The application of statistical methods to the problems of psychophysics Volume 3

Commentary/Murray: History of psychophysics

obviously useful in many experimental contexts to have a metric for what is called sensation strength, my point is that the choice of a reference continuum is entirely arbitrary, and that as a consequence the relations that obtain among "sensation strengths" will depend on the choice that is made. Murray characterizes such a point of view as behaviorist and unsatisfying for most psychophysicists. Perhaps so, but my guess is that in another 150 years the measurement of sensation strength will be no better understood than it is now.

ACKNOWLEDGMENT

I would like to acknowledge the support of the Laboratoire de Mécanique et d'Acoustique, CNRS, Marseille, and the director of its Psychoacoustics Group, Georges Canévet; I was a visitor there while this commentary was written. I'd also like to acknowledge the contribution of Martha Teghtsoonian in valuable discussions of the ideas contained in this commentary.

Psychophysics and the mind-brain problem

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Murray's target article deals with various strands in the development of psychophysics. The present comments are restricted to one set of issues.

Murray's point of view largely reflects that of Stevens (1957; 1961). His presentation has the virtue of bringing to the fore assumptions that have been implicit in the work of many psychophysicists, including Stevens, but have not usually been acknowledged. These assumptions constitute a philosophically questionable interactionist basis for psychophysics. They are represented in Murray's Figure 1 as the sequence $I \rightarrow E \rightarrow S \rightarrow R$, where I represents the physical intensity of the stimulus, E an effect at the neural level, S sensation, and R the overt response. The author derives this representation from Fechner and uses it as the basis of a classification of psychophysical developments.

What is "sensation"? In Murray's account of Fechner's views (sect. 1.2) "physical events in the brain were translated into mental events of sensation"; the latter is a "mental experience" or "conscious experience." Murray adopts and supports this interpretation of Fechner's approach on the basis that "most psychophysicists do want to talk about psychological experience" (sect. 2.1, para. 4).

They may well so wish, but the question is, What can usefully be said about this topic? The unargued and uncritical adoption of an interactionist stance fails to confront the dilemmas that that position entails. I shall consider them briefly.

The sequence $I \rightarrow E \rightarrow S \rightarrow R$ represents a causal sequence. In the physical world, causation, the action of one event such as the impinging of physical energy on a sense organ, to alter another such as neural activity at an internal locus, is subject to physical laws. Thus, when a racket strikes a ball, energy is transferred and entropy increases but the total energy of the system is conserved. Such laws apply to the neural stage, or series of neural stages, that lie between I and E. What about the sequences $E \rightarrow S$ and $S \rightarrow R$? If a given value of E causes a given strength of S to be produced, and this value of S initiates a corresponding response R, and these causal events are governed by the laws of physics, such as the law of conservation of energy, no problem arises: except that if S is an event governed by the laws of physics, then it is a physical event, one that happens to occur in the brain. Inasmuch as the physical components of the brain are neurons it is a neural event, and thus S is a stage of the same sort as E; and so in explaining how I produces R, both E and S refer to intervening neural stages and one or other of the symbols is redundant.

We have arrived on one horn of a dilemma, in which the special status of S disappears, and to avoid the discomfort this causes we must switch to the other horn. That is, to preserve the special status of S in this context we must claim that S is not a physical event governed by physical laws but a mental event not governed by such laws. What can this mean? That when E acts to determine S, the law of conservation of energy does not apply: Energy disappears from the physical world? Or that the neural acts that determine S do not dissipate energy? That when S acts to produce R it transfers energy from a mental into the physical world? Or that S produces physical effects, changes in the states and actions of neurons, without transferring energy to them? These are very difficult positions, and I shall leave it to those who support them to clarify and defend them.

It is clear that we cannot simply insert "S" into a causal sequence without acknowledging the problems and answering the questions that the assumption of an intervening interactive mental stage raises. But even if we were to assume for the sake of argument that these assumptions were not problematic, that we can postulate the sequence $I \rightarrow E \rightarrow S \rightarrow R$ without explanations being required, there would still be serious difficulties in any attempt to determine "inner psychophysical" functional relations that are not acknowledged by the article.

I have argued previously that Stevens's (1957; 1961) attempt to interpret direct scaling results as evidence for a "law" relating stimulus magnitudes to sensation intensities is flawed (Treisman 1961; 1962; 1963a; 1963b; 1964a, 1964c; 1985; 1989); that if we assume a sequence such as $I \rightarrow E \rightarrow S \rightarrow R$, and have experimental observations on the relation between I and R, these data cannot uniquely specify each stage in this sequence. If we determine the relation $R = f(I)$ experimentally, we cannot arbitrarily assign this relation to one or a subset of the intermediary stages above, such as $E \rightarrow S$, or $I \rightarrow S$, however much it might please us to do so. One can replace the relation f with an infinite number of triples ($f'' (f'(f'))$) representing the transformations from I to E, from E to S, and from S to R (i.e., $E = f'(I)$, $S = f''(E)$, $R = f'''(S)$), where the functions are so chosen that any one of these triples would be equivalent to $R = f(I)$. Thus, from the observed relationship between R and I we cannot derive a unique relation between S and I, or between S and E. This argument is ignored, not answered, by Murray's treatment. Let me illustrate the application of the argument to his discussion of lightness contrast. Consider a range of luminances in which we perceive the same contrast between two surfaces when the same objective ratio holds between the light reflected by each surface, whatever the absolute luminance level. The author of the target article is concerned whether this is determined by our perceiving a constant degree of contrast for constant ratios between sensations or for constant differences between sensations. But is this a substantive issue?

Let us suppose that in such a case we have somehow determined a scale of sensation $S = f(I)$ having such properties that if the contrast between stimulus intensities I_1 and I_2, on the one hand, and stimulus intensities I_3 and I_4, on the other, are judged to be the same, then $S_1 - S_2$ is equal to $S_3 - S_4$. That is, Murray would claim that equal contrast is determined by equal sensation differences. But it is fully open to us to substitute for S a new scale of sensation defined as $S' = e^S = e^{f(I)}$, *and on this scale it would be equally true that for equal contrast* S'_1/S'_2 is equal to S'_3/S'_4, that is, equal contrast would appear to be determined by equal sensation ratios. Whatever experimental predictions may be derived from the model containing S can equally well be derived from the parallel model containing S'.

Thus there is no substantive problem requiring us to decide whether the perception of constant contrast for the same objective ratios between luminances is determined by our perceiving constant contrast for constant ratios between sensations or for constant differences between sensations. The answer depends

Phenomenological Psychophysics (Kubovy & Gephstein) can be and the application of methods for the quantification of the constructs studied. .. Luce R.D., Krantz, D.H., Suppes, P. & Tversky, A. (). Foundations of measurement: Vol. 3. The application of Statistical Methods to the Problems of Psychophysics.Statistical. Methods for. Psychology. David C. Howell. University of Vermont. SEVENTH EDITION . An Additional ExampleA 4 3 2 Design x. Contents Heterogeneity of Variance: The BehrensFisher Problem . included material that will make the book a useful reference for future use. The instructor.The applications of psychophysical methodology to problems of practical utility are briefly described. Conditions affecting the amount of information in absolute judgments. Introduction to statistical analysis. Journal of Experimental Psychology, 43(3), pelatihanpengusaha.com; Garner, W. R. ().The Application of Statistical Methods to the Problems of Psychophysics. In R. Wagner (Ed.), Handworterbuch der physiologie. Vol. 3. (pp.).Table Analysis An Additional ExampleA 4 3 2 Design Heterogeneity of Variance: The BehrensFisher Problem . This seventh edition of Statistical Methods for Psychology, like the previous editions, sur- veys statistical included material that will make the book a useful reference for future use.Advances in Consumer Research Volume 1, Pages has been an increasing application of multidimensional scaling methods (MDS) to The problem he investigated was to scale the sensation magnitudes in terms of the Direct response methods in psychophysics such as magnitude estimation, "ratio" .Psychophysics quantitatively investigates the relationship between physical stimuli and the Psychophysics also refers to a general class of methods that can be applied to Psychophysics has widespread and important practical applications. the handling of a psychological problem, and at the same time stimulated my.psychophysical interest included such objects as weight, pitch, color, and METHODS IN. In , Fechner [3] proposed a logarith- rect scaling method advocated by Thurstone suggest that this is . statistical and nonstatistical criteria have that minimize the quantity Q = iproblem and uses ML estimation.A description is given of a psychophysical method that incorporates the beneficial features of the October , Volume 13, Issue 3, pp Cite as.Psychophysical methods are the tools for measuring perception and physically answerable question is to formulate the problem as a task that the observer . Page 3 Nowadays the idea is statistical; we know that the observer's probability of .. One can use the method of constant stimuli to measure performance as a.Logistic Modelssupport an alternative general solution to compute the point of subjective equality (Vidotto et al., I modelli simple logistic e rating.Chapter VIII: Statistical Methods Related to Test Construction and Evaluation. Show all authors. John C. Flanagan John C. Flanagan See all articles by this.One of the changes was to give the students research problems in the beginning of the course that were Other changes were to create a course webpage and to use more computer-based . 3. Theoretical frameworks .. The book Statistical Methods for Psychology by Howell () Howell, D. C. ().Remark on Statistical Testing, Key References 1~3. Outline, . Notation, First Method,

Difficulties, Second Method , Representation Problem for Extensive .. Signal detection theory is one application ofthe concepts .. involves a considerable amount of arbitrariness.Business fluctuations: Forecasting techniques and applications. Englewood Fundamentals of scaling and psychophysics. New York: Solving linear least squares problems by Gram-Schmidt orthonormalization. Bit, 7 .. In K. Enslein, A. Ralston, and H. S. Wilf (Eds.), Statistical methods for digital computers. Vol. III. (pp .Volume 3, pp. in A problem complex as this requires simplification and reduction that dates back to Fechner [3]. His idea since no statistical methods exist that allow for appro- . For many applications, the power law and the.Make research projects and school reports about Psychophysics easy with credible detectable change in energy (the measurement of resolving power); (3) the . Like the absolute threshold, the difference threshold is a fluctuating quantity, .. The Application of Statistical Methods to the Problems of Psychophysics.Psychophysical determinants of stress in sustained attention. Human Factors In S. Kotz & N. L. Johnson (Eds.), Encyclopedia of Statistical Sciences, Vol. 3. Problems with interval estimation when data are adjusted via calibration. Journal .Joreskog, K. G. Statistical Estimation in Factor Analysis: A New C. W. Mueller Factor Analysis: Statistical Methods and Practical Issues. Vol. 2. in Qualitative Applications in the Social Sciences. Beverly Hills: Sage Publications. S. Koch (Ed.), Psychology: A Study of a Science. Vol. 3. New York : McGraw-Hill.Psychophysical methods were used by pioneering researchers in the field . The application of psychophysical ratings in a clinical setting, .. Theory of statistical decisions and problems of modern psychophysics. .. In J. M. Brookhart & V. B. Mountcastle (Eds.), Handbook of psychology (Vol. 3, pp.).