

**Temporal continuity and phonological discontinuity  
in linguistic communication:  
Collaboration between perceptual psychology, linguistics, and speech science**

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**【Outline of survey】**

This project was planned in order to cast scientific light on semiological aspects of acoustic signals employed for auditory communication, especially speech. Experts in perceptual psychology, auditory physiology, the psychology of music, and speech engineering work together to achieve this goal. We have proposed and examined a hypothesis on the formation of auditory streams, which many researchers consider to be basic perceptual units of auditory organization typically consisting of auditory events and silences. Auditory streams have been hypothesized to be linear concatenations of *auditory subevents*, i.e., onsets, offsets, fillings, and silences, which should be connected to each other according to a simple grammar, which we call "Auditory Grammar." This hypothesis has been supported to a certain extent by other researchers in the world, but it probably needs some modifications. The biggest problem to be tackled is that the present hypothesis does not give a clear description of how to determine cues of discrete auditory subevents in continuously changing acoustic signals. Another problem is that the grammatical interpretations of percepts, though useful in describing perceptual and linguistic data, are not immediately related to realistic mechanisms of auditory stream formation. Therefore, we are attempting to improve "Optimality Theory," which is influential in the present linguistics, so that it can deal with acoustic features of speech on an empirical basis. Our short-term target is to clarify the perceptual mechanism of syllable formation. When the present project is finished, we will create a new research area by fusing some parts of perceptual psychology and linguistics.

**【Expected results】**

We have been hypothesizing so far that it is necessary to introduce phonological temporal structures as described in linguistics into the investigation of auditory organization. This project will determine the validity of this hypothesis, and probably some phenomena that have been often considered specific to speech will turn out to be caused by basic mechanisms of the auditory system. With this, we will take a first step to create a new research area involving both perceptual psychology and linguistics. We will develop and improve speech enhancement systems to be used for acoustic equipment in public places, hearing aids, and telephone systems.

**【References by the principal investigator】**

- Nakajima, Y. et al. (2000). Illusory recouplings of onsets and terminations of glide tone components. *Perception & Psychophysics*, 62, 1413.
- Nakajima, Y. et al. (2004). Time-shrinking: the process of unilateral temporal assimilation. *Perception*, 33, 1061-1079.

**【Term of project】** FY2007—2011

**【Budget allocation】** 15,900,000 yen

(2007 direct cost)

**【Homepage address】**

<http://www.design.kyushu-u.ac.jp/~ynhome/>