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From Number Mysticism to the Maßformel: Fechner's Psychophysics in the Tradition of *Mathesis universalis*.

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ἀριθμὸς αρχὴ πὰντων - Number is the origin of all things. The enthusiasm for numbers is the origin of the occidental tradition of science. It became the *Leitmotif* in our attempts to understand nature theoretically, i.e. within the framework of natural science.

The history of psychology often refers to an event that is strongly related to this enthusiasm for numbers: Gustav Theodor Fechner's sudden insight on the 22nd of October 1850. According to Fechner, he was still in bed when he had a sudden insight of a world in which body and soul, mind and matter, find their mystic unity within number. In this vision, „an expression of the real interrelation of soul and body can be gained from the schema of geometrical series."

Pythagoras must have had a similar experience when he passed by a blacksmith's shop and recognized the musical intervals in the sound of the hammers: the octave, the fifth, and the fourth. Weighing the hammers, he found that their weights stood in a relation of 12:9:8:6. At home, he re-examined this observation using strings, which he stretched with weights of the same proportions. These strings, as well as investigations of other instruments, confirmed his observation. It is a nice story, handed down to us by Iamblichos. It demonstrates that it is possible to find the unity behind diversity, to find simple and invariant regularities behind the manifold of appearances, which can only be expressed in numbers, and that the subjective qualities of tones too have their origin in the relations between numbers. In the presence of these facts, we may generously overlook that physical realities alone call into question the authenticity of this anecdote.

In physics, the *Leitmotif* of strongly connecting the development of theories to the 'Quantitative' originated in Pythagoras and subsequently evolved over a long period. However, in psychology this Leitmotif presented oneself quite suddenly. In 1860, Fechner declared in an authoritative tone:

"As a matter of course, we cannot in general deny that the mind is subject to quantitative principles. This is because apart from distinguishing stronger and weaker sensations, we can also distinguish stronger and weaker intensities of drive, higher and lower degrees of attention

or vividness of recollections and fantasies, as well as different stages of consciousness and different intensities of individual thoughts. … Consequently, the higher mental processes can - in much the same way as sensory processes - be measured quantitatively, and the activity of the mind can be measured quantitatively in its entirety as well as in its components."

The man who formulated this statement was an experimental physicist, who had already gained a reputation for his achievements in electrophysics. He was a private scholar of philosophy with his head in the clouds and almost the caricature of a savant in his personal habits. He was a wandering spirit - incessantly writing, pondering and writing, as a slave to the themes that had captured his attention and that dominated and compelled him to the point of total exhaustion. His biographer and nephew Emil Kunze describes him as "genuine and earnest", as a deeply sensitive natural mystic attempting to find the wholeness in all things. As he wrote in a letter in 1825, he wanted to see the wholeness whilst looking at the details. Fechner felt a deep distrust for Bacon's *dissecare naturam*, and was against the dissection and decomposition of nature, where the components of natural phenomena were isolated to fit into a theoretical system in order to comprehend the original order behind the diversity of phenomena. With his metaphor about light, Fechner describes his idea of distinguishing a *"Day Perspective"* from a *"Night Perspective"*. He stresses the importance of the *"Day Perspective"*, in which "sensual phenomena form a unity of immediate experience". He would not accept the platonic concept of reason being superior to the senses. The *"Night Perspective"* was equivalent to an estrangement from sensual experience. He did not search for some abstract truth behind sensual phenomena, but he wanted to comprehend the phenomenal order that is inherent to our conscious self, and he tried to achieve it by applying inductive methods and drawing conclusions from analogies. For him, the *"Night Perspective"* was equivalent to the partition of a unity and the estrangement of abstraction, and he compares it to the "search of the mirror-image behind the mirror".

Fechner's zeal was to reconcile opposites and to reunite estranged parts, as for example natural science and religion, the *"Day Perspective"* and the *"Night Perspective"*, the inner and outer side of nature, and the objective and the subjective perspective. Quite like Goethe, he opposed a characteristic feature of natural science, namely the disintegration of nature, its idealisation and utmost abstraction that serve to estrange it from its original phenomenology.

Can we – taking Fechner's real concern seriously – place Fechner's psychophysics in the tradition of *Mathesis universalis* at all? Would this not amount to ignoring his dearest ambition, trying to fit him into Procruste's bed of tradition, which actually constitutes the opposite of Fechner's fundamental metaphysical position? – Yes, it would, and what's more: *Any* categorization along the lines of previous traditions would wrong Fechner because it is, frankly speaking, utterly impossible to respect all of Fechner's facets. Whatever we do to squeeze the whole Fechner into the bed of any tradition – at least half of him would always end up sticking out of the other end.

Fechner contemplated many traditional philosophies at the same time. However, even with various references to previous traditions, his reception of philosophy and general academic conception was not very pronounced. In a rather eclectic way, he selected from various sources whatever he deemed suitable for constructing his personal vision of wholeness. He knew about his eclectic and syncretistic approach to philosophy and therefore rejected the title of a philosopher for himself.

Among the wide range of ideas that Fechner contemplated, one philosophy stood out: the idea of the *Allbeseeltheit* (the animation) of the universe - reaching from Thales, Plato, Aristotle, and the Stoics to Leibniz. Fechner rejected mechanistic-materialistic concepts, especially the reductionistic program of establishing physiology on a physico-chemical footing, as proclaimed by Carl Ludwig, Hermann von Helmholtz, Ernst von Brücke and Emile du Bois-Reymond in 1847. In the same year, Carl Vogt presented a thesis that indeed must have sounded quite frivolous to Fechner - "that all those capabilities we subsume under the name of soul-related activities are merely functions of the brain. Or, to speak boldly, the relation between thoughts and brain is of the same nature as the relation between bile and liver, or between urine and kidneys". Nevertheless, his idealistic position was inconsistent enough to allow him to accept that the body is the bearer, the foundation and the organ of the soul. Like Leibniz, Spinoza and many others before, Fechner was convinced of a monistic concept of reality; like Leibniz, he saw a continuum between perception and apperception. Although he shared Leibniz' view that the death of a human being was a transition from an appercepting to a sleeping monad, where man descends down to the lowest stage of the hierarchy of monads, he however rejected Leibniz' philosophy in general. This syncretistic approach is typical of Fechner – it was only towards Spinoza that he felt a strong affinity. If one tried to follow Fechner's references in the intellectual history, one would have to traverse *philosophia naturalis*, the philosophy of religion, mysticism, and romantic theory of nature, in all directions.

I will content myself with mentioning Fechner's contact with natural philosophy, because this will provide us with some insight on his approach to the development of his *Maßformel*. In February 1820, Fechner became acquainted with Lorenz Oken's romantic philosophy of nature, a biologist among the natural philosophers, whose personality as well as his works held a great fascination for the public at the time. According to Fechner's diary, the natural philosophy of Oken "filled me with such enthusiasm that it influenced my thinking for a long time. … In my view a new light had dawned upon the entire world and the sciences of the world, and I felt like dazzled from this light."

In Oken's work, we find many things that influenced Fechner in the development of his number mysticism. For Oken, mathematics was the mother of sciences; its fundamental principle is the "Zero = 0". The universality of all sizes, numbers and figures is potentially present in the Zero. The potential that is intensive and ideal in Zero becomes extensive and real in the actual number. In becoming real, the Zero will be divided into plus and minus, into "postulation" and "negation", into positive and negative. By way of postulation and negation

– setting the numerical series 1 + 2 + 3 … + n accordingly – God transforms into plus and minus, while he remains the 'no-thing-ness', and therefore himself.

To our ears, such attempts to rationalize mystic experience seem to resemble merely an aberration of language. Within the obscurity of such number mysticism we can, however, find thought figures related to numerical series that inspired Fechner to develop his *Maßformel*.

"I was dazzled with these ideas," he writes, "for sure I did not comprehend all of it, but suddenly I had the notion of a great united *Weltanschauung* (world view)." Thus, he adopted this holistic perspective while at the same time abandoning the concept of romantic natural philosophy. In his diary he noted, "Natural science lies out of this line", and continued, "gradually, I was lead into a path of more perspicuous thought, since it occurred to me that this might be the only way to obtain transparent, correct and fruitful results in natural sciences. … Nevertheless, I still believe in the one-ness of nature and its spiritual animation."

Oken's number mysticism still resonates in Fechner's major philosophical work *Zend-Avesta. Oder über die Dinge des Himmels und des Jenseits (Zend-Avesta. Or on the Things of Heaven and the Hereafter*, published in 1851. The short supplement *Kurze Darlegung eines neuen Prinzips der mathematischen Psychologie (A Short Introduction to a New Principle of Mathematical Psychology)* already contains Fechner's idea about the *Maßformel*, and thus the core element of his psychophysics. Following his typical way of analogizing, he compares the body with a numerical series of higher order and the soul with a numerical series of lower order. Henceforth, the activities of the soul are less complex than the corresponding material processes. In mathematical terms, the "soul is acting inside the body" according to the simplest laws of numerical series, whereas the series of higher order represent the more complex physical organisation. All series, however, are "made of the same material".

The number series quite fascinated Fechner, because to him they seemed to reflect the relation between part and whole, between the superior and the inferior, and the dynamic change between higher and lower levels of complexity in the organisation of the world. In the course of this, it was almost inevitable that Fechner hit upon logarithms. He considered logarithms to provide a suitable base for his idea that all that exists can be conceived in terms of numerical series. The logarithmic tables became Fechner's daily lecture and, according to Stanley Hall, almost his evangelism. These tables suited him perfectly, since he had a liking for calculating, and, according to his own description, "entirely lacks the talent for mathematics".

This was the ground from which Fechner's psychophysics was to emerge. From there, however, we have some more work to do until we can finally incorporate psychophysics into the tradition of *Mathesis universalis*. On our way, we must neglect Fechner's comprehensive metaphysical perspective and instead single out an isolated element, which we will investigate separately.

Of course, Fechner's way of mingling natural-scientific methodology with animistic and teleological concepts, with number mysticism and mystic cosmology, hardly differed from

that of other great scientists. Newton, for instance, was an enthusiastic and devoted alchemist who, at nighttime, conducted experiments in order to transmute metals and enciphered the results in a secret code afterwards. Another example is Kepler, who wrote in his *Harmonice Mundi* about number mysticism and investigations into the harmony of celestial bodies and the music of the planets. Apparently, the metaphysical abstemiousness of a scientist like Galileo ought to be regarded as rather exceptional in the history of natural sciences.

However, the course of development of the natural sciences tends to dismiss the intentions and passions of those who contribute mostly to their advancement. The alchemy of Newton did not persist and neither did the spherical harmony of Kepler. The course of history follows its own logos, advancing the ideas that are to last – i. e. ideas that increase the explanatory depth and width of theories – and eliminating those that are idiosyncratic. Likewise, Fechner's metaphysical worldview was a highly idiosyncratic mixture of rather disparate traditions, and therefore dismissed in subsequent developments.

In the history of psychology, however, Fechner remains unrivalled in his vigorous combination of mysticism and sober experimental methodology. Here, we have two irreconcilable ways of gaining an understanding of ourselves. Ever since man has transformed himself into the subject of his theoretical curiosity, he has been pondering over possible ways to uncover the truth about himself. Among the many ways to examine the very nature of the human mind, two stand out in the radicalism and totality of their scope: firstly, mysticism, which intends to reveal the depth of the soul by means of contemplative introspection. Secondly, natural science, which regards the human mind as a natural object and attempts to comprehend it from without, as it were, i.e. from a perspective of objectivity.

Fechner was determined to follow both ways at the same time; he wanted to combine and reconcile instead of deciding in favour of one of them. His attempt to reconcile modes of understanding that are irreconcilable entailed the consequences that, according to the appropriate characterization of Gerd Mattenklott, "a permanent crisis was the psychic presupposition for achieving his individual productivity." It must have been tragic for him to see that history acknowledged only those aspects of his philosophy that he himself regarded as mere vehicles to convey his views, and which were not the core of his philosophy. His actual core believes, on the other hand, came to be rather ignored in the course of further developments, much like the alchemy of Newton.

In his radical combination of mystical philosophical views with the scientific research methodologies of the natural sciences, Fechner represents indeed a discontinuity in the history of psychology. However, this discontinuity is often misrepresented in the conventional history of psychology, because the seeds for the establishment of psychology as a natural science had been sown a long time before Fechner, especially in the the study of perception.

A thousand years ago, the Arab natural philosopher and mathematician Alhazen developed the idea of the *unconscious inference* – a central concept of perceptual theory, which has been given a precise formulation in current Bayesian approaches to perception. Alhazen recognized

that the process of visual perception cannot solely be understood on the basis of the geometrical processes involved. Rather, he assumed that non-geometrical mental operations have to be involved. Alhazen, whose work was well-known to natural philosophers of the 17th century, provided a detailed description of corresponding psychological mechanisms, which he regarded as occurring so rapidly that we were not able to recognize them. Philipp Melanchthon, who was probably the first to have used the term *psychology* 500 years ago, regarded psychology as being part of *pneumatology*, the theory of spiritual beings, and therefore as being part of the *philosophia naturalis*, which is the science of all natural things.

Likewise, most authors of the 18th century regarded psychology to be a natural science. Hume, for instance, pursued an entirely naturalistic approach to psychology and regarded his methods and his concept of explanation as equivalent to those of Newton. He even imagined himself to be the "Newton of psychology". In the 18th century, quantitative studies were common practice – especially in the field of perception. Carus listed in his *History of Psychology*, published in 1808, more than 120 authors of the 18th century, who made quantitative observations in attempts to deal with theoretical problems. Additionally, many systematic experiments on psychological issues had been carried out: In the year 1756, Johann Gottlob Krüger, for instance, outlined in his work *Versuch einer Experimental-Seelenlehre* (*Essay on an Experimental Theory about the Soul*) an experimental approach to psychology, whilst eschewing metaphysical aspects. There, he deals with the illusion that the moon appears much larger on the horizon than in the zenith of its orbit. Krüger found out that, while keeping the retinal image constant, the perceived distance had an influence on the perceived size.

To put it briefly, in the course of the gradual differentiation of psychology as a natural science, Fechner did not represent a discontinuity at all. It rather was another aspect that accounted for his unique position in the history of psychology; in a more radical fashion than anyone previously, Fechner oriented towards the question of whether mental events could, in a precise sense, be measured quantitatively.

By this time the motive of a comprehensive quantification already had reach a point of culmination as a guiding idea for the development of theories in physics. Due to the great achievements of physics, each of the other natural sciences tended to define its state of maturity according to its potential to express its concepts in quantitative terms. While psychology was in a position to boast of interesting regularities and laws, it was, however, denied the status of a natural science for principled reasons: Due to an apriori prejudice the psychic was not regarded to be amenable to investigation by quantitative methods.

Before examining Fechner's solution to this problem, let us briefly return to Pythagoras in order to investigate the quantitative in its relation to the qualitative in the history of natural science. This will then lead us to *Mathesis universalis*, and finally to Fechner's *Maßformel*.

Already Pythagoras had been fascinated by the similarity between numbers and certain relations in the real world, especially in acoustics and celestial mechanics. Greek philosophers

discovered that through the abstraction of numbers we could arrive at conclusions about the real world, and this with a precision that real conditions could never have provided. The most important step, however, was the transition away from merely operative counting and calculating towards the question "What *is* number?" This transition led the Greek philosophers to the development of a theoretical concept of number and to the conclusion that their conception of number is subordinate to the concept of magnitude. Those two concepts – number and magnitude – represented the fundamental roots of natural-scientific and mathematical thinking. From this basis, both mathematics and physics evolved, and the theoretical success of physics can be entirely attributed to the fact that it tied itself to mathematics.

In physics, the classic separation between quality and quantity had dwindled early due to a continuous redefinition of these terms. Differences in quality were attributed to differences in quantity, i.e. differences in geometrical structure or in number.

The Pythagorean idea to seek the unity of the world in an abstract harmony had generated a new ideal for the conquest of knowledge. This ideal lasted throughout Western history of ideas. It recurred in the work of Cusanus, who emphasized that amongst all the symbols, of which the human mind is capable of conceiving, only mathematical symbols achieve ultimate certainty. Cusanus etymologically linked the term 'mens' (mind) to the term 'mensura' (measurement), therewith expressing a belief that Kepler later concretized: in the same way as the eye strives towards colours and the ear strives towards tones, human mind strives towards gaining knowledge of the quantitative.

According to this *Leitmotif*, which dominates the entire history of Western philosophy, the human mind was able to conceive order behind the world of phenomena postulated only knowledge of the quantitative. This idea that the unity of principles behind the multitude of appearances can only be revealed by way of gaining knowledge of the quantitative finds its symbolic culmination in the 23-year-old Descartes who, in his famous dream on November 10th in 1619, had the vision to unite all of natural science under the roof of mathematics, formally uniting all principles of nature in a *Mathesis universalis*. In his work *Regulae* Descartes describes this enterprise: "I came to see that the search for order and measure belongs to this *Mathesis*, whereby it is absolutely irrelevant whether this measure is expressed in numbers, figures, celestial bodies, tones, or any other objects whatsoever."

This *Leitgedanke* of a universal theory of magnitudes and relations, in which the natural sciences, in their process of differentiation and dissociation from immediate experience, ought to form a methodological unity, has since been a characteristic of the development of modern natural sciences. The *Mathesis universalis* – which Max Bense appropriately characterised as "generalized mathematics of non-mathematical objects" – became a *Leitfigur* that shaped the entire tradition of modern natural science and its ties to mathematics from Pythagoras, Kepler, Descartes, Leibniz and Newton.

Now, which place can we assign psychology within this tradition? Is it not all too obvious that the *architectus divinus* has precisely not subjected the human mind to the regularities and laws of other natural sciences, which in fact render possible their mathematical treatment in the first place? Is it not – lets once more word the traditional philosophical prejudice – exactly the dichotomy between quality and quantity that is the landmark of the difference between the physical and the psychological? Or has the mental also been organised, in line with the scriptural statement of Wisdom of Solomon 11.21, *in numero et mensura et pondere*, according to number, measure and weight?

This is where Fechner's significance in the history of psychology is most striking. He was the first to radically formulate the question of the measurability of sensations, simultaneously developing operative methods to verify it empirically. In contrast to all those before him who held that the nature of all knowledge is mathematical and that all things are tied together by numerical relationships, he insisted on proving the correctness of this approach by empirical studies. Like Kepler, Fechner was a mystic, prepared to subject his metaphysical speculations to empirical evaluations, or to discard them if they failed to stand the test in the field of observations and facts.

In order to achieve his goal of finding "a measure for sensation", however, Fechner needed a unit of measurement that enabled him to express the magnitude of a sensation in terms of a "multiple of the same". He based his search on the assumption, that we are able to make judgements about the "equality in the field of sensation". According to him, a basis for this measure must not necessarily belong to the realm of the psychic, because "it will never be possible to juxtapose two sensations in a way that one can be taken as a measure of the other. However, it is possible to arrive at a measure by taking advantage of physical entities to which sensations are intrinsically tied as is the length of a yard to the matter of a yard." Fechner found this physical entity in the equation he named "Weber's Law". Even if in the realm of the psychic the mathematical operation of adding values was impossible, one can, according to Fechner, find a measure by counting the numbers of just noticeable differences above the absolute threshold. By taking the just noticeable difference as a unit of measurement, Fechner derived from Weber's law his "Massgesetz der Empfindung" and his "Unterschiedsmaßformel", according to which the magnitude of sensation was proportional to the logarithm of the physical magnitude of the stimulus related to its threshold value.

No doubt, the assumptions Fechner based his Maßformel upon remained highly controversial. The great scientists of his time like Gauß, Helmholtz, Mach, Brentano and Hering distrusted either details or even the whole of his line of argumentation. Von Kries reproached Fechner with simply combining a physical experiment with an arbitrary convention regarding his unit of measurement. Despite all of these reservations, however, the essential impulse for the development of a quantitative and experimental psychology had been given.

Fechner's methodological approach to derive from judgement variations metrical information about internal subjective magnitudes and his method for dealing with error – he was the first

to introduce the concept of the normal distribution to psychology – provided the essential conceptual steps for the development of quantitative psychological methods. Fields as diverse as learning theory, decision theory, test theory, and attitude measurement cannot be imagined without the concepts that he developed.

In psychophysics, the reception of Fechner's ideas suffered, however, a less fortunate fate due to the way his ideas were transformed into the behaviouristic and elementaristic perspective of S.S. Stevens. By an abundance of publications and by polemically distorting historical facts Stevens attempted to adapt the historiography of psychology to his own advantages, as he did before in the case of the so-called 'scales of measurement'. His research paradigm gave rise to arguably one of the most sterile phases in the history of perception theory.

In contrast to Fechner's metaphysically motivated zeal, Stevens' interest in the construction of scales was related to an elementaristic measurement-device misconception of perception. He claimed that the sensory system fulfils the task of a kind of measuring device, which convey information about elementary physical magnitudes. This approach would merely reduce psychophysics to some kind of perceptual physics, thereby completely neglecting the complex functional aspects that characterise the adaptive coupling of organisms to their environments and the ensuing complex perceptual achievement.

Gestalt psychologists had already proven the fundamental inappropriateness of this conception. Only during the 1980's and in the course of the computational revolution instigated by David Marr, Stevens' elementaristic paradigm and his preoccupation with numerical scales could finally be vanquished. With the preparatory work carried out by Brunswik, Kardos, Bühler and Gibson it was now possible to merge a functionalistic conception of perception with concepts provided by computational approaches. These approaches thereby resumed a long and fruitful tradition in perception theory, stretching from the 17th century to Fechner, Helmholtz and the Gestalt psychologists.

The impact Fechner's ideas had on psychology are as complex and diverse as their evolution. Fechner's radical investigations into the measurability of mental magnitudes and the solutions he proposed, however, matured to become a completely independent field of investigation. In a rather unexpected synthesis with Helmholtz' abstract inquiry into the nature of 'measurement' and following the tradition of *Mathesis universalis*, this field, called *Abstract Measurement Theory*, dealts with in ways by which systems of empirical relations can be represented by numerical structures. Of course, Fechner did neither intend nor foresee such a development.

Helmholtz was convinced that "only the mathematical is shared by the outer and inner world". He claimed that, within the natural sciences, mental processes can be subjected to theoretical investigation only in as far as they could be expressed in mathematical terms. In the year 1887, he published his work *Zählen und Messen erkenntnistheoretisch betrachtet* (*Counting and Measuring from an Epistemological Point of View*), in which he confined himself to physical entities and did not address the problem of the measurability of mental magnitudes.

In this work he tried to abstractly deal with a theory of magnitude, in order to provide a justification for any kind of measurement of magnitudes. Considering the very different nature of the contributions Fechner and Helmholtz made, it seems surprising that their advancement and synthesis has lent such a new strength to *Mathesis universalis*, now involving psychological magnitudes as well.

The synthesis of Fechner's ideas with those of Helmholtz initially revealed a great need for conceptual clarification: Fechner aimed at the quantification of psychological magnitudes through the analysis of fluctuations of judgements, whereas Helmholtz tried to define the traditional concept of an extensive magnitude. In the process, it became more and more clear that the quantitative was the qualitative in another guise, as it were: the 'quantitative' was yielded by certain systems of structural qualitative relations between objects. The important consequence of this was the complete redefinition of the traditional dichotomy between quality and quantity. This analysis resulting in the redefinition of the concepts quality and quantity completely abolished the apriori prejudice that psychological magnitudes could not be measured due to their lack of an operation of addition.

Helmholtz' conceptual clarifications were to require many more steps before they cumulated – via Otto Hölders influential mathematical analysis – in the so-called 'Scott-Suppes paradigm', the standard theory of *fundamental measurement*, before probabilistic measurement theory came to be developed, and before the concept of extensive measurement came to be generalised by the concept of *additive conjoint measurement*.

Fechner and Helmholtz were the forefathers of *Mathesis universalis*, i.e. a "generalized mathematics of non-mathematical objects", which also included psychological magnitudes, too. Because the two initially unrelated concepts were attached to very different perspectives, their clarification was the only way to integrate them into an independent theory of measurement. In the course of these clarifications *Abstract Measurement Theory* evolved, which yielded a wealth of deep new insight into the role numbers play in representing idealised empirical relations. *Abstract Measurement Theory* is now an independent discipline, which in the tradition of *Mathesis universalis* includes all the sciences that, according to Descartes, "examine measurement and order", regardless of whether we examine psychological, physical or economical magnitudes.

I have attempted to assign Fechner an appropriate place between Pythagoras and the present – in spite of the fact that Fechner is unique and cannot to be placed anywhere due to his crossing the borders between irreconcilable traditions. I have attempted to classify at least a large proportion of Fechner. This symposium will aim at investigating the whole Fechner. In order to assign him some place in the tradition of *Mathesis universalis*, I have had to isolate a single aspect that he only used as a vehicle to convey his philosophy, but which did not embody his philosophy as such. I had to extract that aspect from his syncretistic worldview, which he did not expressively formulate but experienced rather intuitively, describing it in analogies.

At the end of his long commitment for a holistic worldview, Fechner had to realize that his philosophy was dismissed as irrelevant for the progress of psychology as a natural science. Nevertheless, his idiosyncratic philosophy gave a essential productive impulse to the future development of psychology. It had been Fechner's most fruitful and greatest contribution to the history of natural sciences, notably psychology. He was the first to formulate the problem of the measurability of psychological magnitudes in a radical manner, and he proposed a solution to it.

In the great tradition of *Mathesis universalis*, which right from the beginning has been the central *Leitmotif* in the evolution of the natural sciences, Fechner's achievements are extraordinary, though he himself would probably regard such an assessment as a misrepresentation of his dearest ambitions. We can even go as far as saying that the failure of his zeal gave the most fruitful impulse to psychology, helping us to better understand how the principles underlying the natural sciences can be extended to dealing with mental phenomena as well.

While attempting to integrate the perspective of the subjective self into natural science, Fechner foresaw many findings in phenomenology. He was doomed to failure, however, because the very concept of the natural sciences is based on the notion of objectivity and thus on the requirement of being independent of a specific perspective. Consequently, the natural sciences employ a very specific notion of understanding, which is incomparable to other modes of understanding, because there is no *tertium comparationis*, with which a comparison would make sense in the first place.

To speak in terms of Fechner's light metaphor of a polarity between *"Day Perspective"* and *"Night Perspective"*: We do not at all stand at the cross-roads between a *"Day Perspective",* which preserves the unity of the consciousness of the self, and a *"Night Perspective"*, which disintegrates and divides this unity by abstracting away from immediate experience in order to find the 'real order' behind the appearances. In the same way as day and night represent the laws of nature, *"Day Perspective"* and *"Night Perspective"* mirror the nature of the human mind. They illustrate that human mind is capable of quite different ways of understanding. Fechner's heroic attempt at combining both ways of understanding – understanding within the framework of the natural sciences, and understanding from the perspective of the subjective self - into one and the same theoretical framework was doomed to failure. At the same time, it revealed that *"Day Perspective"* and *"Night Perspective"* could lead to a mutual advancement without, however, any need to play off one perspective against the other. The ways to theoretically comprehend the nature of the mental are, to take advantage of Lichtenberg's ironic formulation, as wide as they are long.