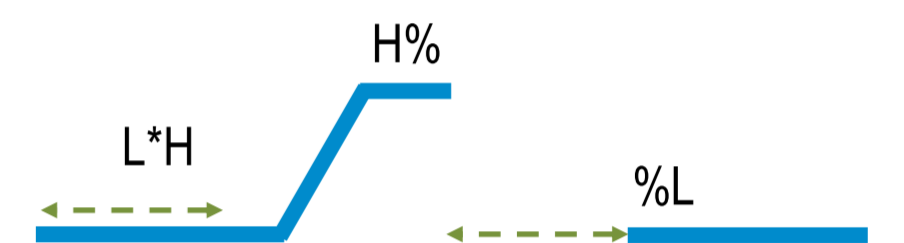
Reliability of prosodic information against rhythmic disturbance

- Is prosodic information robust against different types of noise maskers? Or
- Does a fluctuating noise masker disrupt the rhythmic structure of the speech signal?

Material

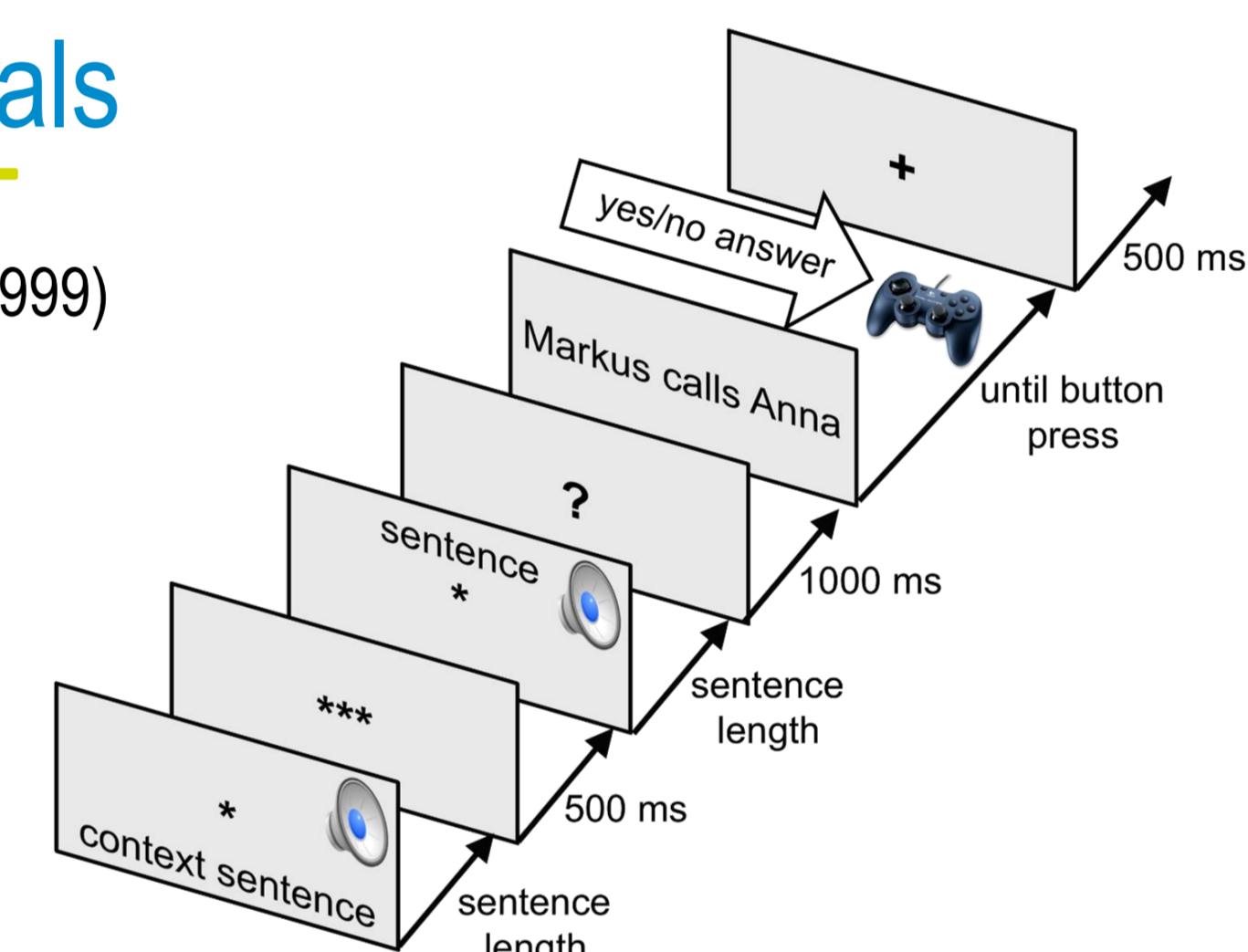
Introduction	Die Schüler sollen eine Brieffreundschaft anfangen. The students are to start a penpalship.
IPB 2	[Ingo schreibt] _{IPB1} [Judith nicht] _{IPB2} ... Ingo writes Judith (does) not
IPB 1	[Ingo schreibt Judith nicht] _{IPB} ... Ingo writes Judith not/ does not write Judith
Continuation	... aber beide bekommen einen Brief. ... but both receive a letter.

- Female speaker recorded in sound attenuated booth
- Consistent realization of IPBs:



Method: Event-Related Potentials

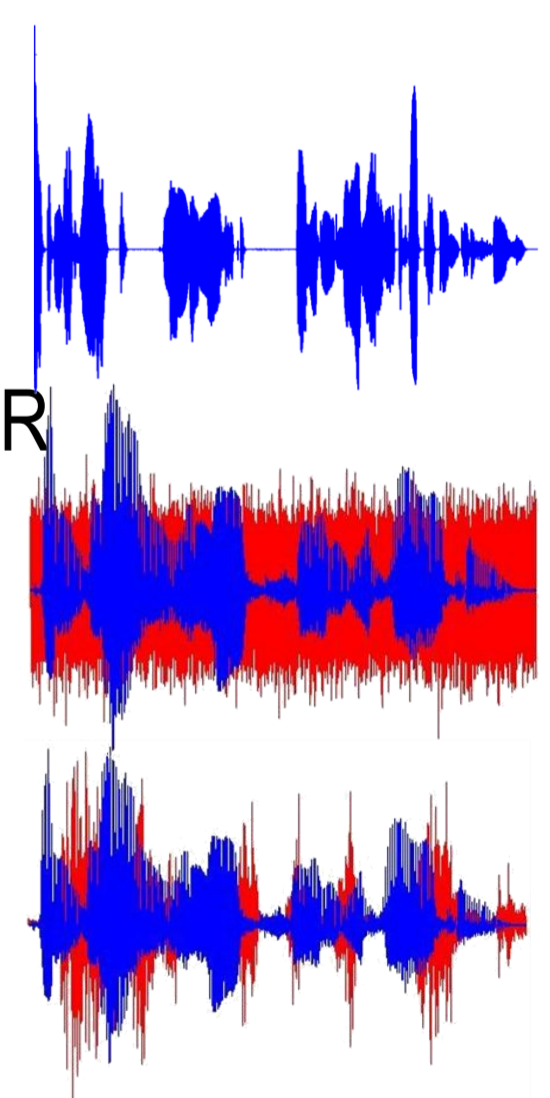
- Closure Positive Shift (CPS, Steinhauer et al., 1999) as prosodic ERP component
- 64 channel Ag/AgCl electrodes (10/20 system)
- Context sentence
- Offline comprehension task: interpretation



- Participants:**
 - 25 young listeners with normal hearing
 - Native speakers of German (bilinguals excluded)
 - Right-handed (adapted Edinburgh handedness inventory, Oldfield 1971)

- Manipulation:**
 - Clear speech (no noise) at normal speech rate
 - Speech in **stationary** speech-shaped noise and supra-threshold SNR **0 dB SNR** (approx. 90% intelligibility)
 - Speech in **fluctuating** (amplitude modulated) speech shaped noise, **-4 dB SNR** (approx. 90% intelligibility)

- Presentation:**
 - Speech in silence at 65 dB SPL (RMS)
 - Speech in noise: speech level kept constant at 65 dB, noise added
 - GENELEC 8020 loudspeakers, ECHO Gina audio interface
 - Sound attenuated & electrically shielded booth



Expected Results

- Speech in silence:** Closure Positive Shift (CPS) clearly observable at IPBs between 150 and 500 ms post prefinal syllable onset
- Speech in stationary noise:** CPS slightly delayed, reduced amplitude
- Speech in fluctuating noise:** CPS not measurable, reduced amplitude
- Higher error rates** on offline comprehension task in fluctuating noise
- Delayed effect = "listening effort"?
- Reduced amplitude = individual differences / lower reliability, usability of prosodic cues

REFERENCES

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