Conventions of measurement in psychophysics: von Kries on the so-called psychophysical law

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Abstract—A translation of von Kries's (1882) paper 'On the measurement of intensive magnitudes and on the so-called psychophysical law' is accompanied by a commentary. Von Kries claims that intensive magnitudes are not measurable in themselves, because the establishment of an equivalence between different steps in a scale of intensity does not make any sense without further clarification. Where intensive magnitudes are determined in a domain of the natural sciences, he claims this is only a matter of counting, and of the measurement of temporal and spatial magnitudes. Every measurement of intensity should then be reduced to these operations by explicit conventions. Likewise, we can only speak of the measurement of sensations once we have established an arbitrary convention that determines what we will consider equal. The debate whether sensation varies with the logarithm of stimulus intensity, or in direct proportion to stimulus intensity, is then not a difference over matters of fact. Instead it is an empty dispute over words that is rooted in misunderstanding.

‘...de savoir, mais quoi, les lois de la conscience peut-être... que par exemple l'eau monte à mesure qu'on s'y enfonce et qu'on ferait mieux, enfin aussi bien, d'effacer les textes que de noircir les marges, de les boucher jusqu'à ce que tout soit blanc et lisse et que la connerie prenne son vrai visage, un non-sens cul et sans issue.’

Beckett (1951, p. 17)

The basic notion that a law of psychophysics is to be found or discovered is a confused notion, according to Johannes von Kries (1882). Talk of 'conceptual confusion' may come easily to modern psychologists, standing as we do in Wittgenstein's shadow, as von Kries stood in Kant's shadow. Our use of the term 'conceptual confusion' is informed by the last section of Wittgenstein's Philosophical Investigations (1953, IIxiv, 232e; which though much-quoted may bear repeating for clarity's sake):

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The confusion and barrenness of psychology is not to be explained by calling it a 'young science'; its state is not comparable with that of physics, for instance, in its beginnings. (Rather with that of certain branches of mathematics. Set theory.) For in psychology there are experimental methods and conceptual confusion. (As in the other case conceptual confusion and methods of proof.)

The existence of the experimental method makes us think we have the means of solving the problems which trouble us; though problem and method pass one another by.'

This is very much the charge von Kries levels against nineteenth-century attempts (specifically Gustav Fechner’s attempt) to discover a law of psychophysics. Likely von Kries would have levelled the same charge against twentieth-century attempts to discover a law of psychophysics, because ‘the influence of Fechner’s program on contemporary psychophysics is overwhelming, even though the favored terminology may have evolved somewhat.’ (Falmagne, 1985, p. 3). And if von Kries’s charge is cogent, then neither better physics nor additional mathematics nor improved experimental design will justify the search for a psychophysical law. Instead we must consider what we mean by a law of psychophysics, and why we ever sought a law of psychophysics.

Fechner (1882, pp. 321–324) published a reply to von Kries’s article; there Fechner quotes a page and a half of von Kries’s text (1882, pp. 273–274. In present translation the passage begins [I would like, to simplify matters in the following section...] and ends [The situation is exactly the same when people seek to establish the congruence of two different increments in sensation.] (Note i)). Then Fechner replies to von Kries’s charge that the search for a psychophysical law is confused or nonsensical. One of von Kries’s arguments is that it makes no sense for observers to estimate equal but distinct increments in sensation, that such estimates are the experimental subjects’ meaningless answers to the psychophysicists’ garbled questions. Fechner replies that Weber’s Law has been verified in experiment, using estimates of equal differences at various positions along a scale of stimulus intensity. Fechner adds that in the course of verifying this Law, no one became aware that such estimates are nonsensical. In other words, the existence of the experimental method makes Fechner think he has the means of solving the problems which trouble von Kries; though von Kries’s conceptual problem and Fechner’s experimental method pass one another by.

There is another issue on which problem and method pass one another by. Von Kries insists that [If we do not strike a convention then numerical data have no meaning, though one may still talk of much and little] (1882, pp. 293–294), and this is another of his contentions against Fechner’s method of psychophysics. The activity of measurement supposes that conventions of measure have been established. These are arbitrary in that conventions for a measure of length may involve a king’s nose and his extended arm, or else they may involve marks on a platinum-iridium bar in Paris, or else they may involve properties of the cesium atom. But these conventions are not arbitrary in the sense that a shopkeeper’s or customer’s whim should alter the conventions in the midst of a transaction over a length of cloth. Again Fechner (1882, p. 323, ff. 1) appeals to method to solve this problem: he calls those just-noticeable differences equal that are estimated (the verb is taxieren) as equal from sensation. Fechner says that this is no matter of convention. Von Kries intimates that the manner