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The Epigenesis of Germs and Dispositions in Logic and Life: Kant's System of Pure Reason and His Concept of Race

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Abstract: In the 1787 Transcendental Deduction of the Categories Kant indicates the only possible ways by which one can account for a necessary agreement of experience with the concepts of its objects (B166), using analogies between modes of explanation and biological theories about the origin of life. He endorses epigenesis as a model for his system of pure reason (B167). This paper examines various interpretive claims about the meaning of this theory of generation and its significance for Kant's philosophy (Section 1), showing that, after his Critical shift in perspective, in 1775/77 Kant already combined preformed elements and their purposively oriented formation by natural forces (Section 2). Contrary to the standard view, Kant's theory of race appears to constitute the background to assess Blumenbach's later (1799/1781) shift to epigenesis after supporting Haller's preformism (Section 3). In Section 4, I argue that the ground of affinity between epigenesis and formal idealism rests in tracing the first origin of these conformities: external *a posteriori* climate conditions and predisposed germs and dispositions within the generative power of the human body; and external *a posteriori* experience and spontaneous *a priori* concepts of its objects, within pure sensory intuiting and pure thinking. In both cases the external empirical conditions would function as occasioning propelling factors affecting internal pre-established forms of generation.

This is an invited article.

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1 Introduction: The issue at stake in the development of Kant's thought[1]

In his famous Letter to Markus Herz of 21 February 1772, Kant shows the great difficulty justifying the putative agreement between what we call internal representation with external objects of the senses. The problem would not arise if the *Vorstellung* in us would contain *only* the way in which the subject is affected by objects of the senses, for then representation would conform to outer things as an effect to its (efficient) cause. Neither would we have this problem if the subject, as *intellectus archetypus*, was creative with respect to its objects. What then can give objective reference to pure concepts of understanding, formed by our inner representational intellectual activity itself, and completely *a priori*? That letter leaves this issue of validity unsolved: "this question, of how our faculty of understanding achieves this conformity with the *things themselves* (*mit den Dingen selbst*) is still left in a state of obscurity", (Kant, Ak. 10:131, my italics). As is well known (Longuenesse 1998, 26), Kant offers a solution in §14 of the 1781/1787 Transcendental Deduction:

> […] all experience contains in addition to (*außer*) the intuition of the senses, through which something is given, a *concept* of an object (*Gegenstand*) that is given in intuition, or appears; hence concepts of objects in general lie at the ground of all experiential cognition as *a priori* conditions; consequently, the objective validity of the categories as *a priori* concepts rests on the fact that through them alone is experience possible (so far as concerns the form of thought). For they then are connected (*beziehen*) necessarily and *a priori* to objects of experience, since only by means of them can any object of experience be at all thought. (Kant, A93/B126)[2]

Since only through the *formal* conditions of sensible intuition, space and time, can things immediately appear to us or be empirically given (A92–3/B125), a thing *qua* single appearance necessarily agrees with the *a priori* forms of space and time but is not yet a *determinate* object of experience: a *Gegenstand* is not yet an *Objekt*. To cognize a thing as an object, or *phaenomenon* in the terms of Kant's *Inaugural Dissertation*, requires the mediation of concepts "by which an object which corresponds to this intuition *is thought*" (A92–3/B125; *cf.* Longuenesse 1998, 23–4). Indeed, experience, understood as a reflexive cognition of phenomena, arises when several appearances (the raw material of sensible impressions in general) are compared,

1 A shorter version of this paper was the opening keynote address to the HICO Workshop, "The Entwinement of Logic and Life" (Department of Philosophy and Moral Sciences, University of Ghent, Belgium, 12–14 September 2023). I wish to thank the organizers (Levi Haeck, Kobe Keymeulen and Xuansong Liu) and their coordinator (Gertrudis Van de Vijver) for their kind invitation and the audience for stimulating discussion.

2 Some translations are modified without notice.

combined or separated by the activity of the understanding (*cf.* B1; *cf.* Longuenesse 1998, 26–7 note 15). According to Longuenesse, "the operations of comparison/reflection/abstraction, by means of which empirical concepts are derived from the sensible given, are also operations that ultimately combine these (empirical) concepts according to the logical forms of judgment" (Longuenesse 1998, 199). This presupposes a synthesis of perceptions according to the categories (A177/B218–9). Therefore, the agreement between the empirical synthesis of apprehension (perception) and the intellectual synthesis of apperception, is grounded in one and the same spontaneity:

> Thus, if, *e.g.*, I make the empirical intuition of a house into perception through apprehension of its manifold, my ground is the *necessary unity* of space and of outer sensible intuition in general, and I as it were draw its shape (*Gestalt*) in agreement with this synthetic unity of the manifold in space. This very same synthetic unity however, if I abstract from the form of space, has its seat in the understanding, and is the category of the synthesis of the homogeneous in an intuition in general, *i.e.*, the category of *quantity* (*Grösse*), with which that synthesis of apprehension, *i.e.*, the perception, must therefore be in thoroughgoing agreement.*
>
> *In such a way it is proved that the synthesis of apprehension, which is empirical, must necessarily be in agreement with the synthesis of apperception, which is intellectual and contained in the category entirely *a priori*. It is one and the same spontaneity that, there under the name of imagination and here under the name of understanding, brings combination into the manifold of intuition. (B162 & note)

In §10, "On the pure concepts of the understanding or categories," Kant underscores the difference between universal and transcendental logic by writing that the same understanding, by means of the same function, and through the very same actions (*Handlungen*) gives analytical unity to the different representations in a judgment, bringing the logical form of a judgment to concepts, and also gives synthetic unity to the simple synthesis of sensory intuition, bringing a transcendental content into its (intellectual) representations, which on this account are called pure concepts of the understanding that pertain to objects (*gehen auf Objekte*) *a priori* (A79/B105). In his marginalia to his own copy of the first edition (1781) *Critique*, at the beginning of the analytic of concepts, Kant notes that

> Experience consists of judgments, but the question is whether these empirical judgments do not ultimately presuppose *a priori* (pure) judgments. (Kant's note to A66/B91, R XXXII, Ak. 13:22–3)

Kant's test to establish whether something is an experienced fact, rather than a fallacy, is that the particular empirical (*a posteriori*) judgment can stand under a universal rule for judging, so that concepts can be made out of it (*ibid.*). Thus, as highlighted by Longuenesse, the Transcendental Deduction's solution to the problem posed in the 1772 letter to Herz required a shift of perspective and a change of vocabulary, from efficient causality to condition of possibility (Longuenesse 1998, 20).

This is the background to §27, added in 1787 at the end of the Transcendental Deduction of the Categories as *a priori* necessary and universal first principles of knowledge in accord with the logical forms of judgments. Here Kant summarizes his result by distinguishing competing theories of a necessary agreement between experience and concepts of its objects. In doing so, he refers to theories of biological generation. Kant presents his transcendental or formal idealism as a kind of system of epigenesis of pure reason just in so far as, from the side of the understanding, "the categories contain the grounds of possibility of all experience in general." By contrast, the assertion of a (contingent, general and inductive; *cf.* Genova 1974, 268) empirical origin of the first principles of our cognition would be a kind of *generatio aequivoca*, as opposed to *generatio univoca* (Wubnig 1969, 148–149; Genova 1974, 264–265; Ingensiep 1994, 382). The middle way to regard these principles (likely a reference to Crusius; *cf.* Genova 1974, 269; Ingensiep 1994, 388–9), as a subjective disposition to think (*Anlagen zum Denken*), arbitrarily implanted in us by God along with our existence so as to agree necessarily with the laws of nature which structure the world we experience, would be a kind of preformation system devoid of objective necessity (B166–8).

Some interpreters find Kant's appeal to epigenesis odd. Zammito finds the metaphor unsuitable and unilluminating: it risks falling into vital materialism, while the alleged spontaneous power of the understanding is inscrutable (Zammito 2003, 92–3). Sandford finds the analogy "enigmatic" and marking "a stain on the purity of *a priori* concepts, a blot from Kant's own hand" (Sandford 2013, 15, 16–17, 24). She is puzzled by the apparently paradoxical appeal to a theory of natural generation to explain the *a priori* and pure status of the categories, which cannot be explained in natural terms. Malabou (2016, 28) states that this analogy is problematic because "biological epigenesis is incompatible with the idea of pure development." She poses this dichotomy: "either *a priori* epigenesis is nothing but a certain kind of preformation that requires a return to innate predispositions – but again, how can we think a pure development without annulling the very idea of development? – or epigenesis is not pure and includes experience, that is, adventure and surprise, in its process." She proposes to rethink the transcendental as growing, developing, transforming and evolving against the supposed invariability of laws of thought.

Other interpreters regard the analogy as "response to contemporary objections" to the first version of Kant's Critical idealism of the *a priori*, addressing the serious charge of Berkeleyan idealism by Garve and Feder, and also Hamann's 1784 *Metacritique on the Purism of Reason* (Genova 1974, 261; Zöller 1988, 75; Sandford 2013, 22). The former criticized Kant for resolving the mind-independent reality of things in space into representations that exist in us; the latter noted the miraculous birth of principles and concepts and the myth of an immaculate generation.

These interpretations, however, appear to confine Kant's use of the analogy to a specific strategic task within the B Deduction. This overlooks Kant's use of metaphors

drawn from life and generation to characterize his formal idealism in the first edition of 1781 and in passages unaltered in both editions.

From its first edition, the *Critique of Pure Reason* aimed to outline the whole plan to build transcendental philosophy on the basis of originary *a priori* principles. The metaphor presenting this idea of science as the system of all principles of pure reason is architectural (A13/B27), using a discursive and constructive model. The cognitions of the understanding are not a *coacervatio* but an *articulatio* (A833/B861), because the systematic unity of reason functions as a rule for the understanding's activities, connecting them in accord with necessary laws. The architectonic nature of reason considers the multifarious cognitions of the understanding under an idea which is nothing but the rational concept of a whole prior to its parts, through which both the extension and the mutual place of the parts are specified *a priori* (A645/B673). In the Architectonic of Pure Reason, Kant notes the difficulty confronting any new science corresponding to its basic idea, for this idea is in reason like a germ (*Keim*), all the parts of which still lie very involuted and are hardly recognizable even under the microscope (A834/B862). Here the analogy is between originary germ and schema of the system, and between the formation of a system of all human cognition and stages of organic development: at first like a *generatio aequivoca* of worms, from the mere confluence of aggregate conceptual materials, that only with time becomes complete, bringing to light the fundamental idea and outlining the architectonic of the whole according to the ends of reason (A835/B863).

However, Kant requires his Critique to present (*vor Augen legen*) a complete enumeration of the basic concepts which constitute pure knowledge. To indicate these originary and primitive pure concepts of the synthesis of the manifold of intuition which *der Verstand a priori in sich enthält* (A80/B106), and which are nothing but the principles themselves of the prospective system, Kant uses the expression *Stammbegriffe* (A13/B27). Kant then calls the categories *wahren Stammbegriffe* and their table, divided in four *classes,* constitutes the *Stammregister* of the understanding (A81/B107), or the *Stammbaum* of the pure intellect (A82/B108).

In sum: already in 1781, Kant's metaphors for characterizing the categories are of biological ancestry, lineage and generation, presenting the very possibility to understand something of the multiplicity within sensory intuition by thinking it as an object (A80/B106), phrased as a quest for first origins. In the first division of the Transcendental Logic, both in 1781 and 1787, Kant clarifies his use of the term "analytic of concepts" as an attempt to analyze the capacity of understanding (*Verstandesvermögen*) itself as the "birthplace" of the pure concepts:

> I understand by an analytic of concepts […] the much less frequently attempted *analysis of the faculty of the understanding* (*Zergliederung des Verstandesvermögen*) itself, in order to research the possibility of *a priori* concepts by seeking them only in the understanding as their birthplace (*Geburtsorte*) […]. We will therefore pursue the pure concepts into their first germs and predispositions (*zu ihren ersten Keimen und Anlagen*) in the human understanding, where they lie

> *prepared* (*vorbereitet*; Engl. tr., 203: ready) until they finally develop (*entwickelt*) on the occasion (*Gelegenheit*) of experience and exhibited in their clarity by the very same understanding, liberated from the empirical conditions attaching to them. (A66/B91)

This passage has puzzled interpreters. Zammito claims this is "preponderantly a preformationist analogy" and the absence of the term epigenesis (especially in contrast to 1787) is "crucial" to him (Zammito 2015, 206). Another study underscores the "ambiguity" of this passage in respect to the model of epigenesis stated in B167, for here Kant seems not to have in mind a form of genesis of pure concepts but only the development of something "ready" in the mind though still enveloped (La Padula 2023, 191). This sense of "ambiguity" is reinforced by the English (as well as the Italian) translation of the verb *vorbereitet*: "ready" (Italian: "pronti") instead of *prepared* or *predisposed*. Thus, why Kant does choose epigenesis as the most faithful model of the relation between the spontaneity and lawfulness of *a priori* knowledge and the process of physiological generation remains unanswered. As stated in my title, by following the *Leitfaden* of Kant's reflections on the concept of race (Ferrini 2022), I shall address three main issues which have now emerged:

1. What prompted the fundamental shift between 1772 and 1781 from causality to conditions of possibility which paves the way to the Transcendental deduction of the objective validity of the first principles of our thinking faculty?
2. How is it possible to argue for the existence of *a priori* epigenesis without contradiction?
3. What is the ground of affinity between epigenesis and formal idealism?

2 The Conformity Between Experience and the Concepts of Its Objects: Kant's Shift of Perspective

In summer semester 1756 Kant taught his first course in physical geography. In April 1757 he announced his Physical Geography course for 1757/8, devoting a specific section to examining the animal kingdom, "in which man will be considered, in a comparative way, according to the difference of its natural conformation and color in the different zones of the Earth" (Kant 1757, Ak. 2:9). In the manuscript (Ms.) Holstein, composed of annotations by anonymous auditors of that first course (Stark 2011, 72, 76–8), Kant made no reference to organized organic beings, nor to finality and purpose, even if the course devoted a part specifically to humans. Ms. Holstein never explicitly refers to the notion of germ (*Keim*), nor predisposition (*Anlage, Prädisposition*), characteristic of Kant's later theory of race, outlined in 1775 (*cf.* Clewis 2016, 321). Kant initially conceived of climatically determined human diversity, whereby physiology achieves conformity with habitats only through the empirical *a posteriori*

manner in which the body and its generative force of reproduction is affected by external circumstances. This is confirmed by a passage from the Rink edition (1802) of the *Lectures on Physical Geography*, where Kant ponders *the causes* of the various formations and of the natural character of a people. His answer only considers modifications (*Ausartungen*) of animals in relation to their configuration (*Gestalt*) and habits (*Sitten*), because once they are transported to another climate, in contact with different air and food, "their progeny makes them dissimilar" (Ak. 9:317). In presenting the idea that migrations, deportations or transplantations modify the original conformation and customs into a lineage differing from the progenitors in body and character, Kant actually endorsed Buffon's theory (1753) of the efficient causes of climate and nutrition on organic and temperamental characteristics. According to Buffon, Blacks, if moved north, away from the efficient cause of the hot-humid climate, could become lighter in color after many generations, and Whites could similarly become dark if moved to the equator.

Kant publicly distanced himself from Buffon's approach in 1775/77 with *On the Different Races of Men* (first issued in 1775 as the announcement of his next course on Physical Geography, then revised into an essay in 1777), in these three regards: 1. A monogenism of species (with the common descent of mankind from a single original stock) based only on the natural action of the generative force of reproduction and the empirical evidence of cross-breeding with fertile offspring and the phenomenon of hybridization; 2. The theory of germs and natural predispositions in humans, the only animal which can spread over any part of the earth, and of climate as only the occasional, contingent cause of their diverse physiology; 3. A rigorous definition of the concept of race (in relation to species, variety, lineage). The key was to define race in terms of necessary and invariable inheritance of characters from both parents in half-breed offspring (such as skin color and facial traits).

According to Kant, contrary to Blumenbach (1776) and to Buffon, human diversity is articulated into stable and homogeneous typologies (as for Lord Kames), with uniform and lasting properties, whose individuals resemble each other, which cannot be traced back to a fluid, highly variable spectrum of characteristics depending upon accidental causes such as soil, climate, food, etc. Section 3 of *On the Different Races of Men*, titled "Of the Immediate Causes of the Origin of These Different Races," in both versions (1775, 1777), identifies the natural causes of differentiation of one single species into races from the Linnean perspective of the "laws" of generation, laws that excluded equivocal or spontaneous generations, and afford formulation of a general theory of reproduction (Müller-Wille and Rheinberger 2012, 30–4). In this and in the subsequent §4, "Of the occasional causes of the formation of different races" (completely new in 1777), Kant addresses the limits of Buffon's theory of reproduction, which remained linked to the occasional nature of phenotypic differences due to the influence of climate, including prevailing winds, and of nutrition, according to geographical, economic, cultural, and environmental

variables. Instead, according to the monogenic approach endorsed by Kant, the perspective must be shifted from efficient *a posteriori* causes or supernatural local creations, to explaining through natural causes how the generative force of *the only original conformation*, or *Stammbildung*, of the human species, could *contain the grounds of possibility of adaptations* to *all* the different climatic regions of the Earth:

> Man was determined for all climates and for every characteristic of the soil; consequently in him various germs and natural dispositions must be ready to be developed or restrained on occasion, so that he adapts himself to his place in the world and, with the passing of generations, seems as it were to originate from it and be specially made for it. (Kant [1775] 1777, Ak. 2:435; my tr.)

> … what shall be transmitted must already be placed in the generative force beforehand, as predetermined for an occasional development (*als vorher bestimmt zu einer gelegentlichen Auswickelung*) in accord with the conditions in which the creature can find itself and in which it must preserve itself and persevere. (Kant [1775] 1777, Ak. 2:435; my tr.)

My answer to the first question is that a shift of perspective from efficient causes to conditions of possibility to solve an analogous issue of *origin of conformity* between essential organization within the subject on one side, and empirical phenomena on the other side, appears to mature in 1775 in the field of natural history regarding human life, intersecting and interacting with the similar logical concerns of 1772.

3 Epigenesis as *a Priori* product?

Kant introduced a naturalized form of finality, by insisting upon the universality of this precaution of nature (*Vorsorge* in 1775; in 1777 changed to *Fürsorge*, 'foresight') in equipping its creatures, both vegetable and animal, with characters (entire functional parts, or relations among parts) produced from specific germs or natural dispositions differently and occasionally, depending upon environments. Such *Keime* and *Anlagen* must, however, be antecedently rooted *virtualiter* within the generative force, to be reproducible and always transmittable to offspring, once selectively activated by circumstances. Such local circumstances can only act occasionally upon bodies and only during their growth, and thus cannot root invariably transmitted adaptive characteristics in the generative force necessarily required for their reproduction from generation to generation, even in the absence of such causes and circumstances:

> Neither chance nor universal mechanical laws can produce such adaptations. Therefore we must regard such circumstantial developments as *preformed* (*vorgebildet*). Even where nothing purposive is shown (*wo sich nicht Zweckmäßiges zeiget*), the mere capacity to reproduce one's particular assumed character is proof enough (*schon Beweises genug*): that for this [purpose] a specific germ or natural disposition must be found (*anzutreffen gewesen*) in the organic creature. For external things can be occasional, but not efficient, productive causes of what is necessarily inherited and transmitted. (Kant [1775] 1777, Ak. 2:435)

Note that in this context Kant inquires into the conformity of human diversity to its empirical habitats, claiming that this appears *as if* it were a matter of local supernatural creations or material *generatio spontanea.*

His stance in 1775/77 appears unaltered in "On the use of teleological principles in philosophy" (1788), where Kant presents this conjecture, highlighting its inversion of the points of reference in the same vein as his 1787 Copernican revolution (Bxxiii):

> Regarding the first point, one should recall that I took those first predispositions not to be *distributed among different* human beings – for then they would have become as many different *phyla* (*Stämme*) – but to have been *united* in the first human couple. Hence their descendants, in which the *entire* original predisposition (*die ganze ursprüngliche Anlage*) for all future derivations (*Abartungen*) was still unseparated, were fit for all climates (*in potentia*), such that the germ which would make them suitable to that region of the earth in which they or their early descendants would find themselves, could develop there. Thus there was no need for any special wise arrangement to bring them into those places where their predispositions fit. Rather, where they happened to go and for a long period continued their generation, there developed the germ to be found within their organization for this region of the earth, making them fit for such a climate. The development of the predispositions depended upon places; the places did not, as Hr. F. misunderstands the matter, have to be sought out according to the already developed predispositions. (Kant 1788, Ak. 8:173)

Moreover, since these distinctive characteristics occurring by environmental adaptations are *stably perpetuated*, they cannot be the *effect* of the arbitrary will of our Author, nor of physical-mechanical causes alone; hence Kant uses such expressions as *vorgebildet* and *vorher bestimmt* in association with *hervorbringen*, to produce. Thus Kant presents a predetermination of hereditary racial configurations of human corporeality in germs which do not unfold of themselves, because formation of races also requires efficient occasioning causes due to external natural forces.

According to van Gorkom (2019, 358), this aspect of Kant's theory was well understood by contemporaries such as Johann Gottlieb Steeb, in his *On human beings according to the chief dispositions in their nature* (1785). Steeb appreciated Kant's ability to see climate and food not as true and generative (external) primary causes of human diversity *à la* Buffon, but only as propelling factors affecting internal germs and predispositions: thus the new cause of diversity was not completely independent of climatic zone and diet, yet was founded in the nature of the body itself.[3]

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3 [Johann Gottlieb Steeb (1742–1799) in his 1785 *Ueber den Menschen nach den hauptsächlichsten Anlagen in seiner Natur*] "saw the possibility of integrating Kant's germs into a discourse that was to a large extent dominated by Blumenbach. Steeb's synthesis primarily implied that the concepts of germs and races could be amended to Blumenbach's understanding of human diversity […]. He was not convinced that epigenesis excluded Kant's concept of germ. […] his work is relevant because of his attempt in 1785 to synthesize Kant's preformationist terminology with Blumenbach's epigenetic theory" (van Gorkom 2019, 358).

We have a series of Kant's *Reflexionen zur Metaphysik* that Adickes locates in 1771, dated in the Seventies in any event, where Kant explains the real principles of reason from the use of its natural laws according to epigenesis, distancing himself from Crusius' system of preformation, Aristotle's and Locke's physical influx, Plato's and Malebranche's intellectual intuition (R 4275; Ak. 17:491–2), and where he queries whether concepts are simple *educta* or *producta* in terms of the alternative between preformation and epigenesis (R 4851, Ak. 18:8). Kant associates preformism with *educta*, according to the model of individual preformism of encapsulated germs or *emboîtment*, *i.e.*, evolving from itself. By contrast, Kant's articulation of *producta* (always included under epigenesis) considers two possibilities. One is physical (empirical) influence, *producta a posteriori*, where development originates from primary empirical causes. The parallel case of reason is by consciousness of the formal constitution of our sensibility and understanding occasioned by experience: *producta a priori*, so that development in time is empirically conditioned but does not originate from experience, is independent of it and has its source in reason. The term *producta a priori* puzzles Malabou, as does the expression *acquisitio originaria*, but these make good sense in light of Kant's 1775/77 *prestabilism* as the idea of the *possibility of a specific, limited bundle* of germs and dispositions "preformed" (*vorgebildet*) at our species level by nature's wisdom, as also appears in Kant's review of Herder's *Ideen*,[4] with the aim of making humanity (taken as an animal species) inhabit all zones of our planet. Kant's epigenetic prestabilism escapes the subjective, always partial and arbitrary necessity of an innate constitution, because it is no individual original acquisition; nor is it an individual preformism whereby germs and dispositions were ready in all their parts, these are *eductae* which merely evolve from themselves.

This Reflection has elements which resonate with a remark by Tetens in his *Allgemeine speculativische Philosophie* (1775) on the problem of the reality of representations, which the common intellect correctly judges to refer to external visible bodily things and takes as a basis for its own judgments, without having investigated the nature of that idea and its origin in sensation. In the context of endorsing the principles of *der anschaulichen Erkenntniß* identified by Kant's *Dissertatio* of 1770, Tetens (1775, 28 note*) writes that in the end, though unnecessary for the common skill of using the senses, reflections occurring in this development of reason contain "its whole germ" (dieser *Entwickelung der Vernunft* vorkommenden Reflexiones am Ende doch *den ganzen Keim* von demjenigen *in sich enthalten*), which further elaborated constitutes the philosophical study of the mind and its ways of thinking (Tetens 1775, 8–9).

4 See Ferrini (2022, 106–8, 177–80); Helbig and Nassar (2016) claim that Kant shifts to epigenesis in 1787 as a result of his dispute with Herder.

Contemporaneous reviews shed more light on Kant's understanding of the competing theories of preformism (Haller, Bonnet) and epigenesis (Wolff), and on Kant's use of the term *producta*, assigned both to concepts and to living organisms. Reviewing the new edition of Wolff's *Theoria generationis* in 1775, the *Auserlesene Bibliothek der neuesten deutschen Litteratur* highlighted the opposition between "evolving" and "producing," explaining to readers: according to the *systema praedelineationis* or *evolutionis*, the organic bodies of plants or animals were small, imperceptible, already present, with all their parts, in the seeds or eggs of the mother, and subsequently could only evolve from themselves and become visible, though not *formed through the action of natural forces*, as in Wolff's epigenesis (*Aus. Bib.* 1775, 275). In his *Critique of Judgement* (1790), which favors epigenetic theory both experimentally and rationally, and names Blumenbach its undisputed champion, Kant explains why epigenesis is classified under "prestabilism," together with individual preformation or evolutionary theory of generation of mere educts, called theory of "evolution." Prestabilism includes epigenesis in the sense of *generischen Präformation*, since "the productive capacity of the progenitor was preformed in accord with internally purposive predispositions that were imparted to its stock and also the specific form (*die specifische Form*) was preformed *virtualiter*" (Kant, *KU* §81, Ak. 5:423). This feature was already present in Bonnet's 1762 *Considération sur les corps organisés*, where he claims that "the Germ bears the original imprint of the Species, and not that of Individuality." However, Bonnet considered human difference in terms of individual varieties (due to different conditions in which germs develop, the actions of the paternal seminal fluid or the variable circumstances of the mother), without distinguishing between simple transmission and inevitable inheritance.[5]

Interpreters (*e.g.*, Sloan, Cohen, Zammito) often treat preformism and epigenesis *en bloc* as rival theories, at most distinguishing between an Aristotelian philo-hylozoist epigenesis and a Cartesian mechanical epigenesis. Both forms have been contrasted to

5 "It must not be believed that the Germ has in miniature all the traits which characterize the Mother as an Individual. The Germ bears the original imprint of the Species, and not that of Individuality. It is very small a Man, a Horse, a Bull, etc. but it is never a certain Man, a certain Horse, a certain Bull, etc. All Germs are contemporaries in the Evolution System. Their traits, their distinctive characteristics have not been communicated to each other. I am not saying that everything of the same species is perfectly identical. I see nothing identical in Nature, and without resorting to the principle of Indiscernibles, it is very clear that all Germs of the same species do not finish developing in the same Matrix, at the same time, in the same place, in the same climate, in a word, under the same circumstances. Here are the causes of varieties. There are others that are even more effective, which are seminal fluids. The relations that I know between the organ of generation in the male and the different parts of his body are transmitted up to a certain point to the germ by the action of the seminal fluid. The temperament of the Mother, her inclinations, her passions, the foods she feeds on, the education she has received, her lifestyle, the climate where she lives can also more or less modify the Embryo." (Bonnet 1762, II, §338, pp. 256–7; my tr.)

preformism *tout court*, fostering the supposition that Kant passed from endorsing preformism in the 70s, to advocating epigenesis in the late 80s and 90s, influenced by Blumenbach's supposed "conversion." We have seen how Kant introduced the term "preformed" (*vorgebildet*) to account for adaptations which could not be effects of mechanical laws or chance because they are permanently rooted in the generative force as the power to necessarily and invariably reproduce one's particular adaptive character. This purposive element, present since 1775/77, appears to take into account an objection by Haller to Buffon's form of *epigenism* which is *not* the kind of *epigenism* by which Kant orients himself from the beginning, with his theory of a specific range of "productions" integrated by the "virtual pre-existence" of germs and dispositions.

In his Preface (published in French translation in 1751) to the second volume of the German edition of Buffon's *Histoire Naturelle*, Haller expressly *criticized* the mechanical epigenesis of Buffon's *molécules organiques* as lacking direction and purpose. That theory assumed an active (nourishing and generative) but purposeless organic homeomeric matter, universally diffused in all animal and vegetable substances and equally liable to become a human being, an animal or a vegetable. On anatomical grounds, Haller observed that Buffon was unable to explain the "correct" order followed by his organic molecules in animal generation, which effects the proper joints between separate parts of the body, always according to the same invariable plan of execution. In other words, Haller reproached Buffon for not having thought of a force that 'saw' where it was going (*qui ait des yeux*), and unlike the blind mechanical forces of combination, always infallibly achieved the same goal. In short, Buffon's epigenetic model was seen as unable to explain on mechanical grounds the invariable order of parts in a living organism, so that an eye is never attached to a knee (Haller 1751, 42).

Duchesneau (2000) accounted for the variants in the paradigm of encapsulation (*emboîtment*) of pre-existing germs and showed how the elder Haller's preformism was very prudent. Indeed, in a letter to Bonnet dated 1768, Haller (who died at the end of 1777) declared that he had never ruled out the possibility of reaching a "moderate evolution" as a kind of mechanical epigenesis which "forms" an animal: not from raw material, but working on a sketch, different from the perfect animal, which necessary laws then lead to the complete form. Haller's "after-thoughts," made known through correspondence, are mentioned by Blumenbach in his 1781 *On Formative Impulse and Generation* (*Ueber den Bildungstrieb und das Zeugungsgeschäfte*), to justify his clear transition to epigenesis, apparently breaking completely with his influential teacher. In this text, widely considered decisive for Kant, Blumenbach quotes a passage from a letter received from Haller in August 1776 in which he declared himself happy to have lived long enough to amend "many errors" with the new edition of his *Physiologia* (Blumenbach 1781, 6 note*). Blumenbach could thus legitimately raise the question whether Haller, in the final phase of his experimental career, remained a supporter of encapsulated germs (*eingewickelten Keime*).

It is often held (*e.g.*, Sloan 2002, Cohen 2006) that Blumenbach's change of view between 1779 and 1780 occasioned Kant's own change of view before composing the *Critique of Judgment*, therefore the epigenetic hypothesis of the product (proven by hybridization and compatible with gender preformism) versus the educt would mature in Kant after 1775/77, that is, after reading Blumenbach's work on the *Bildungstrieb* of 1781. With regard to the 1775/77 essay, Zammito has no doubts that Kant adopted Haller's sophisticated theory of preformation, both because it would have seemed methodologically practicable to him, and because it was rigorously anti-hylozoistic on a metaphysical level (Zammito 2007, 57). In my view, this reading would be at odds with the *Reflexionen* of the Seventies, taken together with Kant's introduction of finality and his use of the verb *hervorbringen* when he refers in 1775/77 to *vorgebildete Keime* and *Anlagen.*

Note that the possibility of combining preformism and epigenesis was not completely novel. It is also found, *e.g.*, in the many pages Tetens devoted to this debate precisely in 1777, as noted by Sloan. As is well known, in his letter to Herder dated 17 May 1779, Hamann wrote that Tetens' *Philosophische Versuche* were constantly open on Kant's desk before his eyes whilst writing the first *Critique*. Interpreters have generally focused on Tetens' influence on drafting the *Critique of Pure Reason* regarding a conception of objectivity and the need for knowledge afforded by the principles and constitutive relations of thought. However, our analysis indicates Kant's particular interest also in the 14th Essay of Tetens' *Philosophische Versuche*, vol. II, dedicated to the perfectibility and development of man, in connection with the natural history of man by Lord Kames (Tetens 1777, II:370). The second section of this essay, titled "Of the development of the human body," investigates the principle of formation of an organized body and embryogenesis, and analyzes competing theories of generation.

> However, some observations seem to lead directly to the proposition that *new forms arise*, and indeed by this, that several different developing forms unite and by this union develop *new forms*. Among these I include the examples of the concrescence of animal crossings and of the grafting of parts of plants with their trunks […]. The facts mentioned here are such that they necessarily lead to the idea that new forms arise. The group of the rest, upon which great naturalists have based their concept of epigenesis, are almost all of the kind that are to be used for confirmation of the same concept […]. Thus nature seems to put before our eyes quite evidently a genesis of new forms. In the examples given, they are external and wholly contingent circumstances which occasion their generation. If this genesis of new forms, *i.e.* by means of the development of existing forms and by means of their union, actually occurs, then we already have enough to avoid the improbable consequences, especially that of inserting one into another embryo, which are conjoined with the system of thorough evolution. Likewise this genesis makes understandable how new vessels and new modifications of the structure can also be produced by external circumstances, which indeed were possible in the embryo through preformation, but which are not determined by it. This is a very important distinction. (Tetens 1777, 2:505–8; my tr.).

Tetens uses the emergence of new forms as his comparative criterion. The system of evolution finds new relations only in the extension and development of forms which are all originally in the embryo, so that each generation of both individual parts and whole bodies is only an increase in the mass with possible modifications of form and figure. Instead, epigenesis admits that new forms arise which are not simple modifications of pre-existing relations; *i.e.*, parts form for which no particular embryo existed (Tetens 1777, 2:516, 521, 526). Tetens, who comments on Bonnet in particular, makes the hypothesis of an evolution which can coexist with epigenesis (Tetens 1777, 2:1045), proposing an epigenesis by means of evolution or an evolution that produces new conformations through a new conjunction and development of existing vessels (Tetens 1777, 2:513–4). Tetens' 'third way' thus accommodates occasional causes and effects of external circumstances upon generative processes which produce new conformations by developing existing forms. The key concept is that modifications of the structure of the organized body were possible in the embryo through preformation (as in Kant's germinal set predisposed to the adaptations required by various terrestrial habitats), but what *determines the development* of these adaptive forms in time is not their predefinition, but the series of contingent, occasioning natural causes.

My answer to the second question of Section 1 is that this background constitutes Kant's basis to assess Blumenbach's later shift. In particular *hervorbringen*, *i.e.*, to bring forth by external agents, shows that in 1775/77 Kant already combined preformed elements and their purposively oriented epigenetic formation by natural forces at the different levels of formal *a priori* and real *a posteriori*, thus avoiding contradiction. Zammito writes that we need to ask why the epigenesis analogy did not appear until 1787 if, as also Mensch (2013) argued on different basis, it was full-formed in Kant's mind already in the silent decade (Zammito 2015, 209). Certainly in 1787 the direction and scope of Blumenbach's *nisus formativus* provided Kant's explicit and public reference to such a reformulated epigenesis, consistent with the physico-theological considerations of the age, an unquestionable scientific authority. However, we have seen that since *On the different races of men* (1775/77) Kant intended to explain, without polygenism, the existence of typological characters, by the hypothesis of their merely potential or virtual state within a pre-established set of germs for the entire species present in the organization of the first pair. The germs carrying these characters, adaptively activated or silenced according to the natural influence of climatic zones, historically differentiate populations into races; they take root over time in the generative force, becoming invariably and necessarily hereditary and immutable. This approach implies diachronic development which is selective with respect to the germs, depending upon occasional causes, and not an

autonomous evolution of the entire germinal patrimony, as affirmed by ovite preformism; as the unrevised passage at A66/B91 quoted above shows, from 1781 to 1787 Kant made no shift from ovist individual preformism to anti-hylozoistic epigenesis.

4 What is the Ground of Affinity Between Epigenesis and Formal idealism?

Longuenesse understands the categories to be the "germ" present from the outset in experience, but which only "discursive" (conscious, apperceptive) reflection can transform into a developed organism, namely, universal concepts governing a system of conditions according to principles.[6] I have shown instead how Kant aims to trace the first origin of the conformity between experience and the concepts of sensed objects back to its internal generative source within our cognitive capacity, whose functional organization contains *virtualiter*, *in potentia*, *a priori* forms (germs and dispositions) to order the matter of cognition deriving from the senses to orient and preserve ourselves in the world. According to Kant, our logical forms of judging only provide for our 12 basic categories when those forms are brought by transcendental imagination to bear upon our spatio-temporal forms of sensory intuiting. Kant's categories have their roots (or germs) in our basic forms of judging and our forms of sensory intuiting; this is the point of Kant's "*Leitfaden*" for identifying the Categories (A65–83/B90–116), which he later calls their "metaphysical deduction" (B159). These forms, predisposed within the spontaneous power of pure intuiting *and* pure thinking, upon the occasion of the matter of cognition, "are first brought into use and bring forth concepts" (*zuerst in Ausübung gebracht werden, und Begriffe hervorbringen*; A86/B118). That is, our most fundamental concepts are produced (in time) only when their predetermined forms (for all rational creatures of our species) become activated by occasioning empirical conditions. Kant writes that we are justified to search in experience, *not* for the principle of the possibility of the two sorts of concepts which connect to objects (*auf Gegenstände beziehen*) entirely *a priori* (space and time as forms of sensibility, and the categories as concepts of the understanding), but for the occasional causes of their generation (*die Gelegenheitursachen ihre Erzeugung in der Erfahrung aufsuchen*; A85–6/B118). Locke's

6 Longuenesse states: "Where the categories are concerned, I understand this model in the following manner: the categories are the 'germ' which is present from the outset in experience, but which only discursive reflection can transform into a 'developed organism'—namely, universal concepts governing a system of cognitions according to principles" (Longuenesse 1998, 221–2, note 17).

physiological derivation is mistaken precisely because it identifies in experience the birth certificate of pure *a priori* concepts (A86–7/B118–9).

This parallels a passage of Kant's 1775 text, modified in 1777, where what is supposed to be propagated must itself have lain previously in the generative power as antecedently determined to an occasional unfolding in accord with those circumstances in which the creature finds itself and in which it is to persistently preserve itself.[7] For the animal must not be subject to a foreign intrusion into the generative power, which would be capable of gradually removing the creature from its original and essential destiny (Ak. 2:435; *cf.* La Padula 2023, 203–4).[8] Sandford overlooks these passages and parallelisms when she claims that not epigenesis, but the model of supernatural parthenogenesis is the only model according to which the generation of the categories – like an immaculate conception – can remain "pure" (Sandford 2013, 23). Moreover, this epigenetic model for the *system of pure reason* – which in transcendental philosophy Kant uses as a heuristic model, not a substantive theory – conforms to his attempt to trace, without appeal to the supernatural, nor leaving human history despair, nonsense or confusion, the development of rational ends in world history, *i.e.* of human essential destiny, on the ground that nature uniquely endowed human animals also with reason and the freedom of will grounded in it.

As we know from Theses 2–3 of Kant's *Idea for a Universal History from a Cosmopolitan Point of View* (1784), reason needs attempts, practice and instruction to progress, across generations, towards a finalized development of all its potentials in a future progress which is left open in the system of pure reason (A852/B880). This heuristic attempt again appears to be epigenetic in kind, because reason is not something ready at hand, which only needs to grow, *i.e.*, to evolve from itself, because it does not mandate and operate automatically by instinct. It produces new conceptual forms, from crude to enlightened concepts, in the course and transmission of the hard, tense, competitive cultural labor of generations upon generations of humans free to choose by themselves the ends toward which to orient their own actions. To keep in mind this fundamental congruity between transcendental and

7 This casts light on Kant's remark that pure concepts are not innate but acquired, as he stated already in his 1770 Inaugural Dissertation, inquiring about the source (to be sought not in the senses, but in the very nature of the pure understanding), of metaphysical concepts such as existence, possibility, necessity, substance, cause, etc. (*cf.* Kant, Ak.2:395).

8 "… was sich fortpflanzen soll, muß in der Zeugungskraft schon vorher gelegen haben, als voher bestimmt zu einer gelegentlichen Auswickelung, den Umständen gemäß, darein das Geschöpf geraten kann, und in welchen es sich beständig erhalten soll. Denn in die Zeugungskraft muß nichts *dem Tiere Fremdes* [added in 1777] hineinkommen können, was vermögend wäre, das Geschöpf nach und nach von seiner ursprünglichen und wesentlichen Bestimmung zu entfernen, und wahre Ausartungen hervorzubringen, die sich *perpetuierten* [1775: *perpetuieren*]." (Kant [1775] 1777, Ak. 2:435)

historical discourse does justice to the possible trajectory of the human species outlined by Kant in the 1798 *Pragmatic Anthropology*, from *animal rationabile* to *animal rationale* (Ak. 7:321–2).

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