Prosody can provide subtle disambiguating cues for local ambiguity resolution

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BACKGROUND

- sentence comprehension: rapid integration of morpho-syntactic, lexical, semantic or prosodic cues for structural prediction about upcoming input[3]
- thematic role assignment: positional order information and morpho-syntactic cues to map syntactic functions (subject/object) onto thematic roles (agent/patient)
- German: subject-first bias[5], case syncretism and flexible word order (SVO/OVS): locally ambiguous sentences
- re-analysis required in OVS leads to higher processing demands[1]
- rapid integration of prosodic cues, i.e. fundamental frequency (f0) to facilitate structural disambiguation and thematic role assignment, but mixed results on influence of prosodic cues on local ambiguity resolution[7,9]
- variability: variations in decoding prosodic contrasts among listeners, variations in the use and strength of prosodic cues among speakers[2]
- production study: between-speaker variability in f0 cues to syntactically mark and distinguish SVO and OVS in German[6]

AIM OF THE STUDY

- level of sensitivity to speaker-specific prosodic contrasts[6]
- reliability of decoding prosodic cues for local ambiguity resolution
- syntactically marked and enhanced (i.e., increased f0 maximum) prosody

METHODS AND MATERIALS

- participants: 32 healthy native German individuals (*M* = 21.9 y, *SD* = 3.1)
- platform: LabVanced (web-based study)[4]
- auditory stimuli: n = 336; 21 verbs * 2 word orders (SVO/OVS) * 2 prosody conditions (marked/enhanced) * 4 tokens of each sentence
- dependent variables: response accuracy, reaction times
- data analysis: signal detection theory[8], (generalised) linear mixed models

(1) **Das Kamel tritt nun** [den Tiger.]
the$_{NOM/ACC\text{-}n.}$ *camel kicks currently the*$_{ACC\text{-}m.}$ *tiger*
"The camel is currently kicking the tiger."

(2) **Das Kamel tritt nun** [der Tiger.]
the$_{ACC/NOM\text{-}n.}$ *camel kicks currently the*$_{NOM\text{-}m.}$ *tiger*
"The camel is currently kicked by the tiger."

PROCEDURE

- task: 2-alternative forced choice, sentence completion

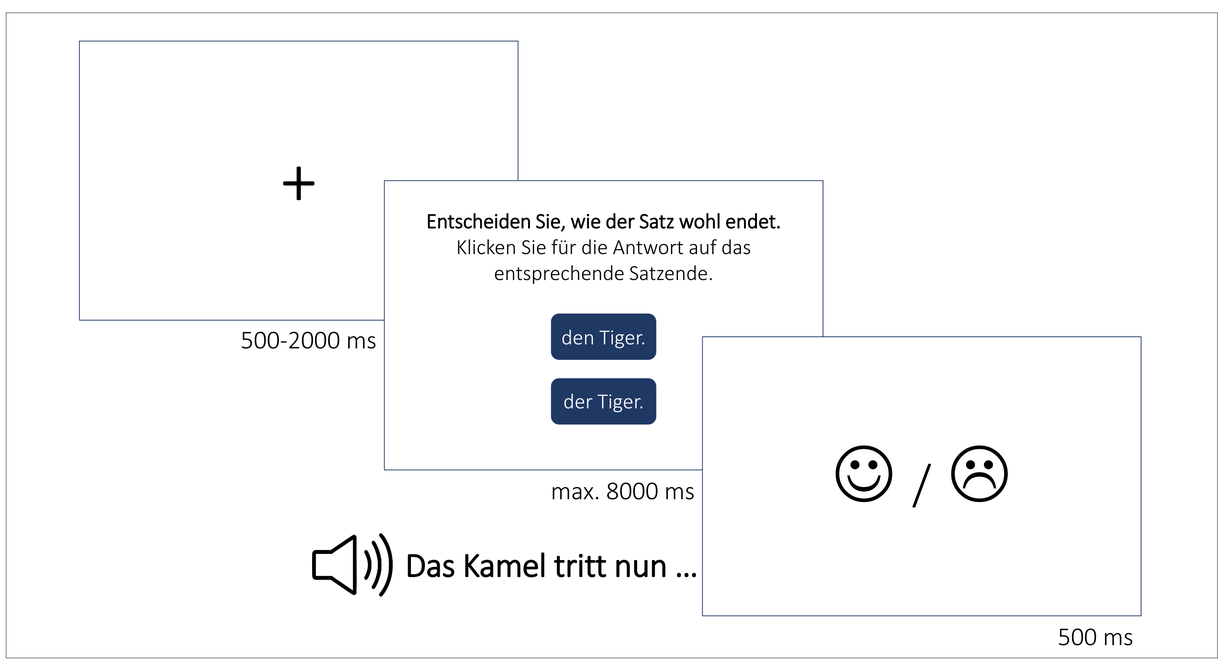

Fig. 1: Experimental procedure.

SUMMARY

Listeners were sensitive to the presented prosodic contrasts only to some extent. The underlying speaker-specific prosodic contrast might not have facilitated discrimination for all listeners. Listeners were more sensitive to discriminate SVO and OVS structures in enhanced compared to marked prosody providing subtle disambiguating cues for local ambiguity resolution.

ACOUSTIC FEATURES OF STIMULI

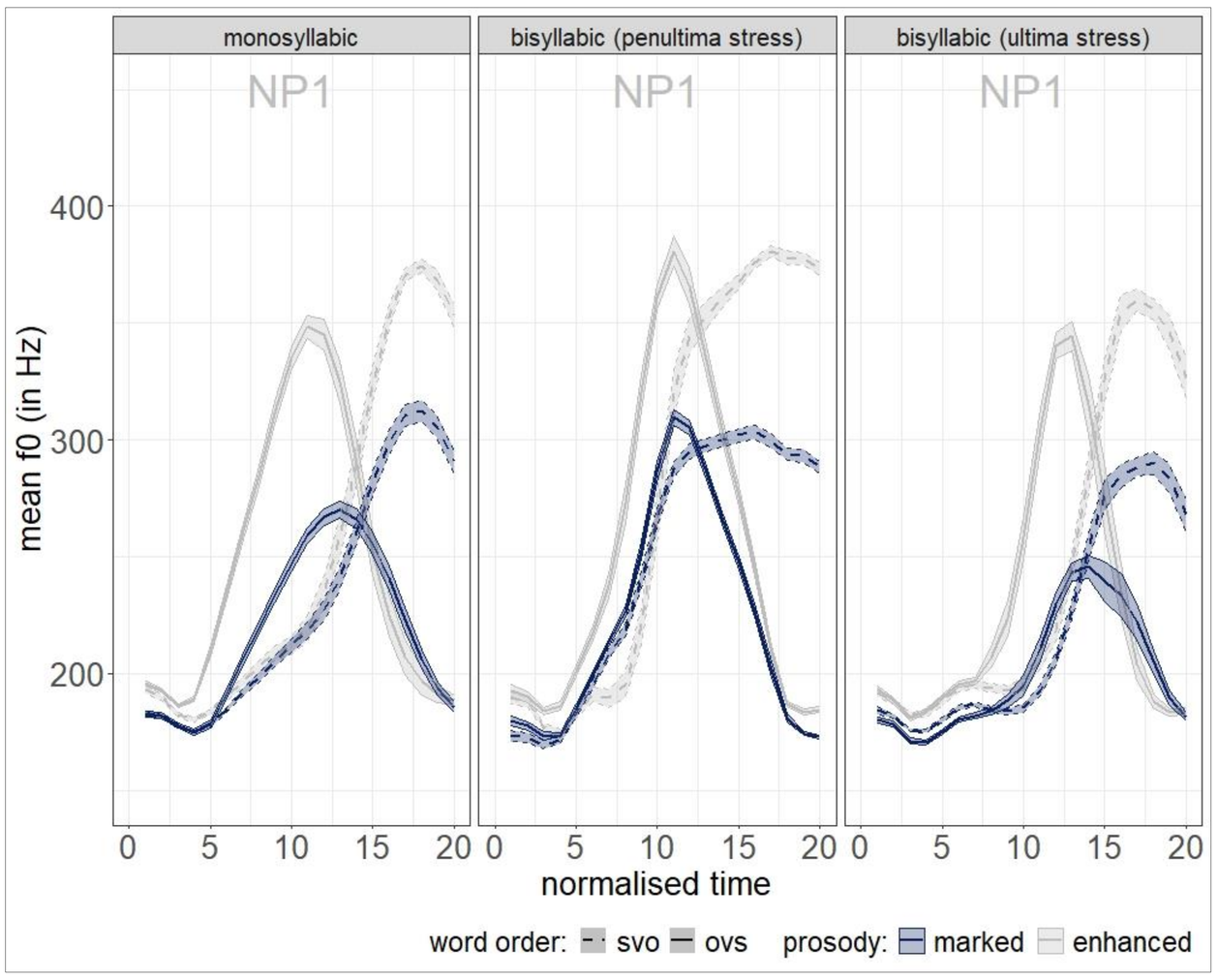

Fig. 2: Time-normalised marked and enhanced f0 contours in Hz for NP1 in SVO and OVS; spoken by a trained speaker.

RESULTS AND DISCUSSION

- moderate sensitivity levels to discriminate SVO and OVS structures (overall: *a'* = 0.69, marked prosody: *a'* = 0.64, enhanced prosody: *a'* = 0.72)
- marked prosody: subject-first bias and supportive role in SVO, chance performance and no beneficial effects for OVS, speed-accuracy trade-off
- enhanced prosody: both SVO and OVS above chance, higher reliability of decoding prosodic contrasts, subtle cues for structural disambiguation

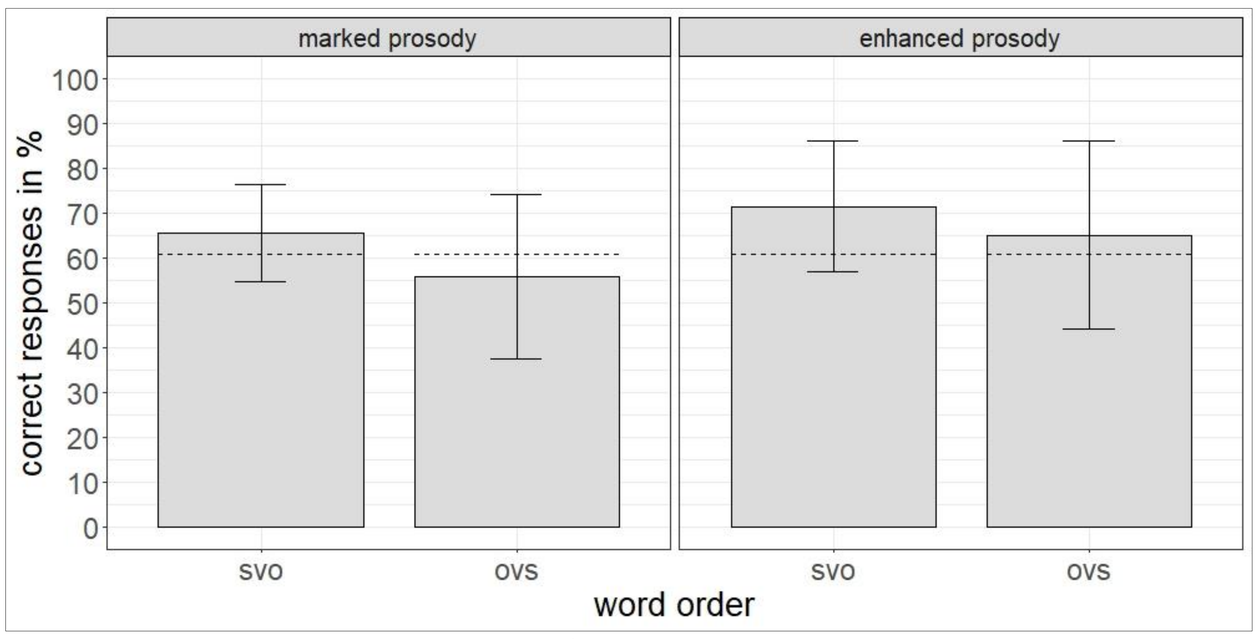

Fig. 3: Mean % of correct responses; whiskers show +/- 1 sd; dashed lines indicate chance level.

		correct condition			
		marked prosody		enhanced prosody	
		SVO	OVS	SVO	OVS
participants' response	SVO	**65.6%** hits	44.1% false alarms	**71.4%** hits	35% false alarms
	OVS	34.4% misses	**55.9%** correct rejections	28.6% misses	**65.0%** correct rejections

Table 1: Mean signal detection theory measures.

predictor	estimate	se	z-value	p-value
intercept	0.74	0.14	5.27	< .001 ***
word order	0.33	0.11	3.04	< .01 **
prosody	-0.47	0.12	-3.93	< .001 ***
block order	0.03	0.18	0.18	0.86
word order*prosody	0.19	0.17	1.13	0.26

Table 2: Fixed effects of the generalised linear mixed model on response accuracy.

predictor	estimate	se	df	t-value	p-value
intercept	2082.41	75.87	29.81	27.45	< .001 ***
word order	30.68	20.92	28.38	1.47	0.15
prosody	106.13	73.57	31.10	1.44	0.16
block order	237.89	141.89	30.11	1.68	0.10
word order*prosody	77.50	27.52	6239.17	2.82	< .01 **

Table 3: Fixed effects of the linear mixed model on reaction times.

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