

FECHNER VS. BRENTANO: THEIR UNPUBLISHED CORRESPONDENCE ON PSYCHOPHYSICS

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Abstract

We present the first steps of our study of the correspondence on psychophysics between Fechner and the German philosopher and psychologist Franz Brentano (1838-1917), kept in Brentano's Nachlass and as yet unpublished. The criticisms already put forward by Brentano to Fechner and his psychophysics in 'Psychologie vom empirischen Standpunkt' (1874) were discussed in the correspondence which the two scholars maintained from May 1874 to July 1874 (4 letters: 2 from Brentano to Fechner, and 2 from Fechner to Brentano) and again from October 1877, straight after the publication by Fechner of 'In Sachen der Psychophysik' (1877), to January 1878 (7 letters: 4 from Brentano to Fechner, and 3 from Fechner to Brentano).

Fechner's *Elemente der Psychophysik* (1860) and the debate on psychophysics

The impact of the work *Elemente der Psychophysik* (1860) by Fechner on the late 1800 scientific community was considerable: for the first time in psychology there was a strict project of empirical and experimental research, based on the model of natural sciences, founded on and legitimated by the possibility of measuring mental phenomena. The model proposed in *Elemente* became that of reference: a model to criticize, correct or refute in its methodological foundations and to examine in its psychophysical, physiological or strictly psychological significance (Heidelberger, 1993; Mucciarelli & Antonelli, 1999; Murray, 1993; Zudini, 2009).

Following a model of measuring magnitudes, which goes back to Euclid and which takes up models and results previously obtained by Johann Friedrich Herbart (1776-1841) and Ernst Heinrich Weber (1795-1878), Fechner removed the main objections, put forward by Kant (1786), to the possibility of a scientific psychology. Indeed, with his psychophysics, he proposed a first quantitative methodology for psychology even if the philosophical basis for the theory, the "identity view" of body and soul, was accepted with difficulty.

The "identity view" (*Identitätsansicht*) of body (*Leib*) and soul (*Seele*) seen as two sides of the same coin, the functional conception of their relationship and the consequent possibility of a mental measurement based on the concept of "just noticeable difference" (*eben merklicher Unterschied*) became the subject of lively debate right from when Fechner first proposed his psychophysical model.

When not dealing with total refusal of the model, based on the impossibility of measuring sensations and more generally mental magnitudes, the discussion centred on two main questions: the first dealt with the correctness of the (empirical and mathematical) procedures through which Fechner had come to establish the "fundamental formula" (*Fundamentalformel*) and the "measurement formula" (*Maßformel*) as well as to derive the

latter from the former; the other concerned the very nature of Fechner's law, that is, its psychophysical, physiological or strictly psychological value.

Very many scholars, from the most varied academic backgrounds, came together to discuss the "Fechner case"; the ensuing debate was particularly lively in the "mitteleuropean" cultural world (with links as far as France and Belgium) and generated ideas and concepts destined to have rich developments in the psychological context and more generally in the 1900 scientific world. Hermann von Helmholtz, Ewald Hering, Ernst Mach, Wilhelm Wundt, Franz Brentano, Joseph Antoine F. Plateau, Joseph Delboeuf were just a few of the great scholars who dealt with psychophysics and generally the problem of measurement in the psychological field, affording original contributions which are still valid in the scientific world.

The criticisms of Brentano to Fechner in *Psychologie vom empirischen Standpunkt* (1874)

Among the first to take part in the debate was the German philosopher and psychologist Franz Brentano (1838-1917) who dealt with Fechner's psychophysics in his main work *Psychologie vom empirischen Standpunkt* (1874). The two scholars held each other in great esteem. The Fechner and Brentano families had long been linked by friendship; for example Brentano's aunt, Bettina von Arnim, had been a regular guest in the Fechner household at Leipzig since 1836 (Heidelberger, 1993). Brentano admired Fechner greatly and, while writing *Psychologie*, studied in depth *Elemente*. In November 1873 he travelled to Leipzig to meet Fechner personally and offer him his criticism on psychophysics which he would shortly publish in *Psychologie* (Brentano, 1989).

Brentano demonstrates generally an open approach with regard to psychophysics while at the same time subjecting it to close examination and criticism and highlighting its limits. Brentano's criticisms deal with, on the one hand, the legitimacy of the argument of the just noticeable difference as a unit of measurement in the mental field, and on the other, with the theory of the functional relationship between stimulus and sensation (Antonelli, 1999).

For Brentano, Fechner's law is based on the argument – not demonstrated (and not corrected) – according to which the just noticeable differences, being magnitudes of constant value, represent the unit of measurement required for the measurement of sensations. Brentano objects that such differences can only be said to be equally noticeable (*gleich merklich*), or rather noticeable with the same ease, but not that they are equal (*gleich*) in an absolute sense. Equally noticeable, therefore, are not the increments of sensation of equal size but the increments which are "unlike between themselves to the same degree" – or rather which are in a same ratio in the comparison of the sensation which undergoes the increase. In other words, equally noticeable, or noticeable with the same ease, are not the increments which are absolutely equal, but the increments which are relatively or proportionally equal (Brentano, 1874, *PeS* I, p. 97f.).

Having once established that the just noticeable increments are equally noticeable, it is a case of understanding the type of existing ratio between such increments. Brentano maintains that every increment is equally noticeable if it is in a constant ratio to the sensation to which it is added, that is, the ratio of the sensation to its increment must be constant in order that, according to this rule, an increase or decrease may be noticed (*bemerkt*).

Thus, in the analysis of the psychophysical principle, the task, according to Brentano, should be divided into two parts – one being the field of the physiologist, the other of the psychologist (Brentano, 1874, *PeS* I, p. 11). Their synthesis leads to a single proposition by which equal relative increments of sensation correspond to equal relative

increments of physical stimulus. Brentano proposes, therefore, two “laws” concerning respectively the physiological and psychological level:

1. if the relative increment of the physical stimulus is equal, then the sensation increases by equally noticeable magnitudes;
2. if the sensation increases by equally noticeable magnitudes, then the relative increment of the sensation is equal.

The synthesis of these two principles leads to the following psychophysical principle:

3. if the relative increment of the physical stimulus is equal, then the relative increment of the sensation is equal. In other words: *if the intensity of the physical stimulus increases by the same multiple, then also the intensity of the sensation will increase by the same multiple* (Brentano, 1874, *PeS I*, p. 98f.).

The “same multiple” does not necessarily mean identical multiple: it would be enough, says Brentano, that whenever the stimulus grows by one half, the sensation increases by one third. The hypothesis of “identical multiple” (that is, a direct proportionality between stimulus and sensation) could be valid in principle but, according to Brentano’s view, it lacks experimental confirmation (Brentano, 1874, *PeS I*, p. 99).

In brief, according to Brentano, equal ratios between the stimuli produce equal ratios between the sensations. In mathematical terms, while Fechner, moving from the differential equation

$$d\gamma = k \cdot \frac{d\beta}{\beta}, \quad (1)$$

obtains the logarithmic measurement formula

$$\gamma = k \cdot \log \frac{\beta}{b}, \quad (2)$$

where γ represents the sensation and β the stimulus, while k is a constant dependent on the sensorial modality and b is the threshold value for the stimulus (Masin, Zudini, & Antonelli, 2009),

Brentano starts from the differential equation

$$\frac{d\gamma}{\gamma} = k \cdot \frac{d\beta}{\beta} \quad (3)$$

and arrives at the measurement formula

$$\gamma = \left(\frac{\beta}{B} \right)^k, \quad (4)$$

where B represents the value of the stimulus to which a unit value of sensation taken at will corresponds.

In this way, Brentano obtains a power function as a psychophysical law, comparable to that proposed by Joseph Antoine Ferdinand Plateau (1801-1883), a Belgian physicist, professor at the University of Gand, regarding experiments on bisection of intervals (Plateau, 1872; see also Plateau, 1875), which came back into favour about a century later in the psychophysics of S. S. Stevens (Stevens, 1957). Both Brentano and Plateau, in effect, support that which Fechner himself in a posthumous work of 1888 defines as the “hypothesis of ratio” (*Verhältnishypothese*), attributing it to these two scholars and setting against his own (and Wundt’s) “hypothesis of difference” (*Unterschiedshypothese*) (Fechner, 1888, p. 174).

The correspondence between Fechner and Brentano (1874-1878)

Brentano also put forward his criticisms to Fechner in the course of their unpublished correspondence which lasted from May to July 1874, immediately after the publication of *Psychologie vom empirischen Standpunkt*. After a pause of more than three years the exchange was taken up again when Fechner published *In Sachen der Psychophysik* (1877) and lasted from October 1877 to January 1878.

The correspondence between Fechner and Brentano contains altogether 11 letters. The first period of correspondence lasts from May to July 1874 and comprises 4 letters of great length: 2 from Fechner to Brentano, respectively of 27.5.1874, and 2.7.1874, and 2 from Brentano to Fechner, in reply. The second exchange lasts from October 1877 to January 1888 and comprises 7 shorter letters: 4 from Brentano to Fechner, respectively of 9.10.1877, 25.10.1877, 31.12.1877, and 10.1.1878, and 3 from Fechner to Brentano, respectively of 20.10.1877, 28.10.1877, and 8.1.1878.

In Brentano’s *Nachlass*, held at the Houghton Library at Harvard University, the originals of Fechner’s letters to Brentano and the rough drafts of Brentano’s letters to Fechner are preserved. The main discussion in the correspondence is psychophysics but numerous other subjects of a psychological nature are dealt with such as, for example, the relationship between representation and judgement.

Fechner replies in his letters to Brentano’s criticisms and in the letter of 27.5.1874 he contests first of all the revision of the psychophysical law proposed by Brentano, considering it not as a simple correction but as a “subversion” (*Umsturz*) of the fundamental principle proposed by Weber: it does not consider the threshold condition and introduces a completely different model of the increase of the relationship between stimulus and sensation.

According to the logarithmic law proposed by Fechner there are, in fact, positive values of stimulation which negative values of sensation correspond to, while, according to Brentano’s power law, positive values of sensation always correspond to positive values of stimulation. In this sense, Brentano’s principle does not take into account the threshold condition and precisely for this reason Brentano prefers a power function (Antonelli, 1999). The logarithmic function would in fact contradict one of the basic arguments of his psychological theory, i.e. that unconscious mental phenomena do not exist.

Brentano does not deny the existence of a sensorial threshold, but gives a completely different meaning to such a concept from that given by Fechner: the value of the threshold is the stimulus value B (see Formula 4) below which no sensation is produced.

Brentano adds other remarks to this basic criticism in the ensuing letters. These remarks are to be found already in part formulated in *Psychologie vom empirischen Standpunkt*. First of all, he maintains that the psychophysical principle has no value for mental phenomena whose antecedents are physical phenomena which take place inside our organism, or other mental phenomena; further this principle does not take into account the fact that the sensations do not depend only on the intensity of the physical stimulus but also

on exclusively psychological factors, as, for example, the degree of attention. Finally, that which psychophysics exactly measures are not, in Brentano's terminology, mental phenomena but physical phenomena: psychophysics measures, for example, sound (which for Brentano is a physical phenomenon) but not the act of hearing (i.e. the corresponding mental phenomenon) which takes the sound as its intentional object; it measures colour but not the act of seeing (colour) etc. It is only indirectly, then, that also the intensity of corresponding mental phenomena is measured (Antonelli, 1999).

The correspondence between Brentano and Fechner is taken up again in 1877, following the publication of the volume *In Sachen der Psychophysik* (Fechner, 1877), in which Fechner replies to the criticisms in the meantime levelled at his psychophysics by scholars such as Brentano, Helmholtz, Mach, Plateau, Delboeuf, and Hering. The discussion between Brentano and Fechner, in this second phase of correspondence, loses, however, a good deal of its liveliness: neither of the interlocutors appears willing to make the least concession to the other.

Two new elements are, all the same, introduced into the debate by Brentano. First of all, he formulates the thesis according to which intensity cannot in any way be defined as a magnitude in proper terms; this is a theory which in *Psychologie vom empirischen Standpunkt* of 1874 he had not yet formulated. In line with the new theory of sensation that in the meantime he had developed, intensity is, for Brentano, a function of the quantity of the phenomenal space filled by a specific sensitive quality. Equally significant is the favoured method by which the psychologist must identify the parts of consciousness and their way of connecting, that is, the dimension of "noticing" (*Bemerken*).

The detecting of the differences between sensations, which is at the basis of psychophysics, can only be carried out by an act of noticing, which, in Brentano's view, is a judgement and not a process of sensorial nature, as maintained by Fechner. In order that such a difference may be explicitly noticed, it is necessary for it to go beyond the "threshold of noticing" (*Schwelle des Bemerkens*).

Brentano highlights in this way a dual threshold in the process a) *stimulus* – b) *sensation* – c) *detecting of differences between sensations*: there is not just the threshold that a difference between two stimuli must overcome to produce a difference between two sensations, but there is also a threshold that the difference between sensations must pass beyond in order that this very difference may be noticed. Such an idea leads to a psychophysics of the judgement function and more generally of higher mental processes which was taken up again by Carl Stumpf in his *Tonpsychologie* (1883-1890).

Conclusions

Generally speaking, despite applauding Fechner's research, Brentano, in his *Psychologie* and in his correspondence with Fechner, is led to relativize the importance of the Fechnerian psychophysical principle: even if correct, the psychophysical law is irremediably defective and less comprehensive than that which Fechner claims. In Brentano's view, Fechner had tried, with his law, to make possible scientific exactness in psychology to raise it to the rank of an exact science but he has only been partially successful.

Brentano's criticism deals with the methodological level of psychophysics and that of psychology itself: experimental psychology cannot achieve exact laws, as Fechner claims, but only "empirical laws", given that physiological antecedents of mental phenomena are still little-known and too complex and therefore unable to be measured with precision.

The impossibility of an exact psychology is presented, therefore, as an impossibility linked to the present state of our knowledge and not as an impossibility in principle. Seen from this point of view, Brentano does not refute totally the possibility of a

mathematization of psychology but believes in the applicability of statistical methods to psychology, which Fechner employs in his works.

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