Function laws and type laws – a significant link between philosophy and the special sciences

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Abstract

The difference between function concepts and entity concepts is found in all the special sciences. Philosophy initially, in ancient Greece and during the Middle Ages, gave primacy to the substance concept. Since the Renaissance function concepts (relational concepts) obtained acknowledgement. What is designated as modal universality and entitary typicality are illustrated by a number of examples. Kant and the neo-Kantian schools of thought wanted to resolve all thing concepts into concepts of relations. In this article it is argued that modal laws hold for all classes of entities, while type laws hold for a limited class of entities only. When attention is given to the typicality *of entities an alternative understanding of the wave-particle duality is made possible. In addition it has been pointed out that living entities have typical functions within various aspects of reality. Attention is given to thermodynamical open systems and to the growth pattern and classification of mammals into* Nesthocker *(nest-squatters) and* Nestflüchter *(nest-leavers) – evinced in the* typically *distinct ways in which animals and humans are functioning within the biotic aspect. Although animals and humans share functioning*

within the universal structure of the biotic aspect of reality, reflected in the function concepts of biology, their ontogeny at the same time specifies this biotic functioning in a typical *way through their distinct ontogenetic developmental types. By comparing opposing views (Simpson and Coyne) it has also been shown that the classical controversy between realism and nominalism is still alive today. The article concludes with an example from the humanities. In the final analysis the difference between modalities and entities constitutes two pillars of a Christian philosophy aiming at the development of a non-reductionist ontology.*

Keywords

Function concepts; entity concepts; modal universality; modal laws; type laws.

Opsomming

Die verskil tussen modale begrippe en entiteitsbegrippe word in alle vakwetenskappe aangetref. Aanvanklik, gedurende die antieke Griekse en middeleeuse eras, is voorrang verleen aan die substansie-begrip. Sedert die Renaissance het funksiebegrippe erkenning begin geniet. Wat aangedui word as modale universaliteit en entitêre tipisiteit word aan die hand van 'n aantal voorbeelde verduidelik. Kant en die neo-Kantiaansse denkskole wou alle ding-begrippe omskakel na relasiebegrippe. In hierdie artikel word geargumenteer dat modale wette betrekking het op alle klasse van entiteite, terwyl tipe-wette slegs 'n beperkte klas van entiteite omvat. Wanneer aandag aan die tipiese aard *van entiteite gegee word is dit moontlik om tot 'n alternatiewe verstaan van die golf-deeltjie dualiteit te kom. Bykomend is daarop gewys dat lewende dinge ook tipiese funksies in verskillende werklikheidsaspekte besit. Aandag word gegee aan termodinamiese oop sisteme en aan die groei-patroon en klassifikasie van die soogdiere in* Nesthocker *(nes-plakkers) en* Nestflüchter *(nes-verlaters) – soos beliggaam in tipies-verskillende wyses waarop diere en mense binne die biotiese aspek funksioneer. Hoewel beide diere en mense gemeenskaplik in die biotiese aspek funksioneer, belig hul onderskeie ontogenetiese ontwikkelingspatrone dat hierdie funksionering tipies gespesifiseer is. Deur opponerende sienings te vergelyk (Simpson*

en Coyne) is dit moontlik om aan te toon dat die klassieke stryd tussen die realisme en nominalisme vandag nog steeds aktueel is. Ten slotte word aandag gegee aan 'n geesteswetenskaplike voorbeeld. In die laaste instansie beliggaam die verskil tussen modaliteite en entiteite twee hoekpilare van 'n Christelike filosofie wat daarna strewe om 'n nie-reduksionistiese filosofie te ontwikkel.

Sleutelterme

Funksie-begrippe; ding-begrippe; modale universaliteit, modale wette; tipiese wette.

1. Orientation

More than a century ago the neo-Kantian philosopher, Ernst Cassirer, wrote a book *Substance concept and Function concept*. It alludes to the fact that within all academic disciplines two kinds of concepts are employed, namely concepts of *entities* ("substances") and concepts of *functions*. We shall see that function concepts are also designated as relation concepts as well as modal concepts. The term "modal" is derived from Latin expressions such as *modus operandi* or *modus vivendi*. It concerns a *way of life* or a *way of existence*. For this reason the various modes or aspects of reality are *ways of existence* (modalities), expressing the "how" of things and at once they may also serve as *modes of explanation*. Thing concepts, by contrast, bring the concrete "what" of entities to expression.

Within the discipline of physics one encounters *function* concepts such as mass, field, volume, velocity, energy-operation, entropy, gravity and so on. Likewise concepts such as quarks, elementary particles, atoms, and (macro-) molecules are *thing* concepts.

This distinction also applies to other special sciences. Consider for a moment the discipline of biology. Within it we find biological function concepts such as life, growth, development, maturation, ageing, differentiation, integration and adaptation. These function concepts relate to biological entitary concepts such as species, genera, families, orders, classes, phyla and realms ("kingdoms"). Implicitly attached to function concepts and entity concepts is the distinction between *function laws* and *entitary laws* (*modal laws* and *type laws*).

2. A challenge to the Aristotelian legacy

While Aristotle still distinguished between the physics of celestial bodies and the physics of things on earth, Galileo and Descartes realized that the same physical laws apply to both domains – in other words that physical laws hold universally (i.e. display *modal universality*).[1] That is to say the universality of modal functions embraces all classes of entities, whereas type laws only hold for a limited class of entities. The type law for *being an atom* holds universally (for *all* atoms), but it is obviously specified for a limited class of entities only, namely atoms – not everything is an atom.

Greek philosophy by and large gave prominence to the idea of *substances*. In his *Categoriae* Aristotle commences with a primary substance (*protēn ousian*) which underlies everything that can be predicated of them or are present within them (Cat. 52b15 ff.). However, for the sake of theoretical knowledge – making *universal* claims – Aristotle soon amended his view by introducing a "secondary substance" which is seen as the *universal form* of things. Yet for Aristotle "all categories are posterior to substance" (*Metaphysica* 14, 1, 1088 b 1-4) – showing that his notion of *relation* is still underdeveloped.

3. Historical notes on the concept of law

Within the era of ancient Greece, speaking of *principles* assumes the place of referring to law. The classical Latin legacy did not distinguish between *lex* or *ius naturae* on the one hand and *naturalis lex* or *ius* on the other. Natural law was used to designate the moral law. Later on Descartes referred to scientific laws as *laws of nature* and to the moral law as *natural laws*. Wootton states: "As a result, for us moderns, laws of nature are scientific laws and natural laws are moral laws. In this respect we are all Cartesians" (Wootton, 2016:368-369).

With reference to Ramus, Wootton explains that the word "law" entails "unbroken regularity, with no exceptions" (Wootton, 2016:370). On the next page he states that Descartes was the first person attaching *universality* to the idea of a law. From Montaigne he drew the idea that a proper law of nature must be universal. According to Wootton our contemporary understanding of

1 In his discussion of "theories about everything" Breuer approximates the idea of modal universality when he states that a theory is universally valid if it holds for the "entire material 'world'," i.e. when "no part of the material world is excluded from its domain of validity" (Breuer, 1997:2).

the “laws of nature” hold for “every time and every place in our universe” (Wootton, 2016:375). This mode of expression is equivalent to saying that laws of nature are *universal* and *constant*. Yet before the modern era the influence of Aristotle is seen in the distinction between laws applying to the sublunary sphere and those applying to the supralunary sphere. Wootton explains:

> In the one there is change and natural movement is vertical, while in the other there is no change and natural movement is circular. There are no physical laws common to both spheres. In the sublunary sphere it might seem easy to formulate some general laws: all living creatures die; children take after their parents. But the phoenix does not die, and monstrous births do not resemble their parents. Aristotelians therefore recognize that, in the sublunary sphere, there are no regularities which do not have exceptions; in the supralunary sphere, all is regularity without exception; there are no regularities which apply in both spheres. Consequently, there are no Aristotelian laws of nature (Wootton, 2016:375).

4. A universe of corpuscles in motion – the mechanistic world view

Isaac Beeckman, a contemporary of Descartes, saw the shortcoming of this split and moved ahead of Descartes by holding that “the universe consisted of corpuscles in motion” (Wootton, 2016:363). On the same page Wootton also points out that Beeckman employed the term “pactum” (“covenant”) for a law of nature. But Beeckman believed that laws belonging to the “microscopic level must be the same as those which functioned at a macroscopic level. He was well on the way to formulating, entirely independently, Galileo's law of fall” (Wootton, 2016:363). Before Descartes and Beeckman another astronomer-mathematician, Jean Fernel (1497-1558), related the laws of nature to God. He holds that there “are eternal, immutable laws which govern the universe” and that “they are ordained by God” (Wootton, 2016:370).

5. The lasting influence of Greek philosophy

At this time the idea of creation was still fused with elements belonging to the legacy of Greek philosophy, particularly in the thought of Lucretius. In 1588 he emphasises that God cannot build the world without *pre-existing matter*: “since nothing can be made from nothing; God could not construct the world without matter” (quoted by Wootton, 2016:372). However, the most important shift in understanding occurred when it was realised that a law like

Newtons' law of gravity holds equally for local phenomena (the sublunary sphere) and celestial phenomena (the supralunary sphere) – showing that bodies involved in vertical or circular movement are indeed subject to one and the same universal physical law – analogous to the view of Beeckman regarding the microscopic and the macroscopic levels.

6. Ontic relations: dethroning the substance concept

The emergence of this insight at once paved the way for dethroning the reigning substance concept, while acknowledging the importance of modal universality. During and after the Renaissance the Greek substance concept (being constituted by matter and form), gave way to the newly emerging function concept. This new concept was focused on the *relationships* between things. At the same time a shift took place away from the traditional medieval metaphysics which assigned a threefold status to the so-called "universalia": universalia *ante rem* (in God's Mind), universalia *in re* (as the inherent substantial forms of things), and the universalia *post rem* (universal concepts within the human mind). According to Descartes – in a typical nominalistic fashion – there is no universality outside the human mind. He holds that number and all universals are mere modes of thought (*Principles of Philosophy*, Part I, LVIII – 1965:187).

Interestingly it was Campanella who acknowledged the true ontic (i.e. extra-mental) nature of relations – having their own being (namely *being a relation*). What has an independent existence has its own being and the same applies to the relation connecting what co-exists (Mojsisch, 1992:594). Later on Leibniz claims that also that which appears isolated is still related to everything else – owing to his view on a pre-established *harmonia praestabilita* (see Baum, 1992:597).

7. Functionalism: transforming thing concepts into function concepts

The switch to relations (functions) is clearly present in the thought of Immanuel Kant. He continued the view of Descartes regarding spatial extension as the "essential" property of material bodies. The outcome of this approach was that in connection with appearances all "we can know of matter are nothing but relationships" (Kant, 1787-B:341).

This tendency is present in both neo-Kantian schools which continued Kant's legacy by the end of the 19th and the beginning of the 20th century. Rudolph Berlinger refers to Cassirer, one of the main representatives of the Marburg school of neo-Kantianism. According to him this school eliminates Kant's idea of "things in themselves" because he replaces the thing concept "by the law concept" (Berlinger, 1969:2).

In the Baden school of neo-Kantianism the same functionalistic view surfaces. Heinrich Rickert holds that ultimately the natural sciences should relinguish rigid and fixed things increasingly, which means "nothing else but transforming as far as possible all thing concepts into relation concepts". The validity of this conforms to the logical ideal of natural scientific concepts, "because this ideal solely concerns relation concepts" (Rickert, 1913:68-70).

We commenced by mentioning the significant work of Cassirer which appeared slightly more than a hundred years ago, with the title: *Substanzbegriff und Funktionsbegriff* (Substance concept and Function concept). This title reflects the fact that within all academic disciplines two kinds of concepts are employed, namely concepts of *entities* ("substances") and concepts of *functions* (concepts of modal aspects). The distinction between these two kinds of concepts is not unknown in the history of philosophy.

8. The universality of modal aspects

The physicist Carl Friedrich von Weizsäcker mentions that Einstein criticized Newton's conception of space and time and then explains that in line with Leibniz and Mach he [Einstein] wanted to reduce space to "relations between bodies" (Von Weizsäcker, 2002:261). He links this issue also to the quantum-mechanical critique of classical physics which, according to Von Weizsäcker, is not aimed at the concept of causality but at the concept of an entity or process "an sich" ("Dinges oder Vorganges an sich") (Von Weizsäcker, 2002:250). On the same page he points out that one should rather say: "Quantum-mechanics acknowledges the relational character of their categories" ("Die Quantenmechanik erkennt die Relationscharacter der Kategorien"). To this he adds the important switch that took shape in quantum-mechanics – the presence of the theoretical subject-object relation between concepts such as substance and causality, that are not realities in themselves and the human cognition of these realities ("Substanz, Kausalität uzw. Bezeichnen nicht Realitäten an sich, sondern von Menschen erkannte Realitäten").

9. Modal universality and typically specified universality

It is remarkable that in his search for the synthetic apriori Kant actually aims at what we designate as *modal universality*. For this reason he holds that "[C]ategories are concepts which prescribe laws a priori to appearances, and therefore to nature, the sum of all appearances (Kant, 1787-B:163). He admits that "initially [it] does sound strange, but it is nonetheless certain, when I state with respect to the latter [the original laws of the understanding]: understanding creates its laws (a priori) not out of nature, but prescribes them to nature (Kant, 1787 par.36:320). But he assumes this position on the basis of an important distinction, namely that between "empirical laws of nature, which always presuppose particular perceptions, from the pure or general natural laws". Already Descartes accepted "general laws," similar to Kant's categories of our understanding. But Wootton points out that such general laws as "described by Descartes could never produce the perfect design that one could find in the paw of a dog" (Wootton, 2016:277).

This anticipates the "empirical laws" of Kant and implicitly illustrates the distinction between modal laws and type laws. The physicist Stafleu articulates the difference between modal laws and type laws clearly. He observes that types are "usually be found by induction and generalization of empirical facts or lower level law statements". By contrast, modal laws "are found by abstraction". He mentions "Euclidean geometry, Galileo's discovery of the laws of motion" and thermodynamic laws. They are "all examples of laws found by abstraction". This explains the "use of the term 'rational mechanics', in distinction from experimental physics" (Stafleu, 1980:11).

It is significant to note that also Boyle already distinguished "universal laws and the municipal laws of nature" (Wootton, 2016:274). While "municipal laws of nature" do not escape from the universality of "universal laws" they rather *specify* them. The shape of the *paw* of a dog has a typical spatial configuration which provides a limitation, because not everything in the universe is a paw. Being a dog paw may be a universal feature discernible in all dog paws, but owing to its *typicality* its universality remains restricted to dogs only, its universality is specified by a limited class of entities only.

Stegmüller also comprehends this distinction between universal modal laws and (specified) type laws. He writes that "this cannot imply that the totality of law-statements present in a natural science could be of an a priori nature. Much rather, such an apriorism should limit itself to the construction of a limited number of a priori valid law relationships, while, furthermore,

all more specific laws of nature should be dependent on empirical testing" (Stegmüller, 1969:316).

Another way to articulate this distinction is to state that whereas modal laws hold universally without a specification, type laws are specified and therefore merely hold for those entities belonging to the same type of entities. Stafleu expresses this insight by referring to classes of entities. Modal laws hold for all classes of entities, while type laws merely hold for a limited class of entities. Von Weizsäcker affirms this view of modal laws: "Quantum theory, formulated sufficiently abstractly, is a universal theory for all classes of entities" ["Die Quantentheorie, hinreichend abstrakt formuliert, ist eine universale Theorie für alle Gegenstandsklassen" (Von Weizsäcker, 1993:128).] And Stafleu writes that one may distinguish between "those 'subjects' which are more or less concrete from those which are more or less abstract. This distinction is mirrored in the one between *typical*, special laws, which apply to a limited class of subjects, and *modal*, general laws, which hold for subjects of a more abstract character" (Stafleu, 1980:6).

10. The interplay of modal universality and typicality

Let us explore the scope of function concepts a bit further. Within the discipline of physics function concepts such as mass, volume, velocity, energy-operation, entropy, energy-constancy and so on are found. Yet, as noted earlier, the discipline of physics does not escape the use of thing concepts, such as atoms, molecules and macro-molecules. Likewise, we have noted that within the discipline of biology function concepts such as life, growth, differentiation, integration and adaptation are found, complemented by entitary concepts such as those found in the familiar classification of living entities – species, genera, families, orders, classes, phyla and realms ("kingdoms").

11. The physical aspect of living entities

Consider for a moment the typical way in which living things function within the universal structure of the physical aspect. What is unique about the way in which a living entity, like the cell, functions in the physical aspect? Although the biotic aspect characterizes the cell as a biotic unit, the vital functions of the cell are still founded in what is metaphorically referred to as the material building blocks of living entities. We may think of the just-mentioned atoms, molecules and macro-molecules. Yet in spite of the

geometrical peculiarity of molecules, the largest macro-molecules are not delimited by a surface (Trincher, 1985:336). Trincher points out that there are four distinct macroscopic properties evincing the unique physical way in which a living cell functions within the physical (and related) aspects (see Trincher, 1985:336). One can first of all note the spatial macroscopy of the cell (defining it as a spatially delimited surface). Secondly one may point at its temporal macroscopy – which reflects the limited time-span in which the energy-cycle of the cell occurs. In the third place the isothermal nature of the cell should be noticed since it regulates the constant temperature throughout the cell. In the fourth place one may note the constant difference between the higher internal and external temperatures of the cell – the former is higher than the latter.

A different account is found in the earlier work of Erwin Schrödinger. Von Bertalanffy introduced his broadened understanding of the second main law of thermodynamics, encompassing also thermodynamically open systems. Such systems persist in what is known as a *steady state* (in German: *Fließgleichgewicht*). Schrödinger published a book on "What is life?" Its subtitle is: "The physical aspect of the Cell" (1955). In this work he analyses the fact that living entities are thermodynamically open systems and that this characteristic therefore cannot serve as a distinct trait of living things. After all a *fire*, a *glacier* and *an idling car* are also instances of thermodynamic open systems.

12. All entities function in all aspects

However, at this point we should note that the status of *type concepts* is controversial. We have mentioned earlier that within the Greek and Medieval *realistic metaphysics* a threefold distinction was drawn between different kinds of universals – *universalia ante rem*, *universalia in re* and universalia *post rem*. Since Descartes modern nominalism rejected universality outside the human mind. Therefore, because Kant also stripped reality from universal features, by commencing with the chaotic sense-material of our experience, his conception of human understanding as apriori formal law-giver of nature is typical *nominalistic*.

Implicit in the distinction between function and thing is the acknowledgment that no single entity could ever be exhausted by merely one of its functions. All entities in principle function in all aspects. Let us look for a moment at the famous wave-particle duality.

13. The duality between waves and particles

After Einstein's switch to a particle theory of light it turned out that it is always possible to assign a wave-character to elementary particles. Experimental evidence also confirmed the particle nature of entities. De Broglie completed the circle by showing that every moving particle could be associated with a wave as well (cf. Eisberg, 1961:81, 151). The astonishing fact is that it is experimentally impossible to establish both features at the same time. Bohr therefore claims that these two modes of description are *complementary* (cf. Bohr, 1966:41 ff.).

The crucial question is if we may describe or explain physical entities in terms of two mutually exclusive experimental perspectives, as particles and waves? Is it then still possible to acknowledge them as singular entities? This question highlights the point where a special scientific description encounters its limits. What is needed is a perspective exceeding the scope of special scientific inquiry. The crucial issue is that the idea of the unity and identity of an entity cannot be provided merely by explaining various modal functions of entities, because this underlying unity is already presupposed in all theoretical explanations. The idea of an entity as an individual whole points at a depth-layer of reality transcending the dimension of modal aspects. For this reason this idea of an entity in its totality actually precedes an analysis of its modal aspects.

The importance of the distinction between function (modal) concepts and type concepts now clearly surfaces. Concepts such as particle, field, and wave are not type concepts but modal functional concepts (they are elementary basic concepts of physics). Consequently, the terms particle and wave reflect backward-pointing (i.e. retrocipatory) elements within the structure of the kinematic aspect. That is to say, they analogically reflect the coherence between number and space within the kinematic mode of experience. Movement multiplicity is a numerical analogy and movement extension is a spatial analogy. These aspects are deepened in physically qualified (material) entities and they are approximated within theoretical physics from forward-pointing elements (anticipations) – just compare Shrödinger's wave function which is formulated in terms of differential equations.

The (philosophical) idea of a multi-functional entity entails that number, space and movement retain their irreducibility regardless of what the nature and type of entities are that function within them – thus evincing their modal universality. This explains at once why the *functionally distinct* concepts *particle* and *wave* cannot be reduced to each other. Irreducible modal perspectives are serving at once as distinct modes of scientific explanation.

Sometimes physicists here speak of a *dualism*. Von Weizsäcker holds the view that the given dualism requires that in characterizing the state of an object one has to use, alongside each other, two totally different groups of concepts: "In the particle image ["Teilchenbild"] we speak of the place, the impulse, and the energy of a particle and in the wave image about the wave length, and the frequency of the expanding speed of a wave."[2] These alternative perspectives derive from classical physics but, as Von Weizsäcker contemplates a page earlier, there is not a third conceptualization available, totally different from the previous two.

Other physicists prefer not to speak of a "dualism" because they underscore the fact that "nature could neither be described by particles alone, nor solely through waves" – which prompts Born, Pyrmont and Biem to discard the struggle with a dualism. According to them we cannot switch between a "particle image [Teilchenbild]" and a "wave image [Wellenbild]". What is needed is a *unitary view* of physical entities. This view explores and employs *function concepts* derived from the first four modal aspects mentioned earlier. Their approach involves the three distinct but co-existent modes of explanation: an 'Ortsdarstellung' (spatial representation), a 'Wellendarstellung' (a wave representation, such as impulses or velocities – kinematic explanation) and an 'Energiedarstellung' (an energy representation – the physical mode of explanation) (see Born, Pyrmont, Biem, 1967/68:416-417). Bohr holds that we have auxiliary means at our disposal, enabling us to express without contradiction "essential aspects" of this phenomenon (Bohr, 1966:23).

14. Onto-genetic growth patterns and typical differences

The famous biogenetic law of Haeckel (ontogeny is a recapitulation of phylogeny) turned out to be mistaken – the human embryo is actually fully human from its inception. It does not pass through successive phases such as being a fish, an amphibian, a reptile and finally a mammal (see Blechschmidt, 1977). Adolf Portmann points out that the dominant "zoological interpretation of early human development is inadequate and in many respects misleading." For this reason he discerns "an independent human type of development before birth" which implies that even "the early prenatal development is the 'ontogeny of a human', not a kind of schematic primate

2 "Im Teilchenbild reden wir von dem Ort, dem Impuls, der Eenergie eines Teilchens, im Wellenbild von der Wellenlänge, der Frequenz der Ausbreitungsgeschwindigkeit einer Welle" (Von Weizsäcker, 2002:240).

formation in which the stages of animal systems appear in sequence, as in a graduated classification" (Portmann, 1990:64).

The larger mammals by and large show a rapid increase in weight while reaching their fully mature weight after one to two years. All (non-human) mammals grow fast right from their birth with the main part of their growth behind them when they reach sexual maturity. Within humans, by contrast, growth is marked by an increase in intensity when they reach sexual maturity. During this late phase a major part of the total growth takes place (Portmann, 1990:101). Portmann distinguishes between different ontogenetic types, designated by him as *Nesthocker* and *Nestflüchter*. The *Nesthocker* are literally: "nest-squatters" (*altricial*) and the *Nestflüchter* are literally: "nest-leavers" (*precocial*).

The *Nestflüchter* (nest-leavers) at birth are capable of moving similar to the behaviour of adults. Their stature and proportions at birth are also similar to their mature form. In addition they are born with open eyelids and hearing channels and little dependency on their parents. *Nesthocker*, by contrast, come disproportionate into the world with closed eyes and ears and dependent on the care of a prepared nest.

The post-fetal growth during the first year of humans is twice as quick and intense as that of the great apes. During this period the weight of humans increases at a relatively constant rate and after this first rapid the developmental pattern is smooth, lasting up to the 8th or 9th year. Then the second rapid occurs (puberty: 8-15 years), followed once more by a smooth developmental pattern until maturity is reached (20-22 years). Interestingly, the growth curve of comparable animals does not evince the two rapids discernable in human development.

Clearly, both the growth pattern and the classification of mammals into *Nesthocker* and *Nestflüchter* represent *typical* ways in which animals are functioning within the biotic aspect. Portmann remarks:

> All mammals (other than humans) grow very rapidly right from the start of their independent lives, and have the major part of their growth behind them by the time they become sexually mature. Any growth still to come is slow and slight. In humans, on the contrary, growth processes experience a marked increase in intensity at the very moment of sexual maturation, and it is during this late phase that a significant part of the total growth takes place (Portmann, 1990:101).

Of course the question is: are humans *Nesthocker* or are they *Nestflüchter*? The astounding fact is that human beings are neither *Necthocker* nor *Nestflüchter*. Like *Nesthocker* humans are helpless and disproportionate at

birth, unable to move like mature humans. With *Nestflüchter* humans share a relatively long gestation period, relatively small offspring, a brain increase with a factor of less than five, and coming into this world with open ears and eyes. Therefore, neither the *Nesthocker* nor the *Nestflüchter* match the growth pattern of humans.

The uniqueness of the human *ontogenetic type* also comes to expression in the so-called extra-uterine period. Compared to the *Nestflüchter* humans are born one year too soon. Whereas the higher mammals, immediately after birth, start to move and perceive in a way typical of the behaviour of the species, the human being, by contrast, at birth has "not yet attained the type of movement, the body posture, or the power of communication typical of its species at maturity" (Portmann, 1990:81-82).

Although animals and humans share functioning within the universal structure of the biotic aspect of reality, reflected in the earlier mentioned function concepts of biology, their ontogeny at the same time *specifies* this biotic functioning in a *typical* way through their distinct ontogenetic developmental types. That is to say, in spite of sharing (functioning within) the same modal aspect of life (the biotic function of reality), the respective type laws involved show that the specification of diverse biotic type laws cannot be neglected.

15. A functionalist continuum versus discrete types

The distinction between modal laws and type laws, implicitly or explicitly, surfaces in various academic disciplines. It is therefore not surprising that it continues to play a controversial role within biology as well.

Darwin represents a consistent nominalist position in his *Origin of Species* (1859). Yet both Darwin and his contemporary neo-Darwinian followers struggle with the status of "natural laws". On the one hand they continue to subscribe to universal (and constant) [physical] natural laws. Yet, as soon as living entities enter the scene they deny any *typicality* within the domain of living entities. Darwin does speak of a "general law of nature" (Darwin, 1859:143) and of "a universal law of nature" (Darwin, 1859:268)24 – but he never speaks of biotical (type) laws of nature (see Strauss, 2007).

The orientation of modern nominalism, rejecting universality outside the human mind and considering biological classification merely as assigning arbitrary names (*nomina*), is clearly found in Darwin's thought in respect of living entities. He states explicitly that "no line of demarcation can be drawn between species" (Darwin, 1859:443). And then he says: "In short,

we shall have to treat species in the same manner as those naturalists treat genera, who admit that genera are merely artificial combinations made for convenience" (Darwin, 1859:456).

Later on Simpson echoed this position. According to him the physical sciences are largely typological and idealistic since they "usually deal with objects and events as invariant types, not as individuals with differing characteristics" (Simpson, 1969:8). Simpson categorically rejects all (biological) type concepts: "Organisms are not types and do not have types" (cf. Simpson, 1969:8-9).

In 2009 the neo-Darwinist biologist Jerry Coyne notes that for years after the "publication of *The Origin*, biologists struggled, and failed, to explain how a continuous process of evolution produces the discrete groups known as species". Contradicting the general neo-Darwinian nominalist stance, Coyne does accept objective traits of living entities – thus approximating what Michael Denton once more underscores in a recently published follow-up book of his 1986 work on *Evolution: A Theory in Crisis*. The title of his new book is: *Evolution: Still a Theory in Crisis* (2016).

In his most recent work (of 2016) he explains his position in the 1986 work:

> I argued that the taxa are analogous to distinct geometric figures such as triangles or quadrilaterals, which cannot be approached via little successive steps from some other class of geometrical figure. I thereby defended the typological view that the taxa or Types are ontologically real and distinct components of the world order, as was widely believed in the nineteenth century before Darwin (Denton, 2016:11).

Exploring some insights of Stephen Gould in his last large book of 2002 on the structure of evolutionary theory, Denton, in his 2016 work, characterizes the "heart of the matter" in a way that reflects the distinction between function and entity (entailing the difference between modal laws and type laws): "Nature is in fact a fundamental discontinuum of distinct Types and not the functional continuum maintained by Darwinian orthodoxy" (Denton, 2016:219).

16. An example from the humanities

Both the state and the business enterprise function within the economic aspect – and are therefore subject to the universal appeal of the modal economic normative meaning of frugality (avoiding what is excessive). This is evident in the contrary economic – un-economic. In this case the universality

of the economic normativity is not specified in any typical way. A state as well as a firm can waste money – and thus act un-economically. Both have to observe this principle in their actions. But this is only possible when the modal universality of the economic aspect is acknowledged, i.e. when the *typical* nature of the business and the state is not taken into account. Let us repeat it once more: modal laws hold universally without any specification. Therefore societal entities, such as schools, business enterprises, sport clubs, states, families and art galleries are all subject to the general meaning of economic norms.

Earlier we have pointed out that a type law has its own universality although this universality is *specified*. The universality of the type law for being a state holds for all states. Yet, since not everything is a state, this type law is specified in the sense that it applies to states only. But businesses and states belong to different kinds of societal entities, entailing that this difference will be manifest in the *typical differences* between the function of a state and the function of a business within the economic aspect. The economic life of a business enterprise differs from state economy. A business cannot 'tax' its clients, but the state can tax its citizens. Tax is different from profit. Phrased in terms of our earlier explanation of the difference between modal laws and type laws this means that modal (economic) laws encompass all possible entities, whereas typical (societal) laws (type laws) only hold for a limited class of entities.

17. Concluding remark

Our discussion of the difference between function concepts and entity concepts turned out to run parallel with the distinction between modal laws and type laws. Whereas philosophy initially, in ancient Greece and during the Middle Ages, gave primacy to the substance concept, the developments in modern (post-Renaissance) philosophy increasingly switched to function concepts (relational concepts). We have argued that an encompassing philosophical perspective is needed in order to come to terms with modal universality and typicality – illustrated by a number of examples highlighting the fact that the distinction between function concepts and entity concepts (modal laws and type laws) mediates between philosophy and the special sciences. In the final analysis the difference between modalities and entities constitutes two pillars of a Christian philosophy aiming at the development of a non-reductionist ontology.

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