

Why do we Accent Words?
The Processing of
Focus and Prosodic Structure

Sasha Calhoun
University of Edinburgh

Sasha.Calhoun@ed.ac.uk

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Overview

- Why do we accent words?
 - focus and “informativeness”
 - metrical prosodic structure
- The relationship between prosody and focus
 - probabilistic constraints
- Accent prediction in the Switchboard corpus
- Prosody and processing
 - how, why and when do prosody and information affect language processing?

Focus and ‘Informativeness’

- Accents can mark **focus**
 - introduces a presupposition of a contextually appropriate set of alternatives to that element, to be resolved in the discourse
 - affects the interpretation (especially in terms of truth-conditional implications) of the utterance in relation to the discourse model
- (Rooth, 1992)

A: What would be the first thing you'd cut [in the budget]? Defence?

B: I would cut [the PRISON systems]**F**



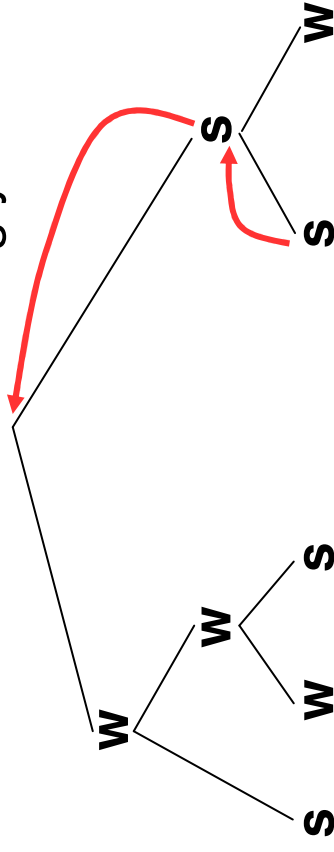
- *And* accents are more likely if word is ‘**informative**’ or ‘newsworthy’
 - Part-of-speech, predictability, “unexpectedness” and lexical ‘**accentability**’ all strong predictors of accent status

(Bolinger 1972, Pan et al. 2002, Nenkova et al. 2007)

Relationship to Metrical Prosodic Structure

- Accents are also manifestations of metrical prominence structure

A: What would be the first thing you'd cut [in the budget]? Defence?



B: / would CUT [the PRISON SYSTEMS]**F**



- Words map onto a rhythmical, right-branching metrical structure
- Foci align with *nuclear* accents
 - addresses problem of ‘non-focal’ accents

(Lieberman 1975)

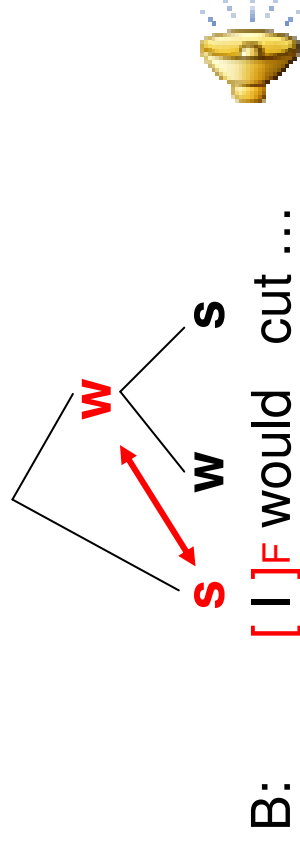
(Ladd 1996, Truckenbrodt 1995, Büring 2006)

My Model

- Mapping of words onto metrical prosodic structure is **probabilistic**
 - focus is a strong constraint on this mapping
- The formation of metrical structure and the alignment with words is also governed by other constraints, e.g.
 - maintenance of rhythmic alternation
 - physiological pressure on phrase length
 - right-branching bias in metrical structure
 - overall emphasis
 - ‘accentability’ of word given part-of-speech, argument status (subject versus object), predictability
 - alignment of syntactic and prosodic phrases

Probability-based Expectation

- The likelihood of any word being accented (or nuclear accented) depends on (at least) its place in prosodic structure, its syntactic properties and its focal status
- Where the prosodic structure associated with a word sequence is not expected, we get a marked reading

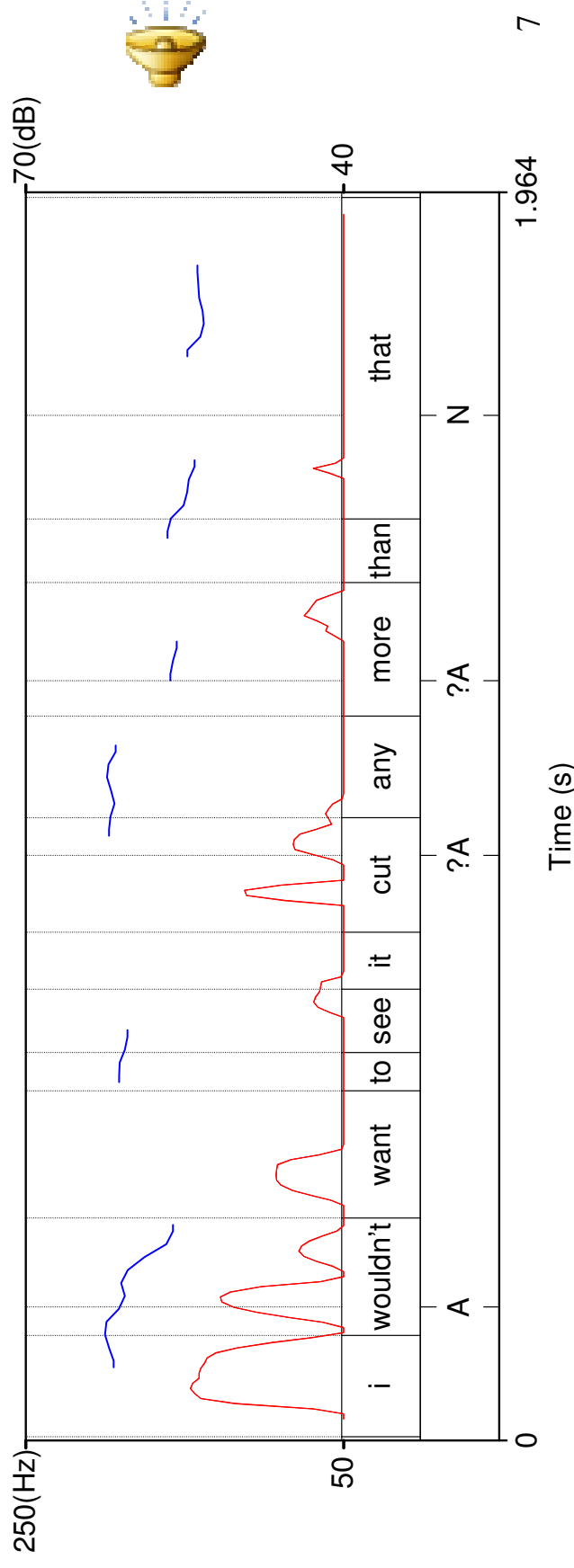


- Foci can be marked by non-nuclear accents when the accented word is more prominent than expected

- Where the nuclear accent falls where expected, we do not need as much phonetic prominence to mark focus
 - this explains why focal accents early in a phrase are generally much higher than focal accents late in a phrase
- The phonetic prominence and tonal shape of a ‘default’ nuclear accent can vary to convey other information

(Rump & Collier 1996, Xu & Xu 2005)

As for the defence budget, they’re already cutting it back what 25%....



Accent Prediction in Switchboard

- Corpus of spontaneous telephone conversations annotated for syntax, focus, prosody and information status (Calhoun et al. 2005)
- Only included words in fluent phrases, annotated for focus status
 - approx 9000 words, 2 ½ hours
- Multinomial logistic regression modelling
- Used models to classify each word as having a *nuclear accent*, *non-nuclear accent* or *no accent*
- Primarily interested in importance of different feature sets

Results (%)

	None	Accent	Nuclear	Overall
Baseline	100	0	0	47.2
Prosodic	82.9	29.0	71.9	61.5
Syntactic/Semantic	77.1	13.2	69.5	57.4
Pros+Syn/Sem+WdPr	85.4	48.4	77.2	67.6

- Nuclear accents can be predicted much more reliably than non-nuclear accents

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- Prosodic features best distinguish non-nuclear accents

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	Feature	% Difference	
		<i>Non-Nuclear</i>	<i>Nuclear</i>
Increase	focus	+ 14.9	+ 25.3
	focus & verb	-	+ 13.8
	num syllables in word	+ 17.4	+ 19.3
	break follows	-	+ 18.9
	words since last accent	+ 5.4	+ 5.8
	relative duration	+ 14.8	+ 18.0
	mean intensity	+ 6.5	+ 8.8
	mean pitch	+ 4.6	+ 7.3
Decrease	pronoun	- 8.8	-
	verb	- 5.3	-
	relative position in phrase	- 18.8	-
	accents in phrase so far	- 14.1	- 21.7
	phrase mean pitch	- 2.9	- 5.2

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Summary

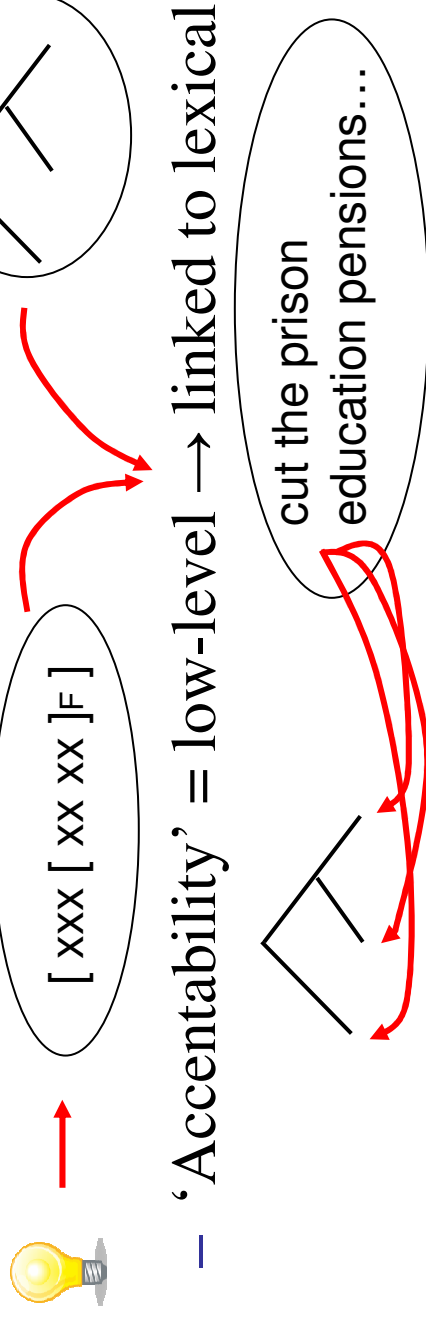
- Both nuclear and non-nuclear accents best predicted by prosodic structure features
- Clear difference in distribution of non-nuclear and nuclear accents:
 - nuclear accents much more linked to focus
 - non-nuclear accents predicted by low-level features, e.g. part-of-speech
 - prediction of non-nuclear accents much worse
- ‘High’ and ‘low’-level informational features have independent effects

Why do we accent words?

- Because prosodic structure tells us to...
 - but why should there be prosodic structure?
 - Prosody acts to hold the different levels of linguistic representation of each utterance together
- (Frazier et al. 2006)
- Prosodic structure, i.e. phrasing *and* prominence, is good for this because it is **predictable**:
 - exploits our pattern recognition ability
 - Having a ready frame in which to slot each information unit aids processing
 - *and* we can exploit this predictability for extra effect

How does information affect prosody?

- We have seen two kinds of “information” effects:
 - Information structure: focus ↔ nuclear accent
 - ‘Accentability’: part-of-speech, givenness, predictability
- Act at different levels of utterance production:
 - Information structure = high level



- ‘Accentability’ = low-level → linked to lexical retrieval
- Ambiguity arises when the two processes lead to similar outcomes

Conclusion

- Presented model of the relationship between prosodic structure and focus
 - focus acts as a strong constraint on the probabilistic mapping of words onto metrical structure
- Corpus Results: accent prediction in Switchboard
 - prosodic structure strong predictor of both nuclear and non-nuclear accents
 - nuclear accenting more strongly related to focus, non-nuclear accents to ‘low-level’ features like part-of-speech
- Prosody and processing
 - metrical prosodic structure binds utterance representations
 - focus part of high-level utterance/prosody planning; ‘accentability’ part of low-level planning

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