

PSYCHOPHYSICAL TERMINOLOGY: SHOULD WE REGULATE IT?

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Abstract

The terminology in current use for perceptual matters is varied and often confusing, particularly for size and distance. The symbols used for psychophysical formulae are also not standardised. Uniformity would help to establish psychophysics as a recognised science.

The distinction between appearance and reality goes back to the earliest scientific and philosophical literature. Attempts to measure appearances, and to attach them to mathematical formulae, are more recent, and belong to the serious history of modern psychophysics. The varied origins of the literature has meant that a ragbag of different terms exists for similar concepts, and a wide range of symbols are used in similar formulae. Such a situation is not tolerated in the physical sciences. There are agreed symbols and terminology for most entities, as recommended by bodies such as the Symbols Committee of the Royal Society (1975). If psychophysics wishes to be regarded as a serious science, perhaps it should do the same. A few common psychophysical acronyms (e.g. DL, JND, PSE, SDT, TE) are listed by Kotyk (1999) in his guide for the life sciences, but the list is dominated by other types of psychology. The psychological body contributing to this document was the International Union of Psychological Science (IUPsyS).

The problem is particularly rife in the perception literature. Perceptual studies have a long history, part of which overlaps with philosophy (Ross & Plug, 1998). This has led to terminological confusion over several aspects of perception, but especially the perception of size and distance. Many examples of disparate terminology can be found in the recent book on the moon illusion edited by Hershenon (1989). Schönbeck (1998) points out that Hershenon's index does not include all the different words for physical and perceived size and distance that occur in the book. He criticises the contributors for using all sorts of undefined terms such as: distance, size, magnitude, diameter, enlargement, commensurability, continuous texture, essentially unbroken visual texture. Moreover, space can be Euclidean, non-Euclidean, near, far, absolute, mathematical, neural, haptic, tactile, perceptual or psychological; and the sun can be perceived, experienced, felt, observed or perceptualised. Such a wide spread of terms is not very helpful. Schönbeck, on the other hand, goes in for almost mathematical precision, and defines his meanings by lower and upper case letters and by subscripts and superscripts. This should be clear, but it places a strain on the reader in remembering what is meant. Perhaps a compromise could be reached, with a much smaller range of permissible terms.

Ambiguity of perceived size and distance terminology

The distinction between real and apparent (or perceived) size goes back a long way - as does the terminological confusion. 'Apparent size' is particularly confusing. The term was used by Euclid to mean both 'angular size' and 'perceived size'. Euclid (see Burton, 1945) maintained that perceived size was determined only by angular size: linear size could also be calculated at an intellectual level, but was not a primary percept. On the other hand, Ptolemy (see Smith, 1996) maintained that apparent or perceived size was similar to linear size, and that it was acquired by a quasi-geometrical combination (probably pre-conscious) of true angular size with perceived distance. This principle is now known as size-distance invariance, and is thought by many to be the basis of size constancy (see Ross & Plug, 1998). Two confusions are hidden here: 1) whether 'apparent size' is similar to angular or linear size; (2) whether 'apparent' refers to what is perceived at a primary level or what is consciously calculated at a secondary level.

In addition to the disagreements within perceptual science, there is disagreement between physical and visual scientists. Astronomers and physicists regularly use 'apparent' to refer to the physical stimulus at the eye (what some psychologists call the 'proximal stimulus'), and not to what is perceived. For example, Hutton (1796, vol.2, p.73) gave the definition that "apparent magnitude is that which is measured by the optic or visual angle". Similarly, 'apparent contrast' is used to describe the physical contrast of a stimulus at the eye after atmospheric attenuation, as opposed to the 'inherent contrast' of an object viewed at a very close distance (e.g. Middleton, 1958, p.69). Wheatstone (1852) was well aware of the ambiguity of the term 'apparent' and wrote : "I do not use the term apparent magnitude, because, according to its ordinary acceptation, it sometimes means what I call retinal, and at other times what I name perceived magnitude." This problem is not so acute with some other dimensions such as perceived distance, because there is no unambiguous 'retinal distance' that could be equated with 'apparent distance'. (There is, however, a hornet's nest concerning the meaning of a consciously or unconsciously 'registered' distance - e.g. Schwartz, 1994; Kaufman & Kaufman, 2000).

Since the term 'apparent' has been preempted by physicists to mean the proximal stimulus, perhaps it should be relinquished by psychologists in favour of 'phenomenal' or 'perceived' (e.g. Plug & Ross, 1994). Even so, ambiguities remain because there is no agreed meaning of 'perceived' size. Perceived size varies with the instructions (Gilinsky, 1955) - which can be angular, linear, something in between, or none of these; and with the method of measurement (Poulton, 1989) - which can be numerical estimates, matching to a variable target, drawings etc. It is therefore essential to specify the type of perceived size and the method of obtaining it. Adjectives to describe methods are fairly straightforward (estimated, matched, drawn etc), but those for types of size can be difficult because they are not free of theory. If the writer believes in perceptual size-distance invariance (e.g. McCready, 1985) he can describe the type of size as angular or linear, and add whether the instructions were to estimate/match the true dimension or the perceived dimension. If instead the writer believes that there is only one type of perceived size, he may be unwilling to classify it as either angular or linear. Disagreements over theory may prove a stumbling block for agreement on terminology.

Confusion of many symbols

The use of different symbols in mathematical formulae is not as serious as ambiguous language, because it is quickly obvious to anyone with any mathematical ability whether the formulae are the same. However, it is not obvious to many psychology students, and it would be helpful if the same symbols were used in common formulae such as Weber's law, Fechner's law and Stevens' law. Recent editions of perception textbooks and other sources show considerable variation (Table 1):

Table 1. Psychophysical notation in several texts

<i>Text</i>	<i>Weber's law</i>	<i>Fechner's law</i>	<i>Stevens' law</i>
Barlow & Mollon (1989)	$\Delta I = kI$	$S \propto \log I$	$S = kI^n$
Coren, Porac & Ward (1984)	$\Delta I = KI$	$S = K \log I$	$S = aI^n$
Goldstein (1989)	$JND = KS$	$P = K \log I$	$P = KS^n$
Goldstein (1999)	$JND/S = K$	-----	$P = KS^n$
Poulton (1989)	$K\Delta S/S = 1$	$R = K \log S + c$	$R = kS^n$
Laming (1997)	$\Delta X/X = \Theta$	$S = \ln X$	$S = aX^\beta$
Rebur (1995)	$\Delta I/I = k$	$\Psi = k \log S$	$\Psi = kS^n$
Sekuler & Blake (1994)	$\Delta I/I = k$	-----	-----
Sutherland (1989)	$\Delta I/I = K$	$A = k \cdot \log(I/I_t)$	$A = kI^r$

The way forward

These matters of terminology are of greater scientific importance than the worries of the American Psychological Association, the British Psychological Society (and many similar organisations) about whether male embraces female, or whether 'subjects' should be replaced by 'participants', or whether certain types of research are politically correct. Perhaps the International Society for Psychophysics could make some recommendations on terminology, and publicise them in its Proceedings and on its website. The terminology could be strongly recommended for papers in the Proceedings, and could be brought to the attention of the IUPsyS and editors and contributors to other relevant journals.

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