Symbolic vs. acoustics-based style control for expressive unit selection

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Background

Unit selection

- \+ high naturalness
- – low flexibility

Expressivity as a “side-effect” of database design

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Motivation

Expressive unit selection with

- smooth joins
- correct style

from mixed-style database

The PAVOQUE expressive speech synthesis corpus

Prompt material

- 3 000 German sentences from WIKIPEDIA, optimized for coverage and prosodic variation
- 400 of these selected for optimal coverage for each style
- 150 style-specific extra prompts (per style)

The PAVOQUE expressive speech synthesis corpus

Recording and processing

- One male native speaker of German
- $\sim$ 8.5 hours of speech (16 bit, 16 kHz)
- manually corrected phonetic segmentation

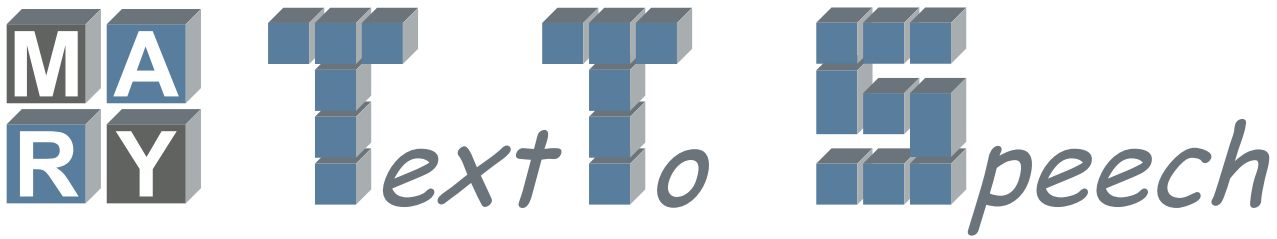
The PAVOQUE expressive speech synthesis corpus

Expressive styles

- neutral “news-reading style”
- cheerful “nice, optimistic, happy-go-lucky”
- depressed “a wet blanket kind of person”
- aggressive “aggressive, irritable and short-tempered”
- poker “cool, laid back”

Overview

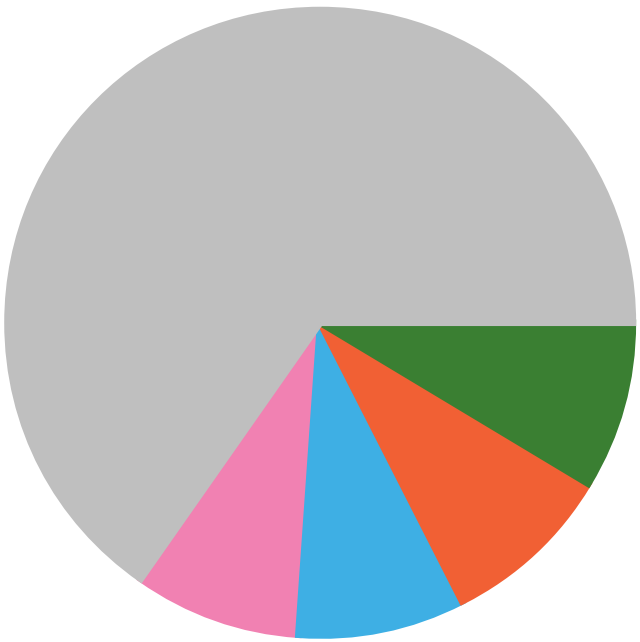
German unit selection voices built using DFKI's open-source



platform (`http://mary.dfki.de/`)

Baseline voices

Built from PAVOQUE data, forced style control



4 519 utterances

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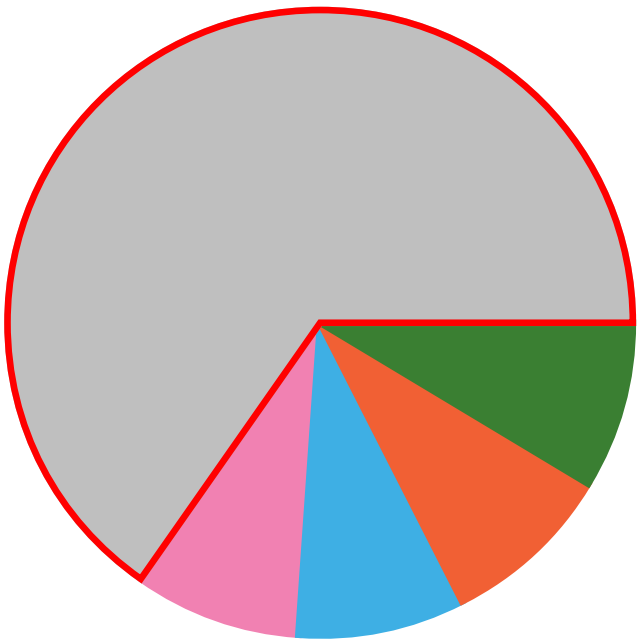

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- neutral (2 946 utts)

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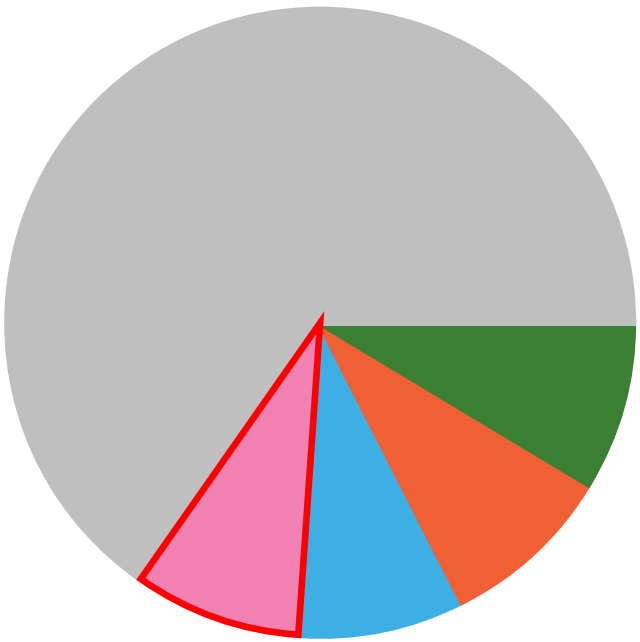

4 519 utterances

- neutral (2 946 utts)
- cheerful (393 utts)

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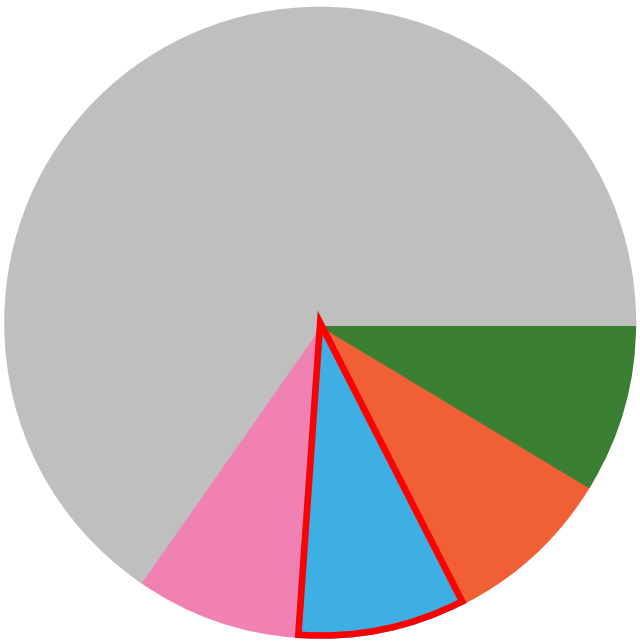

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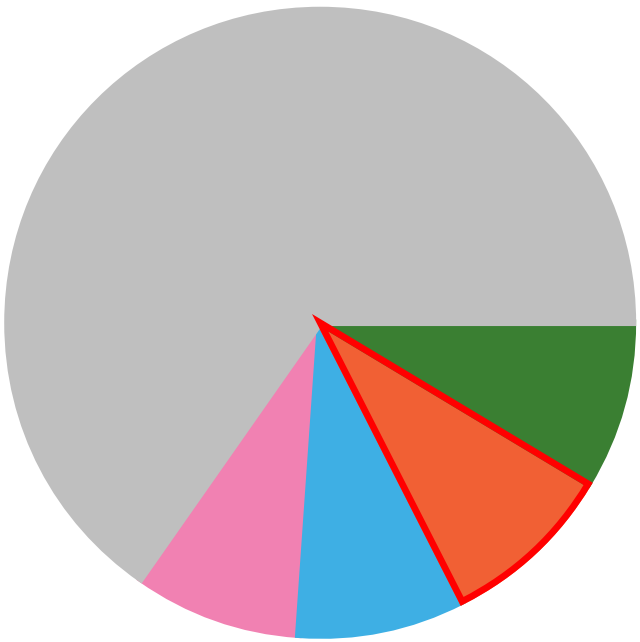

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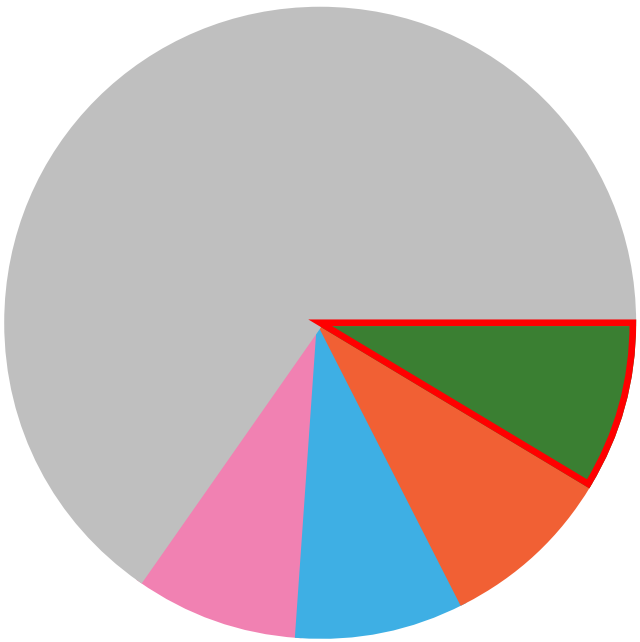

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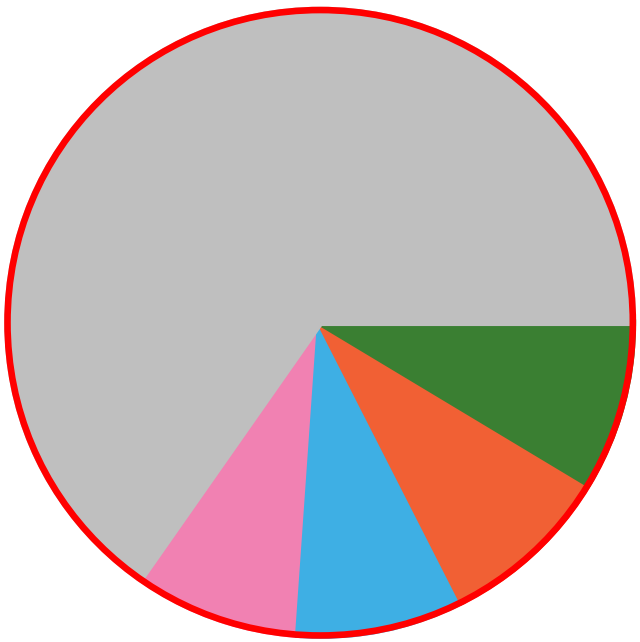

4 519 utterances

- neutral (2 946 utts)
- cheerful (393 utts)
- depressed (393 utts)
- aggressive (394 utts)
- poker (393 utts)
- allstyles (4 519 utts)

Symbolic *style* target cost

allstyles with discrete target cost feature:

$$x_{style} = \begin{cases} 0 & \text{if } style_{target} = style_{cand}. \\ 1 & \text{else} \end{cases}$$

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- symbolic voice (4 519 utts)

Acoustic *style* target cost

allstyles with continuous target cost feature based on voice quality parameter OQG[1]:

$$x_{vq} = |vq_{target} - vq_{cand.}|$$

vq_{target} predicted using CART

[1] Lugger et al. (2006)

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- vq voice (4 519 utts)

[1] Lugger et al. (2006)

Test set

400 WIKIPEDIA sentences resynthesized in each style:

- Smoothness baseline: allstyles voice
- Style match baseline: ⟨*style*⟩ baseline voice ∈ {●, ●, ●, ●}
- Gold standard: original recordings

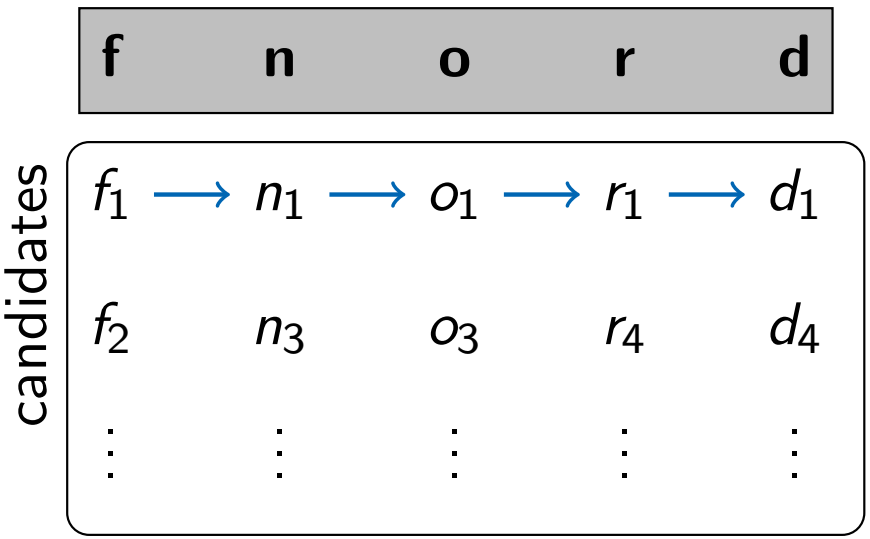
Dynamic utterance blacklisting

	f	**n**	**o**	**r**	**d**
candidates	f_1	n_1	o_1	r_1	d_1
	f_2	n_3	o_3	r_4	d_4
	⋮	⋮	⋮	⋮	⋮

Resynthesize utt 1:

- candidates

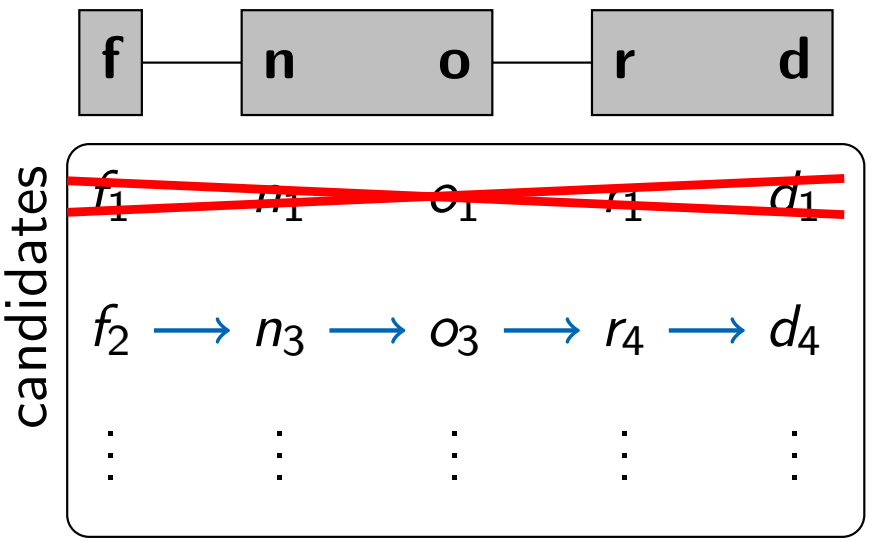
Dynamic utterance blacklisting



Resynthesize utt 1:

- candidates
- utt 1 selected

Dynamic utterance blacklisting



Resynthesize utt 1:

- candidates
- utt 1 selected
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Objective measures

Criteria

- Style: percentage of units selected from utterances with requested style

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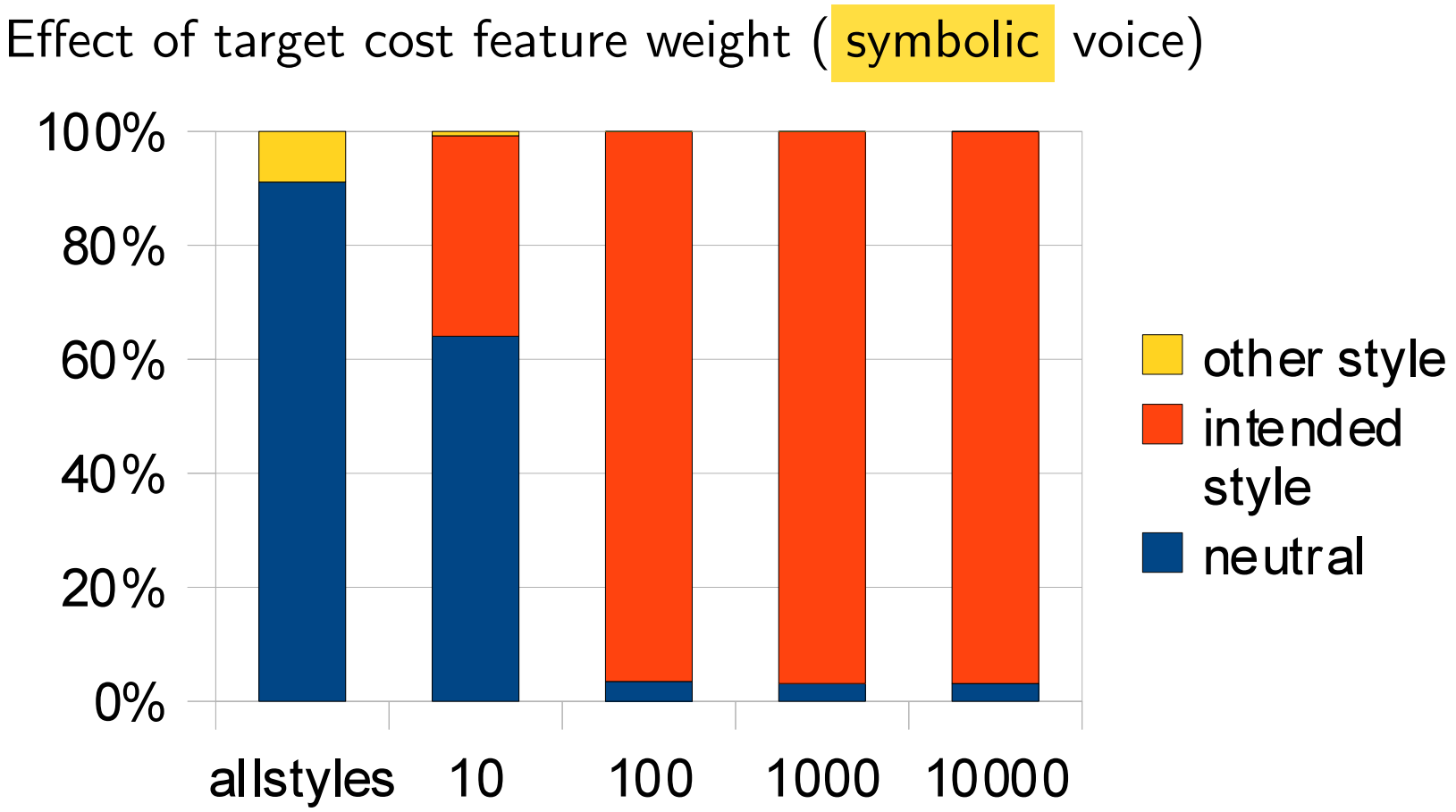
- Style: percentage of units selected from utterances with requested style
- Smoothness: number of joins vs. number of units
- Spectral distance from gold standard:

$$RMSE_i = \sqrt{\frac{1}{P}\sum_{k=0}^{P-1}\left(g_i(k) - s_{m(i)}(k)\right)^2}$$

Style criterion



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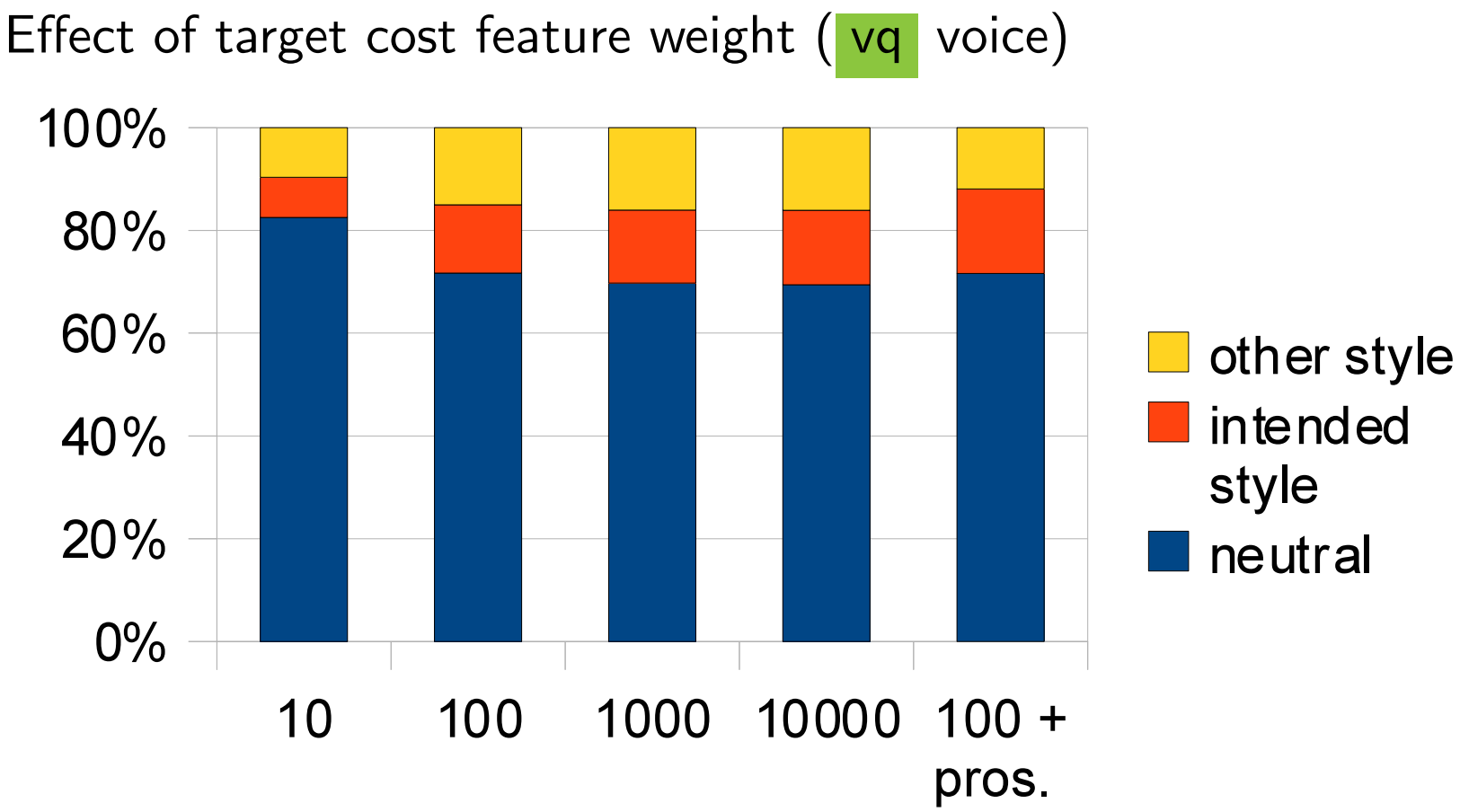
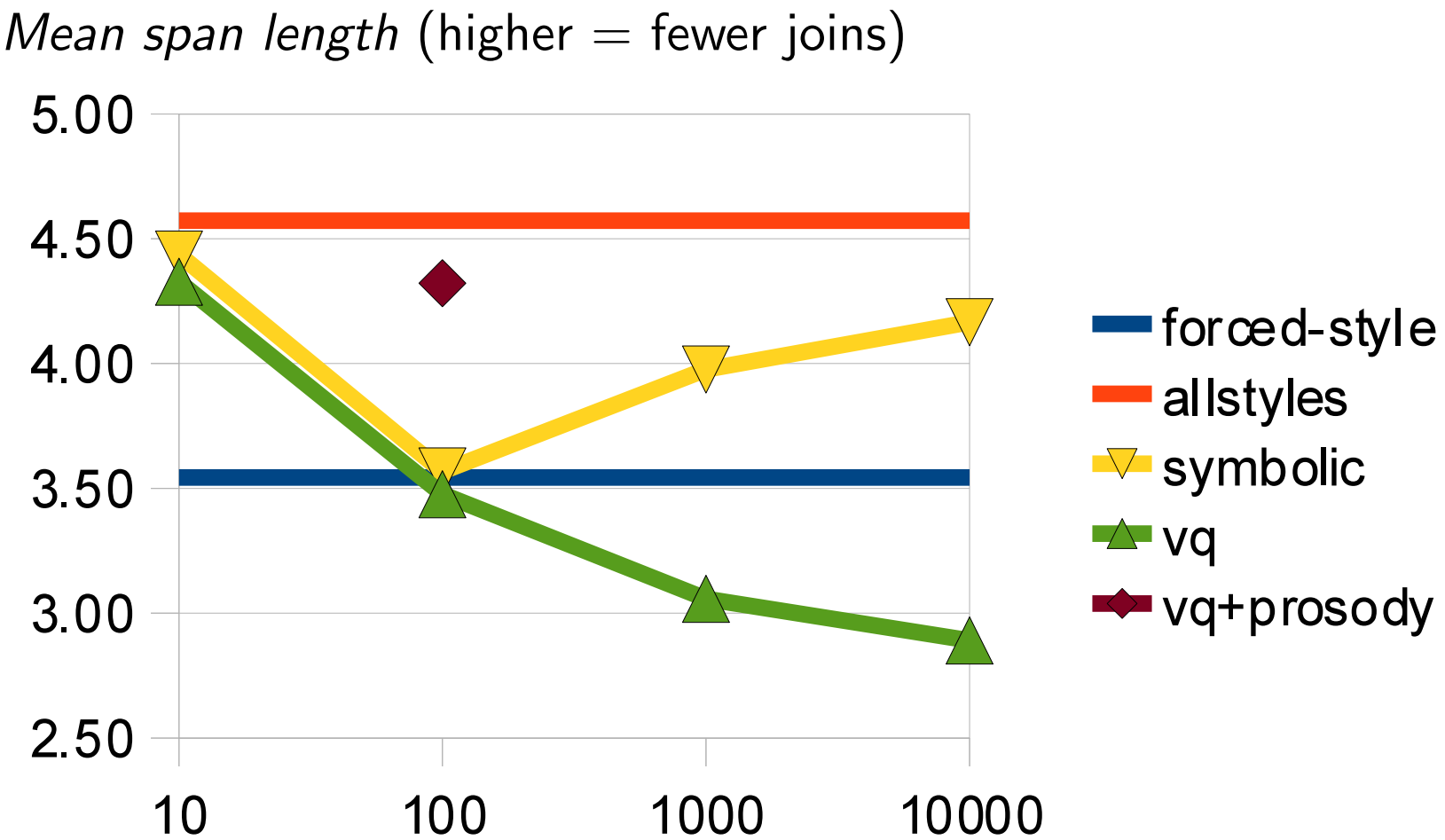
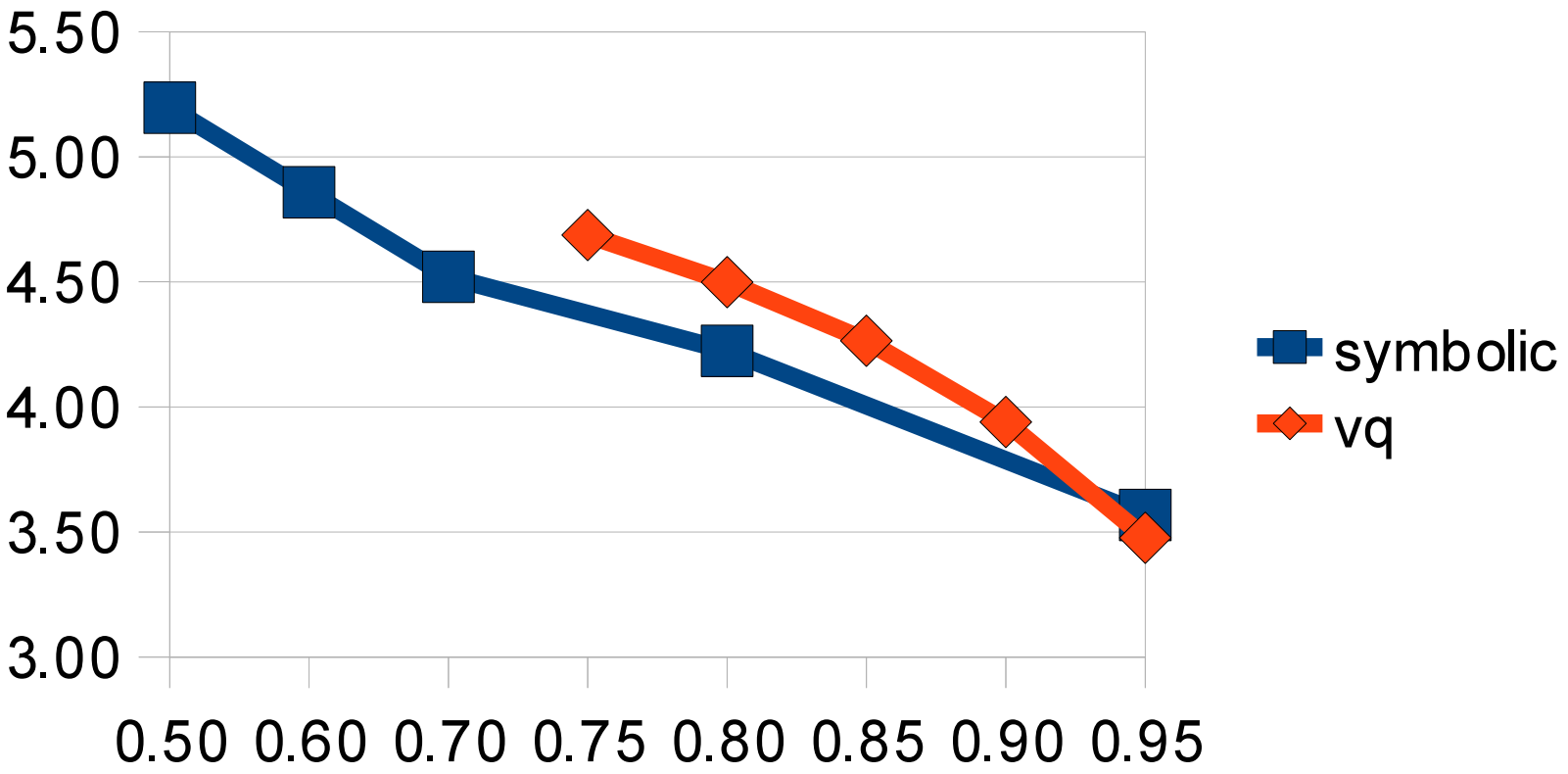


Smoothness criterion



Smoothness criterion

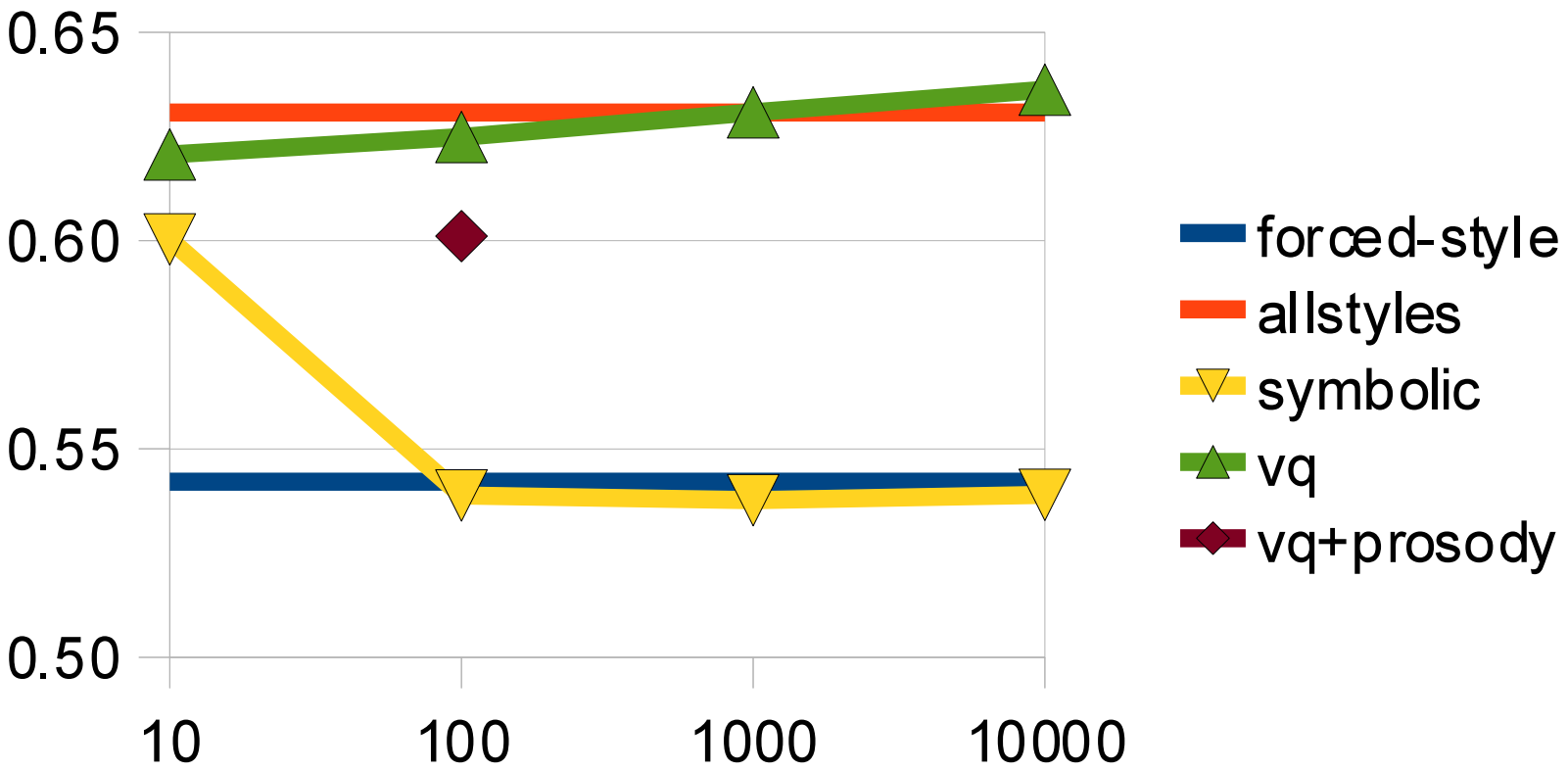
Effect of $\frac{\text{target cost}}{\text{join cost}}$ ratio on mean span length



(at target cost feature weight 100)

Spectral distance criterion

Effect of target cost feature weight on spectral distance to gold standard (aggressive style)



Discussion

- Unit selection voices built from mixed-style expressive database
- Two *style* target cost features:
  - symbolic (discrete)
  - acoustic (voice quality)
- Controlled variation of target cost weight and $\frac{\text{target cost}}{\text{join cost}}$ ratio
- Symbolic control gives expected results
- Acoustic control complex (more features may improve results)

Outlook

Future work:

- Improve robustness of acoustic control with a mix of features
- Combine style selection with modification
- Perceptual evaluation