Chapter 17
Mechanism, Organization, Mind: A Kantian Legacy in Nineteenth Century Psychology

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Abstract In this paper I examine a series of interconnected accounts of the limits of mechanical explanations in psychology that were developed from Kant's late writings to classic late nineteenth century psychology textbooks. The connection among these different accounts is established by a number of originally Kantian doctrines that were worked through and significantly reformulated in the nineteenth century. These doctrines can be summarized as follows: (1) metaphysical hypotheses are ruled out; (2) mechanical laws and explanations can contribute to the analysis of mental processes, but (3) they turn out to be intrinsically limited in this regard, hence "psychology" (in different senses) cannot be grounded on mechanical principles. I will examine elements of this Kantian legacy in Emil du Bois-Reymond, Hermann von Helmholtz, Friedrich Albert Lange and Wilhelm Wundt, and focus on the progressive transformation of the Kantian insights until the early twentieth century.

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17.1 Introduction

In this paper I examine a series of interconnected accounts of the limits of mechanical explanations in psychology that were developed from Kant's late writings to classic late nineteenth century psychology textbooks. The connection among these different accounts is established by a number of originally Kantian doctrines that were worked through and significantly reformulated in the nineteenth century. These doctrines can be summarized as follows: (1) metaphysical hypotheses that have been developed in order to characterize and accommodate the soul in the context of mechanistic science are ruled out; (2) mechanical laws and chemical explanations can positively contribute to the analysis of mental processes, but (3) they

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turn out to be intrinsically limited in this regard, hence "psychology" (in different senses) cannot be grounded on mechanical principles. I will argue that Kant based these conclusions not only on his well-known transcendental arguments on the limits of knowledge in general, but also on less considered epistemological arguments concerning the impossibility of reducing cognitive operations to mechanical and chemical processes. Based on this more fine-grained picture of Kant's perspective, I will maintain that prominent investigators in nineteenth century physiology and psychology, notably Emil du Bois-Reymond, Hermann von Helmholtz, Friedrich Albert Lange and Wilhelm Wundt, accepted different varieties of these claims in their attempts to establish the relation between mental and physical processes. To be sure, they also connected these conclusions to empiricist and naturalist perspectives, and thereby, to some extent, they transformed the original Kantian insights. I will highlight, on the one hand, the Kantian common thread in the arguments that they devised, which determined a significant twist in their appropriation of empiricist and naturalist perspectives; on the other hand, I will point out that this elaboration allowed for a progressive loosening of the original connection to Kant's philosophy. As a final example of this process, I will briefly consider the fate of this legacy at the turn of the century, in Marburg neo-Kantianism and in William James' reception of this German tradition.

17.2 Kant: Mechanism, Organization, Mind

Kant's early views on mechanism and mind were rooted in eighteenth century controversies on Newtonian mechanics and Leibnizian monadology, which were particularly heated in the context of the Berlin Academy of the Sciences.[1] As varieties of monadology were developed by Christian Wolff and others in order to account for the explanatory limits of mechanical philosophy and the explanatory powers of monads, Euler campaigned against monads with the physical claims that monadology contradicted the law of inertia and attributed active powers to matter, thus raising doubts on the thesis that the soul is "not material" (Euler 1746, 281–4, 286). This was a misrepresentation of Leibniz's original monadology, who took pains to separate the mechanical domain from the domain of monads and famously denied that perception could be explained mechanically. In fact, Euler's critique focused on point-like physical elements, which had been introduced by Wolff besides monads in order to avoid the difficulty of connecting monadic representative powers with physical, derivative forces, as Leibniz's original theory requested.[2] Wolffian philosophy was more easily vulnerable to the standard Newtonian objection (formulated by Clarke) that monads could lead to materialism, and indeed a number of

[1] Schönfeld 2000 offers a good reconstruction of Kant's early thought in its historical context. On the controversy over monads in the mid-eighteenth century also see Pasini 1994, Broman 2012.

[2] For an outline of the varieties of monadology and contemporary scholarly accounts see Pecere 2020a.

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Wolffian philosophers accepted some materialist claims. In this context, Kant tried to accommodate "physical monads" in Newtonian mechanics by conceiving them as point-like centres of force. At the same time, Kant wanted to keep the distinction of these physical elements from monads endowed with representative force, but in the 1760s he gradually realized that this project left open the way to a plethora of metaphysical hypotheses, including materialism. Therefore, in the 1770s, he reconceived monads as intelligible beings with no explanatory value (Pecere 2016a).

In his critical philosophy, Kant eventually deprived monads of any objective meaning and argued that mechanical laws could stand on entirely different a priori grounds, that is the transcendental principles of the *Critique of Pure Reason* and the metaphysical principles of the *Metaphysical Foundations of Natural Science*, that were derived from the application of the former to the concept of matter. In this context, scientific explanation was identified with the "mechanism of nature", that is with phenomenal causality according to "mechanical laws" (e.g. KrV B xvii, xxix; AA V, 387–388). This general "mechanism", grounded on a priori principles, did not entail "atomism" (or "corpuscular philosophy") with its "mathematico-mechanical mode of explanation", for the latter assumed "absolute solidity" and thus violated the law of continuity. Kant replaced this explanatory method with his "dynamical philosophy of material nature", which conceives of impenetrability and volumes of matter as the result of an interplay of attractive and repulsive moving forces (AA IV, 523–4, 532–33). This separation of mechanism (natural science grounded on the laws of mechanics) from the mechanistic representation of matter, as we will see, played an important role for Helmholtz's development of Kant's dynamism into a mechanical science grounded on the concept of energy.

Based on his notion of scientific knowledge, Kant excluded spontaneous activity from natural science in general. In the natural philosophy of criticism, the "fundamental forces" of the new dynamics are no longer the "active forces" of Kant's earlier physical monadology, as matter itself is "lifeless". These forces are introduced by means of phenomenal relations of motion, as conditions of impenetrability, and thus associated to *parts* of matter rather than to points.[3] In this context, the I as the source of spontaneity in rational cognition and action is not an object of experience and is therefore excluded from the domain of natural science.[4]

Against this framework Kant introduced the disciplines of rational psychology and empirical psychology, neither of which could rely on mechanical explanations of the mind. Rational psychology conceives the soul as a simple substance, corresponding to the thinking subject, that is entirely excluded from the domain of

[3] On the critical dynamics see the excellent analysis in Friedman 2013, chapter 2. On the "vis activa" of physical monads see AA 1, 476, 481ff. On the definition of attractive and repulsive fundamental forces as causes of relational changes in the phenomena of motion see AA 4, 497, 580, and also see the General Remark to the Transcendental Aesthetics, B 67.

[4] On the pure I see Kitcher 2011 and Longuenesse 2017, part II. On the difference between the pure I and the empirical I also see Pecere 2022.

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natural science (and is not a possible object of knowledge in general).[5] Empirical psychology conceives the mind as the object of inner sense. This doctrine can never attain the rank of a "properly so-called natural science […] because mathematics is not applicable to the phenomena of inner sense", with the negligible exception of the application of the "law of continuity" to "the flux of inner changes", which would be the only possible extension of the empirical cognition of the soul because the "pure inner intuition in which the appearances of the soul are supposed to the constructed is *time*, which has only one dimension". Moreover, empirical psychology cannot become an experimental doctrine either, because inner states can be observed but not "held separate and reconnected at will" (AA IV, 471). Kant also allowed of anthropology as an empirical doctrine grounded on the (direct or indirect) observation of human activity and behaviour, but neither empirical psychology not pragmatic anthropology provided any explanation of the rational sides of cognition and behaviour. Kant granted the possibility of an anthropology from a "physiological" point of view, grounded on the investigation of the body and the brain in particular, e.g. in Descartes' theory of memory traces. But he pointed out that this doctrine concerns "what *nature* makes of the human being" and cannot account for what man "as free-acting being makes of himself, or can and should make of himself" (AA VII, 119). That is, physiological observation cannot account for human freedom, which is the most characteristic aspect of human beings. In this regard, it is not that physiological hypotheses are impossible, they are rather irrelevant (see Sturm 2008).

This did not mean that the empirical process of the mind was entirely excluded from the field of scientific investigation. Kant readdressed the problem of an empirical science of the soul with original results in the essay "On the Organ of the Soul" (1796), devoted to an examination of the book by the anatomist Samuel Thomas Sömmering. In this essay, Kant maintains that to search for a seat of the soul is a metaphysical rather than a physiological task and turns out to be "not only unsolvable […] but also in itself contradictory", because no spatial position could be assigned to the object of inner sense (AA 12, 33–35).[6] Kant also adds two important arguments concerning mind in natural science. First, he defends the possibility of the empirical knowledge of mind in the light of Sömmering's anatomical discoveries on the afferent nerves in the brain, arguing that new (Lavoisier's) chemical discoveries on the "decomposition" of water allow to formulate the hypothesis that "a faculty of the nerves underlies the mind [*Gemüth*] in its empirical thinking, i.e. in separating and combining given sensory representations, a faculty that decomposes the water in the brain cavity into those primary matters according to the difference of sense representations". In other words, primary matters in the brain water are temporarily separated by the stimuli of different afferent nerves. Thereby, this faculty of the nerves allows "a play of different sensations by setting free one or another

[5] On Kant's psychology in general see Leary 1982, Hatfield 1992. On rational psychology in particular see Dyck 2014. On the mathematical and experimental sides of empirical psychology see Sturm 2009, xx–xx, and McNulty 2018.

[6] For a more detailed analysis of this essay see Pecere 2016b.

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of the elements", which "immediately recombine when the stimulus ceases" (AA XII, 34). Thus the formation of representations, and their association, corresponds to chemical processes in the brain liquids. Kant's theory presupposes the previous "dissolution" of matters by one another, which – in case of a *complete* dissolution of matters, when "there is no longer any part which is not made up of the solvent and the solute"– is an infinite process and therefore seems to require the contribution of reason in order to be conceived (see AA IV, 530. See McNulty 2014). This is a significant theoretical novelty compared to the standard mechanistic analysis of phenomena. The brain process that accompanies cognition is also conceived as a kind of organization: this is not a "mechanical organization, based on the juxtaposition of the parts for the formation of a certain shape", but rather a "dynamical organization" produced by chemical forces, "then one could say that this water was being *continuously organized*" (AA XII, 33–34). These passages suggest that this hypothesis, which reflects Kant's engagement with contemporary chemistry in the 1790s (Friedman 1992, 264–190), did not constitute a proper extension of mechanism, i.e. of the mathematical science of nature that Kant takes as "proper science" (AA IV, 470). At the same time, Kant's positive view of the prospects of chemistry contrasted with the resort to vital and representative forces of matter that was rising in German science.[7] As we will see in the next section, scientists that elaborated on the Kantian hypothesis would have an even more positive attitude towards chemistry as a part of natural science.

Kant's second argument against the localization of the soul in the Sömmering essay was meant to set a limit to this empirical investigation. Kant argued that no empirical investigation could "cross over" into the metaphysical domain, which is concerned with "pure consciousness and with the latter's a priori unity in the synthesis of given representations (i.e. concerned with the understanding)" (AA XII, 32n). In other words, the I think, or the "absolute self", could never be accounted for in terms of empirical laws, for its operations cannot be reduced to laws of empirical natural science. In disciplinary terms, the issue concerned the domains of different faculties: "the medical faculty, in its anatomical-physiological division" and "the philosophical faculty, in its psychological-metaphysical division". The strict separation of these domains was necessary in order to avoid a conflict "between those who want to base everything on empirical principles and those who demand a priori grounds" (AA XII, 31). For our present purposes, it is most interesting that Kant identified his own critical philosophy with this new metaphysical "psychology", concerned with the investigation of a priori principles (e.g. of logic, morals and law. See Pecere 2016b, 220–223). This anti-reductionist argument left a significant legacy for natural scientists who shared Kant's view of mechanism and wanted to revive a Kantian perspective in physiology and psychology against monistic *Naturphilosophie* and materialism.

[7] For example, Johann Friedrich Kielmeyer (1793, 37) argued that "what was previously irritability develops in the end into the capacity for representation". See Zammito 2018, 280, and chapters 8–10 and Pecere 2021b.

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17.3 Materialism, Mechanism and Psychology in the Mid-Nineteenth Century

Since the late 1840s, the German "materialism controversy" (*Materialismusstreit*) stimulated discussions on the prospects and limits of mechanistic accounts of the mind.[8] The new German materialism claimed to be a consequence of natural science, a "scientific materialism", rather than a metaphysical hypothesis.[9] To be sure, most materialists relied on the recent progresses of medicine, physiology and brain anatomy rather than on mechanics. However, in contrast with the metaphysical vitalism of *Naturphilosophie* with its critique of "dead mechanism", the prominent materialist Carl Vogt, whose work sparkled the controversy, pointed out that the "same laws that govern the movement of the universe and its stars, have also their application to our movements", i.e. to the "machine of the organism". This mechanistic epistemology established the ground for Vogt's thesis that "mental activities" (*Seelenthätigkeiten*) are "merely functions of the brain substance" (Vogt 1847, 4, 206). That mechanical laws were the foundation of natural science was granted also by Hermann Lotze, who was among the critics of Vogt and materialism: "We have reasons to affirm that all natural events are grounded on the same laws of statics and mechanics" (Lotze 1852, 20–22). Nevertheless, Lotze was an anti-reductionist concerning mental activity, arguing for the separation of material "conditions" from thought itself. In *Soul and Life of the Soul* (1846), he claimed that "the necessity of the conjunction in a logical syllogism, or in aesthetical and moral evaluation […] can never be requested on the basis of a corporeal cooperation [*Mitwirkung*]" (Lotze 1886, II, 144). His example showed how mechanism could coexist with the critique of psychological materialism in the wake of Leibniz and Kant.[10]

The materialism controversy started in the aftermath of 1848 and was embittered by political and religious motives that arguably facilitated the anti-materialist trait of the rising neo-Kantianism (Köhnke 1991). Nevertheless, the return of Kantian ideas in physiology was also motivated by a genuinely philosophical rejection of both the new materialism and the metaphysical vitalism of late eighteenth and early nineteenth century *Naturphilosophie* (Zammito 2018). This vitalism, in particular, contrasted with all the major elements of the Kantian approach to physiology: the rejection of metaphysical substances and grounds, the conception of physico-chemical analysis as the only objectively valid method of scientific investigation and the separation of a priori philosophical and psychological principles from physiology. Schelling argued that "philosophy is nothing other than a natural science of our mind" and that "organization in general can only be conceived by reference to a

[8] On the "materialism controversy" see Bayertz et al. 2007; Beiser 2014a, 53–69.

[9] Gregory 1977. Wolfe (2020) points out that eighteenth century materialism was originally a metaphysical view, variously connected to scientific research but not reducible to the latter's consequence.

[10] To be sure Lotze did not accept Kant's antimetaphysics, but his theory of aesthetic and moral values had Kantian roots: see Piché 1997, 512. Also see Beiser 2013, 223–230

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mind" (Schelling 1797/1994, 93, 95). The prominent physiologist Johannes Müller had similarly claimed that the physiology of the senses had to be "at the same time philosophical and empirical" (Müller 1826, xviii) and introduced in his physiology a "force of organization [*organisierende Kraft*]" that operates according to rational ideas" (Müller 1840, 107). Such metaphysical background did not impede the development of empirical investigations (on the contrary, it even stimulated psychophysical investigations: see Clarke and Jacyna 1987) and Müller in particular educated a generation of scientists with his experimental researches.

A number of students of Müller would eventually decide to get rid of the legacy of *Naturphilosophie* with its metaphysical grounds and its conflation of psychology and natural science and formulate a physicalist program for physiology. They gathered in the "Berlin Physical Society", whose program was formulated by Emil du Bois-Reymond, aimed at the banishment of life-force and similar metaphysical concepts from physiology and the foundation of the experimental study of organism by means of "physico-chemical forces". Some of them, e.g. Carl Ludwig and Rudolf Virchow, would sympathize with materialism; others, notably Hermann von Helmholtz, would prefer a neo-Kantian approach (Finkelstein 2013, 64).[11] The Kantian model had already been praised by Alexander von Humboldt, who would later support the academic career of both du Bois-Reymond and Helmholtz.[12] In the second volume of his ~~1797~~ book on animal electricity, Humboldt presents the causal explanation of mental representations by means of brain processes as "very subtly expressed by Kant as the $\sqrt{}$-x" (a reference to the Kant's recently published "On the organ of the soul"). Indeed, according to Humboldt, "we do not dare any statement about a transcendental object, about something (the soul), whose phenomenon in us is thought". We can just suppose that "something material and simultaneously extant corresponds to sensory processes" (Humboldt 1797, 43). Humboldt also drops his own former hypothesis of life-force, as an "unknown force", which is "by no means proved", and endorses Kant's notion of organisms (343–344). Humboldt now encourages the "empirical philosopher" to proceed unhindered in his research guided by the idea that "everything that happens in the organic matter can be investigated according to mechanical and chemical laws" (49).[13] These tenets, and Humboldt's turn concerning life-force in 1797, may depend on the publication of Kant's essay on Sömmering, who was a prominent life-scientist, had been educated in Göttingen and at that time supported Herder's vitalist programme in natural science. Humboldt, on the contrary, now endorsed a Kantian combination of anti-metaphysics and mechanico-chemical investigations on the mind.

In these regards, Humboldt's early essay appears as an anticipation of the views that emerged in German physiology with the "Berlin school". Du Bois-Reymond and Helmholtz worked through the Kantian legacy in the light of their robustly

[11] For an overview of the school of Johannes Müller see Otis 2007.

[12] On Humboldt's role in Helmholtz' and du Bois-Reymond's careers see respectively Koenigsberger 1902, I, 93–110 and Finkelstein 2013, 98.

[13] Humboldt's book is briefly connected to Kant's essay by Marino 1994, 135–136. On Humboldt's changing views of life-force in the 1790s see Richards 2002, 316–321.

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physicalist program in physiology. This approach replaced Kant's account of mechanism and the "subjectively valid" use of teleological principles, formulated in the third *Critique*, with a physicalist view of life. As regards mechanism and mind, it reprised important elements of the Kantian perspective against both materialism and spiritualism.

In the *Investigations on Animal Electricity* (1848–60), du-Bois Reymond had provided an exemplary application of physicalism to electrophysiology. Du Bois-Reymond has been described as a "non-reductive materialist", however he did not accept the materialist interpretation of science.[14] Such an interpretation had been provided, e.g., by the physician Heinrich Czolbe, who presented electric currents in the brain as the ground of consciousness (Czolbe 1856, 5). Du Bois-Reymond famously tackled alleged scientific explanations of the conscious mind in his lecture "On the Limits of Natural Science" of 1872. At the beginning of the speech, du Bois-Reymond presents natural science as the "the resolution of natural processes into the mechanics of atoms." He points out that, by the use of mathematical formulations and the application of the laws of conservation of energy and quantity of matter, "there remains in these changes themselves nothing further that needs explanation" (du Bois-Reymond 1886, 106).[15] He also makes the hypothesis that a powerful Mind (*Geist*), knowing the momenta and positions of all particles in the universe, would be able to reduce every change in the world to a mathematical "universal formula" of linked simultaneous differential equations (107). Du Bois-Reymond attributes "apodictic certainty" to the "propositions of mechanics", arguing that mechanics realizes Kant's idea of proper science as a mathematized doctrine in the *Metaphysical Foundations of Natural Science* of 1786. On this mechanistic epistemology, du Bois-Reymond allows of a scientific study of organisms and thus expands the domain of natural science with respect to Kant. However, he sets two unsurpassable limits to the explanatory power of science. A first limit is the understanding of the "essence" of atoms and forces. The attempt to reduce the continuum of matter to the causes of movements in the smallest elements of it leads to two unsatisfactory alternatives: extended impenetrable atoms, which would still be divisible and hence not elementary; or the "middle points of central forces," which would be without extension and thus "a chimera" (*ein Unding*) (112). This explanatory limit is very important in order to understand why du Bois-Reymond rejects a whole set of metaphysical hypotheses that attribute mental properties to matter, from Vogt's materialism to Fechner's panpsychism. This point is addressed with the second explanatory limit, which concerns consciousness. Here we face a "chasm [*Kluft*] across which is no bridge". Du Bois-Reymond's analysis focuses on "the first grade of consciousness, i.e. sensation" conceived as a basic feature of all conscious "mental processes" (117–8). We can envisage the possibility of knowing every detail of the material processes accompanying pleasure, pain and all sorts of

[14] Tennant (2007, 748). See my account in Pecere 2020b.

[15] English translation (with some modification) by J. Fitzgerald (in "Popular Science Monthly", 5 (1874), 17–32).

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intellectual operations, but still the mental operations themselves would remain "perfectly unintelligible" in their phenomenal aspect:

> What conceivable connection subsists between definite movements of definite atoms in my brain, on the one hand, and on the other hand such (for me) primordial, indefinable, undeniable facts as these: 'I feel pain, pleasure; I experience a sweet taste, or smell a rose, or hear an organ, or see something red,' and the immediately consequent certainty, 'Therefore I exist?' It is utterly inconceivable how consciousness should result from their joint action (123).

On the whole, du Bois-Reymond endorses a supervenience of mind over matter, and he also conceives of the mind as the product of a gradual evolution in Darwinian sense (127). Nevertheless, he denies the possibility of any *explanation* of mental contents in terms of material processes. This notion of a limit (*Grenze*) strikingly resembles the Kantian one, which means an unsurpassable limit of a domain. Also the "chasm" between matter and mind is analogous to the one separating the world of nature and the world of freedom in Kant's philosophy.[16] However, du Bois-Reymond rejected the characterization of his perspective as a Kantian one, which had been proposed by Lange, probably because of his resistance to accept transcendental philosophy as a purely a priori inquiry.[17] He also did not focus on the implications of his epistemological arguments for psychology.

In both regards, Helmholtz was closer to the Kantian legacy. The obvious novelty in Helmholtz's conception of mechanical processes was the formulation of the law of the conservation of force. In "On the Conservation of Force" (1847), Helmholtz grounds his discovery on the idea that "all effects in nature have to be reduced to attractive and repulsive forces, whose intensity depends only on the distance of the reciprocally acting points" (Helmholtz 1882, 12). These fundamental central forces are explicitly conceived after the model of Kant's account of mechanics in the *Metaphysical Foundations of Natural Science*, although Helmholtz points out that his theory is not a priori valid and is rather grounded on the empirical impossibility of perpetual motion (68, 73). On the whole, phenomena of heat, electricity, magnetism, light, and chemical forces are connected by exact relations to mechanical processes, in both inert bodies and organisms (65–66; See also Helmholtz 1995, 24). Helmholtz then applied the conservation of force to his experiments on nerve transmission in 1850: he measured the time required to initiate a response to a stimulus in different states of attention, implying that "our thoughts" are time-extended processes just like nerve transmission (Koenigsberger 1902, I, 124–125).

Helmholtz's epistemological reappraisal of Kantianism was developed in the speech "On Human Vision" (1855). Here Helmholtz outlines Müller's theory that sensory qualities depend on the specific activity of sense organs and argues that this idea is analogous to Kant's conception of the conditions of objective representations: "As the latter [Müller] has shown the influx of the particular activity of the

[16] On the "limit" (*Grenze*) see AA IV, 352. "chasm" (Kluft) between phenomena and the supersensible, as the domain of freedom, see AA V, 195.

[17] See Lange 1875, 478–492 and du Bois-Reymond 1886, 382.

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organs in sense perceptions, so Kant has shown what in our representations derives from the particular and peculiar laws of the thinking spirit" (Helmholtz 1884, 396). Helmholtz values Müller's theory for its critique of direct realism, while he advocates Kant's philosophy for its introduction of laws that determine how sensations are turned into objective representations. This epistemological analogy overshadows Helmholtz's disagreement with Müller's position of the soul and life-force as conditions of sensation and the monism. Thus Helmholtz accepted both Kant's anti-metaphysical stance – which was also consistent with his empiricism – and the characteristically Kantian discovery of "the contribution of our particular innate laws of the mind, as it were, of the organization of our mind [*Organisation des Geistes*], to our representations" (379).

The puzzling phrase 'organization of the mind' referred to a set of forms and laws that turned out to be necessary conditions of human objective representations. For example, space is a "original form of our representation" (441) and the "pure logical law" of causality is a condition of our connection of sensations to the external world (430, 454).[18] The characterization of these laws as "innate" and belonging to the "nature of sense organs and of our mind [*Geist*]" (446) might suggest that Helmholtz replaced Kant's original transcendental arguments with a mechanistic account. However, Helmholtz's experimental study of vision and spatial perception in the *Handbook of Physiological Optics* (1867) was based 0n Kant's *transcendental* conception of forms and laws as conditions of objectivity rather than an alleged mechanism. For example, Helmholtz explicitly rejects the physiological "nativism" of those scientists – notably Ewald Hering – who consider "determinate spatial intuitions" as the product of "innate mechanisms" or "preformed organic structures" (431, 441).[19] Helmholtz also rejects the anatomical explanation of binocular vision that postulates a physical connection of nerve fibers from both eyes and maintains that the visual image is elaborated by the mind, interpreting binocular rivalry as evidence of his view. Hence Helmholtz' epistemological arguments were corroborated by the (alleged) explanatory advantage of describing detailed learning processes rather than postulating mechanisms. In a successive essay, Helmholtz opposes the "unchanging laws of space", as a feature of mental activity, to the alleged "physiological mechanisms of nerves" (Helmholtz 1903, 343). To be sure, Helmholtz replaced Kant's transcendental account of space with an empirical investigation of how the representation of space is inferred by bodily movements and "motor impulses of the will", but he also pointed out the limits of an entirely empirical account: granted that "most spatial intuitions" are the product of "experience and exercise" (Helmholtz 1867, 438), and that Kant himself was wrong in considering Euclidian geometry as given a priori with pure *intuition*, Helmholtz still

[18] For a more detailed account of Helmholtz's notion of "organization of the mind" and its connection to Kantianism see Pecere 2020c, 7–9.

[19] On Helmholtz's theory of spatial intuition see Hatfield 1990, Lenoir 1993, Turner 1994 and De Kock 2016. For an insightful reconsideration of the Helmholtz-Hering debate see Lydia Patton's chapter in this volume.

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defended Kant's claim that space in general (with no a priori geometrical structure) was a transcendental *form*, i.e. a necessary condition of experience.

In general Helmholtz conceived the "forms and laws" as originally different from natural laws, and in this sense – again, echoing Kant's original approach – he outlined the domain of "psychology". In the *Handbook*, Helmholtz first investigates the physical and physiological bases of sensation, then, in the third book, he maintains that perceptions are always produced "by means of psychical activity"; hence he introduces a "pure psychology" which is concerned with "the laws and nature of mental activities" besides the "physico-physiological investigation" of perceptual processes (427).[20]

The epistemology of the *Handbook* reproduces the main traits of Kant's legacy that I have outlined above. First, it is anti-metaphysical: Helmholtz considers both spiritualism and materialism as examples of "equally ungrounded metaphysical speculation or hypothesis" (796). While this can also be considered as an empiricist tenet, the conception of the limits of mechanistic accounts and the role of psychology strikingly remind of Kant's strategy. Helmholtz's notion of 'psychology', as well as the connected notion of "organization of the mind", diverge from the perspective of those who reformed Kantian philosophy in a psychological fashion. Jakob Fries, e.g., wanted to replace Kant's transcendental account with a psychological and empirical one, which was grounded on the "inner experience" of the "human mind" [*Gemüth*] (Fries 1807, xxxviii–xli, 4). Helmholtz, as we have seen, investigated these laws by their epistemological role in cognitive processes rather than by inner observation. Hence, Helmholtz's "pure psychology" was a philosophical discipline containing concepts and principles that can be applied in physiological investigations. Indeed, in his speech "On Thought in Medicine" (1877), he suggests that the domain of philosophy starts where life science reaches its limits: "Philosophy, if it gives up metaphysics, still possesses a wide and important field, the knowledge of spiritual and mental processes and their laws". Its subject matter is "the human thought – as to its capabilities" (Helmholtz 1884, 188–189).

17.4 Lange: Kantianism, Mechanism, Emergence

Friedrich Lange's *History of Materialism and Critique of its present Importance* is considered as a momentous work in the history of neo-Kantianism and includes original arguments on mechanism and mind that deserve to be analyzed. Although Lange devoted a long chapter to Kant in the book and clearly advocated Kantian theses, he also departed from Kant on a number of crucial points, hence a number of scholars have questioned his characterization as a Kantian, arguing that Lange

[20] Helmholtz's very terminological distinction of "sensation" [*Empfindung*], as a merely subjective condition of our nerves, from "perception" [*Wahrnehmung*], as involving different "acts" and directed to objects, is already a sign of a Kantian legacy.

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should be described rather as a "naturalist" or a "skeptic".[21] I will argue that Lange followed in broad outline the Kantian program concerning mechanism and mind, although he drew on different sources and eventually realized an original combination of physicalist epistemology, phenomenalism and emergentism. In this sense, Lange's work represents an important stage in the Kantian legacy.

A brief overview of Lange's objectives in the *History of materialism* is necessary to introduce our analysis. The book appeared as a late assessment of the "materialism controversy", with the aim of separating the prospects of natural science and psychology from their materialistic interpretation and thus providing a "definitive solution to certain cardinal points in the controversy on materialism" (Lange 1866, iii).[22] Lange maintains that materialists conflate empirical evidence with ungrounded hypotheses on the material essence of reality, thereby producing a mistaken "comprehensive world view" of metaphysical character (60). Thus materialism can be considered, on the one hand, as the "most consequent and simplest" understanding of nature, which provides a new "critique" of the cognitive powers against metaphysical speculation and religious superstition; on the other hand, materialism as a *Weltanschauung* is itself a metaphysical delusion, possibly associated with ethical egoism, and as such it is harmful for Lange's humanistic ideal of a cultural and moral reform of society, particularly inspired by Schiller's thought (v).[23] The critique of materialism in this second sense paves the way to a "wider point of view", capable of including the whole of human "endeavors" (viii-ix).[24]

The mistaken overestimation of science that leads to the second kind of materialism, according to Lange, tends to occur as long as one does not "clarify the nature of the sensible world" (Lange 1866, iv), which has to be considered as a phenomenon. This phenomenalism is explicitly presented as belonging to Kantian idealism. As Lange puts it in the second edition of the book, "the whole worldview of materialism is, as it were, incorporated into the Kantian system without altering its basic idealistic character" (Lange 1875, 147). The result is a "materialism of the phenomenon" (Lange 1875, 398), purged of its metaphysical overtones. This argumentative path clearly parallels Kant's distinction of "transcendental idealism" and "empirical realism" (KrV A 375; A28/B44): matter and mechanical laws are thus the basic elements of natural science, but they do not refer to transcendent realities. Materialism is merely a regulative, if fundamental, "maxim" of natural science.

Uncorrected Proof

[21] Köhnke 1991, 161–167; Beiser 2014b, 356–397, in part. 358, 386; Edgar 2015, 113n. On the skeptical stance also see Lange 1866, 276. Hussain and Patton (2016) have argued that "Lange's rejection of two distinctions central to Kantian thought [a priori/a posteriori; intuition/thought] are one argument against placing him squarely in any neo-Kantian tradition. However, Lange's work in the *Logische Studien* and in the 'Standpoint of the Ideal' chapter are difficult to reconcile with a purely empiricist stance either, so he is difficult to place in the philosophical tradition".

[22] English translations are taken from Lange 1925.

[23] Lange wanted to focus on this legacy of Schiller in a book that appeared posthumous (Lange 1897, see in part. 1–25). See Beiser (2014b, 393–397).

[24] On Lange's interpretation of materialism see Köhnke 1991, 164–165; Beiser 2014b, 368–369.

Nevertheless, Lange does not justify his phenomenalism by means of Kant's original transcendental arguments. He replaces transcendental arguments with the evidence provided by the "physiology of sense organs" introduced by Müller and developed by Helmholtz, considered as an improved realization of Kant's original ideas:

> The physiology of the sense-organs is developed and corrected Kantianism, and Kant's system may, as it were, be regarded as a programme for modern discoveries in this field. One of the most successful inquirers, Helmholtz, has employed the views of Kant as a heuristic principle, and yet in so doing has only followed consciously and consistently the same path by which others too have succeeded in making the *mechanism of sensation* more intelligible (Lange 1866, 482, my italics).

Lange was aware that his was no "orthodox" Kantianism, for he wanted to reform Kant's ideas through the support of natural science. In particular, he grounded phenomenalism on the peculiar "organization" of the human mind: "the sense-world is a product of our organization" and "the transcendent basis of our organization remains […] just as unknown to us as the things which act upon it" (493). This reference to Helmholtz's notion of "organization of the mind" provoked the criticism of Hermann Cohen, who pointed out the difference between this naturalistic approach and the original Kantian one. However, Lange's position was not entirely naturalistic, and was also different from Helmholtz's.[25] For my present purposes, I will focus on two aspects of Lange's views. First, Lange's account of the "mechanism of sensation" differed from Helmholtz's for its stronger physicalist epistemology about the mind. Second, Lange formulated different arguments concerning the irreducibility of mental processes, also indebted to different sources.

In order to introduce the first point, we need to focus on Lange's view of mechanistic science. The critique of atomism was the first step in Lange's argumentative path. According to Lange, atomism is a "hypothesis for the explanation of observed natural processes" which has been accompanied since Democritus by a "metaphysical character" (Lange 1866, 358). This metaphysical character has not disappeared in modern mechanistic science, i.e. in Descartes' mechanical philosophy, but the progress of natural science has diminished more and more its significance. In nineteenth century chemistry, with Gay-Lussac, Ampère, Faraday and others, "the atom is deprived of its extension" (364). Lange considers this result as the realization of the dynamical theory of matter that Kant had already sketched in his *Metaphysical Foundations of Natural Science* (366); this dynamical theory, in turn, is presented as the beginning of a progressive "dissolution" of matter in modern science (e.g. in du Bois-Reymond's *Investigations*), for "the progressive exactitude of research resolves [*auflöst*] matter [*Stoff*] more and more into forces" and matter turns out to be a "misunderstood residue of analysis" (373). These passages suggest that Lange – similar to Kant – conceived natural philosophy as a mathematical science grounded on the notions and laws of mechanics, and wanted to separate the latter from the "crass

[25] For a detailed account of the notion of 'organization of the mind' in Helmholtz and Lange, and Cohen's critique, see Pecere 2021a. On the difference between Lange's neo-Kantianism and the neo-Kantianism of the Marburg school also see Sieg 1994, 86.

Uncorrected Proof

materialist" (371) representation of matter, as composed of atoms, which was characteristic of some variants of mechanical philosophy. Indeed, Lange identifies true knowledge with the "scientific [*Naturwissenschaftlich*], physical [*physikalisch*] account of phenomena" (481). Thus he defends a sort of physicalist epistemology in a phenomenalist framework, where everything supervenes on the physical while the physical itself is phenomenal.

Based on this epistemology, Lange disagrees with Helmholtz on the prospects of the electro-physiological description of mental processes. In his long examination of contemporary science of the brain, Lange contends that the localization of *all* mental activity is possible, as long as it is not conceived in a mistaken, hypostatical way. "Abstractions" such as "thinking", "willing", or "feeling" cannot be associated with particular regions of the brain and the respective physical processes, as it typically happened in Franz Joseph Gall's phrenology, which associated skull bumps with cognitive and moral capacities. According to Lange this is a mistaken "anthropomorphism", reminiscent of the scholastic psychology of faculties. Faculties are "names", corresponding to complex activities that cannot be localized in single areas of the brain (436, 446–7). A similar problem affects the study of reflex action, where the "personification" and hypostatization of the mind has led scientists (such as Eduard Pflüger and Müller) to consider movements of beheaded animals as evidence for the existence of the soul in different parts of the body (438–440).[26] Thus Lange believes that brain research should focus on complex *processes* rather than abstract *faculties* of the soul, for the former can be described in dynamic terms:

> If the reflection of the inquirer were entirely directed to the *processes* of thinking, feeling, willing, he would more easily consider the *overflowing* of the excitation from one part of the brain to the other, the *progressive disengagement of tensive force*, as the objective element of the psychical act, and not seek after seats of the different forces, but after the *paths* of these currents, their relations and combinations (Lange 1866, 442).

Lange believes that thinking, willing etc. are "joint effects" of the brain. In this sense he grants that the cortex could be considered as a "necessary factor" in higher faculties, but not as the latter's "seat" (Lange 1866, 435, 443). He concludes: "Even the most abstract concept in the thinking subject is hardly anything else than the sum of infinitely many very intricate and interconnected nerve impulses, which singularly taken are extraordinarily feeble" (Lange 1866, 457).[27] On the whole, the description of the "mechanism of sensation", which is presented as the program of contemporary neurophysiology in the above quoted passage on Helmholtz, is an example of a general electrophysiological description of mental processes: the objective mechanism of mind can be entirely discovered, with the empirical limitation that derives from the large number of impulses.

> *All these effects of the constellation of simple sensations rest upon mechanical conditions which, when physiology has progressed far enough, we may be able to discover*. Sensation,

[26] On the problem of interpreting these experiments see Klein 2018.

[27] In the second edition (Lange 1875, 357) Lange replaces this infinite sum with "the co-operation of very many […] nerve impulses", suggesting that these elements could be enumerated.

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> and with it our whole spiritual existence, may still be the incessantly changing result of the co-operation of elementary activities, infinite in number and in the variety of their combinations, which may themselves be localized, somewhat as the pipes of an organ are localized, but not its melodies (Lange 1866, 483).[28]

As an exemplary model for this view Lange cites Kant's essay on Sömmering, praising the former's "formalistic formulation [*Einrichtung*]" against the latter's "materialistic" one. Kant's chemical analysis conceives of brain processes in terms of "numerical relations and the kinds and ways of the joint action of organic processes", thus suggesting the possibility of a *mathematical* analysis of the physical correlates of psychological processes (which Lange finds realized in contemporary electrophysiology). On the contrary Sömmering attached mind to matter in a hypostatical sense, thus showing that materialism inevitably turns into a metaphysical hypothesis, such as monadology or panpsychism (Lange 1866, 458–459, 28, 48). Hence Lange presents his critique of mental faculties and his mathematization program as belonging to a Kantian legacy. To be sure, both the critique of faculties and the use of mathematics were also doctrines of Herbartian psychology, which was a major influence for Lange. Nonetheless, Lange separated these doctrines from the metaphysical foundation that they receive in Herbart (by means of the concept of "simples") and thus he went back to the Kantian roots of Herbartian psychology itself rather than drawing on the latter.

According to Lange, indeed, we can develop a psychology "without a soul" (465), conceived as an extension to the mind of du Bois-Reymond's "mechanical analytic of the whole life processes" (du Bois-Reymond 1848/1912, 9): the latter excludes soul and life-force as explanatory grounds of life processes, Lange's psychology excludes the soul, as a non-mechanical factor, from the explanation of psychical acts. The discussion of Helmholtz's account of perception is introduced against this background. Lange interprets Helmholtz's theory of "unconscious inferences" in perception as conducive to his own views: since we can reduce unconscious to material processes, Helmholtz's theory suggests that we might also get to a material explanation of the "higher functions of reason" (Lange 1866, 496). Lange argues that Helmholtz's "unconscious inferences" could actually provide "new support" to materialism unless we formulate an argument on the *limits* of mechanical accounts of the mind. As we have seen Helmholtz agreed with this anti-reductionist side of the Kantian legacy, but Lange did not incorporate Helmholtz's arguments for "pure psychology" in his account and argued that only a robust idealist perspective on matter itself could solve the issue: "the only way" to avoid metaphysical materialism is to follow its "consequences" until it gets to its limit, asking "what is the body? What is matter? What is the physical? And modern physiology, just as much as philosophy, must answer that they are all only our representations;

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[28] In the second edition, Lange also proposes a hypothesis on the neural correlates of consciousness as a "relation of the intensity of excitations given in the domain of sensation" (Lange 1875, 439n). The phrase '*mechanical conditions*', here, may suggest that Lange is endorsing a causal connection of matter and mind. As I will show in the following paragraphs, however, he rather wants to maintain a kind of 'double-aspect' monism.

necessary representations, representations resulting according to *natural laws*, but still never the things themselves". A "consequent materialistic view thus changes round […] into a consequent idealistic view" (Lange 1866, 496).

Thus the intrinsic limits of mechanistic science are presented as an implication of Lange's phenomenalism. But the limitation thesis is supported by two further arguments, which also – like Lange's justification of phenomenalism by means of the physiology of the senses – draw on non-Kantian sources of inspiration: an argument on the quality of sensation and an argument on the meaning and value of representations.

Concerning sensation, Lange first takes for granted a supervenience hypothesis and then concludes that there can be no further explanation of the correspondence between the "subjective state of the sentient person [*Empfindenden*]" and the "objective state" of the nerves. We cannot regard "'thought' as a separate product in addition to the material processes", therefore "the subjective state of the sentient individual is at the same time to external observation an objective one, a molecular movement". He adds that this subjective state "must, on the law of the conservation of energy, fit into the unbroken causal series". It is "not a special link in the chain of organic processes, but as it were merely the *aspect of some of these processes, from another side* [*die Betrachtung irgend eines dieser Vorgänge von einer andern Seite her*]". Although "there is *hardly anything to look for* in sensation over and above the above-mentioned nerve processes", it is "impossible" to further determine the relation between the two processes. Lange's view is that psychic and physical processes are different "modes of appearing" of the same unknown ground (Lange 1866, 456).[29]

This can be considered as a reprise of Kant's original thesis that the "same Something that grounds outer appearances and affects our sense so that it receives the representations of space, matter, shape, etc. – this Something, considered as noumenon (or better, as transcendental object) could also at the same time be the subject of thoughts", although it cannot be known (KrV A 358; also see B 428). This kind of monism of the 'undetermined ground' was advocated by Lange and others as a neo-Kantian alternative to Spinozism (Lange 1968, 358; Pecere 2020c, 95–98).[30]

Lange's last anti-reductionist argument was the claim that the "spiritual value" of perceptions, whose primary example is the aesthetic value of art, cannot be identified with a physical structure or process:

> We have not the slightest occasion […] to seek for that which is spiritually significant, the artistically moulded sensation or the ingenious [*sinnvollen*] thought, outside the ordinary processes of sensation. Only, of course, let us not proceed like a man who should try to discover the melodies that an organ can play in the individual pipes (Lange 1866, 457).

[29] Also see Lange 1866, 166 ("unknown third"), 1875, 125–127 ("something unknown").

[30] Lange's argument is also quite similar to du Bois-Reymond's in the 1872 lecture, and it is no surprise that the "Ignorabimus" thesis was the object of a long appreciative section and presented as a kind of Kantianism in the second edition of the *History of Materialism* (Lange 1875, 148–162, in part. 161). However, du Bois-Reymond rejected this characterization because, as a scientist, he did not allow of any "exoteric" investigation on the ground of empirical facts (du Bois-Reymond 1886, 382).

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The example of organ pipes and melodies, in this context, suggests that Lange might be thinking to Helmholtz's *On the Sensations of Tone* (1863), where considerable space is devoted to the mechanical analysis of pipes in musical instruments and the irreducibly cultural taste for melodies. Helmholtz had defended a similar distinction of music from sound, arguing that no physical or physiological analysis can account for the cultural variability of aesthetic taste (Helmholtz 1913, 385–386). Lange's thesis on "spiritual value" was different and more similar to Lotze's view, which, as we have seen above, had roots in Kantian philosophy. However, Lange supported his conclusion with a kind of emergentist argument. According to Lange, while ideas depend on the "interaction of all the elements of the individual mind", they can only be compared with other ideas as to their "value". The experience of art, in particular, regards "relations of sensations", thus what we may call second-level properties, whose unity appears as a *Gestalt* (Lange 1866, 347, 289). Hence, while it makes sense to refer simple impressions and motor-impulses to brain correlates, to look for "thoughts" or "feelings" in the brain is a mistake: it is like trying to "discover in the muscles of the under-arm of the pianist sharp, flat, allegro, adagio, and fortissimo, each in its particular corner" (454–455). This argument was indebted to John Stuart Mill's emergentism. "Complex ideas", according to Mill (1843 II, 502), cannot be considered as the "sum" of the effects of the correlate causes and can be of a different kind from that of those effects. Mill applied this argument to the origin of moral feelings (also see Lange 1875, 397–398).

This emergentist argument, as well as other sources of Lange's notion of aesthetic and moral feelings (e.g. Schiller and Hegel), suggest that his anti-reductionism was not directly related to Kant anymore. However, in the second edition of the *History of Materialism* Lange reconsidered the limits of scientific accounts of the "synthesis" of impressions from a Kantian angle. He connects the "psychical image of the intuition which becomes conscious in the subject to a direct synthesis of the individual impressions, even if these are dispersed in the brain", and concludes: "How such synthesis is possible remains a riddle" (Lange 1875, 419; also see 418). In the posthumously published *Logical Studies* this irreducible synthesis is presented as a "psychological fact" that traces a boundary between psychology and mechanistic physiology:

> The *synthesis* is the only psychological fact that cannot be reduced to physiology or to the mechanics of brain atoms and which must be added to every process in the brain and the nervous system in order for the mechanical fact to become a psychological one (Lange 1877, 135–136).

With this separation of mechanical and psychological facts Lange reshapes Kant's idea of a new philosophical "psychology": he excludes a priori *principles* and grounds the distinction of the psychological from the mechanical facts on the very operation of the synthesis that results in psychic representations. In order to connect his account of the conditions of human cognition with phenomenalism, as we have seen, Lange elaborates on Helmholtz's notion of "organization of the mind", which he turns into a "psycho-physical organization". Hermann Cohen considered this notion as a naturalization of Kant's notion of the a priori, which was as mistaken as

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Helmholtz's "organization of the mind", and eventually grounded the idea of psychology on pure transcendental arguments (see Pecere 2020c, 2–4, 13–14). Lange, however, believed that Kantians such as Helmholtz were wrong in emphasizing the mental side of cognition, as they "persistently speak of the *mental* organization" and contends that "this 'mental' organization is only the phenomenal side of the physical organization" (Lange 1875, 448 n. 60). As Lange puts it, since both physical and psychical facts are phenomena (whose ground is unknown) "it is all but indifferent, whether we speak of a mental or physical organization, and therefore we might so often use the neutral expression" (Lange 1866, 483).[31] These passages confirm that he wanted to put all physical facts into the perspective of a metaphysically neutral phenomenalism. Granted that both sensations and mechanisms are products of our organization, to consider representations as results of the synthesis of sensations or of the "mechanism in the organs" are equally valid ways of describing the facts (Lange 1866, 493).

17.5 "Scientific Psychology" and the Fate of the Kantian Legacy

The consolidation of quantitative experimental psychology, in the late nineteenth century, was strictly interconnected with a reassessment of the objectives of philosophy: a "scientific" psychology could cede the epistemological interests to philosophy or assimilate the whole field of knowledge into an organic psychological perspective.[32] The fate of the Kantian legacy in psychology is to be considered against this complex background. The attempt at reconciling transcendentalism and mechanistic science of the mind in the name of Kant, although it left some traces, was not successful. The fate of the Kantian legacy in psychology was rather a parting of ways.

The critique of psychologism and naturalism prevailed among self-declared neo-Kantians, as the separation of psychology and philosophy produced a conflict in German universities (Sieg 1994, 357ff.). Hermann Cohen criticized the naturalization of Kantianism of Helmholtz and Lange and advocated a neo-Kantian transcendental conception of consciousness against the possibility of physical or psychological reduction: "The unity of consciousness does not mean the unity produced in the mind [*Geist*] by either nerve molecules or sensations" (Cohen 1885, 207). Paul Natorp developed an idealist psychology grounded on "the existence of consciousness", or "self", as the "fundamental fact of psychology" which can "neither be defined nor deduced from anything but itself" (Natorp 1888, 112). In this framework, the aim of psychology was a "methodical regression" from the

[31] Regarding Kantian conditions of experience he similarly writes: "we cannot speak of a difference of the psychical and the physical yet" (Lange 1866, 257).

[32] For a theoretical and historiographical outline see Hatfield 2012. Also see Sachs-Hombach 1993.

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"objectivations" of psychology to pure subjectivity (Natorp 1912, 198), hence the philosophical importance of mechanical analysis defended by previous Kantians was ruled out.

Wilhelm Wundt, on the contrary, wanted to pursue the conciliation of idealism with physiological psychology, but his attempt resulted in a substantial transformation of the original traits of Kant's approach.[33] In the *Principles of physiological psychology* (1874) Wundt presents an idealist framework for psychology and endorses a kind of compatibilist view on the relation between psychic representations and mechanism. "*All* movements are preformed [*vorgebildet*] in the mechanical conditions of the nervous system" (1874, 822). However, there are "kinds of movements for which there are, at the same time, internal, psychological causes that are immediately accessible to self-observation, or that become probable thanks to outer observation" (Wundt 1874, 823). Even the discoveries of Fritsch and Hitzig on the stimulation of the cortex do not entail that psychic activity is reduced to (or entirely caused) by the physical. E.g., the distribution of neural correlates of voluntary action shows that "the will too *makes use* of a mechanism that has several apparatuses of self-regulation" and thus there are "psychological causes" next to physical ones (830–832), in what Wundt calls a "double determination of the will" (835).[34] In order to substantiate this approach, Wundt defends a kind of emergentism: he argues that the cognitive synthesis is "the creative act in our process of cognition", meaning that its "new" products are irreducible to the original elements (Wundt 1863, 435, 489). In this perspective, the "unity of thought" and the "formal unity" of representations can coexist with a physical account of the respective material correlates (Wundt 1874, 226). Wundt also highlighted the explanatory limits of a "mechanic of the brain" for the explanation of sensations (Wundt 1898, 359) and eventually incorporated the methods and data of *Völkerpsychologie* in order to account for both the physiological and the spiritual dimension of the mind. This approach shared important aspects of the perspective of Lange – who praised Wundt's work[35] – and seems indeed indebted to the Kantian legacy that I have reconstructed, although Wundt did not shun metaphysical hypotheses and explicitly mentioned Leibniz as an equally important source for his elaboration of idealism.

Wundt's original philosophical perspective – named "ideal-realism" – bears traces of all the original elements of the Kantian legacy in physiology of mind and psychology. First, Wundt rejects the soul as substance, arguing that the soul is a rather the "logical subject" (Wundt 1880, 8). He also rejects vitalism (20) and grants the importance of the study of the underlying mechanisms of action. The framework for the incorporation of mechanistic science in psychology is a kind of monism (largely influenced by Fechner), according to which psychical processes are "identical" to physical and only appear different depending on the way we consider them,

[33] See Araujo 2016 for a survey.

[34] Russo Krauss (47) detects an inconsistency of Wundt's formulations on this point.

[35] Lange 1875, 369–370. Lange also discusses the results by Fritsch and Hitzig and similarly comments that the distribution (and plasticity) of neural correlates contrasts the idea of an electrophysiological reduction (363–363).

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twofold: concerning sensations, it looks like

hence he can maintain that "mechanical necessity and logical necessity are not different in essence, but in the way of considering phenomena" (Wundt 1863, 199–200). Wundt also rejects the materialization of representations, arguing that "mental experiences are not objects, but processes" (Wundt 1894, 236), thus recognizing the possibility of an indirect study of the mind by means of physical processes. In this perspective, indeed, "psychical and physical objects […] are not different objects at all, but one and the same content of experience, looked at in one case – in that of the natural sciences – after abstracting from the subject, in the other – in that of psychology – in their immediate character and complete relations to the subject" (Wundt 1897, 10).

However ~~To be sure~~, according to Wundt, "we must recognize the priority of inner experience" (Wundt 1874, 860), that is the epistemic priority of the mind on physical objects. The whole field of psychology is grounded on the fundamental role of "apperception" as the condition of psychical operations. Thus Wundt departs from the models of Herbart's atomistic psychology and of British associationism from Hartley to Spencer (Wundt 1911, II, 532ff.). In this perspective, consciousness is a dynamic, spontaneous and unified structure, which imparts a purposiveness to mental life (Wundt 1911, III, 296ff). This teleological structure of consciousness also entails the causality of the will, which is realized in the physical domain under the assumption of psychophysical parallelism. In turn, this causality entails the autonomy of the mental from both physics and physiology (Wundt 1897, 317ff). Because of these views on apperception, free will and the autonomy of the conscious mind, Wundt's psychology – however indebted also to Leibnizian philosophy – can be conceived as belonging to the Kantian legacy.

and autonomy

Eventually, however, Wundt accounted for the connection of the mental with its mechanical correlates by means of an emergentism that sharply differs from Kantianism. In Wundt's formulation of the "law of psychological resultants" we recognize the examples of Lange's arguments, separated from their original Kantian context and inserted into a new doctrinal complex that would become a standard reference for twentieth century psychology:

> The law of psychical resultants finds its expression in the fact that every psychical compound shows attributes which may indeed be understood from the attributes of its elements after these elements have once been presented, but which are by no means to be looked upon as the mere sum of the attributes of these elements. A *compound sound* is more in its ideational and affective attributes than merely a sum of single tones. In spatial and temporal ideas the *spatial and temporal arrangement* is conditioned, to be sure, in a perfectly regular way by the cooperation of the elements that make up the idea, but still the arrangement itself can by no means be regarded as a property belonging to the sensitive elements themselves […] Finally, in the apperceptive functions and in the *activites of imagination and understanding*, this law finds expression in a clearly recognized form […] for example, in a *work of art* or a train of *logical thought* (Wundt 1897, 321).

Moreover, Wundt wanted both to keep the traditional idealist arguments on the epistemic precedence of apperception over matter, while he associated the latter to the awareness of physical adjustments in the body, thus incorporating physiology into the idealist tradition (Wundt 1880, 217–219).

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Wundt's reworking of the idealist tradition left a significant trace in successive psychology, both in Europe and the United States. Wundt's intertwining of mechanism, experiments and transcendentalism was a testing ground for different interpretation. Although many British and American psychologists attended German universities and thus had a direct connection to the tradition that I have sketched, the dominant tendency was to connect Wundt's physiological psychology to the tradition of associationism and separate its "metaphysical impulse", conceived as a stimulus to experimental research, from Wundt's "dangerous tendency to wander into the unscientific bypaths of metaphysical speculation" (Sully 1876, 30). This quote from James Sully, himself a former student of Lotze, Helmholtz and du Bois-Reymond, is drawn from an article published in the very first issue of the "Mind" journal, where Sully positively (if critically) presented Wundt's work, with a focus on physiological hypotheses and experiments. This kind of approach was characteristic of Wundt's reception in Anglophone psychology, which can explain why James Ward, when he turned against the tendency to mechanistic materialism of British associationism, included Wundt and Lange among those who favored the mistaken exclusion of consciousness from psychology.[36]

One more notable example was William James. The *Principles of Psychology* (1890) contain abundant discussions of Wundt and German neo-Kantianism, which played a major role in James' education. James spent a year in Germany in 1867, studying physiology with du Bois-Reymond in Berlin and planning to follow Helmholtz's and Wundt's classes in Heidelberg (Gundlach 2017). His later work regularly discusses and occasionally incorporates some of the ideas of German physiological psychology, such as the non-reductive approach to the analysis of neurophysiological mechanisms, but easily separates these elements from original Kantian background that was already so loosely connected to them. James acknowledges that matter and soul are but "postulates" behind phenomena and endorses a neutral monism inspired by Ernst Mach (James 1890/1950, 304). He drops the Kantian "Ego" as a useless version of the soul, replacing Kantian synthesis with the appropriation of previous moments of experience inside the stream of thought (401ff. Also see James 1904/2003). The fragile connection of mechanism and a priori of the neo-Kantian tradition was thus broken and would only occasionally and fragmentarily turn up in the successive history of psychology and neuroscience.

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[36] On Ward's perspective see Boccaccini's paper in this collection.

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