Time, Money and Biodiversity

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Introduction

Biodiversity is the feel-bad word for the new millennium. We all know that we want it, and that there is a lot less of it around than there used to be. Indeed, as a species, we have irrupted into timelines stretching back some 700 million years as the cause of the sixth great extinction event in the history of the earth. Extending into the far reaches of Braudel's *longue durée* (Braudel 1973), we are up there with the meteor that (possibly) killed the dinosaurs. We operate truly globally – affecting every nook and cranny on the planet – except, perhaps, the huge frozen lake Vostok in the Antarctic, which:

> is absolutely devoid of interference. The youngest water in it is 400,000 years old. It doesn't know anything of human beings, fossil fuels, or plastics. It is a window into life forms and climates of primordial eras.

And even this we are working to explore – at first non-invasively, with: "radar sounding, laser altimetry, magnetics, and gravity surveys" and at the end of the day we will probably send a putatively clean robot down there (Nature, March 21 2002). We commandeer an astonishing percentage of the sun's energy stored on earth, the fresh water that sculpts its features and are even digging into the earth's archives to release trapped energy in the form of petroleum.

There are two dramatically different modalities for dealing with the question of biodiversity. In the first, one tries to accord every category of living thing a single biodiversity value, so that the policymakers can start the work of determining what should be protected and what should not – in much the same way as we now internationally barter pollution. Drawing on Donna Haraway's work (Haraway 1997), I will call this a modality of implosion. In the second, one tries to list every last living thing – a frenzy of naming that is reaching its apogee with several multi-million dollar international efforts to record just what there is out there. I will call this a modality of particularity.

The two modalities immediately call to mind two great creations of bureaucracy - the coin of the realm (which Schmandt-Besserat (Schmandt-Besserat 1992) places at the origin of writing) and the list (which Jack Goody (Goody 1986) places at the origin of writing). Each are learned responses developed over millennia to deal with complexity and scope – how to handle a large scale enterprise through abstraction and classification. So it's unsurprising that these two behemoths are stalking biodiversity.

I show how these two modalities are constructed around a similar temporality: background stasis and foreground change (as in the production of animation pictures). My argument is that in order to write our 'natural contract' (Serres 1990) we are producing a singular and rich temporality as complex in its own way as that read out of myths by, say, Lévi-Strauss. It is a temporality that as well as being powerful in the world (for who can doubt the power of bureaucracies and the efficacy of technoscience?) is integrally eschatological and mythic. I argue that paying due attention to the full richness of our current discourse about biodiversity entails reading our own emergent global society's discourse just as we would read any other discourse in societies which have never been modern (Latour 1993).

The argument comes in three parts. Firstly, I give a brief account of some recent work in the history of money, as a way of opening up the issue of what we can look for in the modalities of accounting for biodiversity that will be the topic of my inquiry. Secondly, I look at one organization of the modality of implosion. Thirdly, I look at one organization of the modality of particularity. My examples will be drawn from current efforts to database – figuratively, or as we shall see literally – life on earth.

Money, Memory and Discourse

The archetypal figure adjudicating between boundaries is that of the merchant, who is the trader between the inside (members of the *polis* in classical Greece) and the outside (neighboring communities which wish to operate some kind of trade). In his book *Le Prix de La Verité* (the price/prize of truth), Marcel Hénaff traces the vicissitudes of this mediation over time, tying it initially to Plato's apothegms against the sophists selling that which is beyond price – philosophical truth. At this historic conjuncture when we are renegotiating the natural contract, the array of characters may be different, but the figure remains the same. We have something beyond price: the miraculous bounty of the earth – that gift we enjoy or invaluable creation we steward (Worster 1994). We are in the process of setting a price on it. The boundary between nature and culture we are creating is similarly textured to that of the definition of a community – it can be strictly geographical (natural wilderness on one side and urban mean streets on the other) but is more generally the outcome of heterogeneous, partly conflicting operational definitions. The merchant figures in this case are international organizations like the Organization for Economic Cooperation and Development (OECD), which has in the past decade taken up the banner of brokering international deals on the environment:

> A healthy environment is a pre-requisite for a strong and healthy economy, and both are needed for sustainable development. The OECD provides a forum for countries to share their experiences and to develop concrete recommendations for the development and implementation of policies that can address environmental problems in an effective and economically efficient way. … Increasingly the problems they face are more complex, and will require co-operative action at the international level (e.g. climate change) or coordinated packages of policies across regions and/or sectors (e.g. biodiversity, agricultural pollution, and transport). … OECD supports its governments in addressing these problems primarily through the work of its Environment Policy Committee, through Joint Working Parties on Agriculture and Environment and on Trade and Environment and through Joint Meetings of Tax and Environment Experts. Overall, these activities contribute to the crosscutting work of the OECD on sustainable development.
>
> *http://www.sourceoecd.com/content/templates/co/co_main.htm?comm=environm*

Sustainable development marches under the proud banner of OECD's programmatic definition, which has been endorsed by the World Bank, the International Monetary Fund, the World Wildlife Fund and World Heritage among others, and was common to participants in the World Summit on Sustainable Development held in Johannisburg in 2002 (Padolsky forthcoming 2004 2004). Contemporary discourse of biodiversity is structured within this policy framework (Takacs 1996).

In order to render two things (species, wetlands, pollutants) comparable, one needs a token which can circulate in their stead – so that for example you can trade off a marine habitat with such and such a degree of richness with a wetland area with a comparable degree. Not even the spatio-temporal unit comes prepackaged. In order to preserve a wetland you have to preserve its adjacent water table, since otherwise draining an adjacent field can drain the wetland indirectly. Similarly for time – if you look at the decimation of caribou stock through current logging practices, you get a very different picture of sustainability if you take the base unit to be ten or two hundred years ((Jonasse 2001). Yet you do need a tradable unit which can circulate freely without containing too much historical baggage. In *Genesis*, Michel Serres writes that money is the 'degree zero of information' (Serres 1982). He argues that in order to render a thing (a commodity) or an action (digging a field) into money, then all detail about the nature of the thing or action has to be blackboxed, so that what is left is the smooth surface of a coin or note, with a quantitative value attached to it. Money by this account constitutes the least possible information that can be shared about events and objects while still maintaining a viable discourse around them.

When he refers to money as a degree zero, Serres is not asserting that it is an empty set. Indeed not. As Hart remarks:

> The word *money*, as I mentioned at the beginning, comes from Moneta, a name by which the Roman queen of the gods, Juno, was known. …. Moneta was a translation of the Greek Mnemosyne, the goddess of memory and mother of the Muses, each of whom presided over one of the nine arts and sciences. Moneta in turn was clearly derived from the Latin verb *moneo*, whose first meaning is 'to remind, put in mind of, bring to one's recollection'… . There seems little doubt that, for the Romans at least, money in the form of coinage was an instrument of collective memory that needed divine protection, like the arts. (256-7)

What is remembered in the coin is precisely that which is needed in order to carry on economic discourse. So doing, the coin continually evokes (recalls) the compact made with the state to honor information about value expressed in the form of an amount on a coin. Hénaff traces the etymology of *alatheia* (the female avatar of truth in attic Greece) to 'memory' as well. The struggle between the 'sophists' and the 'philosophers' about selling truth mirrors that between the global policymakers and deep environmentalists about dealing in biodiversity. The philosophers and environmentalists go for deep, 'real' truth or wilderness (total memory of thought or world), the sophists and policymakers for marketable truth (a minimal memory set).

The trouble is that while it is clear in a general sense that we as a globalized species and globalizing economy are currently deeply renegotiating the relationship between nature and culture, we really have no place to site a reflective discourse about the range of ecological and economic issues. We can take a lead from, Lesley Kurke's (Kurke 1999) brilliant *Coins, Bodies, Games and Gold.* She explores the discursive dimension of money through analyzing texts in Herodotus. She starts from the curious fact that there is exceedingly little mention of coins in texts for the first two hundred years after the first minting. Indeed, one must go as late as Aristotle to find a philosophical treatment of money. However, she notes, there is a rich thread tying to together two alternative modes

of discourse. The first is the discourse of the symposium. This is associated with leisure, aristocracy, the masculine ideal and pure metals (gold and silver). Then there is the discourse of the agora, associated with bustling labor, merchants, effeminacy and base metals (alloys standing as surrogates for the coin). In this paper I locate a similarly rich and heterogeneous list associated with the language of developing a single currency for biodiversity; figuring prominently in that list is a reading of social time and of memory – here I concentrate on social time.

Modalities of Implosion: The Language of Money in Biodiversity Discourse

The word biodiversity is of relatively recent coinage – it is no more than forty years old. It was developed within the emerging field of conservation biology – a science with a mission (Takacs 1996) to preserve our ecology. Nils Eldredge (Eldredge 1992) argues that the ecological perspective (as opposed to the taxonomic perspective, which I look at in the next section) is an economic one – talking as it does about the way in which species interact in the economy of nature. It thus harks back to the common roots of ecology and economics in the Greek word for household, *oikos* ((Williams 1983).

It has increasingly been seen as important within the biodiversity community to bring ecology and economy together, to find a way of expressing the value of 'ecosystem goods and services' for humanity. The argument goes that biodiversity conservation can only take place if we have a powerful language shared between scientists (who often see themselves as philosophers who have been forced into sophism) and policymakers. The former want to pack in as much complexity as they can into the token that policymakers can then exchange, without knowing anything of the science. Just as the customers don't want to know details about the labor and art that went into forging a bust – they want to know just enough so that they can be assured that the outlay of money is reasonable. Thus the policymakers can say: "We will take this bit of wilderness but we will give you another bit, which has, in the best of all possible worlds, an equal or greater biodiversity value. Or we can lose that species if we preserve another of similar value". Only if we can account for diversity will we be able to preserve it.

So how does one go about measuring biodiversity? The intuitive step of assigning a unit value to each species and then totaling species counts in a given area will not work for two reasons. Firstly, you want maximum *spread* of biodiversity value if you want to save a useful minimum set for life on earth:

> For example, a dandelion and a giant redwood can be seen to represent a richer collection of characters in total, and so greater diversity value, than another pair of more similar species, a dandelion and a daisy … . This shows how the phenotypic characters (or the genes that code for them) could provide a 'currency' of value for biodiversity. Pursuing this idea, we will then need to maximize richness in the character currency within the conservationists' 'bank' of managed or protected areas (History 2002).

In other words, there's no point in preserving a large number of species within a small spread of genetic difference. Secondly, there's no way to preserve just one species – so it is not a useful unit of analysis:

> Often, higher-order species on the food chain have the most exacting environmental requirements and are thus valuable indicators of the health of the entire ecosystem; they or others may be critical 'keystone' species because they are located at the center of a network of interdependencies. Thus, as a practical matter, species values become proxies for ecosystem values: the Endangered Species Act in the United States is an embodiment of this principle in policy. And of course we regularly justify large expenditures to save some species (e.g., the African rhinoceros) but not others (there is no Save the Furbish Lousewort Society)

Some species, then, are more important than others, since they stand as proxies for ecosystems. Species congregate in complex ecological groups.

The species, which is the proximate unit we most intuitively respond to (Lakoff 1987; Stevens and Cullen 1990), holds then a tension between information (going down to the gene level) and community (going up to the ecosystem level). Further, the species concept is of itself highly controversial – there are a number of conflicting ways of severing the great chain of being (Wilson 1999). Central here is that species are not stable, well-defined entities. The difficulty is in trying to snip up emergent processes into stable analytic coins. Much biodiversity discourse is centered on preserving that which is – a current set of species, our current climate conditions and so forth. We talk about preservation and conservation, not potentiating dynamic change. On this logic, we should be preventing orogenesis, which has a huge impact on climate change – the thrust of the Indian subcontinent into Asia which is throwing up the Himalayas has been a significant cause of the lowering of temperature through trapping carbon dioxide; volcanic outgassing is seen as a major variable in lowering the temperature through causing higher reflection of the sun's energy (Huggett 1997). Paradoxically, preventing global warming is extremely harmful for biodiversity – when there were temperate forests up in the Arctic, the biodiversity potential of the world was higher than it now is. A second paradox of the battle between saving stable sets and potentiating change is that it leads to preserving ecosystems which in the present might seem particularly uninteresting to those who care about the environment. Thus Terry Erwin and others talk of preserving evolutionary potential – 'species-dynamo' areas:

> However, there are great difficulties in predicting future patterns of diversification … in patchy and changing environments, particularly as projected human-driven changes are unlikely to reflect simply those of the past. Following Erwin and Brooks et al.'s arguments, the perverse result of extrapolating future diversification 'potential' from recent history is that it leads to favoring conservation of species that are particularly similar to another (e.g. faunas with large numbers of rodents), in preference to biotas with more dissimilar and diverse species. (Williams, Gaston et al. 1994)

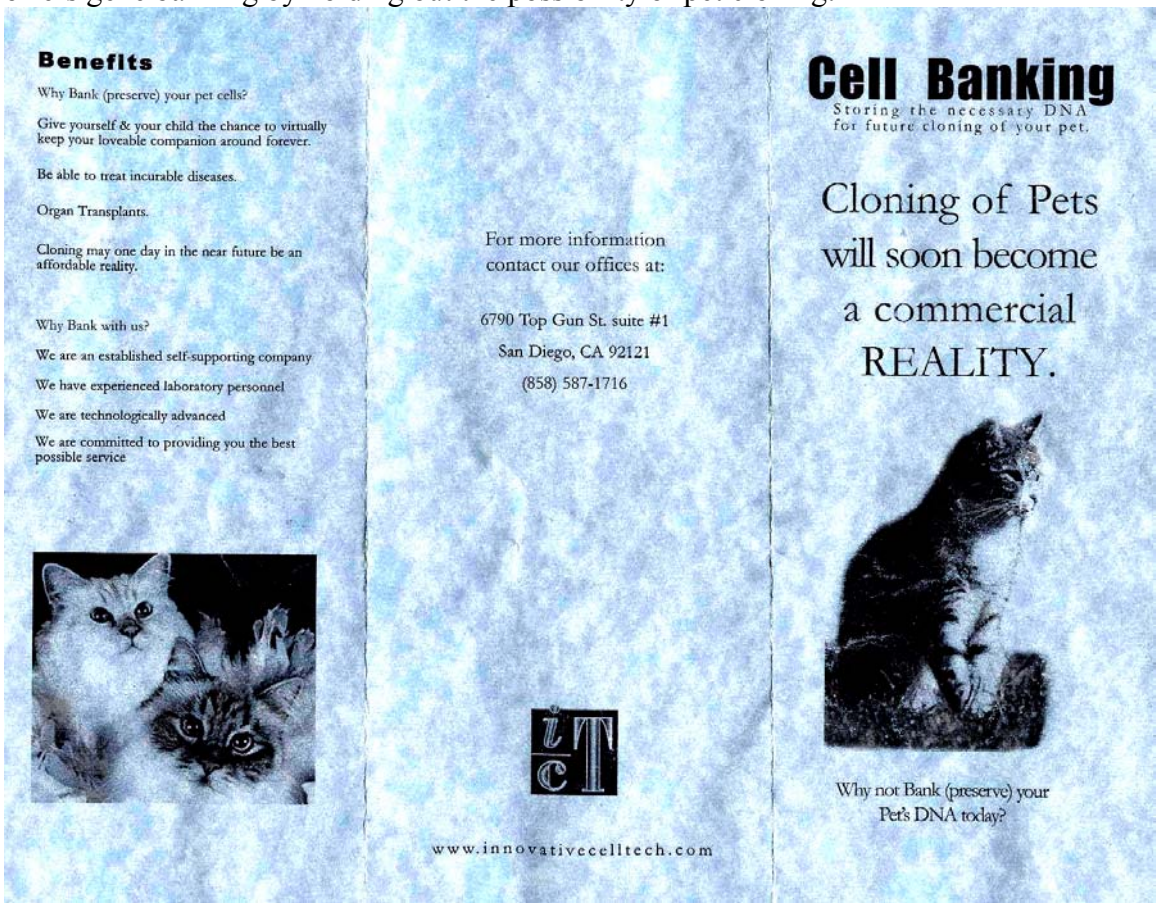
The projects of preserving the possibility of change for a rich future or preserving the current set of species are at best kissing cousins.

Most units defined analytically in conservation biology run into this problem. If you go up a level to the ecosystem, you run into the problem of defining just what sort of a thing an ecosystem is. R.V. O'Neill, for example, argues that the ecosystem concept stabilizes

the system "at a relatively constant equilibrium point" (O'Neill 2001); indeed he goes on to say that:

> Concepts like stability and ecosystem are ambiguous and defined in contradictory ways. In fact there is no such thing as an integrated, equilibrial, homeostatic ecosystem: It is a myth…! (O'Neill 2001)

The word myth is a useful one here, since it is surely what we are dealing with. Much biodiversity currency discourse is concerned with rendering the present eternal – moving ourselves and our planet out of the flow of history. We want this set of species to last; we want this climate to continue and so forth. The background (our canvas) should stay stable while the foreground (human attainment of perfection) should be changing rapidly – even if we no longer use the term in vogue from the 1830s to the 1960s in the West: progress. The *nec plus altra* is the cloning movement. Thus a company in San Diego offers gene banking by holding out the possibility of pet cloning:



Indeed, one vision (popularized in the film *Jurassic Park*) is that we can preserve biodiversity by banking gene sequences and rolling out diversity when we need it… .

Here is one of the central problems of trying to collapse multiple registers into a single currency containing just the necessary information – the resulting units of analysis will be riven with contradictions:

> If there is no stable equilibrium, why bother to conserve? … How do you restore ecosystems when you don't know what to restore them to (O'Neill 2001)

Reid Helford (Helford 1999) has written of this difficulty within the oak savannah restoration project in Illinois. He points to the difficulty of deciding what is natural and what is human (and indeed to engineering a division between the two). The restoration project is trying to restore the ecosystem as it was before European settlement. And yet the native Americans – through fire technology (Pyne 1997) – were central in the creation of that ecosystem. Given the relatively recent orogenesis of the Rockies, the new prairie ecosystem turned duocrop (except along train lines) of the American Midwest has been created out of a string of invasive plants, animals and people. For the policymakers in the project, white humans fall on the side of culture and so are external to the ecosystem, where native Americans fall on the side of nature and are internal to it. O'Neill points out that in general we constitute: "the only important species that is considered external from its ecosystem, deriving goods and services rather than participating in ecosystem dynamics" (O'Neill 2001) – compare (Eldredge 1995). That old nature/culture divide – so central to Lévi-Strauss's mythologies – is alive and well and equally torqued within modern technoscientific mythology.

Which brings us to the question of the work that is being done in order to effect that divide today. The mode that I will examine here is the move to value "ecosystem goods and services" – this move has structured the discourse of seeking to value biodiversity. Now if we are external to nature, we stand in the position of the Creator – outside of the flow of history, acting on, but not being of, the world. It is possible to argue that this move's current form is associated with the science of the industrial revolution, and in particular Lyell's geology (which discusses the question of man and nature at length). However, establishing the case is too long a project for this paper (see (Bowker forthcoming)). For now I treat solely the contemporary form of the divide.

So. Nature is external. We need to find a way of expressing nature in terms of our own value systems. If we start putting number values on aspects of our environment, we quickly run into the problem of infinity:

> As a whole, ecosystem service have infinite use value because human life could not be sustained without them. The evaluation of the tradeoffs currently facing society, however, requires estimating the *marginal* value of ecosystem services (the value yielded by an additional unit of the service, all else held constant) to determine the costs of losing – or the benefits of preserving – a given amount or quality of services. (Daily 1997).

And there is a lot of infinity about. Take the soil, for example:

> Soil provides an array of ecosystem services that are so fundamental to life that their total value could only be expressed as infinite. … Human well-being can be maintained and fostered only if earth's soil resources are as well." (Daily, Mattson et al. 1997)

Now infinite values are not of much use in economics, so in general the shift is toward dealing with units of analysis that produce finite numbers and delete inconvenient infinities. (A ploy borrowed from the physics community perhaps).

There has accordingly been an attempt to separate out the different kinds of value that nature provides. Use value is our current use of the ecosphere. This produces a very large, but vaguely quantifiable number:

> Despite recent estimates that the Earth's ecological systems are worth about $33 trillion annually, the comparatively low cost of maintaining the biological diversity that underpins these services is ignored. (Williams, Gaston et al. 1994)

Not even Bill Gates can rival the ecosystem; however, he may well be worth Australia. This use value can be taken at any unit of analysis – the ecosystem, the species or the germplasm:

> In common with all agricultural crops, the productivity of modern wheat and corn is sustained through constant infusions of fresh germplasm with its hereditary characteristics … . Thanks to this regular 'topping up' of the genetic or hereditary constitution of the United States' main crops, the Department of Agriculture estimates that germplasm contributions lead to increases in productivity that average around 1 percent annually, with a farm-gate value that now tops $1 billion…(Myers 1997)

This last is from a paper describing our genetic 'library' – the modern form of the book of nature metaphor which has a history stretching back many centuries. The figures given are frankly absurd – there is no way that such measures can be made of a system we are part of and in a world in which we don't build statistics in such a way that they could possibly reflect use value – but at least they are finite. We are moving into the implosion of multiple registers into a single value.

But use value alone is not enough to describe the value of biodiversity – there is also option value. Option value is the interest that we have in keeping our current stock of biodiversity against possible future uses – thus a rare strain of corn in Mexico might help us if a new parasite emerges which attacks all other strains of corn apart from this one… . Infinity rears its ugly head again – option value with genetic features as the basic currency:

> gives any included attributes equal value because of the inevitable ignorance or uncertainty of precise future needs. Biodiversity conservation would then focus on maximizing the amount of 'currency' (the number of valued biological attributes, features or characters) to be held within the protection system 'bank' (the set of protected species, ecosystems or areas). Thus the paradoxical consequence of equal value for attributes as units of currency is that their owners, the individuals, species or areas, may have different values because they contribute different numbers of complementary attributes for representation in the protection system.(Williams, Gaston et al. 1994)

A third major category added to option value is existence value – the value that I derive from the existence of the Grand Canyon, say, even though I have no intention of ever going there (Goulder and Kennedy 1997). I feel that way about Mount Uluru (the rock formerly known as Ayer's). This value is rarely quantified.

With use value and option value as the key components of a biodiversity currency – being those components which produce numbers – they are expected to do a lot of work.

They should stand as proxies for other measures, which get a mention but are then to be ignored – the World Conservation Union stated that:

> the justification for preserving genetic diversity is that it is 'necessary to sustain and improve agricultural, forestry and fisheries production, to keep open future options, as a buffer against harmful environmental change, and as the raw material for much scientific and industrial innovation – and as a matter of moral principal' (Williams, Gaston et al. 1994)

The potentially infinite – the moral principle in this case – gets pushed into the sidelines, with the unstated assertion that moral principle will be served by maximizing use and option value. Gretchen Daily makes the same move – relegating the infinite to the sidelines; and structuring the economic argument in such a way that its value is incorporated:

> Our concentration is on use values; aesthetic and spiritual values associated with ecosystem services are only lightly touched upon in this book, having been eloquently described elsewhere (Daily 1997)

However, surely Derrida gets it right: that which is excluded is often that which structures the discourse.

The valuation is created as a way of collapsing multiple registers (aesthetic, religious, spiritual) onto an artificially created unit of currency which can then circulate within modes of discourse hostile to just these sets of registers. In a sense, it's surrogacy all the way down in biodiversity research – the only way you can measure all the life in a given area is to follow Terry Erwin's model, say, and fog the area to count dead beetles: an efficient mode of counting which has the down side of possibly destroying some highly specialized species (beetles can be specific to a given tree). All Taxa Biodiversity Inventories are slow, clumsy and very expensive – all else is surrogacy, such as the aerial map of vegetation cover standing as a surrogate of animal life with the assumption that we know which species tend to be associated with which cover. Williams and Gaston start their excellent paper on biodiversity by sidelining the difficult issue of surrogacy when trying to implode multiple values (here 'the aims of conservationists'):

> We ask whether maximizing inter-specific genetic diversity necessarily fulfils the aims of conservationists most directly, or whether the consequences of this choice may actually be at odds with their objectives, and whether more appropriate currencies for conservation can be identified. We are not concerned here with the extent to which one currency can serve as a surrogate for another, which is regarded as a separate issue (Williams, Gaston et al. 1994)

They conclude by embracing it:

> In reality, currencies may yet prove to be highly correlated among species, so that any direct diversity measurement could present an approximate surrogate for any other, although this remains to be confirmed (Williams, Gaston et al. 1994)

The currency, then, holds out the promise of collapse of multiple social values onto a single measure. If engineered correctly, this currency will enter into policy discourse in just such a way as to promote a broadly common set of values held by conservation biologists. This is a dangerous move, akin to one studied by Bowker and Star (Bowker and Star 1999) by nurses seeking recognition for their *process* work by cutting it up into regular temporal units (half hour work units) which could then be recognized within

hospital accounting systems. In the case of biodiversity, the currency move is collapsing emergence into units (the commodity form) which circulate in a very flat, linear time and space (Sohn-Rethel 1975).

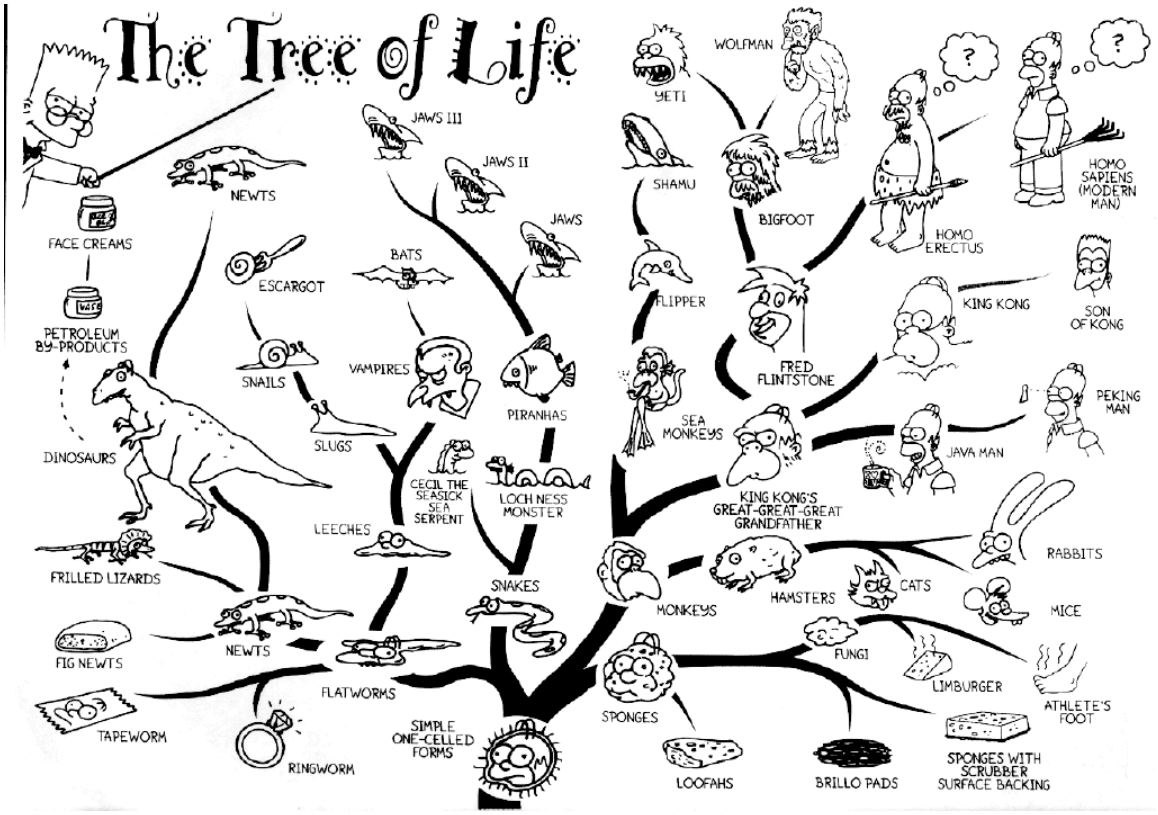
The money tokens which are created must keep in circulation and in a space which has been evacuated of events. The eye should be on foreground change (human development; defining the boundary of culture) against a persistent canvas (background stasis; defining the boundary of nature).

Modalities of Particularity: The Tree of life

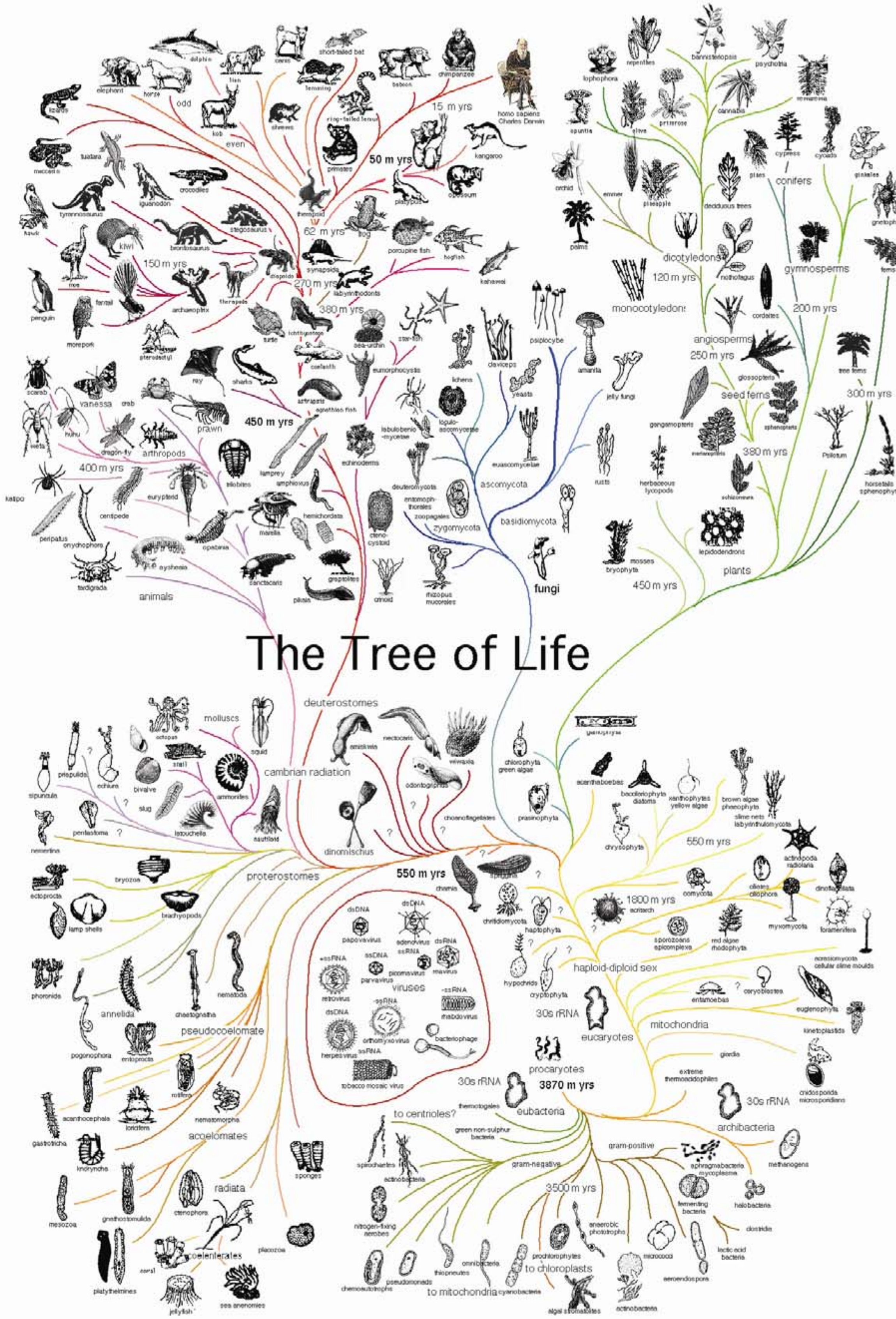
A second modality for accounting for biodiversity is that of the tree of life. This is the art of the particular – any surrogate is a counterfeit, and to counterfeit is death:

The tree of life is a venerable mode of representation of our knowledge about life, its origins and development. Life starts at the root, the single-celled protoplasm and then claws its way up the tree until it pinnacles at Homer Simpson. This representation is an extremely powerful one – it stems from an unsystematic but very general move in the nineteenth century away from classifying objects by their innate qualities (the Aristotelian turn) to classifying them by their genesis (Tort 1989). This new classification modality was associated in complex ways with the regime of governmentality (Foucault 1991). The emergent technoscientific empires of the nineteenth century developed the discipline of statistics (which etymologically refers to the State) and new systems of classification to deal with the vast amounts of impersonal information that had to be collected in order for the Empire to function efficiently.[1]

[1] In order to see the images in this paper in good detail, set your word processor to view them at 200%.



Today, in both the social and the natural sciences, the tree is starting to look somewhat ragged. A more modern form of the tree is less attached to its roots:


The Tree of Life
animals
fungi
plants
homo sapiens Charles Darwin
chimpanzee
baboon
short-tailed bat
canis
dolphin
lion
elephant
horse
odd
even
kob
lemming
shrews
ring-tailed lemur
primates
15 m yrs
50 m yrs
62 m yrs
kangaroo
platypus
opossum
lizards
tuatara
moccasin
crocodiles
iguanodon
tyrannosaurus
stegosaurus
brontosaurus
kiwi
150 m yrs
moa
fantail
archaeopterix
penguin
morepork
therapsid
synapsids
270 m yrs
labyrinthodonts
porcupine fish
hogfish
kahawai
frog
380 m yrs
ichthyostega
turtle
sea-urchin
star-fish
coelacanth
ray
sharks
450 m yrs
scarab
vanessa
crab
prawn
arthropods
dragon-fly
400 m yrs
katipo
eurypterid
centipede
peripatus
onychophora
trilobites
lamprey
amphioxus
echinoderms
hemichordata
tardigrada
sanctacaris
pikaia
graptolites
crinoid
rhizopus mucorales
zygomycota
basidiomycota
ascomycota
deuteromycota
psilocybe
amanita
lichens
yeasts
claviceps
jelly fungi
rusts
monocotyledons
dicotyledons
120 m yrs
gymnosperms
conifers
200 m yrs
angiosperms
250 m yrs
seed ferns
300 m yrs
380 m yrs
tree ferns
Psilotum
horsetails sphenophyta
herbaceous lycopods
lepidodendrons
mosses bryophyta
450 m yrs
lophophora
nepenthes
bannisteriopsis
psychotria
cannabis
opuntia
olive
primrose
orchid
emmer
pineapple
deciduous trees
palms
cypress
cycads
ginkgoes
pines
gnetophyta
ferns
deuterostomes
molluscs
squid
octopus
snail
bivalve
slug
ammonites
nautiloid
cambrian radiation
dinomischus
ameiskia
nectocaris
odontogriphus
wiwaxia
choanoflagellates
chlorophyta green algae
prasinophyta
acanthaboebas
bacillariophyta diatoms
xanthophytes yellow algae
brown algae phaeophyta
slime nets labyrinthulomycota
chrysophyta
550 m yrs
actinopoda radiolaria
dinoflagellata
ciliates ciliophora
oomycota
1800 m yrs
acritarch
myxomycota
foraminifera
sporozoans apicomplexa
red algae rhodophyta
haplophyta
chytridiomycota
haploid-diploid sex
hypochrids
cryptophyta
acrasiomycota cellular slime moulds
entamoebas
euglenophyta
kinetoplastids
mitochondria
30s rRNA
eucaryotes
giardia
procaryotes
3870 m yrs
extreme thermoacidophiles
cnidosporidia microsporidians
archibacteria
methanogens
eubacteria
thermotogales
to centrioles?
green non-sulphur bacteria
gram-positive
gram-negative
spirochaetes
actinobacteria
3500 m yrs
mycoplasma
halobacteria
fermenting bacteria
clostridia
lactic acid bacteria
micrococci
aeroendospora
anaerobic phototrophs
prochlorophytes
to chloroplasts
cyanobacteria
algal stromatolites
actinobacteria
nitrogen-fixing aerobes
chemoautotrophs
pseudomonads
thiopneutes
omnibacteria
to mitochondria
proterostomes
550 m yrs
viruses
dsDNA
papovavirus
adenovirus
dsRNA
ssDNA
ssRNA
parvavirus
picornavirus
reovirus
retrovirus
rhabdovirus
orthomyxovirus
herpesvirus
bacteriophage
tobacco mosaic virus
priapulids
sipunculids
echiura
pentastoma
nemertina
bryozoa
ectoprocta
brachyopods
lamp shells
phoronids
annelida
chaetognatha
nematoda
pseudocoelomate
pogonophora
entoprocta
rotifera
nematomorpha
acanthocephala
loricifera
gastrotricha
kinorhyncha
acoelomates
sponges
radiata
ctenophora
mesozoa
gnathostomulida
coelenterates
placozoa
coral
platyhelmines
jellyfish
sea anenomies

This new tree has no clear roots in the ground – it's a exercise to work out where the origin is stashed away. There's a rough red circle around viruses – these entities don't have simple genetic histories the way that larger organisms do: they are sometimes seen as being devolved from higher life forms (a parasite – that prototypical troubler of inside and outside both physiologically and socially (Serres 1982) - that discovered a simpler way to get their genetic message across), or as evolving in pace with their host – not from any internal mechanism. This is the problem of Occam's razor. It is a computationally huge task to calculate all the possible phylogenies (branches of the tree of life) – there are many possible routes that lead to the present. Thus when producing computer models it is assumed that time is unidirectional – species cannot lose characteristics once acquired. And yet we know empirically that some species do just that. It is assumed that history is simple. One species can never branch off more than one species at a time. There's no particular reason for this assumption other than it makes the calculation possible with current technology (and this is perhaps reason enough …). It is assumed that this simple history only has one underlying cause. If genes can spread by contagion rather than be adopted from parents, then the problem of calculation becomes truly staggering. And yet we know that some genes spread by contagion – see (Maddison and Maddison 1992) for a full discussion of these issues. For some trees, it is assumed that the clock of this unidirectional, simple, monocausal history is also as regular as clockwork. These are the molecular biologists of the 1980s and 1990s who sought for mitochondrial Eve – our shared progenitor, and who attacked phylogenies produced in other disciplines as being historically inaccurate. Their phylogenies were based on the assumption of a regular rate of mutation – so that current percent of difference from the root stock represented the amount of time since divergence. Given the overwhelming evidence for differential rates of mutation, the quest today is to find sites on genes that can serve as relatively reliable timekeepers. So trees as representations of life or knowledge are a problem for the white-coated molecular biologist as well as the unwashed postmodern. There is nothing surprising in these convergent representational problems – Gerald Holton, for example, produces a number of others (Holton 1988) from the fields of history, physics and mathematics over the past century and a half.

The tree of life maps the diversity of life. To do so it breaks the web of life into countable units. These units are assumed to be entities in the world – although there is fierce debate over their nature. These countable units are then aligned in a regular (in some cases metronomic) historical time – in which there is no turning back and no speeding up. The unchanging species is mapped onto the flat time. Although temporality is thus doubly invoked, and is clearly central to the discourse, it is often invisible in discussions of the tree. And yet this folded temporality is precisely our effort to map the world, in all its complexity, onto a linear, featureless time.

A tree, then, is an expression of the modality of particularity. It is an attempt to represent all of life in its infinite diversity within a single representational structure – so that even the ephemeral May fly can find its place. Such modalities are constitutive of much biodiversity discourse today. Stewart Brand's all species foundation (http://www.all-species.org/) as well as the All Taxa Biodiversity Inventories (for example

http://iris.biosci.ohio-state.edu/projects/atbi_db.html) are recent multi-million dollar efforts to produce better lists of life on this planet. This is the other side of the coin from the modality of implosion described above. With the modality of particularity we find background stasis. Events - which would involve entities, a place and a time - are systematically excluded from the representational framework, thus creating background stasis and an argument for taxonomists about whether cladistic trees have roots (represent change over what we have seen to be a deliberately smoothed, anisotropic time) or are formal devices for assigning names. The result is a packaging of species which guarantees humans some kind of immunity from the flow of natural time (we are a single, well-defined species) and so creates room for a foregrounding of the changes we induce on the external object nature.

Conclusion

In a modality of implosion, representations are made of several registers within a single structure – the representations are imploded into a singular form rather than exploded into full detail. A rich example of this comes from the Lukasa memory device (Roberts, Roberts et al. 1996), which contains topographical, historical, property and political relations within a single hand-held board:

Within biodiversity discourse, the standard modality of implosion is scarcely so rich. This modality seeks to reduce plants, animals, viruses, bacteria and so forth into a single 'biodiversity value', which can used in making policy decisions about what to save and how to save it: it might turn out more efficient in biodiversity terms to let a rare species die out if a sister species, with much the same genetic stock, is unthreatened, for example.

Temporal orientation (how we conceive of the present, past and future and the flow) is central to the operation of contemporary modalities of implosion and particularity; and this orientation simultaneously operates on the register of the nature of the world and the operation of our political economy. In the case of the coin, we saw the mapping of infinity onto an amount. In that process, which revolved around the construction of a nature/culture divide, we saw the cutting up of emergent forms into units which could circulate within Newtonian space and time. In the case of the tree, we saw the breaking down of complex historical time into regular, calculable units. Common to the enterprise of both modalities is the incorporation of natural objects into cultural discourse. Describing biodiversity and its value through these modalities involves creating databases out of which only certain sets of narrative form can emerge – the story of the house that Jack built, a simple story that proceeds in a regular rhythm.

Attention to these modalities draws us to a (global) anthropological reading of biodiversity discourse. This new discourse is confronting other ways of knowing (referred to as indigenous, local and vernacular – all terms have their problems if you think about their other – knowledge) not as another myth system revolving around the construction of the nature/culture divide, and yet which has some valuable nuggets of truth but as a truth system revolving around the way the world is. This seems unfair. Money is not the optimal symbolic form for bringing together the various actants in mutual accord. As currently being worked through, money discourse encourages the evacuation of event-based ontologies through excluding just that sort of memory we should be exploring in order to deal with planetary management. So doing, it settles the question of the mediation between inside and outside (nature and culture) in a way that is ineluctably ethnocentric. Ethnocentric because the discourse is structured by the way 'we' handle the nature/culture divide; it casts the world and time according to the very singular *oikos* of our emergent globalizing late capitalist *ethnos.* Stable tokens beget tokenism.

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