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DISENTANGLING AND CONNECTING DIFFERENT PERSPECTIVES ON PROSODIC PROMINENCE

1. Introduction

Prosodic prominence is an umbrella term encompassing related phenomena such as phonological stress, paralinguistic emphasis or linguistic salience. As prosodic prominence has therefore received interest from researchers across various disciplines, it has also been studied and operationalized from multiple perspectives. A main challenge lies in finding out how these individual perspectives connect. Our paper provides a first roadmap to a more unified account of the subject matter.

2. Perspectives on Prosodic Prominence

A *functional perspective* focuses on its realization being indicative of information structure, contextual givenness, phrasal stress, word order or lexical class [1, 2]. A functional perspective may also encompass *paralinguistic* functions. These may affect the same signal parameters as linguistic prominence, perhaps more gradually than categorically, and may be confounded with linguistic functions of prominence [3, 4].

The *signal perspective* searches for physical correlates of prominence such as fundamental frequency, duration, voice source features, hyper-articulation, intensity and multimodal cues [5, 6]. The interaction of the various continuous signal cues and its functions is hitherto not well understood.

A *cognitive perspective* focuses on perceptual processing, i.e. it studies the low-level neural pathways and psycho-acoustic processing mechanisms that contribute to higher-level cognitive processing [7, 8], strongly shaped by linguistic knowledge and expectations [9, 10].

3. Connecting perspectives

Each individual perspective taken to prominence is too narrow: A physical signal perspective not taking into account function related impressions fails to model what makes prominence "prosodic", while a functional perspective may rely on overly simplistic signal correlates or ignore processing constraints potentially exploited by phonology. We suggest the following strategies to a) identify the individual research perspectives and b) better understand the complex relationship between them: (i) clarifying definitions, (ii) typological investigations, (iii) comparing annotations, and (iv) building technical models.

(i) Given the wide range of functions, forms, and research perspectives, neither an overly generic definition nor a too narrow one appears to be helpful. A currently more fruitful approach seems to be *a set* of definitions which clarify the way the term prominence is used individually.

(ii) A comparison of how prominence can be described at signal level across typologically diverse languages will reveal information on the universality or language-specificity of cues, their relative impact and interaction with other linguistic features, e.g. tonality or information structure.

(iii) A useful step lies in a comparison of annotation schemes shaped by different perspectives: the physical signal, the linguistic expectations, and the way our cognitive system connects and weighs these factors.

(iv) In technical systems, both rule-based and machine learning approaches for prominence detection and exploitation may significantly contribute to an improved understanding of the subject matter, as they may provide an understanding of the complex signal weightings, and function-signal interactions.

4. Conclusion

Despite prominence being a popular research area, results often fail to contribute to a comprehensive understanding of the concept – due to vastly different conceptualizations and operationalizations, our insights often forbid comparison and integration. We have made a first set of suggestions for strategies solving these problems.

References

[1] Vainio, M., Järvikivi, J. 2006. Tonal features, intensity, and word order in the perception of prominence. *Journal of Phonetics* 34(3), 319–342.

[2] D'Imperio, M. 1998. Acoustic-perceptual correlates of sentence prominence in italian questions and statements. *Journal of The Acoustical Society of America* 104.

[3] Niebuhr, O. 2010. On the phonetics of intensifying emphasis in German. *Phonetica* 66, 95–112.

[4] Chasaide, A. N., Yanushevskaya, I., Cane, J., Gobl, C. 2013. The voice prominence hypothesis. *Proceedings of INTERSPEECH 2013,* Lyon, France. 3527–3531.

[5] Terken, J. 1991. Fundamental frequency and perceived prominence. *Journal of the Acoustical Society of America* 89(4), 1768–1776.

[6] Fant, G., Kruckenberg, A. 1989. Preliminaries to the study of Swedish prose reading and reading style. *STL-QPSR* 30(2), 1–80.

[7] Ludusan, B., Origlia, A., Cutugno, F. 2011. On the use of the rhythmogram for automatic syllabic prominence detection. *Proceedings of Interspeech 2011*, Florence. 2413–2416.

[8] McAngus Todd, N. P., Brown, G. J. 1996. Visualization of rhythm and meter. *Artificial Intelligence Review* 10, 253–73.

[9] Cole, J., Mo, Y., Hasegawa-Johnson, M. 2010. Signal-based and expectation based factors in the perception of prosodic prominence. *Journal of Laboratory Phonology* 1, 425–452.

[10] Simon, A.-C., Goldman, J.-P., Avanzi, M. 2013. Prominence perception and accent detection in French: from phonetic processing to grammatical analysis. *Language Sciences* 39, 95–106.