The Unity of Nature and Mind:
Gustav Theodor Fechner's Non-Reductive Materialism

MICHAEL HEIDELBERGER

19th-century scientists did not hide their pride in having proved that nature could be reduced to matter and motion. As for example Emil du Bois-Reymond put it, to understand nature means:

> to refer all changes in the corporeal world to the movements of atoms, produced by their central forces independently of time; else, to explain the processes of nature in terms of the mechanics of atoms.[1]

This theory, openly proclaimed, exerted a lasting influence on the development of all scientific disciplines. As physics especially dealt with the mechanics of atoms, it followed logically that physics should become the foundation stone of all sciences. One could assess the maturity of a science in terms of its closer or further resemblance to physics. It was generally agreed that it was only a matter of time before all empirical knowledge about nature would be capable of being explained in physical terms, that is, as a particular case derived from physics. This applied especially to biology and psychology: as far as these sciences dealing with nature and the mind could be studied empirically and as far as anything could be understood about them, they could be reduced to physics. The Unity of Nature was considered in terms of unity of matter and its physical laws.

If today we ask ourselves whether this reduction to the "mechanics of atoms" has at last been accomplished and all sciences, first among them psychology and biology, are about to be once and for all assimilated into physics, it appears that in spite of the substantial progress made in this direction, we are still as far from du Bois-Reymond's goal as we were in the 19th century. Since then, the dominant opinion is that it is mere utopia to desire to reduce all sciences to physics, and that maybe this problem was tackled in the wrong way from the very start. However, one still hears rare, isolated cries in support of the unity of sciences as theorized by "Physicalism" and strenuously advocated by the Vienna Circle in the 30's.

In this context it may be helpful to turn our attention to Gustav Theodor Fechner. Fechner wished to conciliate his conviction that science coincides with the "purest materialism" with the idea that there exists a "higher animation" in the Universe[2] which cannot be reduced to mere atom mechanics. He thought that life and consciousness were not produced by matter, but were the original attributes and active principles of the universe. In the following pages I wish to present the main concepts of Fechner's philosophy from my point of view, and to argue that he created a non-reductive sort of materialism, which offers a fascinating as well as naturalistically valid ground for the unity of nature and the human mind.

This essay is structured in three parts; first, a short introduction of Fechner's life and his major works. In the second part, I will outline Fechner's "non-reductive materialism", which is fundamental to his philosophy of science, and I will summarise it in six theses. In the third part, I will describe the basic principles of Fechner's *Naturphilosophie*, which took shape from his "non-reductive materialism" and produced two important conclusions.

In this essay, I will also attempt to evaluate Fechner's philosophy from a systematic point of view. I cannot dwell on questions pertaining to history of philosophy, that is, about how deeply Fechner was rooted in tradition and what influence he exerted on other scientists and philosophers. I will also limit myself to a few words about how his philosophical ideas were related to his multifarious scientific activities. I will not try to explain why his theory of science is still worth our attention at the present day, as these topics have all been included in a major project, of which I present only a fraction here.[3]

I. Gustav Theodor Fechner – Life and Work

Fechner is famous for being the father of Psychophysics and for discovering a psychophysical law that was named after him (Weber-Fechner-Law). Otherwise he is today almost totally unknown. Already during his lifetime, his philosophy was only partially understood. With the institutionalisation of empirical psychology by Wilhelm Wundt, Fechner's interpretation of psychophysics was soon considered obsolete. However, his methods for measuring mental parameters became and still are a permanent and essential part of every textbook on experimental psychology.

Fechner, son of a country parson, was born in 1801 in Großsärchen, Lower Lusatia (today in Poland).[4] He took up his university studies in Leipzig in 1817, where he lived until his death in 1887. Fechner studied medicine, but then decided not to practise as a doctor. Instead, he occupied himself with physics and starting from 1824 he gave university lectures on this subject based on his extensive experimental research. He earned his living by translating, editing and publishing French scientific textbooks, including Jean Baptiste Biot's manual on experimental physics and Louis Jacques Thénard's chemistry textbooks.

Between 1822 and 1836, Fechner translated 1500 to 2000 pages of text yearly. By 1850 he had additionally published more than 30 articles in physics journals and several books, mainly on topics such as electricity, electromagnetism, and subjective optical phenomena.[5] Finally in 1834 Fechner was appointed professor of physics at Leipzig University.

His most important contribution to physics was an atomistic model for the transmission of electricity inside conductors, put forth in 1845, which made it possible to combine the induction phenomena discovered by Faraday with Ampère's electromagnetic laws. This model became the basis of Wilhelm Weber's "fundamental electrodynamic law" of 1846, which remained the central law in the theory of electricity in Germany until the adoption of Maxwell's field theory.[6] With J.J. Thomson's electron theory, essential aspects of Weber-Fechner atomism were revived and incorporated into field physics. In 1828 Fechner had already devised a theory according to which atoms consist of elementary particles. This was undoubtedly the first time that someone had conceived of the atom as being composed of smaller particles that circle around a common nucleus. Between 1840 and 1843, Fechner went into a physical and mental crisis accompanied by temporary blindness, probably connected with manic depression. He lost his professorship, which was taken over by Wilhelm Weber. From 1846, however, Fechner resumed lecturing on topics which were to occupy him for the rest of his life: philosophy, the mind-body problem, psychophysics, aesthetics, as well as physiological and anthropological subjects.

Before the outbreak of his illness, Fechner had already shown interest in philosophical problems and published philosophical writings. The most important stimulus in this respect came from the philosophy of nature of Lorenz Oken, a disciple of Schelling's and a naturalist. In 1820, Fechner came across Oken's textbook about the philosophy of nature, which impressed him deeply. In his *Büchlein vom Leben nach dem Tod* (Booklet of Life after Death), published in 1836, Fechner asserted that consciousness does not cease with the life of a human being. He sees consciousness after death as carried on by the causal effects of actions begun during an individual's lifetime. Then, in 1846 there followed the draft of an eudaemonistic ethical theory entitled *Über das höchste Gut* (The Highest Good) and in 1848 he published *Nanna oder über das Seelenleben der Pflanzen* (Nanna, or the soul life of plants) in which he attempted to prove that plants have souls. Finally in 1851 appeared his philosophical masterpiece *Zend-Avesta oder über die Dinge des Himmels und des Jenseits* (Zend-Avesta, or Matters of Heaven and the World Beyond). Here he claimed that the entire universe has a soul.

In 1855 he published a plea in favour of the reality of atoms in his work: *Über die physikalische und philosophische Atomenlehre* (On Physical and Philosophical Atomic

Theory). In 1862, a defense of his theory of souls again followed, and in 1873 he presented a scientific theory about organic development and a discussion of Darwin's theory of evolution. In 1876, his *Vorschule der Ästhetik* (Propaedeutics to Aesthetics) appeared. Finally in 1879, an attempt at a synopsis of his philosophical views was published: *Die Tagesansicht gegenüber der Nachtansicht* (The Daylight View as opposed to the Night View).

This is only a selection of Fechner's most important philosophical works. Among his writings on experimental psychology I only mention his *Elemente der Psychophysik* (Elements of Psychophysics), published in two volumes in 1860, whose basic concepts are already outlined in *Zend-Avesta*.[7] This work was followed by approximately 25 additional essays on psychophysics. In 1897, ten years after Fechner's death, his *Kollektivmaßlehre* (Theory of Collective Measurement) was published, where he attempted to formulate a mathematical theory of statistics.[8]

Of course scientists are in their right if they do not want to have anything to do, at least officially, with pan psychical and pantheistic topics such as the soul of plants, the soul of the universe and so on. For this reason, Fechner's philosophy was seldom taken seriously. In my opinion, however, this led some people to overlook the fact that his ideas contain a distinctively empirical, materialistic and rational core, which can and even must, as Fechner himself points out, be distinguished from his speculative *Naturphilosophie*, which nonetheless is built upon this core. Like Fechner, we can conceive psychology and biology as autonomous, irreducible sciences without having to submit to panpsychism. If we make a methodological distinction between Fechner's non-reductive materialism and his *Naturphilosophie*, we can more easily understand and evaluate the influence of psychophysics over Fechner's philosophical ideas.

II. Non-Reductive Materialism

Before going into the details of Fechner's theory of science, which is a non-reductive materialism, I would like to discuss what requirements a non-reductive image of nature must fulfil in order to be taken as a valid alternative to reductive materialism. At any rate, what matters most is that the new image should not diminish science's achievements, nor should it arbitrarily alter or invalidate the standard methods. Second, nothing new may be added that cannot be warranted by the current scientific methods. Third, even without reducing all scientific knowledge to the knowledge of physics, the unity between nature and the image science has acquired of it must be safeguarded. The advantages we gained by an ontological reduction of phenomena since Descartes must be reached one way or another also in non-reductive materialism.

Now I will enunciate six basic theses which characterise Fechner's non-reductive materialism. In the course of this exposition, it will also become clear how non-reductive materialism differs from its reductive counterpart.

First thesis: the source of our experience is not only what we can immediately perceive with our senses in the external world, but also what we elaborate with our sensations and mental activity. Inner perceptions differ from outer ones in their epistemic status, on account of the fact that they are directly available only to the person who has them. As Fechner says, they are *Selbsterscheinungen* (appearances to one self). On the contrary, external phenomena can also be perceived by others; for this reason, they are *Fremderscheinungen* (appearances to others). Fechner believed he had found the fundamental distinction between psychical and physical phenomena in the different ways they are perceived. On this basis he drew an ontological distinction using an epistemological criterion; in other words he incorporated epistemology into ontology. Both kinds of phenomena, the psychical and the physical, have one thing in common: they are both demonstrable things,[9] that is, they can be proved by

resorting to direct experience. Fechner considers talking about psychical phenomena as empirically justifiable as talking about physical ones.

The *second thesis* concerns the relation between physical und psychical phenomena. According to it, everything that is psychic is determined by something physical insomuch as there can be no psychical change without a corresponding physical one. This is not meant to establish any *causal* dependence of the psychical sphere on the physical, but rather to set a weaker bond, which however should not be prejudicial to a relation of causality. Experience tells us only that *when* psychical phenomena do exist, particular physical phenomena have occurred, and *when* a psychical condition has changed, a physical change has also intervened. A physical phenomenon that conditions a psychical one (without the interposition of other physical phenomena) in direct relation to it is called "psychophysical".

Fechner tries hard to keep the relation between physical and psychical as unbiased and as neutral as possible, to avoid putting himself under any obligations to a philosophical mind-body theory (or Matter-Mind conception). The second thesis attempts to express in the easiest and most convenient way the empirical connection that describes the relation between inner and outer experiences, without making any special ontological premises about body and mind. On account of all the experience accumulated by physiology, the physical processes of the brain are necessary conditions for our psychical processes. Of course, this cannot be checked directly by experience, as the person who is feeling or thinking is unable to follow the physiological processes taking place in his or her brain at that moment. It is however possible, as is also the case in other sectors of natural science, to extrapolate from what is known into what is unknown by way of induction. The second thesis suggests therefore that, in order to be considered as scientifically valid, every body-mind theory must allow for physical changes as the necessary preconditions of psychical ones.

The *third thesis* concerns the scope of validity of the explanations of external phenomena as provided by empirical science. Fechner assumes that all physical changes occur in compliance with the strictest physical laws, meaning that any physical change (at least in principle) can be entirely explained by natural laws. To explain physical phenomena it is neither necessary nor appropriate to abandon the sphere of physical phenomena. Fechner sees the best endorsement of the correctness of this thesis in the law of energy conservation>: physical changes cannot produce effects "outside" the realm of physical phenomena; in fact, this realm is causally closed.

Like the principle of energy conservation, the third thesis also is only empirical; yet it has been confirmed so many times that one can rely on it, and even consider it a prerequisite for meaningful scientific research. Furthermore, this is the simplest generalisation that can be drawn from our experience so far.

Finally, the *fourth thesis* explains the organic world: Fechner assumes that the origination, variety and development of the organic world can be entirely accounted for by natural laws.

Before proceeding to Fechner's further theses, let us re-examine the four preceding theses in their entirety and let us compare them with the claims advanced by reductive materialism, with which we are more familiar. First, let us examine how it is possible, starting with these four theses, to arrive at panpsychism without surrendering scientific principles.

Unquestionably, for this theses Fechner adopts a rigorously empirical standpoint, which measures the admissibility of an assertion about the world depending on how far it conforms to direct experience. Those statements that cannot be proved empirically true are discarded; it is affirmed that physics can provide explanations for every sort of change in the world. It is therefore out of the question that our mind, or even a transcendent spiritual being, may actively or correctively interfere with the course of nature's and the world's laws. In addition, it is asserted that every psychical phenomenon is conditioned by a physical one ("conditioned" is used here in a weak sense, as mentioned before). Thus, what is spiritual, cannot be any "free-floating entity" that can be postulated at will. Finally, the development of

the world and all its variety must be explained in an exclusively natural way, without calling into play any supernatural causes.

At a first glance, the image of nature and the role of science that emerge from these precepts seem to be in complete agreement with what we might otherwise expect from reductive materialism; what is more, we can even clearly perceive some reductionism here. But a closer look reveals that no reductionist implications are contained in these four theses. They are simply compatible both with a non-reductive and a reductive point of view. In effect, two questions are still open for discussion: the precise relation between what is physical and what is psychical, and also the clear relation between the organic and inorganic worlds. As already seen, theses 2 and 4 presuppose only minimal conditions for psychological and biological explanations which are themselves still incomplete. If Fechner really wants to advocate a non-reductive materialism capable of competing with its reductive adversary, then:

1. he must integrate those statements about the conditioning imposed upon psychical and organically phenomena by physical ones from a non-reductive point of view;
2. his additional theses must be at least as plausible as those offered by reductive materialism to explain the same relations in addition to its theses about mere conditioning.

First of all we should ask how reductive materialism normally deals with both physical-psychical and inorganic-organic relations. A reductionist will add a fifth thesis to the other four, according to which all psychical phenomena are either *caused* or *produced* by physical processes or events. As a sixth thesis, he will claim that precisely those laws which account for physical changes in the world, are also behind the origin and development of all organisms and the world as a whole.

These two additional reductionist theses are not without consequences for the other four. Beginning with the first thesis, we observe that: if psychical phenomena are of physical origin, then they themselves have a physical nature, as can be deduced from the world being a causally closed system. To a reductionist it becomes superfluous, if not downright senseless, to claim at this point that science can focus on anything psychical supplanting its physical aspect. At best, psychical phenomena are, for the reductionist, the subjective correlate of outer, objective processes. In fact, outside their physical nature they do not really exist and can be eliminated from science's sphere of interest with no loss. Further, the supplementary reductionist theses call for an expansion of the third thesis. According to it, every physical change can be accounted for by physical laws. If reductionism is correct, then physics can explain not only any *physical* change in the world, but also *any* change that occurs, whether it is perceived as physical or not.

The reductionist has good arguments in favour of his two additional theses. What he wants is that a scientist should also extend the methods of explanation already available to him and so successfully applied by him to the relation between the physical and the psychical, the organic and inorganic. This does not require any substantial modification of the four theses. What is more, the explanation of the reductionist brings clarity where there is none. What else should the dependence of the organic sphere on the inorganic indicate, other than a causal relation?

In order to counterattack the reductionists, Fechner is obliged to go to great lengths to provide supplementary theses that not only explain the relation between the various spheres, the psychical and the physical, the organic and the inorganic in alternative to reductionism, but are also compatible with the four theses, though retaining their non-reductive character.

What does this mean in detail? In the first place, it should be made clear what it means to affirm that the factual relation between the physical and the psychical world need not necessarily be explained in terms of a causal dependence of one on the other. In the second

place, a rational answer must be provided about the question why the laws of *physical* change alone fail to explain the origin, development and diversification of living organisms in nature and require the help of even more and other laws to fulfil this task.

Fechner performs the former task by introducing the following *fifth thesis*: a psychical phenomenon and the physical one tied to it in a relation of condition are both aspects of the same object. He calls this thesis the "theory of identity". He argues for it by stating that an object may (at least potentially) appear in different ways to an observing person. Things will appear different to us if we look at them from different perspectives. For example, if two people observe a material process, say, the movement of a body, they will only see *one* causal process going on and not two, although the moving body will produce a different visual impression to the single observer depending on where he stands.

Similarly, the fact that some phenomenon appears as psychical is the result of the special perspective from which one perceives it. The psychical perspective differs from those of everyone else when they look at a person as a physical being.

At the bottom there is only *one* entity that appears different when observed from different standpoints […] Neither do two causal chains unknown to each other interfere in disorderly fashion with each other because there is only one causal chain that acts in *one* substance only but can be perceived in two ways, that is, from two standpoints.[10]

The material, corporeal, carnal world and the psychical and mental states conditioned by it are two ways in which the same being shows itself, one external for other beings, and one internal for oneself; both are different, because that one being will produce a different impression, depending on the angle of observation. [11]

As suggested here, everybody has a double access to himself, a twofold perspective: if I appear to myself in a way I can to nobody else, then I perceive my mental and psychical processes, I appear to myself as a psychical being. If on the contrary I appear to myself the way I could look to another person (for ex. Looking at myself in the mirror), then I will see the same processes in a corporeal form; I will appear to myself as a physical, material being.

It makes a difference whether a person thinks with his brain or looks at the brain of the thinker. Of course the result is different, as also is the standpoint; on the one hand, the standpoint is internal, and on the other it is external. [12]

Let's attempt now to express this theory of Fechner's in a more modern way: every psychical occurrence (or state of mind) is identical to a physical occurrence (or state). This means that once I have described an occurrence as psychical, I can then, in principle, also describe it as physical. As causality is a relation between different events, it would be a categorical error to say that physical events are caused by psychical circumstances (or vice-versa).One could raise this objection: if mental events are identical to certain physical events, then we relapse once again into reductionism. If the psychical is identical to the physical, then of course, it is completely superfluous, at least from a scientific point of view, to describe certain events also as mental.

To this one could thus reply: if all living beings who breathe with lungs also have hearts, and, consequently, beings with lungs and beings with hearts are identical, it does not follow that possessing a heart is the same as possessing lungs. Applied to the relation of psychical to physical this would signify that even if a psychical phenomenon is also physical, we are still far from concluding that being in a given state of mind is the same as being in a given physical condition. At most we could assert this if we knew that a particular physical state is not only sufficient, but also necessary to bring about a particular mental state. Fechner always insisted, convincingly in my opinion, that we can ascertain, possibly in particular cases, whether a physical state is *sufficient* to determine a particular state of mind, but we cannot know what state is *necessary* for it. Therefore, the description of the psychical aspects of certain physical states is neither superfluous nor eliminable.

Fechner likes to exemplify this with the following image. If I want to produce a sound, I can play it on a violin. To hear the sound, it is sufficient to make the strings vibrate. If for once we exclude that we can also beat on the sound box, but then the vibration of the violin strings also becomes necessary in order to produce a sound on this instrument. In this case, producing a sound and making the strings vibrate are identical events. Yet, I can also produce a sound with a flute, even if a flute does not have strings. Therefore I cannot say that making a sound is always and invariably identical to vibrating the strings of a violin.[13] We identify the occurrence of sounds by the causal role they play for us, no matter how they are produced. Two sounds produced are identical if they play the same functional role for a listener, no matter what physical process underlies them. For the same reason, a mental state may be identical to a physical state in a *single case* (as a single token). However, one cannot establish as a general rule that one and only one kind of physical state brings about a certain mental state. This conception is also called "functionalism" in the contemporary mind-body theory. It is not possible to enumerate all the physical states that, each taken separately, are sufficient to determine a specified mental state. To do this, we need a method capable of extending our knowledge also to physical states which, though not concretely materialised, would nonetheless condition a psychical state if they actually existed.

To corroborate the evidence of this argument, we can also draw more examples from physics. The property of water, i.e., its being liquid, depends on particular characteristics of the microscopic particles water is made up of and on their combination. These characteristics, however, are not *identical* to being liquid, because, in the case of different materials, completely different microscopic particles with different qualities may lead to the macroscopic characteristic "liquid". In any case, we cannot exclude *a priori* that this happens. Or, let us take the characteristic "fragile". Possibly, the fragility of a body is determined by completely different microscopic characteristics. We do not have any empirical methods available that can provide us with a general knowledge about all possible conditions that determine something being either fragile, liquid or in a given mental state. In such a situation, not even the conviction that these conditions are always physical can help.

Clearly, this argumentation is only plausible if we consider it unacceptable that certain characteristics or conditions are *caused* by microscopic agents. According to this view, it would thus be false to say that the characteristic of being in a certain psychical state (or, being liquid or fragile) is *caused* by the action and combination of elements at a microscopic level. One would say, instead, that this characteristic is constituted or realised by this action.

This way of putting things has many advantages because since David Hume it is usually held that relations of causality obtain between events and not between objects, and that the language of objects, if logical, can always be translated without loss into the language of events. Applied to our problem, the reason why water in this hall is liquid is that ambient temperature is above the freezing temperature of water, and that there is a thermal balance between water and the air in the space around it. It would be wrong to say that particular characteristics in the movement of water molecules are the cause of this. If for example I am feeling agitated, it is because I am holding a public conference and not because of the behaviour of my brain cells. This is not meant to question the validity of the scientific analysis of the microscopic particles objects consist of. The study of microscopic elements can result in highly satisfactory explanations, but does not change the fact that in this way we cannot find any explanation for what causes our mental states.

How can we define Fechner's thought if we compare it with the present-day positions of the mind-body theory? The expression "principle of identity", chosen by Fechner, should not mislead us into thinking that his position has something to do with the theory known today as "theory of identity".[14] The modern theory of identity is reductive in nature and states that psychical phenomena are identical with certain phenomena in the brain. On the other hand, Fechner's principle of identity formulates a weaker hypothesis, that is, that every event or

every state that is psychical is always also a determinate physical event or state, without implying that one can identify the psychical attributive of that event with its physical nature. In a modern debate, Fechner's conception should therefore be classified as an epistemic variant of a functionalist double aspect theory – epistemic because here the decisive characterising element of the psychical is defined in terms of a gnoseological criterion (the "appearance to oneself").

An analogy which can exemplify the difference between the modern theory of identity and Fechner's theory of double aspect can possibly be provided by the following example from colour theory. A supporter of the theory of identity would be likely to say: something that appears yellow is identical to (monochromatic) light from a distinct sector with a wavelength of 577 nanometers. Yet, a supporter of the theory of double aspect would retort in this way; it is true that every object is yellow is so on account of its own capability of reflecting light at a definite wavelength. The colour yellow is nothing but physically conditioned. But the quality of an object, that is, of appearing yellow, cannot be identified with a particular physical state of reflective light. In fact, we perceive light as yellow even if it is composed of two monochromatic components measuring 540 nm and 670 nm each; in fact, it looks exactly like light measuring 577 nm. In the final analysis, this example also illustrates the functionalist character of Fechner's mind-body theory. Being yellow or being in a particular mental state means fulfilling a very precise function, which in principle could be also carried out in completely different ways.

We have shown with two arguments that Fechner's principle of identity offers us a non-reductive explanation for the psychical-physical relation. In the first place, psychical phenomena represent a special way of looking at what can also be considered as physical phenomena; therefore, they cannot be considered as being produced by physical phenomena. In the second place, there still remain open questions about what physical states are necessary for the creation of psychical states, why talking psychical cannot be replaced by talking physical, that is, why the psychical cannot be reduced to the physical. Fechner's explanation remains nonetheless materialistic to the point that a psychical state (event) is always realised by a physical state (event) and any change in a psychical state is determined by a physical change.

After this discussion of the fifth thesis, only the relation between the organical and the inorganical spheres remains to be explained in a way that could serve as an alternative to a reductionist's view of biology. Let us recall what a follower of reductionism says about this relation. For a reductionist, the origin and development of life and the cycle of organic processes can be explained by the laws which govern the "movement of atoms", that is, that are responsible for every single change taking place in the inorganical sphere. Against this point Fechner set the *sixth thesis*: in order to explain the organic world, we need at least an additional law, which distinguishes itself from the laws, being valid for the single changes within the inorganic field. Laws, which describe only the single movements of the atoms, are not sufficient to explain entirely the changes of the organic world.

What should the additional laws be like? At first sight, the sixth thesis might seem to violate the third one. Is all this perhaps not a refined form of vitalism, dealing with particular laws in the place of vital force? I do not believe that Fechner made it so easy on himself. Sticking to Fechner's own terminology, one could define these additional laws he mentions as "laws of tendency" to distinguish them from the "laws of change". He wants to say that even if we were able to explain and predict the behaviour of each individual atom in accordance to one or more laws of change, we would not, however, be able to use this information to predict the tendency (if there is one) by which systems of atoms (or all atoms) enter a definite state. We need at least one additional law and that is precisely a law of tendency to inform us how much the frequency at which groups of atoms find themselves in a given state changes in the

course of time (if it really changes in abeyance to laws). The laws of change that apply to the inorganical sphere do not suffice alone for laws of tendency to be derived from them.

In his work *Einige Ideen zur Schöpfungs- und Entwickelungsgeschichte der Organismen* (A Few Ideas on the History of Organic Creation and Development), dated 1873, Fechner lays down a principle that is supposed to play a similar role for laws of tendency active in our world, as the principle of energy conservation for the laws of change.[15] He calls this the *principle of the tendency towards stability*. He sees here a general principle which "incorporates in itself and connects all laws of organic development [as, for example, Darwin's laws]".[16] It must necessarily be on account of this principle that there can be organic development at all in the world. Such a principle is satisfied when a closed system advances closer and closer to a state in which it already was beforehand, that is, when it becomes ever more stable in the course of time.

In Fechner's own words, this principle of the tendency to stability which applies to closed systems consists in the fact that

> Through the action of its inner forces, the system moves closer and closer to a so-called stable condition, that is, a condition where parts periodically, at even intervals, return to the same relations of position and movement in relation to each other.[17]

In open systems, this stability can decrease for limited periods, but in the long run at least an approximate stability is reached. The universe as a whole strives towards an absolute stability, to be reached in the long run. Fechner expressly remarks that in his opinion the principle of stability extends to include Darwin's theory of evolution as well. Thus, Darwin's laws of evolution are a typical case of laws of tendency which are subjected to the principle of stability.

Fechner essentially gives two reasons whereby the organic world can only be adequately explained if we hypothesise laws of tendency that are sufficient to the law of stability. Only in this way, he says, can we explain why the speed of phylogenetic development and, with it the variability of organisms, decrease with time. He also believes this principle can account for the adaptation of species. Without a principle of stability there would be an all too small probability of preserving those "devices" that "are able to survive and to proliferate".[18]

As far as I can see, this argument was again brought forward by Herbert Simon in 1962. Simon showed that complex systems can develop only through evolution, provided that intermediate forms of development remain stable to a given degree and do not split up again into their components at every failed attempt at adaptation. From this it follows that complex systems organised hierarchically with stable intermediate forms develop much faster than non-hierarchical systems of equal complexity.[19]

In view of the following discussion it is important to point out that Fechner calls the principle of stability also "principle of finality".[20] With this principle he intended to demonstrate that Darwin's laws are also laws of finality. I will return to this concept later.

So, with his sixth thesis, Fechner provided a non-reductive alternative to the reductionist explanation of the organical world; this thesis, though grounded in materialism, is nonetheless compatible with the empirical methods of natural science. So much for the description of Fechner's non-reductive materialism; now we can proceed to discuss his *Naturphilosophie*.

III. Fechner's Naturphilosophie

With non-reductive materialism on the side of his philosophy of science, Fechner has, so to speak, a free hand to develop his *Naturphilosophie* in a stricter sense, which is what he really has at heart. From his principle of the identity of the psychical and physical one can derive the possibility of a *Naturphilosophie* that can co-exist with science. Natural science deals with

that part of nature which is subjected to external observation. On the other hand, a philosophy of nature deals with the inner side of nature, that is, the side that is visible only to nature itself, i.e., that appears to itself. This implies that a follower of *Naturphilosophie* must come to terms with the internal side of nature in a way that does not fall in contradiction with the results of scientific research and of direct external observation. However, a philosopher cannot test his hypotheses by means of direct observation or experiments, as, say, a scientist can. He can do this only indirectly, by representing his results as the likeliest completion of the picture that science paints about the external aspect of the world. "Here the results of scientific research are only utilised, not misused",[21] says Fechner.

But now it is necessary to show, in the first place, that the philosophy of nature also has its own object sphere, and that this sphere is not empty. As psychical phenomena are accessible only to the person who experiences them, everyone of us, so it seems, can practise *Naturphilosophie* in one case only, that is, his own. In fact, nobody can acquire a direct knowledge of others' psychical phenomena as he can of his own. Only in the case of physical phenomena does it stand out clearly that more than one person can learn them directly. A theory applicable to a single case only, and not even accessible to more than one person at that, would be too insignificant and would not deserve to be called a theory. Thus it seems as though a *Naturphilosophie* could not "get off the ground".

In reply, Fechner points out that both in our daily lives and in the empirical sciences, we currently give explanations that we accept as valid, though they are based on theses which are not directly accessible. From our "natural position" as human beings, we are often compelled "to complete" our "immediate experience" by "imagination and reasoning".[22] No physicist has ever seen an atom, nonetheless all are convinced of the existence of atoms; even physics in Fechner's time wanted to explain the whole world through the mechanics of atoms (see Emil du Bois-Reymond's quotation at the beginning of this essay). In my daily life I start from the fact that my fellow-men have intimate psychical lives and are not robots, though all I can perceive of them are their physical changes. Why should it now be forbidden or empirically disreputable to employ also in the *Naturphilosophie* the same method of reasoning, which under certain conditions allows physics and the interpersonal relations between people to accept what cannot be observed? The task of *Naturphilosophie* is to penetrate into the intimate side of nature from "external, material signs". The forms of reasoning available to the philosopher of natural science when using the results provided by scientific research into nature are in principle no different, but no fewer, than those already in use in natural science. In no case are they inductive conclusions that make suppositions about something that is not experienced, by deriving them from given experiences.

What are now the external material signs that can lead us to the rational conclusions required for *Naturphilosophie*? For Fechner the similarity in their functions is of decisive importance. The thesis according to which a system has a psychical intimate life (that is, it is capable of producing inner phenomena) is all the more true, the more similar the functions of its single parts are to those implemented by the parts that make up the system of a person in the realisation oh human psychical states.

The example quoted before to illustrate Fechner's principle of identity is again relevant to this case. An instrument is a musical instrument if a person can produce sounds with it, no matter whether by blowing it or striking it or in whatever way. In the same way, a system can have a psychical side even if it is completely different from man in material or structure. What is required is only that there should be similarity of function.

Fechner tirelessly drew up catalogues full of symptoms which in his opinion indicated that the universe has got a soul, that is, is endowed with the function of *Selbsterscheinung*:[23]

- if it forms a unitary whole, which is relatively closed from the surrounding environment;

- if it can be distinguished from other systems of the same type in terms other than simply place and time, that is, if it possesses individuality;
- if it is capable of provoking an unlimited variety of effects which are partly unable to be foreseen;
- if single parts of the system are there to preserve its integrity more or less strongly.

These and other similar criteria seem to Fechner to apply not only to animals and plants, but also to the world at large. In his opinion, we have good reasons to assume that the world has a soul, that is, that the world has a side that appears only to itself, and these reasons are not more hypothetical or more uncertain than ordinary inductive reasons in natural science. If for us human beings there are cogent reasons for the existence of God, then the world in its entirety must be equated with Him. The physical universe is in fact the biggest carrier of something psychical that can ever exist. Fechner does not even want to make any exception about God's spirit to his conviction that what is psychical is conditioned by what is physical. He shifts from the theses of his non-reductive materialism towards panpsychism und pantheism by connecting a functionalistic conception of the psychical sphere with realism about the existence of the psychical aspect and extending this connection to cosmic dimensions. From this we can formulate as the first and foremost thesis of Fechner's *Naturphilosophie*: the world as a whole has a psychical side.

The task of the philosophy of nature lies not just in ascribing an inner sphere to the world at large; it also seeks to infer the inner sense of the world's *development* from its externally visible *course*. The law of stability for the whole universe makes it now possible to speak about a purpose in the development of the world from a materialistically philosophical point of view, without at all questioning its external development, which can be described only in physical terms, or considering it as caused by psychical factors. As psychical development is determined by purpose, a teleological interpretation of the world's development is possible in *Naturphilosophie* without falling into conflict with its scientific counterpart. The highest purpose in the development of the world lies in the psychical meaning of physical stability, towards which the world tends. The "need to reconcile the teleological and the causal principles in everything that happens is here given its clear and formulated expression".[24]

Those conditions in the world that are responsible for the validity of the laws of change at the same time determine the laws of tendency, which the philosophy of nature considers as "laws of finality" (or, as Ernst Mayr calls them: "teleomatic laws"):[25]

> As little as a twitching of a nerve is in itself a sensation, although to the twitching of a nerve observed from an external viewpoint sensation is a self-appearance, so little are the material tendencies of nature in themselves tendencies towards an end, except those that are meaningful only in consciousness and for consciousness; however, these tendencies can have purposes as self-appearances, and to the law of the material evolution of those tendencies there (can) correspond a law of evolution for the mind, the self-appearance.[26]

The development of the world can therefore be seen from the inside as a teleological process without having to modify or even reverse the concept of causality in the external facts taking place in the world, or to make any other unscientific implications of a teleological nature. Not even here does Fechner add any metaphysical theses to his philosophy of nature, which would break apart his non-reductive materialism. On the contrary, he finds a refined way of combining his philosophy of nature with the materialistic observation of nature.

In order to provide a plausible reason for the fact that the world appears to have a purpose in the philosophy of nature, the external final state that the world will reach in its stability must also have a psychical meaning if it wants to be accepted as an internal finality at the same time. It is now necessary to name that inner end, known to self-appearance, that the development strives to fulfil. This end can again be found only by inferring to the mental sphere of the world in general from those cases in which we are given a direct insight into the

motives and purposes of mental life, that is, from our experience alone. According to all we know directly about our psyche: "all motives and purposes of actions are by their nature and essence […] directed towards pleasure and displeasure".[27] Thus we have good reason to assume that the aim underlying the development of the world in its globality is to reach the highest standard of pleasure possible,

> the natural physical tendency towards stability (is) carrier of a physical tendency towards the implementation and preservation of just those states at which the physical tendency aims.[28]

The closer a psychophysical movement comes to stability, the more it is perceived as pleasurable; the further it is from stability, the less desirable it appears and the more displeasure it causes. This is also true of individuals and even parts of them as well as the world in its globality. Seen from the outside, living beings are material systems which function in observance of physical laws and are subjected to the principle of tendency towards stability. Seen from the inside, they are mental beings who aspire to happiness and for this reason they obey the principle of the tendency to pleasure. I said at the beginning that I did not intend to discuss the effects of Fechner's philosophy. However, at this point I have to say that Fechner's conception of man as developed in his natural philosophy gave a decisive impulse both to Sigmund Freud's doctrine about the principle of pleasure and to all of his metapsychology. [29]

The transfer of the psychical tendency of man to the whole universe enables Fechner to reverse as an additional thesis of his philosophy of nature the tenet that had emerged as second thesis in his non-reductive materialism. On that occasion we said that everything that is psychical is conditioned by something physical, that is, that there is no psychical change without physical change. But if now the world in its globality has a soul, then the contrary is also true: what is physical is conditioned by what is psychical. This means that there can be no physical change in the world without a psychical change internal to it. This reciprocal conditioning is what Fechner calls psychophysical parallelism. In order to understand Fechner's ideas, I think it is very important to keep both relations of condition strictly separate: the acknowledgement of parallelism in one direction belongs to the natural materialism of the scientist, whereas in the other direction it is a hypothetical supposition of natural philosophy that rests on indirect inductive reasoning.

Fechner even tries to relate the human mind to the law of stability. As biological living beings with a psychical side, we are subjected to the law of stability not only through our actions, but also through our thoughts. The truth of hypotheses is related to the pleasure they give us. Factual statements that cannot be proved directly with empirical means but are nonetheless acceptable for theoretical reasons are the more likely the more they serve to please us, that is, the more useful they are for our practical lives and the more they are accepted by people in the long run and in the course of history.

In Fechner's opinion, besides theoretical principles of truth there are also practical and historical ones. Here I can only note Fechner's development of a form of pragmatism well before Charles Sanders Peirce and William James – who were both very familiar with Fechner's writings – elaborated their own versions.[30]

However, Fechner's extension of his philosophy of nature is not only an account of our way of thinking and a theory of truth. His philosophy of nature even becomes the foundation of his ethics and aesthetics. In this aesthetics he tries to indicate the material conditions that must be fulfilled so that we can perceive a form as beautiful. With the help of statistical research, he wanted to find the stable aesthetic forms towards which the arts were gradually developing. As for ethics, the continual elevation of the state of pleasure for the whole becomes the highest norm of action. Thus, we see that the philosophy of nature, which is built on the science of nature, becomes the foundation stone of all philosophical attempts at

orientation in this world, which go beyond science. This radically separates Fechner from Neo-Kantianism, which was contemporary with him. According to this doctrine, our practical actions do not depend on our natural position as human beings in the physical world.

To conclude, I would like to return to the problem of the unity of science, on which I touched in the beginning. The condition for a non-reductive materialism was to reach a unified image of the scientific world as convincing as that developed by reductionism (or, if possible, even more convincing). Is this unity not given up if Fechner thinks it possible to have empirical truths which are not physical truths and cannot be reduced to them? Such a conclusion would be admissible if the non-physical truths had only a subjective status. They cannot be proved true by observation (such a requirement would be so strict that it would be impossible even to a reductionist to carry out really interesting research), but their objective consistency can at least be evaluated depending on the success they have in our theoretical and practical lives, when we derive our convictions from them.

Fechner replaces the reductionist idea of unity, which is based on the unity of matter, with his theory of identity between physical and psychical. In reductionism, the existence of consciousness and with it the existence of life appears as a "fragmentary and illusive aspect of the universe". Reductionism "enters consciousness under the head of sundries, as a forgotten trifle", as once Peirce, who was ideologically related to Fechner, formulated it.[31] To the heterogeneous and fundamentally disunited world of reductionism, Fechner opposes a world that encompasses the psychical and physical as equally justified and real aspects of one reality. Without giving up his naturalism, he brings to maturity the concept of a unified world, whose psychical and organical aspects are no unimportant exceptions from a tiny corner of the universe, but germinate everywhere in the physical world.[32] Only the identity between what is physical and what is psychical guarantees the true unity of nature.

A C K N O W L E D G E M E N T

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N O T E S

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[31] See note 30.