National Institute of
Advanced Industrial Science
and Technology
AIST

独立行政法人産業技術総合研究所 関西センター 講演会

共催：日本音響学会 関西支部

日時:2005 年 7 月 30 日(土), **13:30-15:00 （当初予定から変更になりました！）**

会場:大阪府池田市緑丘 1-8-31
独立行政法人産業技術総合研究所関西センター
産学官研究交流棟(MOL 棟) セミナー室
(阪急宝塚線池田駅より徒歩 15 分)

講演者:Dr. Peter Cariani (Tufts Medical School, Boston, MA, USA)

講演タイトルおよび要旨:

Temporal coding of pitch and timbre in early auditory processing: implications for understanding the nature of central auditory processing

We will discuss the neural representation of pitch and timbre in the auditory pathway, from auditory nerve to cortex. We will focus on temporal, interspike interval codes for pitch and timbre in the auditory nerve and cochlear nucleus with the aim of shedding light on the elusive and the problematic nature of their central representations. Our working hypothesis is that the auditory system uses information derived from both neural timing (interspike intervals) and cochlear place (tonotopic maps) to support perception of periodicity (pitch) and spectrum (timbre). Most aspects of pitch and timbre perception that are critical for perception of music and speech appear to be based on fine timing information (10-4000 Hz periodicities) that is produced by the phase-locking of auditory nerve fibers to acoustic stimuli. Like pitch and timbre perception, such information remains highly precise and invariant over wide dynamic ranges, and the existence region of this information parallels that of musical tonality (octave equivalence, musical interval and melody recognition, which holds up to ~4-5 kHz). By comparison, place-based representations are much coarser and highly level-dependent, not unlike auditory perception in high frequency registers (above 5 kHz).

At the level of the auditory nerve the population-wide distribution of interspike intervals in the auditory nerve forms a general-purpose autocorrelation-like, temporal representation of the stimulus whose properties explain many diverse aspects of pitch

perception (e.g. missing fundamentals, level-invariance, pitch equivalence, octave similarity, pitch shifts of inharmonic complex tones). We will present data from neurophysiological and computer simulations studies. Population-interval distributions (PIDs) also provide robust representations for those aspects of timbre that are related to stationary power spectra (e.g. formant structure and vowel quality). PID-based models f masking and harmonic resolvability that are based on the competition of interval patterns integrate this information across cochlear territories in a manner that reflects cochlear excitation patterns. Notions of pitch multiplicity and fusion that are based on competing interspike interval patterns also provide a basis for tonal consonance in musical contexts in which pitch (in) stability produces harmonic tension and relaxation.

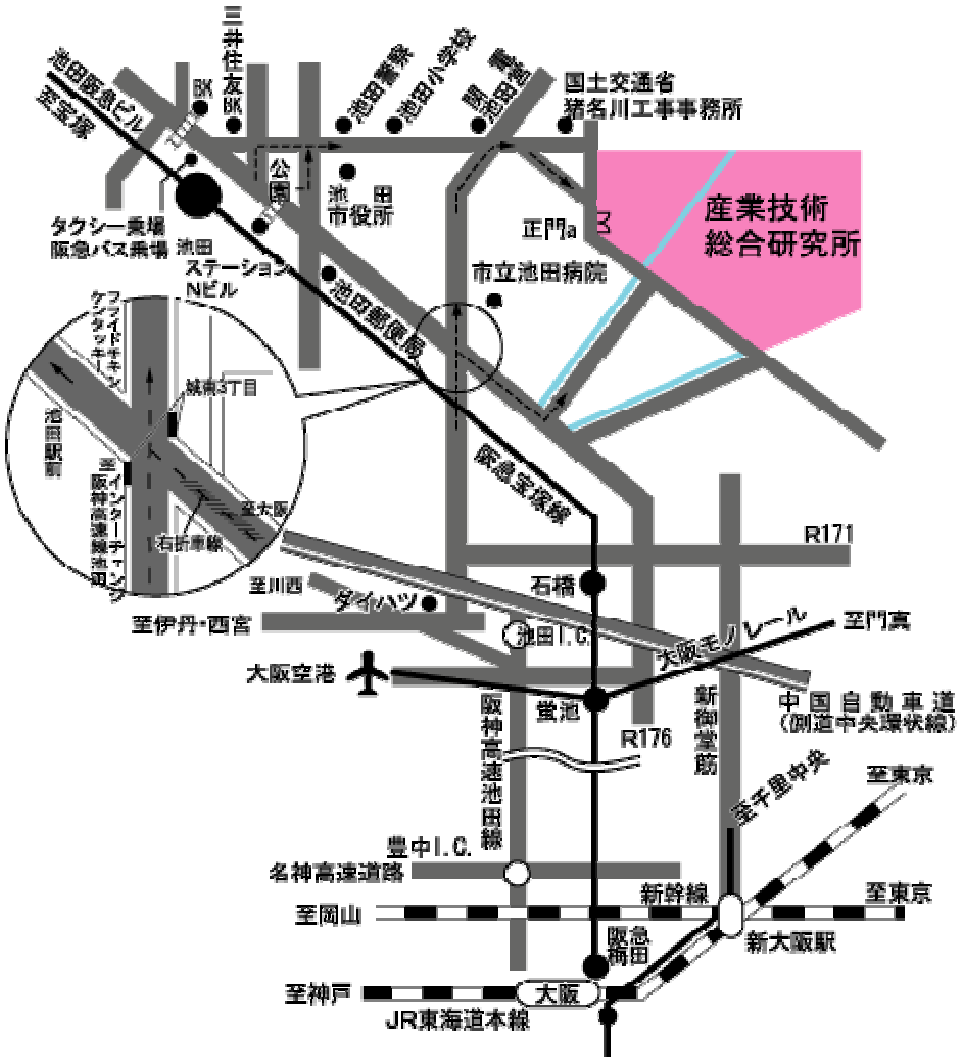
A central question for auditory neurophysiology concerns the means by which the central auditory system might make use of such timing information, not only to represent pitch and timbre, but also to form and separate auditory objects (e.g. different musical instruments, concurrent vowels). An adequate, neurally-grounded model for the central codes and computations that subserve pitch should minimally account for 1) equivalence of pure and complex tone pitches, 2) level and location invariance, 3) the relative nature of pitch perception, 4) the precision of pitch discrimination, and 5) the ability to hear out multiple pitches (e.g. in a chord). We will critically discuss several broad possibilities: pitch detectors, modulation detectors, other time-place transformations, time-latency transformations, and recurrent timing networks.

連絡先:

〒563-8577 大阪府池田市緑丘 1-8-31
独立行政法人産業技術総合研究所 関西センター
人間福祉医工学研究部門 くらし情報工学グループ
中川 誠司 (072-751-8785, s-nakagawa @ aist.go.jp)
添田 喜治 (072-751-9496, y.soeta @ aist.go.jp)

会場までのアクセス:

独立行政法人産業技術総合研究所 関西センター
大阪府池田市緑丘 1-8-31
阪急宝塚線池田駅より徒歩 15 分



産総研関西センターは住宅街の中に位置しており，駅からの道のりがわかりにくくなっております．この地図をプリントアウトして，お持ちになっておくことをお奨めします．

より詳しいご案内は http://unit.aist.go.jp/kansai/access.html をご覧ください．