Anschauung and the Archetype: The Role of Goethe's Delicate Empiricism in Comparative Biology

Malte C. Ebach
Université Pierre et Marie Curie, Paris, France

Comparative biology is a field that deals with morphology. Johann Wolfgang von Goethe recognised comparative biology, not as a passive science obsessed with counting similarities as it is today, but as an active field wherein he sought to perceive the inter-relationships of individual organisms to the organic whole, which he termed the archetype. I submit that Goethe's archetype and his application of a technique termed the Anschauung *are rigorous and significant ways to conduct delicate empiricism in comparative biology. The future of comparative biology lies in the use of the* Anschauung *to communicate the archetype as a set of inter-relationships of homologues that we perceive intuitively. In this essay I present how the extension of our own intuitive perception forms the foundations of a method for seeing and discovering the archetype in comparative biology.*

In Memory of Ronald H. Brady

> The phenomenon is not detached from the observer,
> but intertwined and involved with him.
> —Goethe (1998, p. 155, Maxim 1224)

There are currently two fundamentally different ways of thinking influencing comparative biology. The dominating mode of consciousness, herein termed the *analytical mind* (Bortoft's *intellectual mind* [Bortoft, 1998a, p. 52]), is predisposed to Cartesian (dualistic) perceptions of the world. This dualistic way of thinking has become the driving force of a mechanised reductivist brand of science widely practised today.[1] Goethe remains as one of the few who rejected the 'objectivity' of Galilean/Newtonian physics as a misdirected and mechanised way at looking at Nature (Goethe, 1995, p. 311). In Goethe's approach, the science of comparative biology recognised and embraced the involvement of the observer. The assertion of a barrier between the observer and the thing observed is a dualistic concept that was demolished by Goethe in his *Morphologie* (Goethe, 1981; see Goethe, 1995). Goethe's approach was influenced by the writings of Benedict de Spinoza who validated experience and thought as a direct way of knowing phenomena. The monistic philosophy of Goethe did not attempt to divide our knowledge of the world between what we think and what we see. To him, knowledge *is* our experience—an activity of our sensing mind.

Janus Head, 8(1), 254-270.

The significance of the holistic application of the mind's ability to discover something of the world is difficult to appreciate for those who are trained to think analytically. The analytical mind only 'sees' phenomena in terms of empirical tests or in reference to how they fit some mechanism or model. Under the analytical mind, our experiences are subjective and must be open to 'falsification' to be devoid of opinion. Phenomena are therefore *generated* as by-products of models, tests and predictions. If we replace our own experiences with models and theories, then the world can only be 'united' (i.e. made intelligible) by a general or unifying theory: one which all phenomena obey (i.e. natural selection, dispersal etc.).

> As I have repeatedly said, but cannot too much emphasize, the actual value and invincible strength of the Theory of Descent does not lie in explaining this and that single phenomenon, but in the fact that it explains *all* biological phenomena, that it makes *all* botanical and zoological series of phenomena intelligible in their relations to one another (Haeckel, 1925, p 363 original italics).

Those, like Ernst Haeckel, who champion their unifying model or theory, see the world by generating explanations rather than experiencing phenomena. A giraffe, for instance, is no longer observed as an interaction of qualities, but as a quantification of parts that fulfill the requirements of a theory or model.

Holistic comparative biology, a small developing field and a remnant from Goethe's day, has remained sidelined. Goethean science should not remain a footnote to science, but rather it should become an important and active approach. Comparative biology will be greatly enhanced by extending the holistic approach that was initiated by Goethe, rediscovered by Agnes Arber and defended by many contemporary scientists and philosophers, in particular Ronald Brady.

The premise of comparative biology is the discovery of *homology*, namely, the relationship of the parts, called *homologues*. The analytical approach assumes evolution has occurred and seeks a mechanism to explain its history. Organisms are therefore subjected to mathematical and statistical scrutiny, divided into infinitesimal parts, calculated as probabilities and expressed as units or even in terms of 'DNA barcodes'.[2] Our own experiences of the organism however are deemed subjective, and thus a barrier between our minds and the world is raised. Homologies are no longer seen

as a multiplicity of relationships that express the unity of form, but rather as scenarios that infer direct paths of descent. The further comparative biology moves towards a general model, the further it removes the scientist and the science from the ability to appreciate *multiplicity in unity* within the organic whole. In order to re-discover homology as an intuitive association of homologues, we need to investigate the significance of the organic whole and extend our ability to see and to perceive *intuitively* and re-assert the importance of classification in comparative biology.

The Organic Whole

The whole needs to be defined by the relationship of the parts rather than the whole existing as a set of finite known parts. A bird shaped object with wings and feathers and the relationships of the positions of the wings compared to the head, for instance, begins to define something we recognise as 'bird-ness.' To say, for example, that a certain number of known measured and sampled parts contained in the same vessel define a known bird reduces our own experience to a statistical measurement and statement of quantity. Do we take this approach when describing a cheesecake? Do we need to know all the ingredients, their exact measurements and cooking instructions before we know that we are eating cheesecake? Our experience of the relationships between the texture, taste and consistency of the cake intuitively tells us that what we are eating is in fact cheesecake.[3] The 'composite cheesecake,' one defined by obtaining the quantity of individual parts (the recipe) is the 'counterfeit approach to wholeness' (Bortoft 1998b, p. 294), the same 'whole' Agnes Arber calls the "naïve conception of Oneness" (Arber, 1954, p. 106). Wholes are certainly made of 'parts,' however, the parts should not naively or simplistically be seen as cogs in a machine,[4] but rather as *inter-relationships* within the whole. Arber's 'naïve oneness' is analogous to Bortoft's fake whole (Bortoft 1998b) or extensive dimension (Bortoft 1998a).

Phenomena within the *intensive dimension* (Bortoft, 1998a) can be perceived as wholes without recourse to splitting them up into measured parts. The whole, in this sense, is greater than the sum of its parts as is it is recognised as the inter-relationships of parts. The ability to experience and perceive the inter-relationships that make up the whole is knowledge. In comparative biology these interrelationships are the homologies that are essential to the organic whole, namely the archetype.

Homology and the Archetype

Homology is the inter-relationship of homologues. The difference between the analytical and intuitive definitions of homology and homologue lies in how the homologues are related. Under the analytical mind, homologues are related by a mechanism, namely descent. Homology, then, is reduced to being the result of a linear process that is not observed, in this case, phylogeny. The model, and no longer the phenomenon, is the focus.

The homologue, in the intuitive mind, is a structure with manifestations occurring in different organisms. In other words, two different organisms are related because they share the same structure. Consider the following: "These buttercups are the same" compared to "It's the same buttercup!" (Bortoft, 1996, p. 258). In the case of the analytical 'homology,' the homologues are seen as different structures within a transformation series that is linked because of similarity. Returning to our example, these homologues are 'similar buttercups' that is, they are different individuals but look the same. In the intuitive mind, however, the different homologues are perceived as manifestations of the same structure. That is, that these are all the same buttercup.

We might consider, for example, one of our forearms. The forearm is a structure that is present in all mammals but in altered forms. In bats the forearm is a wing, in whales the forearm is a fin. Although both share the same structure with most mammals, our forearm is more like an orangutan's forearm, but its degree of relation is apparent only when we compare it to the same structure in a bat. Under the analytical mind the forearm, wing and fin are a linear progression of three different structures that share the same form and history. Under the intuitive mind however, the forearm, fin and wing *are the same* thing, and the process or progression is unknown because it cannot be observed. These two definitions of homology have also led to two different definitions of archetype.

The concept of the archetype in comparative biology has always been misinterpreted as referring to an organism, namely the ancestor. Goethe too, during his visit to Palermo, Italy in 1787, made the same mistake:

> Confronted with so many kinds of fresh new forms, I was taken again by my old fanciful idea: might I not discover the primordial plant amid this multitude? Such a thing must exist, after all! How else would I recognize this or that form as being a plant, if they were not all constructed according to one model?" (Goethe, 1989, p. 214).

The archetype is not an individual 'primal' organism, but an experience of the unity that presents itself through multiple manifestations in organisms.[5] The bat, whale and human for instance are present in the mammal archetype as they all share the same structure, but as in the buttercup example, the archetype is present in a man, a whale or a bat as much as the man, whale and bat are present in the archetype.

Goethe stated that the archetype is the progression from less 'ideal' or less specialised forms into more complex 'ideal' or specialised organisms (Goethe, 1999, p. 127). A worm, for instance, has many homologues that are similar. When we consider a human, for instance, those homologues become less similar to one another and more complex. A more 'ideal' organism has many specialisations and fewer similar looking homologues. In order to compare a worm with a human, both need to be compared for their degree of relationship to a third form, or in Goethe's case, the archetype.

The activity of relating form is not a linear progression. Certainly we are able to observe the linear progression of seed to plant to fruit to seed and back again and replay the experience in our mind's eye. As observers, however, we are blind to historical processes such as the transformation of one form to another.

Metamorphosis

That comparative biology is a historical science is certainly not a radical claim. Evolution, herein defined as 'change over time,' is also quintessentially a historical subject. Goethe certainly viewed his comparative anatomy by looking back and modifying the phenomenon of form by "*regression to produce pictures of less perfect* [ideal] *creatures*"[6] (Goethe, 1995, p. 119 my italics). For Goethe, the metamorphosis of form was something that happened both over time and in our 'mind's eye.' We could investigate a new form, such as leaf, by simply looking at it. Not as a photograph or as a cursory glance but as an experience that involves *active participation* of the mind. The word that Goethe and later Arthur Schopenhauer used for this activity is *Anschauung*. It is a term that is at first difficult to translate into English as it moves beyond the simple translation of 'to look' or 'to view.'[7] Goethe used another term, *aperçu,* that explains 'seeing' not as an explanatory process, but as an 'insight' (Zajonc, 1998, p. 26) or 'appearance.' If we were to sit down and look at the leaf as it first comes 'into being' we recognise it as a leaf based on our past experiences, and we then may investigate its shape,

colour and physical development changing over time. If we sit long enough, the leaf can be traced from the germination of a seed straight through to its position on the stem of a fully grown plant. To experience this transformation and each individual part of the plant's history we can replay it in our 'mind's eye,' from plant back to seed, from seed back into plant. For Goethe, the metamorphosis is a natural process, a kind of 'morphing in the mind's eye'.[8] In his sense, metamorphosis is *adirectional transformation*, something that we can perceive intuitively when observing and experiencing the phenomenon.[9] Our knowledge of transformation or metamorphosis is strictly limited to our observation and experiences of phenomena. To arrive at the stage of the *Anschauung* we must understand the phenomenon through *thinking intuitively*.

Intuitive Perception

The ability to morph objects in our mind's eye is central to intuitive thinking (see Bortoft, 1998b; Brady, 1998; sensu *Contextual thinking* of Holdrege, 1996, p. 52). Robert Ornstein defined *intuition* as "knowledge without recourse to inference" (Ornstein, 1996, p. 24). Knowledge through the intuitive mind is our experience of the phenomenon.

Comparative biology is an activity that can be achieved by thinking with the intuitive mind. Evolutionary biology, however, is a passive science, one that focuses on abstraction, inferring causal events and transformations that are beyond our experience. It *generates* abstractions that are based on a presumption of what may have happened by separating out our experiences from our thinking, an extensive or process disengaged from the phenomena. In other words we use our imagination, not our experiences, and are making things up. Causal transformations, for instance, are generated as they are concerned with proposing mechanisms and not discovering the archetype. It is this generative type of biology that Goethe never countenanced. He did, in fact, deride its manifestation in Galilean/Newtonian physics. Dualistic science devalues our own experiences as being subjective and non-empirical.

Entering into the experience of phenomena as an activity within the intensive dimension is certainly a different way of thinking or consciousness than to separate one's mind from the experience and instead see the world through a series of pre-determined models. To break free of mechanistic or quantitative thinking is a difficult task. Many of the sciences, especially systematics and biogeography, are today trapped in what Goethe called "the

gloom of the empirico-mechanico-dogmatic torture chamber" (translation in Heller, 1952, p. 18; see also Goethe [1998, p. 55, Maxim 430]). A move away from reductivist thought requires a change of perspective and a return to understanding Goethe's archetype.

Relationship is not simply a comparison of two things. Any two things in the world can be 'related' to each other simply by quantitatively listing their parts, like the parts of a cheesecake. This 'recipe' analogy demonstrates generative thinking that tells us nothing of what we are experiencing. Relationship becomes meaningful when two things are compared to a third. Once the degree of relationship is uncovered, such as squirrels and rats are more closely related to each other than they are to humans, intuitive thinking has been established. The rat and squirrel relationship is based on the shared homologue. The concept of relationship in comparative biology is not based on modelling or on hypotheses. Thinking in terms of relationship is an *intuitive activity*. Arber (1954) called this type of perception, *intuitive perception* deriving the term from Goethe's and Schopenhauer's *Anschauung* (two terms I will be using interchangeably). Intuitive perception is an *active* way of thinking.

With *Anschuuang* as our first step into uncovering a relationship, the phenomenon comes into being. A familiar organism such as a house plant is easily recognised, but something more unusual, such as a tapir, requires a little more concentration. At first we see a hairy, pig-like 'elephant nosed' dog. We rely on our past experiences of organisms, the inter-relationship of their homologues to other phenomena. We know that recognising the tapir does not include any of the animals mentioned in our description, but we still try to relate the tapir *to something else.*[10] A tapir is more closely related to another tapir than it is to any other animal, so it remains a tapir *in itself*. If we were to closely examine the homologues, such as the position of the tapir's legs in relation to its head and to other parts of its body, the tapir relates more to a horse than to a dog. That relationship does one of two things: it relates the tapir to horses as an intuitive association and secondly it classifies the tapir with horses. Our intuitive perception is nothing more than relating our experiences of the phenomenon to itself and to other phenomena. The *Anschauung* is thinking by way of relationship.

In this way, our own intuitive perception acts as the 'method' in comparative biology. I prefer to use the term 'application of the intuitive perception' or '*Anschauung,'* rather than 'method' as the latter has come to imply that the mind is separate from the phenomenon. The world of phenomena

makes sense only by relationship. I still remember examining trilobites as an undergraduate. The class exercise was to sort out the trilobites into groups, but the trilobites laid out before me looked very much like each other. Several years later, after some considerable taxonomic training and experience as a palaeontologist specialising in trilobites, I came to revisit those same trilobite specimens. To my surprise I realised that the trilobites were all part of the same family and that only a trained palaeontologist with considerable knowledge and experience of that particular group of trilobites would be able to tell each individual apart. No wonder many of my class mates were turned off to taxonomy– to them trilobites all looked the same. In my own teaching, I use very different looking trilobites as well as fossils from similar looking groups, such as horseshoe crabs. Not surprisingly, students always manage to group the trilobites separate from the horse-shoe crabs *intuitively* without any taxonomic training. Even obscure looking trilobites that had slightly altered forms were grouped in with the trilobites. Intuitively the students knew what trilobites were because one trilobite relates more to another trilobite based on their morphology than to a horseshoe crab. A third form will always relate two similar forms together in order to establish a classification. A relationship is simply the experience of *Anschauung*, not a model, mechanism or hypothesis, but *knowledge*.

The relationship between two organisms to a third provides us with knowledge of the nature of the homology and the archetype. Intuitive perception, the *Anschauung*, is about uncovering the multiplicity of form by relationship. These relationships are a part of the unity, namely the archetype.

Intuitive perception as a way of observing the world has been dismissed as 'theory-laden' (see Hanson, 1958). On the contrary, to reduce our experiences through modelling is certainly 'theory-laden' as we infer a mechanism prior to understanding and perceiving the phenomenon. Theory-laden observation is a product of the analytical consciousness (Bortoft's 'Intellectual Consciousness').

Goethe's 'delicate empiricism' starts with the *Anschauung* and ends in the archetype. The modern comparative biologist today, adopting the Goethean approach, works through the same method of identifying the archetype in order to form working classifications. The classification of organisms as a 'Natural System,' a term Goethe called "a contradictory expression" (Goethe, 1995, p. 43) implies a unity based on a synthesis that is driven by a model, such as Darwin's natural selection or the 'Modern Synthesis,' championed by

George Gaylord Simpson, Ernst Mayr, Theodosius Dobzhansky and Julian Huxley (see Huxley, 1942). A classification based on the archetype needs no model. *Anschauung*, expressed as the extension of intuitive perception, provides us with the means to classify empirically without recourse to unifying models that generate a general synthesis.

Delicate empiricism: Applying the Anschauung *and the Archetype*

Applying the *Anschauung* to discover the archetype is the basis of Goethe's delicate empiricism in comparative biology. Our experiences move beyond the empirical to include ourselves, our *active* perception in the study. We are, as Goethe observed, the experiment, the method, the theory and the idea. To insist that a method exists outside our minds, as separate entity, is an anathema to Goethean science. We need to recognise the validity of our own intuitive perception when experiencing phenomena. Viewing the relationship of the parts of the whole in this manner is not reductive but *comparative*.

The archetype is reached through application of the *Anschauung*. Goethe's archetype was novel in that it included the notion of relationship in order to make sense of the growing number of homologues within each new discovery. An archetype of the mammals would include every homologue as a relationship of two compared to the whole. In modern comparative biology this translates as two taxa (organisms) or homologues are more related to each other than they are to a third, namely a three-item relationship (Nelson and Platnick, 1991). Goethe's archetype has also been applied to biogeography as the relationship between two endemic areas (defined as their biota) to a third (Nelson and Ladiges, 1991; Ebach and Humphries, 2002). The archetype, as the inter-relationship of the homologues and taxa to the whole, is alive and well in 21st century science as the monophyletic group in systematics and as the geographical congruence in biogeography.

Monophyly

The concept of monophyly derives from *Idealistic* [*Systematic*] *Morphology* of Adolf Naef (Naef, 1919; Naef, 1931). A monophyletic group is the archetype that has a hierarchical order of homologies that progress from the less ideal to the specialised. If we consider the above homology Bats (Humans Orangutans) for instance, a hierarchy forms when we include

another relationship Gibbons (Humans Orangutans). The relationships combined tell us that humans and organutans are more closely related to each other than they are to both Bats and Gibbons. If we however discover the homology Bats (Gibbons, Humans), we discover that Gibbons, Human and Organutans are more closely related to each other than they to bats. If we add another organism it will either relate more closely with the Gibbons, Humans and Organutans or with the bats. The Human, Gibbon and Orangutan group becomes the archetype (monophyletic group) based on our experience of relationship.

Arber's naïve Oneness appears often in comparative biology as a non-monophyletic grouping. A grouping that contains organisms that are not part of the same archetype is artificial. The reptiles, for instance, are considered to be monophyletic based on an assumed phylogenetic lineage. This assumption relied on a hypothesis of transformation and not on shared homologues. The mechanistic comparative biologists of the 20th century had already assumed an evolutionary history for groups based on models rather than the search for homologies. The error of the dualistic application of methodology in comparative biology lay in the systematic classification of the reptiles, a group described by their characteristics, a list of ingredients, rather than by homology. The 'recipe' model established a group of organisms that were later to be found to be more closely related to birds and mammals than to each other. Birds and dinosaurs, we often hear, are more closely related to each other than to any other group. If this is the case, the reptiles do not belong to the same archetype, thus making the grouping non-archetypical and therefore meaningless. The Modern Synthesis and neo-Darwinism have left many such non-monophyletic groupings because evolutionary history has been assumed and a model implemented to explain that history (see Brady, 1987). Models generate 'historical' inferences rather than discover monophyly.

Goethe's delicate empiricism in comparative biology is defined as implementing the *Anschauung* as an extension of intuitive perception. The implementation moves beyond Goethe's *Anschauung*. In modern comparative biology such implementations already exist,[11] but have been sidelined by the neo-darwinist majority as being subjective, non-empirical and methodologically inferior. Comparative biology today is not about discovering and classifying the archetype but has become speculative modelling for the mechanisms.

The Intuitive Mind in Comparative Biology

The current mechanical approach in comparative biology is a result of the analytical consciousness that has persisted since the adoption of Newtonian/Cartesian dualism in biology. Unity in multiplicity is also the underlying fundamental of the Cartesian viewpoint. The separation between mind and body denies the activity of *Anschauung*. The organism becomes the subject of reality and our minds the interpreter. Our mind, deprived of our experience, is reduced to abstract reasoning in order to come to grips with a 'truth' or reality hidden within the mechanical organism. The move away from reductivism in biology, first started by Goethe and later practised by Agnes Arber, Andreas Suchtanke, Wolfgang Schad, Jochen Bockemühl, Craig Holdrege, Nigel Hoffmann and others challenges the supremacy of the analytical mind.

Fundamentally, the difference of a holistic approach lies in how we perceive the organism and the archetype. A taxon may be interpreted mechanistically as a vessel made of parts that when added together forms a 'whole,' or taxon is part of a whole in which the whole manifests itself in the taxon. In this sense the whole is greater than the sum of its parts. Arber argued that the former, the 'naïve oneness' is in the "Platonic tradition where the Whole precedes the Parts" (Arber, 1954, p. 106), an activity Bortoft calls "finding unity in multiplicity" (Bortoft, 1996, p. 250). Spinoza's contrasting view, "treated the concepts of body and mind as both referring to the same reality … [p]erhaps we may modify Spinoza's view so far as to think of the body as the individual considered under the aspect of multiplicity, since the body may be seen, from one standpoint, as consisting of component parts whose structural and functional variety beggars description; we should then regard the mind as the individual contemplated under the contrasting aspect of unity; but the realization of relatedness may offer a bridge between those conceptions" (Arber, 1954, p. 99).[12]

Bortoft demonstrates the difference between 'unity in multiplicity' and 'multiplicity in unity' as a 'switch' between modes of thinking and consciousness. Consider again the phrase, "These buttercups are the same" and "It's the same buttercup!" (Bortoft, 1996, p. 258). The former sees multiplicity from the analytical mind. Buttercups are numerous and can be quantified as so: one buttercup is part of the total sum of buttercups. Goethe's dislike of the term 'composition' again comes to mind. The naïve oneness of unity in multiplicity puts the 'whole' in context of a bucket that contains a set or

finite number of parts that define the whole – Plato's whole that precedes the parts. Bortoft's later statement, "It's the same buttercup," requires an intuitive insight.

The intuitive mind does not model 'Wholeness' and assume its parts. The whole cannot be split into smaller parts; rather, the parts reflect the whole in certain manifestations. The familiar forearm, fin and wing analogy can be seen as three individual parts that can be summed up by statements of similarity, or intuitively they are seen as the one structure that has three types of manifestations. The forearm is present in the archetype and so the archetype is present in you. The individual is not a part of the whole, but a *multiplicity* of the whole. The multiplicity is no more than the inter-relationship of the archetype. Our forearm is present in whales, in bats, in tapirs and in the archetype - the organic or biological whole. The different manifestations of our forearm do not make them different structures, but the same thing appearing many times.

Goethe's delicate empiricism, *die Anschauung*, is a necessary step for comparative biology. Evolutionary biology, with its analytical mindset and generative models, has dominated biology for too long. In order to establish a holistic comparative biology there needs to be a change in the way we think and lead our investigations into phenomena. The competitive nature of comparative biology, struggling to survive has, ironically, created a Darwinian milieu for most comparative biologists. Ideas, as Richard Dawkins' 'selfish gene' concept would have us believe, are competing. Only the most fundable, 'exciting' and politically correct ideas are surviving. Society and the scientific community have been indoctrinated by analytical thinking and believe dogmatically in the models that they propose. A world that sees through Darwinian 'spectacles' (Holdrege, 1999) is living in tune to a model. We see natural selection happening in economics, science, and politics. Not surprisingly, by adapting natural selection as an acceptable means of conduct in our social sphere we start to 'see' it happen in nature, kindling ideas like *sociobiology* (Wilson, 1975). Like H.G. Well's 'Country of the blind' (Wells, 1927) we do not see the phenomena but only generate explanations in our minds that provide a general unity or model. The experiences and subsequent descriptions of a sighted person would not and could not be believed as they challenge the 'unity in multiplicity,' namely the general model that is natural selection. Viewing nature is not enough – here we see Haeckel's 'explanation' retold:

> We have a description of what goes on in the universe but we don't have an explanation. A description says this is how things appear, an *explanation says this is how things have to be*" (Ken Peach, in *The Guardian* February 3, 2005, p. 3, my italics).

The *Anschauung* can never explain 'how things have to be.' Things are as we experience them, they need no further explanation.

The means by which to do Goethe's way of science are available by applying our experience and our active minds. We just need to open ourselves to trusting them as being a *delicate empirical* way for discovery. Goethe's delicate empiricism is in fact being practised in comparative biology, albeit by a small community, under funded and under siege by a dogmatic neodarwinist agenda of unifying multiplicity.

In order to use the *Anschauung* and discover the new archetypes in systematics and biogeography we need to acknowledge and embrace *Anschauung* as a science that gave birth to morphology and sees through to a unity that is comparative biology.

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Notes

[1] In comparative biology (systematics and biogeography) today, most research is oriented towards statistical and mechanistic explanations of form. This includes measuring the similarity between the smallest biological units, namely the molecules that are the building blocks of DNA, to retrodict the precise timings of former 'evolutionary' and diversification events that are unknown to the observer. Similarity measurements of molecules are considered to provide more 'revealing' information about hidden the processes that 'make sense' of morphology and ontogeny. Hence the stark differences in funding between genetic research, such as the Human Genome project and taxonomy.

[2] DNA Barcoding, a recent development in systematics and conservation ecology, aims to 'barcode' every organism based on its genetic information. The barcodes will be stored in databases and be retrieved electronically and the need for morphology (i.e. taxonomic

description) becomes secondary (see Ebach and Holdrege, 2005).

[3] The dualistic response to such an approach is that all observation is 'theory-laden', but as I will discuss below, 'theory-laden' observation is dependent on one certain mode of consciousness.

[4] Goethe disliked Geoffroy Saint-Hilaire's usage of the term 'composition' in his dispute with Cuvier. To Goethe 'composition' inferred that organisms are made of parts like a machine is made of separate bits and pieces. "If he [Saint-Hilaire] would express the single parts of an organic being, he has no other word but *material:* thus, for instance, the bones, which, as homogeneous parts, form the organic whole of an arm, are placed upon the same scale of expression as the stones and planks with which a house is built" (Eckermann, 1998:415 original italics).

[5] The Goethean concept of the idea is perhaps best illustrated in the 'Fortunate Encounter' between Goethe and Friedrich von Schiller at the end of July 1794. After being introduced the Goethe's the organic whole, the *archetype*, Schiller stated, "That is not an observation from experience. That is an idea" (Goethe, 1995, p. 20). Brady saw this as a distinction between two different types of thought, "Schiller's distinction was a modern one. He suggested that Goethe was hypothesizing something that *he could not actually find in experience*" (Brady, 1998, p. 96). Schiller viewed the phenomenon from the Kantian perspective, derived from Descartes. The archetype was not knowledge of the inter-relationship form in space and time and relationships that are historical, but a theory, a mere hypothesis that is derived from inference. Hanson's critique of observation as theory-laden is a modern representation of Schiller's encounter 200 years before.

[6] In German the word *'vollkommener'* (an adjective as in English) is used in reference to concepts and cannot be used to evaluate the mechanical function of material things, such as a 'perfect or accurate result'. The word the *'vollzählig'* is used instead. *Vollkommen* can be used to describe a feeling, '*vollkommener ruhe',* 'perfect peace' or 'rest', or to describe the aesthetic experience of an object, feeling or person. *Vollkommen*, as used by Goethe, may be best translated into English as 'ideal' to mean 'fitting' or aesthetically 'complete', as in an 'ideal husband' or an 'ideal holiday' or an 'ideal painting' to describe the mood. Therefore, 'physiologically ideal' would mean 'best suited, or specialised, rather than a mechanical degree of accuracy. So an ideal holiday is experienced as being 'ideal' and a biblical painting by Peter Paul Rubens as 'aesthetically complete' not 'historically and scientifically accurate.

In summary, the different usage of the term 'perfect' in Goethe's writings can therefore be resolved by renaming 'perfection' defined as 'a degree of perfection' (i.e. between a 'less perfect' and 'most perfect organism') as in "… the most perfect organism appears before us as a unified whole, discrete from all other beings." (Goethe 1995, p. 58), from the original "Je vollkommner das Geschöpf wird, desto unähnlicher die Teile einander" (Goethe, 1999, p. 49) as 'ideal' or 'specialised'. However, the term 'perfection' as in "… we are justified in considering every animal physiologically perfect." (Goethe, 1995, p. 121), from the original " … so ist auch jades Tier als physiologisch *vollkommen* auszusehen." (Goethe, 1999, p. 127) stays the same.

[7] Arber (1954) translates *Anschauung* as 'intuitive perception' (Arber, 1954, p. 122), a

term that I will use herein. Heitler (1998) also described *Anschauung* as "intuitive observation, not analytical thought" (Heitler, 1998, p. 61) as well as Miller (Goethe, 1995, p. xxi, 315), the same term Bortoft (1996) calls "concrete vision" (Bortoft, 1996, p. 90).

[8] Brady (1998) stressed that the direction of movement "has no part in this result. We could, as Goethe suggests, let the movement run forward or backwards. The metamorphic relation does not depend upon direction" (Brady, 1998, p. 106).

[9] Goethe called this his *Genetishe Behandlung* (Goethe, 1964, p. 131-132), translated by Miller as 'Genetic Method' (Goethe, 1995, p. 75), but is best translated as 'Genetic Treatment'. Goethe usage of the term 'Genetic Treatment' is an active participation of the intuitive mind as "thinking which traces phenomena in unbroken succession" (Miller, in Goethe, 1995, p. 331, footnote 4) where we "see that empirical observation finally ceases, intuitive perception [Anschauung] of the developing organism beings, and the idea is brought to expression in the end" (Goethe, 1995, p. 75). Goethe Genetic Treatment is an activity of Anschauung, confined only to the metamorphosis of an individual organism, rather than a 'method' for "[o]nly he who finds empiricism irksome is driven to method" (Goethe, 1998, p. 155, Maxim 1214).

[10] Brady (2001) mentions that "[i]ndiviudal objects must first be picked out by the activity of thinking (intending), and then related. Unity is also a relation, and by it we entitize (make into an individual unity) the objects of our perception" (Brady, 2001).

[11] The methods a result of the work by Gareth Nelson and Norman Platnick (Nelson and Platnick, 1981). The methods resulting are Three-item analysis (Nelson and Platnick, 1991), Paralogy-free Sub-tree Analysis (Nelson and Ladiges, 1996), the Transparent method (Ebach et al., 2005) and Area Cladistics (Ebach and Humphries, 2002; Humphries and Ebach, 2004).

[12] The same idea was explored by Bortoft, "[t]he nonreductionist perspective is simply seeing the dimension of One instead of the empirical many …. The notion of 'unity in multiplicity' appears as Flatland (Abbott, 1963). 'Flatland' here is the extensive perspective of the empirical mind, which sees only the sheer multiplicity of the many" (Bortoft, 1996, p. 260). But what of Arber's 'relatedness' that 'may offer a bridge' between the conceptions of multiplicity and unity? Arber believed that, "[b]odily multiplicity, in its ultimate organic relatedness, *becomes* unity, and this unity *is* the mind-body individual" (Arber, 1954, p. 99, original italics). Arber's 'relatedness' in a modern context, is the relationship between our intuitive perception to the Archetype. That is, our ability to classify and identify the Archetype, the Whole or One, through the active participation of our minds. To grasp fully the context of the One in comparative biology we return to Bortoft.

Author's Note: Correspondence concerning this essay should be addressed to Malte C. Ebach, Laboratoire Informatique et Systématique (LIS), Université Pierre et Marie Curie, 12 rue Cuvier 75005 Paris. E-mail: mcebach@yahoo.co.uk.