

Review by R. Duncan Luce of MS 643 Psychophysical Interpretation for Utility Measures

(i) *Is the contribution of the paper potentially significant?*

I do not find this easy to answer because the MS seems to rest upon a very confused and very incomplete understanding of the relevant psychophysical literature. For example, I personally have worked extensively on an explicit psychophysical theory and behavioral predictions for the past decade including work on utility theory. In particular, see Luce, R. D. (2010)¹ and the general overview Luce, R. D. (2012).²

By the way, part of my problem may be due to the fact that the title is grossly misleading; it should be "Fechnerian Psychophysical Interpretation for Utility Measures".

(ii) *Is the analysis correct?*

I do not think so as I spell out below. Part of the reason is that the author seems to have a very poor and/or very incomplete understanding of the relevant psychophysical literature. For example, although He cites Luce and Krumhansl (1988) on p. 4, it seems clear that He did not understand the thrust of Luce & Edwards (1958)³, which L & K explicitly discussed (p. 63). They showed that Fechner's differential equation approach to his not tested hypothesis that subjective jnds are perceived as equal is, in general, incorrect. What Fechner did was to arrive at a functional equation, called Abel's equation when Weber's law holds, and attempted to transform it into a differential equation by replacing small differences by differentials. L & E showed that this yields the correct answer to the functional equation when *and only when* Weber's law is strictly true for which there developed considerable empirical doubt during the 20th Century.

In the utility case, the argument on the bottom of p. 4 leading to the second display on p. 5 (which should have been numbered) is far from clearly made. In any event, the data in Table 1 hardly seem to support that property.

Moreover, the claim just before Subsection 2.3.1 that "The logarithmic law should be generally suitable for utility scaling" is an overly large claim given the many psychophysical studies of the second half of the 20th Century that offer considerable support in many domains, e. g., audition and vision but not money, for power functions, which is equivalent to a simple testable behavioral property (Luce, 2012). For money, Luce (2010) derived three possible forms: proportional, exponential, and negative exponential functions which he interpreted as personality differences.

¹Interpersonal comparisons of utility for 2 of 3 types of people. *Theory and Decision*, 68, 5-24.

²Predictions About Bisymmetry and Cross-Modal Matches From Global Theories Of Subjective Intensities. *Psychological Review*, in press.

³The derivation of subjective scales from just noticeable differences. *Psychological Review*, 65, 222-237.

On p. 8, the “mathematical demonstration” seems flawed in many ways, not the least is the sentence right after (3) “Set $\frac{\sum (q_i - r_i)}{Q+a} = \lambda$.” The author has not shown that the expression on the left is a constant as this expression claims. Also, the role of differentials is not really defended.

On p.10, we learn that nearly 50% of the subjects run were discarded because they failed “to deliver complete valid data”, whatever that means. No psychologist would consider this a well designed experiment with such a high discard rate.

I find the explanation of the reported experiment to be quite obscure. I’m unsure whether it is just not clear what has been done or whether it is because the MS throughout is written in very, very poor English. It is mandatory that before a revised version is submitted anywhere that it be edited by someone with a far better command of the language than the author.