

Perception and production of spoken language: processing mechanisms and functional units

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Participating research teams

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Short abstract

Although spoken language production and perception have been studied as unrelated topics for decades, more recent psycholinguistic approaches now treat them within a unified conceptual framework.. In this approach, speech production and perception involve strongly interrelated processes and representations, and the focus is on the interactions between production and perception. Our research goal was an in-depth investigation of the relationships between speech perception and production, whereby the two capacities would be studied for several parallel aspects.

Four main issues were addressed: 1) cooccurrence constraints for segmental units (phonotactics), 2) syllabic and subsyllabic functional units, 3) morphological functional units, and 4) variation and segmentation in running (continuous) speech (re: the “liaison” issue).

New findings published in the recent literature led us to a change in focus for some of the topics listed above. In particular, with respect to the issues of liaison and word segmentation, we have reoriented our research towards the study of those acoustic variations in production that potentially allow for the recovery of underlying form in perception, for example in cases whereby liaison could entail ambiguity at some surface level of representation. This change in perspective has actually resulted in previously non-expected conclusions: In case of potentially ambiguous speech, a negotiation is taking place, as it were, between the speaker and the listener, so that the produced speech is less affected by variation (e.g., liaison or assimilation) than it could be in theory, and at the same time, the perception of phonetic detail is more accurate.

The other results obtained are relevant to the role of native language sound system on speech perception and extend this role to the perception of sound sequences (theme 1); our results also support the notion that the syllable is –at least in French– a key element for both speech perception and production (theme 2); finally, we find that the morpheme is obligatorily processed as a sublexical unit (theme 3).

Initially set goals and issues

The general aim of the project was to compare speech perception and production data: (1) regarding native language phonological constraints, (2) regarding syllabic and morphological representation units, and finally (3) regarding aspects that are specific to continuous speech (word segmentation and variation, with a special focus on French liaison).

The project was also intended to investigate more in depth several issues addressed in the previous research of the 4 research teams involved. One result relevant to phonotactic constraints had been the finding of a perceptual assimilation phenomenon turning /t/ into /k/ (LPE and FAPSE). This project so addressed the issue of whether this phenomenon is universal. The universal versus specific issue was also of concern regarding the syllable unit: Is the syllable a universal unit of perception and/or production, or is it specific to certain languages only? Although the same concern holds for morphological units, we limited ourselves to the investigation of morphological processes in French. Our purpose was to test the proposition of morphemic decomposition in perception

as well as in production. Finally, the last topic considered in the project was form variation as entailed by continuous speech as, for example, liaison or assimilation (voice assimilation in French, place assimilation in other languages such as English). The initial question was of whether listeners have trouble processing variations and how they eventually cope with them. We then added to this the investigation of the acoustic consequences of variation and of the perception of altered forms when isolated from context.

Initially planned experiments.

1. Phonotactic constraints
2. The syllable as a functional unit in speech production and perception
3. The morpheme as a functional unit in speech production and perception
4. Perception and production in continuous speech

Summary of actually achieved results

Phonotactic constraints

The /t/-to-/k/ perceptual assimilation is specific to listeners' native language. It is determined by whether the involved clusters (/d/, t/) are legal or not in the listeners' native language. It is also modulated by articulatory-phonetic properties of segments in one language relative to the other. The same language-specific phonotactic constraints are expected to bias production patterns. (Involved groups: LPE and FAPSE: French; ILPGA: Hebrew; Haskins: English.)

Functional units in speech perception

Our research confirms the special status of the syllable as a natural unit of perception in French. (LPE and FAPSE). As for morphemes, we have shown that morphological structure is sufficiently real in French readers' minds for them to "blindly" analyze words into morphemes based on apparent rather than actual morphemic composition (LPE and ILPGA).

Functional units in speech production

With the experimental paradigm used (implicit priming), we could not clearly establish the role of the syllable in speech production for French (LPE, FAPSE). We believe that this paradigm is problematic and decided not to use it (as planned) to explore the role of morphemic composition in production. With the classic naming paradigm, however, using masked or overt primes, we have been able to demonstrate that the segmental syllable is a production unit in Chinese (LPE).

Liaison and assimilation

This research, in particular the study of voice assimilation, showed the importance of the subtle articulatory-phonetic patterns that allow listeners to retrieve the speaker's intended words in cases whereby word forms have been affected by context-dependent alterations with respect to canonic form, or, even, whereby word forms have become potentially ambiguous. In the latter case, we find that potential ambiguity is resolved through a phonetic negotiation, as it were, between speaker and listener (LPE, ILPGA, FAPSE). Finally, pilot production data suggest that the perceptual and production salience of liaison consonants is modulated by articulation rate (Haskins, LPE).

Publications induced by the project

Journal articles

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- Spinelli, E., Segui, J., Radeau, M. (2001). Phonological priming in spoken word recognition with bisyllabic targets. *Language & Cognitive Processes*, 16, 367-392.
- Chen, J.-Y., Lin, W.-C., & Ferrand, L. (à paraître). Masked priming of the syllable in Mandarin Chinese speech production. *Chinese Journal of Psychology*.
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- Snoeren, N. (2002, Juin). *L'assimilation de voisement en français: Mesures objectives et mesures perceptives*. Mémoire de DEA de Sciences Cognitives, Paris V.

Published communications

- Fougeron C., Bagou, O., Stefanuto, M., & Frauenfelder, U (2002, Juin). A la recherche d'indices de frontière dans la resyllabation. *Proc. 24es Journées d'Etude sur la Parole* (pp.125-128). Nancy, France.

Book Chapters

- Ferrand, L. (2002). Les modèles de la production de la parole. In M. Fayol (Ed.), *Production du langage. Traité de Sciences Cognitives* (pp. 27-44). Paris: Hermès.