NATURAL KINDS

For KPC 27 April 2022

PREAMBLE: We human beings are intensely linguistic beings. We, as it were, saturate our ineffable experiences with words, with concepts, ideas, verbally conditioned feelings and emotions.

None more so than **scholars** such as philosophers and scientists.

But there was a time, when I and we were babies, between ages 0 and about 12 months, when I , and all of us, lived entirely in the non-verbal world. We have no recollection of that time.

Babies are conscious of course, but not self-conscious until they reach some linguistic point, with the feeling and word "I".

ANIMALS/ANCIENT HUMANS: Apart from humans, it looks like all other animals, conscious though they may well be, live their entire lives in the non-verbal world.

Our very ancient ancestors, however intelligent they were, lived their entire lives non-verbally – language arrived perhaps only 50,000 to 100,000 years ago, whereas the subtribe *Hominina* existed for maybe 6 million years before that.

NATURE or REALITY IS NOT VERBAL: But though we saturate our world with words and concepts (including very abstract concepts), we always continue to live in the nonverbal world too. After all, nature, or reality or whatever name you use, doesn't speak to us in language. It doesn't speak, full stop. Nor does nature-within-us, the workings of our organs and physiology. Rather we experience nature as non-verbal signals, such as sensations, colours, warmth and cold, pleasant and unpleasant;

- though we can *name* them (e.g., as a colour sensation, or an ache in a limb, we can only compare, say, one colour with another colour or at least with another equally ineffable sensation: – "red is rather like pink but darker, but quite different to blue". "Dark blue is a depressing colour…"

CONSCIOUSNESS: One could define consciousness as the state or condition of being aware – *apart from the effects or influence of words* – of one's own existence, environment, and sensations, that is, of one's own self and place in the nonverbal world.

Neurophysiology suggests that the *feeling* that something is real (or true) comes not from the thoughtful speech areas of the neocortex, but from evolutionarily much older – and nonverbal - emotion centres of the limbic cortex.

Hence the notorious ineffability of experiences as such – the redness of red things, the painfulness of a given kind of pain somewhere in the body, the hedonic tone of a sensation or mood, the haptic feel of a surface, etc, etc.

It could not be otherwise, I suggest –reality is, as such, nonverbal; things do not literally speak to us.

"The Nonverbal world is a landscape without language, billboards or signposts, a realm without writing or symbols of any kind. It is a place where information consists of colours, shapes, smells, and natural sounds – untouched by narration": see http://center-for-nonverbal-studies.org/htdocs/nvcons.htm (David B. Givens and John White, Center for nonverbal Studies, 1998 – 2022).

WILDERNESS: This is the **unspoken world** some of us seek in wildernesses, mountain tops, or looking at the stars at night.

And as has also been noted we do not need words to "decode an Armani suit or to decipher "new car smell"": http://center-for-nonverbal-studies.org/htdocs/nvcons.htm . Advertisers know all about the nonverbal world, as do politicians and other persuaders.

BRINGING REALITY INTO THE VERBAL WORLD: Given the sheer ineffability of reality from this viewpoint, linguistic humans have always sought to bring it into the verbal world – most literally in religions, where divine revelation (e.g., the Bible, the "word of God") is said to work this way, to bring us the true reality of the world, how things really are, and thus some possibility of salvation for us if we do one kind of thing as against another.

SCIENCE: One could also see science in this light: to bring the ineffability of reality into a clear, logically-articulated realm of concepts, symbols and explanations in terms of physical mechanisms: pushes and pulls, strength and weaknesses, approaching and going away from.

The fundamental notion or tool discovered long ago for scientific thinking is geometry: unambiguous structures, with measures such as lengths and angles, like the geometry of Euclid. As Descartes wrote: *"the ideas of geometry are clear and distinct, and therefore they are easily understood unlike the confused and obscure ideas of sensation".* And of course, numbers, the things we obtain during any measurement can be turned into geometry, and vice versa, as pioneered especially by the self-same Descartes. Nowadays, as well as Euclidean geometry, very abstract geometries are studied, and applied in the natural sciences and technology.

Symbols and concepts linked logically to each other (e.g., as a "mechanism") to allow deductions and inferences, and thus, vitally in terms of the practical import of science, predictions about, say, wood (in engineering and construction) and giraffes (in zoology and ecology) and indeed people in the social sciences.

NATURAL KINDS

In everyday terms, a natural kind is a category of things that are all the same as one another, but different from some other set of things. These things may (or may not) look the same on the surface, but they are the same "kind" in some objective natural way.

This grouping, or category, is, according to this philosophy, given by nature and is *discovered*, not created or stipulated by the human mind. In a natural-kind category, instances cluster together because they have something *real* in common.

Commonly, it is thought that universal laws (operating throughout the universe) account for such natural kinds, and so, by discovering such laws we can gain rational control over natural kinds, and predict what a natural kind will do under this or that set of conditions. For example, there is the natural kind *iron*, and the laws of nature in the form of quantum physics account for the properties of iron (whether it be in stars or in human blood), and we have been able to use iron in a vast number of applications to meet human needs and wants, such as the many types of steel.

Aristotle, for example, assumed that each kind has an *essence*—some underlying cause that defines it and makes the kind what it is (distinguishing it from other kinds). From an essentialist point of view, an essence is the mechanism that guarantees the identity of the natural kind and serves as the principal defining element for instances of that kind, regardless of what those instances actually look like (e.g., iron in the sun, or in steel or in blood).

Iron seems to have an essence (its "iron-ness") all of its own (almost like its own "personality," independently of anything else in the universe). A piece of iron looks and feels radically different to a piece of carbon. But, from the point of view of fundamental physics, iron and all the other chemical elements are but successive solutions of the Schrodinger equation ("eigenstates") for different integral numbers of protons, neutrons and electrons, below a threshold temperature. It is just a matter of numbers (of protons neutrons and electrons), not any unique "essence" coming into being for each eigenstate (for each chemical element).

The idea of essences is very deep in human thinking. A grain of sand has as its essence the intrinsic property of "being a grain of sand", and even if, so the intuition goes, the entire of the rest of reality vanished, it would still be there, just as it is, all on its own, inherently "a grain of sand".

Aristotle said that "man is the *rational* animal" (the essence of man is *rationality*), and even though an individual man could, and indeed does change in physical characteristics (his "accidental properties"), for example losing his sight or hearing, he would continue to be *essentially* a man, whereas if he lost his rationality he would cease to exist.

On a more global scale, physicist Stephen Hawking asked: *"Even if there is only one possible unified theory, it is just a set of rules and equations.* ***What is it that breathes fire into the equations and makes a universe for them to describe?*** *The usual approach of science of constructing a mathematical model cannot answer the questions of why there should be a universe for the model to describe. Why does the universe go to all the bother of existing?"* (Stephen W Hawking, *A Brief History of Time, From the Big Bang to Black Holes*, 1988).

Our languages must, to be languages, classify what we experience: from the "*blooming buzzing confusion*" (to quote William James in refence to the supposed world of babies), or "one damned thing after another", we distil out *kinds* of things linguistically:

Which of these is a natural kind?

"Red things",

"Wooden things" – and, more abstractly, **stuffs** that are wooden or metallic, or plastic, etc ;

"Money";

Countries, e.g. "Italy" and its denizens, "Italians"

"Emotions" - named (e.g., anger, happiness, depression), sensations named – e.g., the taste of sugar

Kinds of people , e.g., "working class"; male, female, Hindus.

Ornamental marbles

In science: kinds of substances such as acids, oxidising agents, phenols, water = H_2O; electrically-charged things, wires at a voltage above Earth, etc; zoological species e.g., *Homo sapiens*, one of the Phylum: *Chordata*.

"Fundamental particles" such as protons, quarks, photons, etc of which wood, metals, the sun, and people are said to be "made of".

Health: *"total normality and subjective well-being"*, or WHO Constitution: "*Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."*. Is there such a state in any human being? Does "health" have an essence? Are diseases, infirmities etc, natural kinds? E.g., being obese or having high blood pressure, or consuming a healthy or unhealthy diet? In medical psychiatry we have the famous DSM - The *Diagnostic and Statistical Manual of Mental Disorders* (DSM; latest edition: DSM-5TR, published in March 2022, published by the American Psychiatric Association (APA) for the classification of mental disorders using a common language and standard criteria. It has criteria for diagnosing over 300 mental illnesses.

"CARVING NATURE AT THE JOINTS": Long ago, Plato wrote that philosophy or science-and-philosophy (as the two were not distinguished from each other as much a they are now), should aim to "carve nature at its joints". In other words, we should aim at a classification identifying the structure of truth and reality that exists whether or not humans recognise it. This uniquely objective, once-and-for-all, classification is allegedly to yield natural kinds, as contrasted with "kinds" that are merely stipulated by humans for various human-centric purposes: e.g., "footwear" under £30"; what a fishmonger calls "fish" is something radically different to how a zoologist would (allegedly objectively) classify the various kinds of organisms sold by fishmongers.

An assumption here is that humans (and especially those humans who seek the truth) could actually do this; and indeed an assumption that there *is* such a thing as an essence or true structure, "the structure of reality as it really is"; nature carved at its joints.

Is nature jointed? Do you see the joints as you look around you, and as you listen around you, or taste your food?

I am getting suspicious here: is a "God's eye view" being proposed, and that we humans are in some sense Godlike here? What would even a "God's eye view" mean? How would I ever know that I have achieved God's view?

The philosophical literature on "Natural Kinds" is nowadays very technical and full of nuances, but also controversial.

Very roughly indeed:

<u>The kinds-in-science tradition.</u> This tradition is impressed by the explanatory and predictive power of classification in science ("fundamental" particles such as electrons, quarks, etc; the chemical elements, and the countless molecules that they can form; biological species) and is interested in those kinds ("natural" kinds) that enable such successful classifications.

But does practical success prove that there "really are" natural kinds?

<u>The Aristotelian tradition:</u> the existence of natural kinds is taken to be of importance not only for explaining the behaviour of members of a kind (as in the kinds-in-science tradition) but also for making sense of problems concerned with identity, development, and change. For Aristotelians, the character of an individual depends on what kind of thing it is, and the ways in which individuals can change while yet retaining their identity thus depends on the natural kind to which they belong. Thus, a tadpole changing into a frog continues to be the same individual (same identity), because such changes are part of the natural development of individuals of that type, while a tadpole that is eaten by a fish ceases to be.

"New Essentialists": emphasise *essences.*

While Aristotelians also talk of essences they can be distinguished from "new essentialists" as their very different metaphysics leads them to nominate very different contenders for

"essences". Aristotelians will suggest that "being a rational animal" might be the essential property of humans. New essentialists think of essences as being the properties fundamental physics and chemistry find explanatory. New essentialists have principally been interested in the metaphysical implications of a kind having such an essential property; for example, some have argued that natural laws are necessary. They have restricted their interest to those kinds, such as fundamental particles and chemical elements, that conceivably do have essences in their sense. Other kinds, such as biological species like *Homo sapiens* or *Stegosaurus stenops*, fail to have such essences according to this metaphysics.

Famously, modern physics casts severe doubts on the natural-kind thinking implicit in the above, including a world of discrete, essentially-propertied entities such as "atoms of sulphur", "electrons", "grain of sand".

Actually, experimentally and theoretically, no intrinsic property of a physical "preparation" is registered under <u>any</u> circumstances (to use the jargon: one prepares a "physical system" within a particular physical set-up e.g., by heating a piece of calcium metal inside a given instrument or apparatus, or by shining light on a given volume of water in a given container).

Rather, the case is that a *correlation* between an "attribute" of the physical preparation (e.g., an "attribute" corresponding to the *classical* concept of "position in space (metres)" or "angular momentum" (joule*second), or "mass (kilogram)") and an "attribute" of a measuring instrument is *CREATED* at the moment the instrument prints out a datum point such as "position 2.67 metres" or "angular momentum 0.35 joule*second", "mass 7.836 kilograms".

As far as all the experiments ever done are concerned, there are no intrinsic properties that a physical preparation as it were "has" (ever) – just correlations between the measured and the measuring physical systems- an ontology of merely relations. This is the famous "contextuality" of quantum physics. All this has been formalised in the mathematics, one has a "state" of the preparation and a "state" of the instrument" and a "state" of the combined preparation of instrument-plus-preparation that can for example print out "mass = 87.3 kilograms", Relations of what? Well, just relations. See Carlo Rovelli *"Reality is not what it seems".*

And these experiments are very striking indeed, striking in that classical thinking such as that of separable things with "intrinsic natural properties" simply fails.

The core idea is that the separation principle fails (See Michael Esfeld: *"Quantum theory: a challenge for philosophy!"*, in "*Entangled World*", Jurgen Audretsch (editor), Wiley-VCH, 2002). Some of you will have read about the double slit experiment, and have encountered your own classical mind, as we all have classical minds: does the particle go through the top

slit? *No.* Does it go through the bottom slit? *No.* Does it go through both simultaneously? No. Where is the particle then between the start and finish of the experiment? This question cannot be meaningfully asked. We simply let the mathematical formalism do the work of understanding the experiment: that is, we *do* something physical to something, a piece of calcium metal for example, or a drop of water, and a result, a number (a "measurement result") , is obtained. These numbers on the one hand refer to some classical notion, e.g., mass or position or momentum; on the other hand the numbers obtained do not behave mathematically like classical quantities – this fact is sometimes called the "uncertainty relations", though this is often badly misunderstood. The mathematical formalism is *radically* non-classical, but it works, indeed works brilliantly, and is now the basis of many of the technologies that are changing our lives so much.

The tradition stretching from at least Aristotle to Einstein of *any* separate things with intrinsic inherent properties - "all by themselves" - is called into serious question by quantum mechanics and quantum field theory. Einstein powerfully and all his life rejected quantum physics as a complete physics because of the denial of the separation principle. But actual experiments since the 1980s (when they became technically possible) - based on the Bell's Theorem (which was published in the 1960s after Einstein's death) have shown, as conclusively as one can be conclusive, that Einstein was along the wrong track.

By the lights of modern physics and chemistry, where fantastically precise measurements are possible (even almost routine), an atom of sulphur or a lump of sulphur on this table is going to be different from the atom or lump that has moved to another part of this room. Electric, magnetic and gravitational fields are different over there than on this table.

Indeed you can measure the faster running of the atomic clocks (oscillations) in a piece of sulphur a metre off the floor than when it is on the floor.

Chemistry itself today, is all about the countless different ways an atom exhibits itself in different, often very subtlely different, molecules. The Nobel Prize chemist Roald Hoffmann wrote an entire book on this: "*The Same and Not the Same*", concerning chemistry. And there is the influential "Atoms-in-Molecules" (AIM) framework of chemistry.

Of course, no one is questioning the *utility* of classifications such as the chemical Periodic Table, or the utility of the many ways we classify our collective experiences – in science, in the trades, in the arts, etc, etc, etc.

Only the notion that we can, by achieving a God's-eye power, really carve nature into its joints (or that nature has joints) , such as into sulphur, oxygen, germanium, and the other 92-odd chemical elements.

In the case of counting the number of protons in the nucleus of an atom (to give the allegedly essential atomic number), a proton-as-preparation in encounters with measuring instruments is a pullulating indeterminate swarm of many protons themselves and other particles in the light of current physics.

What you are supposed to be able to neatly, unambiguously, count as protons, 16 in sulphur atoms, is actually not determinately countable after all: experimentally a given nucleus, e.g. of sulphur atom, does not "really" (in inverted commas) have a discrete number of protons, neutrons, electrons etc within it. Protons and the rest do not retain their identities within nuclei or within atoms (whatever it even means to say "within" an atom. An atom has no boundary). Nor similarly do atoms retain their identities in molecules, nor molecules in different environments. DNA in a crystal is a very different entity, even by the lights of chemistry, to DNA in a cell in your little toe.

SOCIAL SCIENCES: What about, say, psychiatry or classifications in the social sciences? For example, some of the problems that mental disorders can raise for questions relating to the identity of persons. For example "dissociative disorders": one may ask whether identity is destroyed or has fragmented.

The basic idea is that if mental disorders are Natural Kinds, we can discover the natural-laws (physical or chemical laws) that cause mental disorders, and so find a cure.

While chemical kinds could be said to be more objective, or so the argument goes, the identification of psychiatric kinds is often alleged to be *value-laden*. Psychiatric classification involves classifying people, and unlike chemical elements – it is said- , those people can respond to being classified in various ways.

Perhaps in the old days- but I emphasise perhaps, , many people who might now be diagnosed with one (or several simultaneously) of the 300 kinds of mental illness (with the implication that they could be scientifically cured – brought back to a "normal" human being) would have been regarded as merely oddballs, eccentrics, free spirits, villains, even geniuses or people of mystical powers, or merely a load of trouble, but not "ill". They would have been lumped into the "human condition" – "it takes all sorts". To some extent this applies even to physical health – is an elderly person afflicted by pain and disability "ill" or merely an elderly person? The same with, say, obesity or anorexia. And genetic conditions, e.g., Downs syndrome.

This type of problem is also a general one in all the social sciences, and becomes acute in some aspects of modern politics, e.g. concerning classifying, often with legal consequences, people according to race, or gender. See:
https://eprints.lancs.ac.uk/id/eprint/50918/1/naturalkinds.pdf

CONCLUSION: As I said at the very start, I am sceptical of seemingly God's-eye claims about there being Natural Kinds that carve nature at the joints, or indeed, in this general vein, of any convictions concerning the absolute truth, of how things are or *must be.* Philosophy depends greatly on what seems *plausible,* but what is plausible or even utterly convincing for one person may not be at all so for another.

No physicist at the start of the 20th C would have regarded quantum physics as plausible. They would have thought it the ravings of a lunatic, albeit one who knows highly advanced mathematics. It is only the sheer experimental evidence that shifted physicists pragmatically if not necessarily philosophically.

In the case of physics, and the other natural sciences, *motion* is the phenomenon from the non-verbal world that is the crucial focus of mathematicising and geometricizing. Thus formerly seemingly unconnected phenomena of change, such as colour, warmth and cold, voltage, etc, etc, are mapped into some geometry in terms of motion of matter points in space, which are just points with no intrinsic properties (being points, their only property being how far, in metres, they are from the other matter points, at any given moment). We have simply discovered that we can conjure up mathematical structures called dynamical structure that, at least in fairly simple situations, can allow us to predict, maybe precisely or maybe only in terms of probability, where matter points will be next. For example, mass, energy, forces, wavefunctions, entanglement of wavefunctions:

- Some of which one, simply for mathematical utility, can attribute to the matter-points themselves (e.g., mass, energy, momentum) , some to the space between the matter points (e.g. fields, wave functions) . One can be entirely uncommitted to this dynamical structure in regards to whether it is real. The bare ontology of matter points in space stays the same, and the utilised dynamical structures change with the history of science. One simply sees where one gets with any dynamical structure in experiments. Maybe for example, quantum physics will hold up indefinitely in all experiments attempted: one is then tempted to say, *THIS* is the real nature of reality.

One can in addition to the basic physical ontology of matter points in space, propose a mental ontology, which is far less geometrisable, if at all. So mental phenomena as studied in psychology, social science, philosophy, literature, politics, etc, dramatically lack clear and distinct delineations.

But as far as I am concerned, what is to forbid one from being as free in one's mental ontology as one is in the physical ontology, free to conjure up dynamical structure? One sees where one gets….

In terms of the natural sciences: any propositions about the so-called physical (or biological) world are indeed *propositions*, in a human language(including mathematics). But propositions cannot tell us anything about ultimate ontology.

Any “world” isomorphic (in the mathematical or geometric sense) to our so-called “physical” or material world, but in which the “ultimate stuff” -*whatever that even means* – is constituted of “mental events” (this being the claim of Idealism) or of some “substance” that has no resemblance to matter or mind whatsoever -something completely unintelligible to us (like some versions of God, or Milton’s Chaos and Old Night, for example, or Kant’s concept of “noumenon” which forbids its own use on pain of uttering gibberish). Scientific theories describing our world cannot possibly distinguish or decide between these mathematically equivalent worlds: it is impossible for us to know in which such world we “really” live in. Or maybe better, even the question of whether we live in one or in another is meaningless.

The most we should expect from science is stable and useful regularities, preferably quantitative, between as most experienced phenomena (“from the nonverbal world”) as possible. It is then for philosophers to argue (from plausibility) which world we really do live in. But plausibility is in the eye of the beholder.

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