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Essays in Philosophical Biology

Philosophical biology, one might venture to assert, is an effort to delve as deeply as possible into the underpinnings of biological structure. Consequently the effort will be, first, to understand how continuity can be maintained in the drastic change from cold-blooded to warm-blooded vertebrates, from the property of cold-bloodedness to the property of warm-bloodedness. The effort will be extended, second, to consider how properties, in the fully explained sense provided by philosophers, can be used to explain winter and summer adaptedness, and to explain adaptedness and non-adaptedness. Finally, the effort will take up, third, what is deeply germane in a distinction between two environments, the ocean and land environment – for the relational *supporting* and the attributional *suited to* dictate very different accounts of environment and species in the Pacific Ocean and on the North American continent.

The three efforts just mentioned will be presented as: I. Can evolution be philosophically integrated?; II. Properties and adaptation; III. A view of two worlds.

I. Can Evolution Be Philosophical Integrated?

The present discussion will first show that the cold-blooded to warm-blooded change in land vertebrates is insurmountable philosophically. Thus the issue is quite unlike the physical issue, where it is clear that the change did happen. What could a philosophical account have to offer that would create a difficulty in understanding so clear a change at the physical level? More specifically the difficulty can be presented in the following way.

Lewontin (1978) says "the wholesale reconstruction of a reptile to make a bird is considered a process of major adaptation by which birds solved the problem of flight." What Lewontin does not point out is that the process of adaptation is from being *not* adapted to flight (reptile) to being adapted to flight (bird). For what else could process of adaptation mean? Process is from an animal having one property, non-adaptedness, to another animal having a different property, adaptedness. But can the change from non-adaptedness to adaptedness be bridged in an evolutionary setting? So a comment on the evolutionary setting would seem appropriate.

Land evolution as paleontology is from reptiles to birds on the one hand and to mammals on the other hand. The evolutionary change to birds was primarily in the Cenozoic, mostly in the Ecocene and Oligocene (Romer, 1959; Carrol, 1988). The evolutionary change of reptiles to mammals occurred throughout the Mesozoic and was by small intergrading steps (Carrol, 1988; Hopson, 1987; Jenkins and Parrington, 1975-1976). These changes are all at the morphological fossil level. It will be assumed here that physiological changes went along with the morphological changes. Thus the

amphibian and reptiles will be grouped together because they now have the property of cold bloodedness and birds and mammals will be grouped together because they now have the property of warm-bloodedness.[1] And the feature of having the property of cold-bloodedness changing into the property of warm-bloodedness will be thought of as an evolutionary change in which this property change, following a long philosophical tradition (Copi, 1954), will be considered a change in essential properties. Here cold-bloodedness and warm-bloodedness retain their respective essential identities regardless of the environment.

These essential properties are pure properties. Impure properties are gotten when properties are dependent on the environment. Impure properties include the properties of being discontinuously active annually in temperate regions, stemming from cold-bloodedness, and being continually active under similar conditions, stemming from warm-bloodedness. These are physical corporeal properties. Incorporeal, abstract properties include being adapted, adaptedness, and being unadapted, unadaptedness.

Properties divide philosophers into three factions, extreme nominalists, moderate nominalists, and realists. Extreme nominalists countenance only particulars (Armstrong, 1978, 1989; Loux, 2003). Moderate nominalists accept each particular thing as composed of properties (Stout, 1923, 1936; Williams, 1953; Campbell, 1981, Armstrong, 1989; Loux, 2003). Realists require each particular thing to have a common property

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[1]Some temperatures of animals are: cattle 100º-102.5ºF, cat 100-103.1ºF, dog 99.5-102.5ºF, ferret 100-102.5ºF, goat 101-104.5ºF, horse 99-101.5ºF, rabbit 100.4-105ºF, sheep 101.3-104ºF, swine 100-102ºF (Plumb, 1995); rhesus monkey 101º (Ransom, Fisher, Ingram); house sparrows 42ºC (Miles and Heath, 1972); Peking duck 42ºC (108ºF) (Hagan and Heath 1980).

property which bridges from particular to particular (Moore, 1900-1; Russell, 1911; Williams, 1930; Bayliss, 1953; Quinton, 1957; Allaire, 1960; Donagan, 1963; Wolterstorff, 1970a, 1970; Jackson, 1977; Armstrong, 1978, 1989; Westphal, 1990; Loux, 2003; Moreland, 2001). So there is this development: if there are ten of the moderate nominalist's particulars with ten resembling properties, then there are ten instances of one common property in the realist's ten particulars. Ten roses with ten rednesses equal ten instances of one redness in ten roses. Ten rednesses = ten instances of one redness.

The question is: What happens when evolutionary change is seen in terms of moderate nominalism or realism? If evolutionary change is found to be part of one of these views, it will become part of the structure of things, rather than merely a separate scientific consideration.

The Moderate Nominalist View and the Realist View

The moderate nominalist view will be presented through the logically valid structure of contraposition. Nagel (1977, pp. 55-70) stresses this structure as being one of the basic ingredients of rational understanding of the external world, with no thinkable exceptions of alternates and immune from the contingencies of psychology, language, and culture. Nagel's presentation of contraposition is in the form of modus tollens and is sentential: if *p* then *q* plus Not *q*" implies "Not *p*". Contraposition more specifically is: if *p* then *q* implies if not *q* then not *p*. The converse is: if not *q* then not *p* implies if *p* then *q*. But if the subject, and object, of the sentence is separated from the predicate,

severe problems emerge whether to treat contraposition (and converse) nominalistically or realistically.

The logically valid form contraposition plus the converse provide equivalence. Thus a dyadic (two-part) structure (*x* is adapted to *y*) is impressed upon the external world, following Hulburt (1992, 1996, 1998). Thus we can portray aspects of the foregoing discussion in the following way:

$$(\ y)[Ty \cdot (Bxy \supset Axy)] \equiv (\ y)[Ty \cdot (\sim Axy \supset \sim Bxy)]. \qquad (1)$$

Which is: There is a *y* such that *y* is an annual temperate temperature range and if *x* is behaviorally active throughout *y* then *x* is adapted to *y* – equivalent to (≡): there is a *y* such that *y* is an annual temperate temperature range and if *x* is not adapted to *y* then *x* is not behaviorally active throughout *y*. Any single bird or mammal (except hibernators) can be put for *x*, so that *x* takes this animal as a value; thence the part to the left describes it as it actually and factually is – adapted because active the whole year – and the part to the right describes it as it can be counterfactually imagined to be, as it would be if it were otherwise than it is. Any single amphibian or reptile can be put for *x*, so that *x* takes this animal as a value; thence the part to the right describes it as it actually and factually is – unadapted because not active the whole year – and the part to the left describes it as it can be counterfactually imagined to be, as it would be if it were otherwise than it is.

It is to be pointed out that when *x* is behaviorally active throughout *y*, *x* has the property of being behaviorally active throughout *y*, and when *x* is adapted to *y*, *x* has the property of being adapted to *y*. And likewise when *x* is not adapted to *y*, *x* has the property of not being adapted to *y*, and when *x* is not behaviorally active throughout *y*, *x*

has the property of not being behaviorally active throughout *y*. These properties are confined to each animal *x* in the view of the moderate nominalist. But according to the realist each property, each numerically single thing, is exemplified, embodied, instantiated in every particular bird and mammal, in every particular amphibian and reptile. The importance of taking the realist view is that properties make birds and mammals cohere as a group and amphibians and reptiles cohere as a group.

Expression (1) portrays the two properties of warm-blooded birds and mammals (hibernators excepted) and the two complementary properties of cold-blooded amphibians and reptiles, without showing any evolutionary coherence between the two groups of animals and between their properties.

It is possible that the variable *x*, if not a mere part of a linguistic logical schematism, could be instead, in some way, a real ingredient in complementation, in the change from unadapted to adapted. The variable *x*, one might postulate, should remain single throughout in the reality underlying the schematism of expression (1). The variable *x* should be unaffected by its association with positive or negative properties. It should be part, perhaps, of the bundle of properties that compose each animal (Stout, 1923, 1936; Loux, 1970). But the first interpretation of (1) is in the moderate nominalistic tradition, in the Stoutian sense that properties (universals) exist within the confines of particulars, particular animals, but do not bridge the gap between particulars. And so the variable *x* cannot bridge the gap either.

Thus the moderate nominalist interpretation of (1) makes the use of logical validity seem to need justification. But can interpretation in the realist tradition be achieved and thus make evolution philosophically integrative and cohering?

The Realism of Variables

Moore (1993, p. 94) and many others treat predicates as entities that variables have. Quine (1972, p. 115) objects. For Moore *Fx* is: *x* has *F*; for Quine *Fx* is: *x* is *F*. In the standard formula for the identity of indiscernibles *Fx* is: *x* has *F*:

$$(F)(Fx \equiv Fy) \supset (x = y),^{1} \qquad (2)$$

if, for every property, *F*, *x* has *F* if and only if *y* has *F*, then *x* is identical with *y*. More briefly, in the arresting words of Armstrong (1989, p. 66) "if two things have the very same properties, then they are the very same thing." There is a certain convenience here for if (2) is rewritten in accord with Quine's view we get the much more cumbersome:

$$[(z)(Fz \supset Hxz) \equiv (z)(Fz \supset Hyz)] \supset (x = y), \qquad (3)$$

if, for all *z* if *z* is *F* then *x* has *z*, if and only if, for all *z* if *z* is *F* then *y* has *z* – then *x* is identical with *y* (*x* and *y* are the same, are one).

If we stick with Armstrong's succinct words, we see, as he suggests, that the identity of indiscernibles is ideally expressive of an animal's (thing's) being a bundle of properties, as previously mentioned. So the issue is whether two animals can be one (Loux, 1976) or whether the whole principle of same properties same animal can be falsified by the possibility of two animals – or many animals – with exactly the same

[1] This is an instance, since the quantifiers, (*x*) and (*y*), have been omitted.

properties. But this 2-1, 1-2 impasse does not turn up in *Fz* of (3), which is *z* is *F*. Since the property of being adapted, adaptedness, is single, *z* is *F*, *z* is adaptedness, means that *z* and *F* are one.

The avoidance of impasse suggests another view, which is that variables in general can be considered non-linguistically and thus not as vehicles taking particulars as values, as when any animal is put for *x* or *y* in (3). Thus variables can be considered as real ingredients of the external world as in *z* is *F* in the sense of *z* and *F* being one above. A variable, then, would be part of *F* in *x* is *F*, part of *F* in *y* is *F*. We are not to interpret *Fx* as *x* is an instance of *F*, *x* is an example of *F*, for this would be *Fa*, *a* is *F* – *a* is a constant and cannot be associated, in good conscience, with *F* and ~*F*. But *x* can, *z* can too. Denial applies to the whole of *Fa* in ~*Fa* but only to *F* in ~*Fx*, because *a* exemplifies *F* and *x* doesn't. The variable *z* is the whole of *F* in *z* is *F* above. But the variable is part of *F*, a bit of *F*, in *x* is *F*, in *y* is *F*.

So *x* is a bit of *F*. Likewise in *Bxy* ⊃ *Axy*, *x* is a bit of *B* and *A*. And there is no reason that *x* should not be a bit of, a part of ~*A* and ~*B* in ~*Axy* ⊃ *Bxy*. This is a marked departure from normal procedure. But *x* is the same *x* throughout. Even in the case of the essential properties of being warm-blooded or not being warm-blooded corresponding to *x* is a part of a warm-blooded animal or *x* is a part of a not warm-blooded animal in *Wx* v ~*Wx*, the same bit, *x*, persists throughout. And so validity in (1) and *Wx* v ~*Wx* is a coherence endowing ingredient of nature when our subjective view is transformed by our objectified variable *x*.

Realism

Giving up the standard value-taking role of a linguistic variable, and instead avowing a real variable, allows jumping the gap between complementary properties. You can get in (1) in reverse from the not adapted not continuously active *x* to the continuously active adapted *x* in the evolutionary process by the coherence endowing *x*. Thus the logical schematism of (1) is no longer an empty subjective schematism but is the reality of nature – a reality unreducible to the discontinuities of mere physicality.

Traditionally realism means that particulars have common properties and the more common properties they have the more similar they are until they have the very same properties as in the identity of indiscernibles. The gaps between terrestrial vertebrates are bridged by so many common characteristics or properties. And the emergence of so many different combinations of properties occurs as the principle of the identity of indiscernibles breaks down a little and provides for the many animals of the same species, for each individual has most of the properties as each other within the species. And when the identity of indiscernibles breaks down a lot, all the different species of the terrestrial vertebrates are provided for. But this does not take care of any change in the sense of contrapositional equivalence. In order for evolution to have occurred, as in the contrapositional (4) next, the variable as an objective reality is required to be continuous, as it is schematically and subjectively. Next is:

$$(\ y)\ [Ty \cdot (\sim Bxy \supset \sim Axy) \equiv (\ y)\ [Ty \cdot (Axy \supset Bxy)]. \qquad (4)$$

Which is: There is a *y* such that *y* is the same as an annual temperate temperature range and *if x is a part of* a not behaviorally active animal within *y* then *x is a part of* an animal

not adapted to *y* – equivalent to: there is a *y* such that *y* is the same as an annual temperate temperature range and if *x is part of* an animal adapted to *y* then *x is part of* a behaviorally active animal within *y*. In this presentation one *x* runs throughout. This one *x* is unaffected as it becomes part first of a not adapted animal then second of an adapted animal. The reason for using *x* in this way is to make the unadapted parts and adapted parts of nature cohere. Without this coherence evolution as a process could not occur.

Recapitulation

We cannot understand evolution without contraposition and without the symbolism of predicate logic. We are quite used to our language of predication as in 'Jones is ill' or '*x* is ill' grading into 'Jones is a man' or '*x* is a man'. We accept the identity of '*x* is a man' without noticing that beyond the confines of language there is the reality that language attempts to get hold of. It is not noticed, remarkably, that though there are two things, two entities, in the linguistic '***x*** is a man', there is just one real entity. The make-believe world of language and logical schematism must be altered for a real world, *x* must be the same as or at least part of man in such a world. And when, as mentioned in (3), *z* is adaptedness, this means that *z* and adaptedness are the same one thing. Thus the variable *z* is the whole of the property adaptedness. Likewise in (4) the variable *y* is the whole of the annual temperature range, for they are the same one thing. Finally, *x* is part of an animal not active under *y*, so not adapted to *y*; if and only if *x* is part of another animal adapted to *y*, so active under *y*. Same *x*. Two animals. Without same *x* evolution would not be understandable. But understandable is not the point.

There would be no evolution if a real, single *x* were not split across two animals, when the cold-blooded, warm-blooded distinction came to pass.

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II. Properties and Adaptation

There are properties. There are universals. At least for some philosophers there are. And in this essay we are going to follow the philosophers who endorse and hold dear properties as constituents of things. We will rely on such late twentieth century critical arguments in favor of properties as those given by Jackson (1977), Loux (1970, 1976, 1998), Wolterstorff (1970), Armstrong (1989), and Moreland (2001).

Two basic schools of thought view properties, or universals, in two basically different ways. One school is the moderate nominalist or trope school. Here properties are confined to the particulars that have the properties, which in turn compose, constitute the particular. Here properties of similar particular things are similar; similar properties of similar things form a similarity set – the adaptednesses of different organisms form a set of adaptednesses.

The other school insists that properties are not confined to particulars; this school is the metaphysical realist school. Here a single property, adaptedness say, is repeated from particular organism to particular organism. The adaptedness of flying is repeated, is instantiated in this bird or that bird, in this bird species or that bird species. Such a numerically single property is instantiated, is exemplified not just in different organisms and species. A numerically single property, or characteristic, can be exemplified, by a species in different ways: there is adaptedness in division rate to ten different temperatures by two algal species (Hulburt, 2002). There is multiple exemplification of the numerically one property in numerically ten aspects of these species. And the question is: how can the realist see his way their being this multiple exemplification? If

the realist can accomplish this, the advantages are enormous. One entity, adaptedness, would integrate the multiplicity of biota and their processes into one whole.

Thus, if we assume a full-blown realist view, what character would a property such as overwintering have? The answer is very simple. There is agreement among the organisms, the species, the groups that overwinter: they all have special features for getting through the winter. Thus because many entities simultaneously overwinter, the realist is confident that one and the same universal is exhibited or exemplified by a multitude of plants and animals or by many species of plants and animals. But to champion this audacious scheme wholly, the realist is forced to avow a non-spatio-temporal view, because one thing cannot simultaneously be in several places – one universal, if it is physical, cannot occur in its entirety, in non-overlapping, discontinuous regions at the same time. But there is no difficulty with overwintering, because the character of overwintering, like adaptedness, is not spatio-temporal in itself. In itself it is incorporeal. Overwintering and adaptedness are incorporeal but enter into the things that have them, just as 'north of' is incorporeal and abstract in itself but does enter into the cities referred to in 'Edinburgh is north of London' – Russell's (1997) well-know example. But physical properties can and should be treated as abstract, not just to be consistent but to promote an insight into the nature of a property. Then when such properties enter into particulars they are concrete exemplifications.

Thence a numerically single, unifying universal when entering into a particular, even a diffuse particular such as a species, dictates a structure for the particular. Suppose we consider one oyster; if it is like other oysters it pumps through its gill system 9 liters

of water in one hour between 16º and 28ºc (Loosanoff, 1958; Hulburt, 2002). This is an attribute, a property of oysters in general, this pumping rate. So on the one hand constituents such as gills, digestive system, shell, etc. are tied together by intercellular stickiness; on the other hand constituents such as pumping rate are tied into the physical stuff by a metaphysical glue. The rate in itself is as diaphanous and incorporeal as 'north of' or adaptedness or overwinteringness. And so there must be a metaphysical tie that ties together the instances of corporeal properties, such as gills, and the instances of incorporeal properties, such as pumping rate. The tie and properties are transmitted to all oysters, to the collection of all oysters, to the kind of thing that an oyster is.

Now there must be, one school of realists theorizes, an individuating principle to account for each oyster. There is no trouble in telling one oyster from another; of all animals they are the most easily distinguished from each other. But this distinguishability should be accounted for in constructing ontologically an oyster from the basic materials of properties and ties. And so we should have an individuating element, an element variously labeled bare substrate, bare particular, individuator – in the view of the substrate-attribute realist. This element is also a propertyless bearer of properties, for it is tied to the properties, to the instantations of properties. When we say that a particular has such and such properties, this is the element that does the having, the possessing of the properties.

But a certain possibility has to be guarded against, which is what the propertyless individuator does. Suppose man-made objects, like two samples of the same shade and brand of paint, are considered – these two samples by having the same properties (same

shade, same chemistry) would be the same, would be one and not two, if it were not for the individuating propertyless bearer of properties. And it cannot be the case, the realist argues, that the samples are two by location, one to the left of the other, for example, for numerical difference must occur first in order for location difference to occur second. Of course, although we have managed by the device of the individuator to keep the two samples of paint two, they are totally alike; they are, to use a technical phrase, qualitatively indiscernible. A further point is the possibility that natural objects might conceivably be exactly alike; two squirrels perhaps could be exactly alike, or qualitatively indiscernible.

The individuator is not the only way that something can have or possess properties. If a core collection of instantiations of properties is bound together by inter-cellular stickiness plus a tie to hold onto the instantiations of the nebulous, incorporeal properties (rate of pumping, rate of growth, rate of cell division) this core collection can be repeated. Each repeat, each organism, is a whole. Each can possess extra, ephemeral properties, which are accidental and contrast to the essential properties of the core. The variety of shapes of the oyster are accidental but the thick, bivalve shells are essential. But each whole, each repeat is a member in a kind, which is a species. And species can be members in a further kind, a genus. And genera are members in the kind, family. And so on, to still larger taxonomic categories.

The way that initial taxonomic categories come about ontologically, is by the breakdown of the identity of indiscernibles. This principle requires properties, which

includes the view of the metaphysical realist. The principle says that "if two things have the very same properties, then they are the very same thing" (Armstrong's succinct words, 1989, p. 66). But as pointed out above in the case of the paint samples the two things can be kept two by an individuator, but they will be exactly alike. This happens in machine-made things. But natural things, the individuals of a species, seem usually not to be exactly alike. Consider, then, the gray squirrels of North America. Already they do not share all the same properties, since there are 5-6 subspecies (Pratt, 1935; Steele and Kaprowski, 2001). Somewhat less sharing of properties happens between gray squirrels and fox squirrels, for these two species have a different number of premolar teeth. So speciation is an initial taxonomic category process and is obviously an identity of indiscernibles breakdown.

Summarizing, "a property is a universal construed as a multiply exemplifiable abstract entity that is a numerically identical constituent in each of its instances" (Moreland, 2001, p. 74). Non-spatio-temporal is equitable with abstract, and both of these with incorporeal. Tie is eminently philosophical; if you could breathe life into the word 'and' and make it part of the structure of the world, you would have tie. Individuator (bare particular, bare substrates) plays a dual role of distinguishing between entities that are totally alike and thus qualitatively indiscernible and being the anchor that properties (their instantiations) are hitched to.

The biologist' species has a dual role, too, in that a species is a single, scattered thing, like a dealt deck of cards, a broken plate, the plankton, the Milky Way. A species is also a kind – closely akin to a class, a set – of which the pieces, the organisms are

members. A further point here is that although the species is a scattered thing, the pieces transmit from the metaphysical structure of properties, tie, and individuator the property portion to the species – each redwood has tallness, the species redwood has tallness. And although the identity of indiscernibles may be broken down initially to provide species, only a few physical properties are left in an exhaustive breakdown to provide for the great classes, mammals, birds, reptiles, amphibian, insects, angiosperms and gymnosperms. However, the non-physical, incorporeal properties cut across in an uncorrelated way these taxonomic groups. This will be clear in what follows:

Winter and Summer Adaptedness

There are various groupings when only the properties of overwintering, of spring – summer growth, and being adapted (adaptedness) are to be exemplified, instantiated. The property adaptedness will be seen to be the inclusive property. Next are these groupings for land biota in temperate regions. These groupings are properties of a property, just as red is a color tells us that the property of redness is a property of coloredness.

1. Overwintering by bare limbs
2. Overwintering by seeds
3. Overwintering by underground parts
4. Overwintering by diapause stages
5. Overwintering by hibernation

1 – 5 are instantiations of the property of overwintering. Overwintering is exemplified by each bare limb of every deciduous tree. Each seed of each annual plant instantiates over-

wintering. The property of overwintering is embodied in all underground parts of perennials. An insect's larvae diapause stage is an instantiation of the property of over-winteringness. Mammals when they hibernate multiply exemplify the biological characteristic of overwintering.

All these instances are substance instances. Each instance, each exemplification, is a whole tree, a whole seed, a whole underground part, a whole diapause (larval) stage, a whole sleeping (hibernating) animal. Property instances are radically different. There is the overwinteringness of each one of these entities (tree, seed, etc.) – all these over-winteringnesses are property instances; they are tropes, too. And further these over-winteringnesses, taken apart from the organisms they are in, are indistinguishable from each other and simply revert to the numerically single property, overwinteringness.

Overwinteringness, the property of overwintering, is related to the further property, the property of winter adaptedness. The relation, it was just said, is such that overwintering is a property of the property of being winter adapted. There is, I think, nothing strange here. We just have a simple sequence, with winter adaptedness a capping property, a terminal universal. But this sequence is such that overwintering dictates winter adaptedness necessarily, just as redness dictates coloredness necessarily.

Then for the spring – summer growth and activity property that the land biota has there are these groupings.

6. The spring-summer growth of leafy limbs
7. The spring-summer growth of annual plants
8. The spring-summer growth of above-ground parts

9. The spring-summer growth of non-diapause stages

10. The spring-summer activity of non-hibernation

6-9 are instantiations of the property of spring-summer growth, wherein 6. is for deciduous trees, 7. is for annual plants, 8. is for perennial plants, 9. is for winged, non-diapause insects, and 10. is for active mammals that do hibernate. These instantiations, these instances, are substance instantiations.

Spring-summer growth is a property of the property of spring-summer adaptedness. So spring-summer growth dictates spring-summer adaptedness necessarily.

In this section there is only affirmation of adaptedness. In the next section only affirmation of adaptedness will be the result also.

Reciprocal Adaptedness

Birds are to be considered separately. The striking aspect of most manuals on birds is that every species has a picture of the species and a map showing the area where it is found. So it has adaptedness to the area of its occurrence, otherwise it would not be there. Now let us think of single but different case. You get the ground ready for the plants you are going to plant in your garden – you make the ground adapted to the plants. Then you plant the seeds or plants and if they come up or do well they are adapted to the ground. In this two step way you can see that the plants are adapted to the ground which is adapted to them. And this reciprocal adaptedness is necessary, otherwise the plants would not be there. Likewise with birds and their areas of occurrence. For bird species that do not migrate each species is an instance of the property of reciprocal adaptedness with respect to its area of occurrence, both when it is breeding there and when it is not

breeding there. For birds that migrate there are northern breeding areas where the species are instances of reciprocal adaptedness and southern wintering areas where the species are instances of reciprocal adaptedness. That is, the species multiply exemplify reciprocal adaptedness when breeding and when not breeding.

More generally birds exemplify the property of overwintering when they are not breeding and often in southern areas and they exemplify the property of the spring-summer correlate to growth when they are breeding and often in northern areas. Thence overwintering – southern – non-breeding dictates winter adaptedness necessarily and northern – breeding dictates summer adaptedness necessarily.

Only affirmation of adaptedness is the result here. But in the next section both affirmation and denial of adaptedness seem to be the appropriate interpretations.

Adaptedness and Non-Adaptedness

Angiosperms, insects, hibernating mammals, and birds have been described by properties which are constituents of each organism's structure. Constituents include properties, the tie, and the individuator, which is that property-less bearer of properties. But properties are the crucial constituents, and very few of them are relevant to the description at hand. What is needed are properties that describe several more large groups. And it is noticeable that the organisms described so far have very distinct morphological or physiological differences between winter and summer forms, so that there could be both winter and summer adaptedness. But other organisms lack any difference between winter and summer forms. Gymnosperms and cold-blooded

vertebrate on the one hand and non-hibernating mammals on the other hand are such groups of organisms in temperate regions.

Let us consider the property of being year-round functional in the sense that the organism is metabolically and behaviorally active year-round – this would be in a non-hibernating mammal. Therefore this property, instantiated in each such animal could be a property of the property of year-round adaptedness and thus dictate the property of year-round adaptedness. Then let us consider the property of not being year-round functional – getting through the winter in a moribund or inert state and only coming to life, so to speak, with the return of spring and summer. Cold-blooded animals and gymnosperms are substance instances of such a property. And such a property is a property of the property of not being year-round adapted. Not being year-round functional dictates not being year-round adapted.

So there is both affirmation and denial of adaptedness here.

Discussion

One may wonder why a theory of the structure of a particular organism or species has been followed, in which properties, tie, and individuator are required – this is the substrate attribute theory. Instead a theory having only properties might have been followed – this is the bundle theory. At first the tie seemed to be required to glue the abstract, incorporeal attributes to the physical attributes. But now the bare substrate, the propertyless bearer of properties – the individuator – seems to be required in order to steer the identity of indiscernibles away from lapsing into ambiguity. The next three steps portray this ambiguity.

1) If the bundle theory is espoused, then it is not only true but necessarily true in the sense that every property of the bundle is an essential constituent in the structure of a thing. 2) And if it is impossible for two things to share all their properties because complete qualitative indiscernability entails numerical identity (Loux, 1998, pp. 106-107), then two things that conceivably do share their properties are not two but are one, are numerically identical. 3) But being one can be falsified by the logical possibility of two things that are exactly alike (Armstrong, 1989, p. 67), because two things exactly alike in empirically pure properties might differ by each having an impure property the other does not have, such as being identical with itself or being in a certain location (Loux, 1998, p. 110). This ambiguous 2-1, 1-2 vacillation ought to be avoided. Thus an individuator would seem to be required, and the identity of indiscernibles can then be used in a further and exhaustive breakdown to derive ontologically the taxonomy of species.

As our exposition has progressed the instances of properties have clearly come to be whole organisms. Instances of this sort, it was said, are substance instances. But the overwinteringness in one single animal (or one single plant stage) is one instance and this is a property instance – just as the redness of one rose is a property instance of the redness in all the roses of that shade of red. Substance instances, whole concrete animals or plants form kinds (closely akin to sets or classes). Substance instances form species, in other words. So each animal or plant is a member in a kind; a species. Now there are many property instances that are constituents of each organism, that thus account for the repetition of properties so that there are common properties shared by all the members of

the species. But few of these common properties are shared in the large classes when the properties are physical. When properties are incorporeal, there is extensive sharing in the large classes.

Some common properties mentioned so far are shared as follows:

1. Overwintering
2. Spring – summer growth
3. Winter adaptedness
4. Summer adaptedness

Their substance instances are in:

Angiosperms

Insects

Hibernating mammals

Birds

Further properties are:

5. Year-round functionality
6. Year-round non-functionality
7. Year-round adaptedness
8. Year-round non-adaptedness

And their substance instances are in:

Non-hibernating mammals (5. and 7.)

Cold-blooded vertebrates and gymnosperms (6. and 8.)

The portrayal of adaptation in the larger taxonomic classes has nothing to do with the evolutionists' portrayal of adaptation. There is no reason that the evolutionists' adaptation as a result of natural selection should preclude a different approach to

adaptation. There is every reason to abandon the evolutionists' approach with its supposition of natural selection and embrace an empirically based approach, as here and as presented in Hulburt (1996. 1998, 2001, 2002, 2004).

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During the Twentieth Century a great many articles on universals advanced insight into their structure so that the books by Armstrong, Loux, and Moreland could summarize this insight. In this article I have relied on a reading of some of these studies and on the books particularly. I have selected what seemed salient and arresting aspects of universals for this small discussion.

III. A View of Two Worlds

A view of two worlds is presented in the following description:

(A) If there's one environment that supports (is suited to) many species, then those species are supported by (are suited to) one or more environments.

There are two worlds here. One world is a confronting, effective world held together by a relation, the relation of supporting; *x* supports *y* so *y* is supported by some *x* or other. The other world is a neutral, benign world of attributes, where *x* is suited to *y*; *x* has the attribute of being suited to *y* – and perhaps *y* is suited to *x* too. There is a great difference between the relation, supporting, and the attribute, being suited to. And so the environment may be viewed as supporting, producing, many species, wherein supporting in itself is separate from it and the species. But the environment may also be viewed as having, possessing the attribute (property) of being suited to, being adapted to many species as a part of the composition of the environment.

The two world view that is being put forward can be elaborated upon by pointing out that in the case of supporting the description above is logically valid, but that in the case of suited to the description is not logically valid. In the case of the relational supporting the above structure by itself endows validity. But in the other case the attributional suited to could be logically valid if it were ensconced in a factual situation. Thus if *x* were, as a matter of fact, suited to *y* and *y* were, as a matter of fact, suited to *x*, then further elaboration would achieve logical validity. This is shown as follows:

(B) If an environment is suited to a species, then the species is suited to the environment; and if the species is suited to the environment, then the environment is suited to the species – equivalent to: species is suited to environment if and only if environment is suited to species.

This is compendious, to be sure, but it is valid (Hulburt, 2002). And it certainly seems to drive the point home. And yet, does it really drive the point home? Not really, because –

(B) is ambiguous, as further refinement shows. In the case (1) that one single environment is large and undifferentiated and yet harbors a number of species, no one-to-one correspondence between the one environment and its various species can occur. In the contrasting case (2) each distinct environment is paired with each distinct species uniquely and one-to-one correspondence is achieved.

So (B) gets two results, one with no one-to-one correspondence and one with such correspondence between environment and species – on the proviso that the attribute suited to is used. But could such a range be gotten with (A) instead of (B).

We return to (A) with the relational supporting: if some one environment supports many species, then each of the many species is supported by its own environment. This is a little different from the original (A) – this is a modified perception of the latitude available from this logical model. Though one environment might support many species and the many species synonymously be supported by one environment, it is quite possible that one large environment could support many species each of which is supported by its own unique small environment (Copi, 1979, pp. 120-122).

Examples of the two aspects of (A) are, first: the blue tropical Pacific Ocean has many species of gastropod plankton larvae, which are supported by this single great environment (Sheltema, et al., 1996); and second, the North American continent which supports more than 900 species of birds (National Geographic, 1999) each one of which is supported by its distinct, unique area of occurrence. But with the attributional suited to the distinction under (B) between the tropical ocean and its plankton species and the North American continent and its bird species is still non-one-to-one for the ocean and clearly one-to-one for the continent.

And so whether the distinction of two aspects in (A) for the confronting relational world view or the same distinction of two aspects in (B) for the benign attributional world model is made, the distinction deserves a close analytical portrayal.

Surjective ands bijective designations introduce sets (classes) of environments and species. Surjective means that for each member in a set of environments there must be at least one member in a set of species that is supported by and is suited to at least one member of the set of environments (Lipschutz, 1998, pp. 98-99; Milewsky, 1989, p. 29). Here a pictorial, graphical presentation is such that environments are to the right and species to the left. To have just a surjective account there have to be more members in the set of species to the left than there are members of the set of environments to the right. To have a bijective account there have to be exactly the same number of members in the set of species (left) and in the set of environments (right). So it is apparent that in the set of the larial plankton species where there are a number of member species and that in the set of the tropical ocean environments where it is the only member, the surjective

account applies in a non-one-to-one way, since for that environment there are a number of member species and each one is both supported by and suited to that one environment. And to have a bijective account it is apparent that the set of bird species has each member species supported by and suited to its particular, unique environmental area of occurrence in a one-to-one correspondence.

But there is more to bijective than this. Bijective means that the environment-species relation is reversible. In the case of the set of occurrence areas of bird species and the set of bird species, each area is suited to its species and its species is suited to it, as in the one-to-one case of the valid (B). But such reversibility is not to be had for supporting – the environmental area supports its species but its species does not support the environmental area.

So bijective works for the attributional suited to but not for the relational supporting. And the two-world views of relations and attributes are separable when bijective and attributes are put together.

Thus a crisscross of perceptions has emerged from these analyses. Perspicuous analysis thus reveals an explicit richness of content. But a more lengthy illustration of the principles involved would be advisable and is planned.

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