IN SEARCH OF MODELS –

A REVIEW OF THE AUTHOR'S RESEARCH OVER A HALF CENTURY

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Extended Abstract

In this talk I will start by defining what I mean by a 'model' and by emphasizing the importance of creating a proper model for the phenomenon under study. What is meant by a proper model is not just an *ad hoc* mathematical approximation of what one superficially observes, but one that is based on understanding of the underlying principle. I will then show four examples of such models I developed during my research career of over the past 50 years.

1. **A model for the human use of language in sending and receiving information**
   By looking into the processes involved in the use of language in sending and receiving information, this work shows that the two aspects are quite different and their characteristics require separate mathematical formulations.
2. **A model for the human processes of controlling the fundamental frequency of speech**
   By examining the underlying mechanisms, this work explains why formulating the fundamental frequency contour in terms of logarithmic frequency leads to a precise model and separation of two types of components related to phrasing and accentuation, respectively, and why the two components have shapes of response curves of second-order linear systems.
3. **A model for the human processes involved in identification and discrimination**
   By critically analyzing the cognitive processes involved in identification and discrimination experiments, this work shows the mathematical relationship between the two processes and hence between the two performance curves, and proves that the so-called phenomenon of categorical perception is an artifact coming from the experimental paradigm.
4. **A model for the process of dialogue**
   By looking into the process of dialogue, this work clearly shows that the finite-state automaton often used in modeling a dialogue is inadequate, and presents a novel alternative way of modeling a dialogue in terms of two interacting finite-state automata that are different from conventional finite-state automata.

In summary, it is the author's belief that one needs to go beyond conventional views, but proper models are often based on the common sense.

On the presenter

Born: October 18, 1930.

Education and Professional Career: BS, MS, PhD from University of Tokyo; Fulbright Scholar at MIT ('58 -'61), Guest Researcher at KTH ('60) Joined the Faculty of Engineering, University of Tokyo ('62), Full Professor at EE Dept. ('73 - '91), serving twice as Chairman, Also Professor of Speech Science, Graduate School of Medicine ('74 -'77) and Lecturer, Dept. of Linguistics, Graduate School of Humanities ('64-'91)
Prof. Emeritus, University of Tokyo ('91- present); Professor, Tokyo University of Science ('91- '06)
Visiting Professorship: U. Texas, Austin, U.S.('80); KTH, Stockholm, Sweden ('81), U. Göttingen, Germany ('81),.Nanjing University, Nanjing, China ('85-'86), University of Science and Technology of China, Hefei, China ('87-'91).

Project Leader, the Japanese National Project on Advanced Human-Machine Interface Through Spoken Language ('87-'91)
Project Leader, the Japanese 'Research-for-the-Future' Project on Human-Machine Spoken Dialogue Systems ('96-'00)
General Chairman, IEEE-ASJ International Conference on Acoustics, Speech, and Signal Processing (ICASSP-86) ('86)
ASJ-Chairman, the Second Joint Meeting of the Acoustical Society of America and the Acoustical Society of Japan ('88)
Founder and Chairman, the International Conference on Spoken Language Processing (ICSLP) ('90)
Member, the Permanent Council for the Organization of ICPhS ('79 - '07)
Life Member, the Permanent Council for the Organization of ICSLP ('92-present)
Member, ISCA Board ('00-'07), Life Member, International Advisory Council of ISCA ('04-)

President, the MIT Association of Japan ('82 - '90)
President, the Boston Association of Japan ('97 -'99)
Vice President, the Japan-China Science and Technology Exchange Association ('03 - present)