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COMMENTARY

Rating a New Hedonic Scale: A Commentary on ''Derivation and Evaluation of a Labeled Hedonic Scale'' by Lim, Wood and Green

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To the extent that our experiences of tastes and odors have underlying dimensions, one can mount a strong case that the expression of those dimensions is via hedonics (Scott and Mark 1987; Khan et al. 2007). The hedonic dimension is crucial in defining responses in the chemical senses in a way that is not true for other senses, in that all chemosensory stimuli are intrinsically valenced, either at birth (e.g., in the case of sweetness and bitterness) or as a result of our subsequent experiences with them (arguably the case for all odor qualities). Traditional psychophysics, developed primarily for studies in vision, audition or touch, asks questions about stimulus intensity, but this may be of less importance for taste or smell, which derive much of their meaning from their hedonic properties. Moreover, certainly in the case of taste qualities, our hedonic responses may provide crucial clues regarding the adaptive significance of those qualities. As such, the overall paucity of attempts to ''fine tune'' our psychophysical methods in relation to chemosensory hedonics is all the more puzzling.

Even in the tortoise world of psychophysics, the development of hedonic measurement has been startlingly slow. This may be because much of the interest in psychophysical measurement has been centered on addressing the question of how best to directly access perceptual processes, that is, to characterize sensory systems in psychological terms, which could then be usefully linked to underlying physiological processes. The importance of the development of the Labeled Magnitude Scale (LMS), first published in 1993 (Green et al. 1993), and later modified as the general (g)LMS (Bartoshuk et al. 2002), lies in the attempt to provide a means of scaling consistent with S.S. Steven's psychophysical model, which specified a relationship between physical stimulus magnitude and sensation in ratio terms. Magnitude estimation (ME), derived from the same theoretical base, enjoyed a period of application that has waned in recent decades. It has been suggested that the primary reasons for ME falling out of favor was both that people do not themselves consistently use numbers in a ratio fashion and also that the measurement process itself was unwieldy because of the prior training that was deemed necessary. Thus, the introduction of the LMS was timely, quickly being adopted by many psychophysical researchers, especially those hoping for a measurement free of the context of the stimuli under measurement (Bartoshuk 2000).

Accessing ''secondary states,'' including the hedonic evaluation of sensory stimuli, has been regarded as less important because it has been felt that the stimulus-affective relationship is less direct (although there is evidence that affective states might occur in the absence of perceptual awareness—see Kunst-Wilson and Zajonc 1980), has less to tell us about perception per se, and is further from being ''objective,'' in that affective states clearly show considerable individual variability (often, of origin unknown). Ironically, to date, one of the most common applications of the gLMS has been in the study of individual differences in perception, particularly in relation to oral irritation and 6-*n*-propylthiouracil bitterness (Bartoshuk 2000; Prescott et al. 2001; Green and Hayes 2003). One of the benefits of the gLMS is that, via the use of a supposed (and perhaps, in practice, actual) frame of reference external to the stimuli themselves, generated by the top-end label ''Strongest Imaginable Sensation of Any Kind,'' we can minimize the generally uninteresting variability associated with scale usage and maximize the quite interesting variability associated with individual perceptual or physiological differences. Affective states and responses are, of course, expected to show considerable individual

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variation. Even with the closest thing we have to a stimulus with universal positive valence—sweetness—populations can be divided according to hedonic optima (Yeomans et al. 2009).

Given increasing acceptance of the LMS as a sensitive and reliable scale, it is not surprising that a similar approach to scaling has been investigated for hedonic measurement. Lim et al. (this issue) report the development of a new scale—the Labeled Hedonic Scale (LHS)—that aims to provide an hedonic equivalent to the LMS. The key aspects of the research used to develop the LHS are, firstly, that the authors have addressed some of the potential weaknesses in the development of an earlier version of this type of scale, the Labeled Affective Magnitude (LAM) scale (Schutz and Cardello 2001). In particular, Lim et al. argue that the failure to provide training in ME for their subjects and the use of a rating context that included only food stimuli limited the comparability and applicability, respectively, of the LAM scale. Secondly, Lim et al. compared responses on the LHS with those derived from ME and the Natick 9-point hedonic scale (Jones et al. 1955), as had Schutz and Cardello. These specific comparisons are crucial in that they allow a judgment of the LHS in relation to the closest thing we have to a ''gold standard'' in ratio measurement, namely, ME and also with the standard scale for hedonics in applied settings.

Despite the equispaced labels of the Natick scale almost certainly providing at best interval measurement, its use has been almost ubiquitous in industrial settings, as much as anything through psychophysical inertia. Development of a hedonic scale with ratio properties—indeed, any advances in hedonic measurement—therefore has potentially important practical implications. The food industry has long recognized the need for reliable measures of hedonic states for the obvious reason that it has been thought that ratings of liking might predict food choices, despite the evidence for this being rather slim (see, e.g., Levy and Koster 1999). Hence, for the LHS to be useful, it should be psychophysically similar to ME (which the data suggest it is) and show some advantages over the Natick scale. The proof of the (''liked very much'') pudding is in the rating, and the LHS shows important properties in that it has, at least for the limited stimuli that Lim et al. used, greater sensitivity to stimulus differences than the Natick scale, particularly at the extremes of the scale. Thus, the LHS appears to address the 2 major problems that have beset the Natick scale, namely, a reluctance by raters to use the end categories (''dislike extremely/like extremely'') and compression of ratings when stimuli are similar to one another *and* lie toward those end points.

The LHS, like the gLMS, aims to avoid problems associated with extreme ratings on equal-interval scales through the use of end points—''Most (Dis)Liked Sensation Imaginable''—that effectively expand the gap between the final labels to cover all stimuli likely to be measured. This is unlikely to eliminate context effects entirely (see Lawless et al. 2000 for a study of context effects with the LMS) but may mean that the frame of reference for the stimuli under study is less influenced by rating scale behavior tied to idiosyncratic experience. Nevertheless, such top-end descriptors, although useful in terms of defining a context outside the range of stimuli under consideration, do raise their own issues, at least at a theoretical level. Thus, what constitutes ''strongest imaginable'' for hedonics? If you have experienced an intense hedonic event that is of a higher magnitude than I have (although, how would we know?), do we really have the same context of measurement? Or, even if we don't have the same *range* of experiences, do we *use* our extreme experiences, or merely the upper end of our distribution of common experiences, when rating? In other words, are what the scale asks you to do and what you actually do the same?

The use, per se, of labels that act as anchors, allowing interpretation of distances along the scale, may also be problematic because emotional expressions, especially with respect to modifiers such as ''extremely,'' ''moderately,'' and so on, may vary between individuals, and almost certainly between cultures. One can imagine, for example, that the French ''C'est fantastique!'' can be equivalent to ''Actually, that's quite good'' in (British) English, depending on the emphasis of the latter. A related issue arises from the assumption of symmetry of hedonic experience implied by the symmetry of the labels associated with likes and dislikes. We appear to be more sensitive to unpleasant events, to the extent that we can equate these events perceptually with hedonically positive events. Thus, for example, changes in bitterness that decreased liking had a greater impact on discriminability of food stimuli in a memory paradigm than did perceptually-equivalent changes in sweetness (Koster et al. 2004).

Whether such issues are actually important in determining the outcomes of LHS measurement of responses to chemosensory stimuli is a matter for further investigation, of course. In the meantime, such a development in hedonic measurement comes at an opportune time, as the need for recognized standards in measurement of hedonics is assuming greater importance in chemosensory neuroscience. The field of affective neuroscience has attracted considerable recent research interest (e.g., De Araujo et al. 2003; Gottfried et al. 2003; Small et al. 2003; Bender et al. 2009), perhaps motivated by a recognition that an evaluative process is a key purpose for the neural integration of odors and tastes. Despite the existence of naïve views that neuroimaging provides a pathway to an ''objective'' assessment of likes and dislikes (such views, it must be pointed out, are not present in the cited works), there is clearly no point in investigating the neurobiology of pleasure if you do not have a way of assessing the degree of ''subjective'' pleasure that is reliable and sensitive to differences across affectively laden stimuli.

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