
Profile Analysis

A Different View of Auditory Intensity Discrimination

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ABSTRACT: *This article describes some auditory experiments involving the detection of a change in the spectrum of a brief auditory signal. Unlike the more traditional view of intensity discrimination that emphasizes a change in level in a particular frequency band, a new view based on the evaluation of the overall shape or profile of the spectrum is proposed. This new view is different in several ways from the traditional description. First, the memory requirements appear to be quite different, as demonstrated in an experiment in which the interstimulus interval is changed. Second, the mechanism of detecting the change appears to be global rather than local, since detection improves as the spectrum increases in width and density. Despite the global nature of the process, one does not seem to be able to combine spectral estimates across the two ears. Finally, the idea of profile analysis is applied to the problem of detecting a sinusoid in noise and to the results obtained when signal frequency is uncertain.*

This article analyzes the common auditory problem of detecting a difference between two sounds. This analysis is restricted to sounds that differ only in the intensity of some part of their spectra. Examples of problems usually treated under this restriction are the detection of an increment in a sinusoidal signal, the detection of a weak signal in noise, or the change in intensity of some component or components of a multicomponent signal.

There are two general accounts of how intensity discrimination is carried out. The first is a traditional view, one that has developed during the past 20 years and that still represents the best current theoretical position we have for dealing with a certain set of intensity discrimination problems. The second view, which we call profile analysis, represents, in part, the realization that certain problems of intensity discrimination may involve mechanisms and processes quite different from those described in the traditional view. Profile analysis stresses the importance of certain variables that the traditional view largely ignored. By the same token, profile analysis suggests that other variables, held to be crucial in the traditional view, are largely unimportant.

These two views are not exclusive. When discriminating the change in the intensity of a single pure tone, for example, the traditional view is the only analysis possible because no profile is available. But in a number of situations there is appreciable energy distributed throughout the spectrum. This energy, which the traditional view ignores, becomes part of a "profile" that can strongly influence our ability to detect a small change in energy in some other part of the spectrum.

The task, then, is not to choose between the two views, but to determine those situations in which one or the other view is more appropriate. This article's organization is not chronological, and the theoretical issues described in the first part did not motivate the experimental work presented later. Rather, a number of experimental results suggested something amiss with the traditional view, and further experimental work suggested the idea of a profile. Still further work has clarified some of the properties of this concept, but additional work is needed to understand the process in more detail and to answer the many important questions that remain unanswered. The results presented here largely summarize what we have learned in the past two years.

Finally, I should indicate the thanks I owe to my collaborators in this effort, Murray Spiegel and Gerald Kidd, who were postdoctoral fellows in my laboratory, and Maria Picardi, who programmed many of the experiments and collected some of the data.

Theory

Figure 1 displays, in its simplest terms, the difference between what I shall call the traditional view and profile analysis. The difference is illustrated in a two-alternative forced-choice task. The observer's task is to detect the signal increment added to one of two sounds presented at two different times. The figure illustrates the spectra of the two sounds and the measurements presumed to be made by the observer in trying to detect the difference. The nature of the measurement is not known in detail, but we will try to characterize its general features in the discussion that follows. The figure highlights that the critical difference is whether the comparison is between two

Profile Analysis Auditory Intensity Discrimination

Michael Brown



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Profile Analysis David Marvin Green,1988 This book brings together recent research on the ability of human listeners to discern changes in the shape of complex acoustic spectra It systematically discusses issues surrounding the discrimination of a change in acoustic intensity and the physiological mechanisms responsible for this process The book also proposes two new theories which attempt to explain spectral shape discrimination on the basis of more elementary auditory processes The research described here is helping scientists gain a better understanding of auditory skills such as those involved in listening to music and speech

Sensation and Judgment John C. Baird,2014-02-25 Psychophysical theory exists in two distinct forms one ascribes the explanation of phenomena and empirical laws to sensory processes Context effects arising through the use of particular methods are an unwanted nuisance whose influence must be eliminated so that one isolates the true sensory scale The other considers psychophysics only in terms of cognitive variables such as the judgment strategies induced by instructions and response biases Sensory factors play a minor role in cognitive approaches This work admits the validity of both forms of theory by arguing that the same empirical phenomena should be conceptualized in two alternative apparently contradictory ways This acceptance of opposites is necessary because some empirical phenomena are best explained in terms of sensory processes while others are best ascribed to central causes The complementarity theory stresses the mutually completing nature of two distinct models The first assigns importance to populations of sensory neurons acting in the aggregate and is formulated to deal with sensory effects The second assigns importance to judgment uncertainty and to the subject strategies induced by experimental procedures This model is formulated to explain context effects Throughout the text the exposition is interlaced with mathematics graphs and computer simulations designed to reveal the complementary nature of psychophysical explanations

Advances In Hearing Research - Proceedings Of The 10th International Symposium On Hearing H Fastl,G M Klump,C Koppl,Geoffrey A Manley,1995-05-31 The main aim of the symposium on the hearing system is to provide a forum in which data ideas and models from both the physiological and psychoacoustical standpoints can be presented and discussed Apart from those areas traditionally covered by such meetings two areas with important recent advances have been included viz development and regeneration The present volume will be of interest to all scientists working in the field of auditory research

Hearing Stanley A. Gelfand,2017-11-22 This fully updated and revised sixth edition of *Hearing An Introduction to Psychological and Physiological Acoustics* provides a comprehensive introduction for graduate students and professionals in audiology and other fields dealing with audition including hearing speech science psychology otolaryngology neuroscience linguistics and speech language pathology The sixth edition reflects the current status of this rapidly evolving multidisciplinary field of hearing science

Hearing United States. National Recovery Administration,1933

Human Psychophysics William A. Yost,Richard R. Fay,2012-12-06 The Springer Handbook of Auditory Research presents a series of comprehensive and synthetic reviews of the fundamental topics in modern auditory

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The Journal of the Acoustical Society of America Acoustical Society of America, 2007 Human Auditory Perception of Trajectories of Motion in a Simulated Open-field Environment Joshua Alexander Miele, 2003 *Auditory Physiology and Perception* Yves Cazals, K. Horner, L. Demany, 1992 Auditory Physiology and Perception documents the proceedings of the 9th International Symposium on Hearing held in Carens France 9-14 June 1991 The aim of the symposium was to promote exchanges between hearing scientists working with different approaches from cell biology to psychology The volume is organized into 10 parts Part I contains papers on the biology of inner ear cells Part II presents studies on auditory periphery functioning Part III examines frequency selectivity while Part IV contains papers that deal with the subject of pitch The papers in Part V examine the coding of i

Neural Computation, 2001 **Sensation and Perception** Margaret W. Matlin, Hugh James Foley, 1997 Sensation and Perception Fourth Edition sets the standard in bringing technical scientific information to a wide range of students with outstanding readability and thorough coverage Retaining its traditionally clear and accessible writing style this new edition boasts a thoroughly revised art program and over 1 300 new references The motion chapter now focuses solely on visual motion perception so it appears earlier in the text In addition the book includes thirteen In Depth sections each of which explore a current hot research topic to provide a sense of how researchers ask questions with subjects varying from the role of face recognition in eyewitness testimony to phantom limb perception Above all this text is written by two professors who have received national awards for their teaching It features strong pedagogy abundant student friendly examples and an engaging conversational style **Experiments in Auditory Distance Perception** Pavel A. Zahorik, 1998 **Congress Reports**, 1989 Factors in the Identification of Environmental Sounds Brian Gygi, 2001 **Annual Review of Psychology** Calvin Perry Stone, 1996 *Journal of the Washington Academy of Sciences* Washington Academy of Sciences (Washington, D.C.), 1990 Sept issue 1975 contains directory of members **Notes on Human Engineering Concepts and Theory** University of Michigan. Engineering Summer Conferences, 1996 **Publications - International Congress on Acoustics**, 1989 All Things Coherence Zachary Andrew Constan, 2002 **Modeling Vowel Formant Discrimination in Quiet and in Noise for Natural Speech**

Chang Liu, 2002

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