Leibniz and Telicity

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Summary

An important aspect of Leibniz's model of the world is the invocation of what might be called end-directed dynamics, telicity, or Aristotelian final cause. The aim here is to consider both the consistency of Leibniz's justification for this usage and whether or not he is vindicated by present day physics and biology. Leibniz uses the telic account of the behaviour of light rays as a paradigm. He wants to apply telicity both to the fundamental dynamic units he calls monads and to the purposeful behaviour of organisms, including human beings. Comparison with present day physics suggests that Leibniz correctly identifies an aspect of fundamental dynamics with remarkable prescience. Fundamental dynamic units in field theory appear to be end-entailing in an important sense. In evolutionary biology post-Wallace/Darwin there are also potential modern versions of telicity in terms of 'survival-directed striving' at the organism level. It is argued here, however, that these two forms of telicity are distinct and that biological proposals are much more problematic. Both Leibniz and present day theorists may have been guilty of conflations. Nevertheless, the logical principles that Leibniz employs to arrive at his practical proposals may provide a basis for building a more robust account.

Introduction: Mixed motives?

Leibniz's metaphysics recognises the concept of purpose, more or less as implied by Aristotle's final cause.[1] For him it was legitimate to ask 'why did the chicken cross the road?' expecting an answer not in the form 'because its nerves and muscles were activated' but rather 'to get to the other side'.

Arguably, the emergence of modern science is based on an assumption that the latter type of explanation is redundant. This shift in thinking dominates physics in the seventeenth century and biology in the nineteenth. However, Leibniz appears, at least at first glance, to resist the shift, even if at the same time seeming to accept the completeness of efficient causal explanation for all observable events.

The cultural pressure to retain telicity for chickens, humans or a deity are easy to recognise. Many think life has a purpose. What needs more explaining is why Leibniz, seemingly perversely at the time, introduces telicity at a level most people would not think of. Leibniz implies that even within a grain of sand, at a microscopic and again at sub-microscopic levels, monadic units instantiate 'final causes'.

It is important to note, however, that Leibniz is not suggesting the sort of story that science was critical of. He is not saying 'effects are due to blind mechanics *plus* magic vital extras'. He says that mechanical causation gives a complete explanation (in keeping with the scientific trend)[2]. But he argues that *for such a mechanical explanation even to be coherent there has to be another sort of explanation at a deeper level that is telic*[3]. The question is why Leibniz should propose this and whether he was justified.

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[1] Gottfried Leibniz: *Monadology,* English translation in: *GW Leibniz, philosophical texts*. Ed. Roger S Woolhouse and Richard Francks, Oxford 1998 (Hereafter 'WFT'), p279 #79.

[2] For further discussion, see Richard Arthur: *Leibniz* Malden MA, USA, Polity Press 2014, p71.

[3] Gottfried Leibniz: *New System,* WFT, pp144-6 #2-3.

Why fundamental dynamic units should be telic

Leibniz appears to have three motivations for introducing telicity for fundamental units/individuals. One is to underpin the familiar concept of purpose in life. The others relate directly to dynamics, one being logical (avoidance of contradiction), the other empirical. These are linked but I will consider the latter two first.

A key feature of Leibniz's approach, typified both by his divergence from Spinoza in the Discourse on Metaphysics[4] and the opening of the Monadology[5], is insistence on the reality of individuals. In the Discourse this draws on the place of human subjects in the world; there must be real individuals for there to be *points of view*. In Monadology, on the other hand, the initial justification for individuals, or simple substances, is more like a logical necessity.

> 'And there must be simple substances, since there are composites; for a composite is nothing but a collection or aggregate of simple things.' (Monadology, #2)

This sounds almost circular. However, it expresses the plausible assumption that attributing real dynamic relations to arbitrarily chunks of a monistic continuum is unintelligible. Put another way, if we accept that the dynamic relations of complex objects we perceive are resultants of real relations of components, as often proves necessary, there must be real components to avoid an infinite regress in which there are no ultimately real dynamic relations. One can argue that this puts reasoning before reality and reality might not follow. However, as I shall come to, the sort of mis-ascription of dynamic relations that Leibniz aims to avoid proves to have empirical consequences. Leibniz is saying we must take dynamic individuals seriously.

Leibniz inherits, via Descartes[6], the premise that a true individual or simple substance is by definition indivisible. And since for Leibniz the nature of substance is a dynamic relationship to the universe this *relationship* must be indivisible. This leads to a claim that can seem extravagant. If there is a simple substance that some dynamic predicates identify, implying a unique relation to the world, then all other dynamic predicates applying truly to this substance are true from its inception. As Leibniz puts it, everything that ever happened to or will happen to a monad is 'certain', as an aspect of its biography, from its creation. (He notes that this *token* certainty (or 'accidental necessity') should not be confused with absolute necessity.)[7]

Despite the initial implausibility of this claim, if we take the idea of a dynamic indivisible seriously, it is hard to deny. If everything about the unit's future is not entailed from the outset then the entity becomes dynamically divisible. If predicates up to any time t define an actual token unit and beyond that there are possibilities, then after t we no longer have an actual token but rather a type with possible exemplars. The biography is divisible in time. Relations after time t are independent of relations before. We hit a version of the paradox of change – how something can have a possibility of change and yet be the same thing. Leibniz's strategy is to say that

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[4] Gottfreid Leibniz: *Discourse on metaphysics*, WFT, pp59-67 #8-14.
[5] Gottfried Leibniz: *Monadology,* WFT, pp267-284.
[6] Rene Descartes: *Meditations on First Philosophy,* English translation in: *The Philosophical Writings Of Descartes*, 3 vols., translated by John Cottingham, Robert Stoothoff, and Dugald Murdoch, Cambridge 1988.
[7] Gottfreid Leibniz: *Discourse on metaphysics*, WFT, pp60-61 #9-11.

a simple substance has a *constant* principle of progression, so that a varied unfolding biography can be based on an unchanging relational predicate, giving rise to a biography of changing perceptions of the world[8]. But the entire biography must still be 'certain' *ab initio* for the actual token unit.

Rehearsing this sequence of arguments makes it easy to see why many regard Leibniz's metaphysics as ingenious but absurd. I shall return to why I think this is a mistake but at this point focus on the punch line. For a simple substance *any dynamic state that we might consider its 'end' must be certain*. It may not be known or knowable to the substance but any alternative 'end' is impossible. A simple substance has a 'telic' biography in the sense that its end is entailed within it from the outset.

As I shall come to in the next section, there are reasons for thinking that in setting things up for this conclusion Leibniz tells us something of crucial importance to present day physics. Yet, he does not, as far as I know, quite spell out the conclusion as laid out above. And he has a pressing, if unconscious, reason for this. 'End' in the literal sense is not the same as 'end' as implied by final cause. Moreover, the distinction matters to Leibniz's analysis. In Monadology he proposes that the monad will always achieve its end to some degree but not necessarily completely.[9] This is an end in the sense of something 'striven towards' rather than an end in the sense of an entailed terminal state. There appears to be an inconsistency.

One way of avoiding this inconsistency is to say that all Leibniz is concerned with when it comes to final cause is the striven for, contingent, type of end and that actual terminal state is not relevant. Yet it is the *certainty* of the terminal state that arises out of his rigorous definition of simple substance.

Telicity of light and other dynamic modes

The main reason for thinking end as terminal state comes into Leibniz's thoughts on telicity comes from his interest in empirical observations on light paths.[10] Leibniz knew that laws covering light paths are most elegantly couched in telic terms. Any path can most simply be explained as the most 'efficient' one between point of emission and point of arrival. This is often the shortest. For refraction and reflection things are more complex, but the telic account avoids postulating what seem more arbitrary requirements for the ray to react to each change in medium with a change in direction. Leibniz was also aware that paths of projectiles hint at telicity in a way later formulated as the principle of least action, but the case here is less compelling.

In the case of light the essential point is that the analysis takes the beginning *and the end* of the ray as given, as if the path follows from these being predefined. Leibniz is aware that this might suggest that the light 'knew where it was going' and he denies this. This allows him to propose that dynamic progression towards an 'end' need not be something that a substance is itself aware of. Even human souls need have no understanding of their strivings towards ends. (Note, however, that 'striven for' ends have slipped in.) Leibniz prefers to say it is God's understanding, manifest as the laws (or reasons) of nature, that gets the connection path right for the light ray so that the end is reached most efficiently.

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[8] Gottfried Leibniz: *Monadology,* WFT, p269 #11-14.
[9] Gottfried Leibniz: *Ibid.,* WFT, p269 #15.
[10] For a detailed discussion see Jeffrey K McDonough: Leibniz on natural teleology and the laws of optics, in: *Philosophy and Phenomenological Research* 78(3): (2009), pp505-544.

The reason why this is not as extravagant as it might seem is that in present day physics, typified by Feynman's quantum electrodynamics[11], the telic account of light proves to be not just simpler but the only viable one. No trajectorial account can explain empirical findings. Feynman shows that the identity of a photon is defined as much by where it arrives as where it begins.

As Leibniz proposes for a simple substance, modern physics shows the history of a light ray to be dynamically indivisible, so that there is no such thing as the light ray having got halfway to one of various places depending on what gets in the way later. You cannot decompose its 'biography'. This might seems strange but if we take Leibniz seriously there are reasons to think that it should not. Leibniz is telling us that we should expect this at the fundamental level. If you believe in indivisible dynamic units you have to expect them to be *truly indivisible* - to take them seriously.

An extension of this story, seen as a milestone in confirming the counterintuitive end-entailing nature of fundamental dynamics, is the testing of Bell's predictions about entangled photons by Aspect.[12] Quantum theory proposes that the 'end' for a photon is not just reaching a place. It can differ according to what property is measured at the end. For the theory to be consistent, if two photons emitted from a source are entangled so that certain properties of the two must be consonant, then whatever way one photon is measured, a measurement of the other has to give a consistent result despite this seeming to depend on a measurement that might be occurring a hundred miles away. Experiments showed that things were consistent.

Various tortuous attempts have been made to explain this by decomposing the photons' biographies but the simplest way is Leibniz's. A photon is a substance whose biography is dynamically indivisible. In the Aspect case the photon pair can be regarded as the simple substance. There is no need to postulate 'action at a distance' or 'sending signals back in time' because the biography of the entangled pair is just what it is from the outset. The measurement never 'changes' anything. It is just the end of that story. Von Neumann confused things by suggesting that dynamic units first proceed as a wave and then 'collapse' to a single location.[13] Leibniz's account is better. A simple substance cannot be decomposed into sub-processes. It is just a single dynamic connection – like a knight's move on a chessboard; there is no fact of the matter whether the knight goes forward then sideways or sideways then forward.

An objection to this might be that an observer can 'choose' to measure the first photon 'a different way' after it has been emitted, requiring retrograde causation. There are good reasons, however, for thinking that choice in this sense is illusory. The idea of 'changing events from what they were going to be' implies a contradiction – they weren't 'going to be' the first way[14]. Although there may be a range of possible histories for a substance within the necessities given by God's reasons (or laws of nature) for a *type* of situation, once a *token* substance exists its history is a certainty.

All of this may remain counterintuitive. There is also no doubt that if Leibniz wrote out his reasoning about dynamic indivisibles in full he did not do so in the widely known texts. Nevertheless, I think Leibniz can expect us to interpolate. A dynamic indivisible cannot have predicates about its future that are defeasible because

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[11] Richard Feynman: *Q.E.D.,* London 1990, pp36-76.

[12] Alain Aspect, Grangier P, Roger G: "Experimental Realization of Einstein-Podolsky-Rosen-Bohm Gedankenexperiment: A New Violation of Bell's Inequalities", in: *Phys. Rev. Lett.* 49(2) 1982, pp91–4.

[13] John von Neumann: *Mathematical Foundations of Quantum Mechanics*, Princeton 1955.

[14] Leibniz explains '…what happens in accordance with its antecedents is definite [ ]; if anyone did the contrary he would not be doing anything impossible in itself, although it is [ ] impossible that it should happen.' Gottfreid Leibniz: *Discourse on metaphysics*, WFT, p65 #13.

that produces a division in the dynamics that would essentially be a sub-mechanism. The dynamic indivisible is where mechanisms cease to be relevant because by definition mechanisms apply to aggregates with parts. Once dealing with something non-decomposable (even if complex like a knight's move) then questions about component events that might or might not come half way through, like a passing asteroid, do not apply. The asteroid is already part of the story.

Perhaps the irony here is that Leibniz's account of the monadic dynamic substance may be a better account of modes of excitation in modern physics than it is of his original motive for individualising – a human soul. The problem is that Leibniz wants human souls to be immortal, and indivisibility in time in the context of a living organism is hard to make sense of. The indivisibility in time of a quantised mode like a photon is empirically robust – measurement of 'where it has got to' terminates that mode. Yet there are determinable waypoints in the mental life of a human being that seem to make it temporally divisible. Past relations are no longer inseparable from present relations. The story up to now seems certain, yet from now on there appear to be possibilities, particularly if we think there is 'freedom from here on'.

We might conceivably rescue Leibniz's idea of immortal souls in modern physics but it would need some rarefied arguments. His 'soul' monads cannot be quite the dynamic units of modern science. The better solution to the apparent divisibility of the biography of a human soul would seem to be to make the indivisibles the 'actual occasions of experience' proposed by Whitehead.[15] This runs counter to Leibniz's desire for souls to be immortal, but that may be something many people would sacrifice for a chance of a coherent metaphysical basis to experience.

Physical or metaphysical?

I have compared Leibniz's monadic account, at what he calls the metaphysical level, directly with quantum physics. Yet it is commonly perceived that Leibniz's metaphysical level is separate from physics. Leibniz may encourage this. He says that the monadic account should not be used to explain mechanical events.

On the other hand, Leibniz accepts a telic account for light rays. Moreover, he tries hard, if without mathematics, to detail the relationship between monadic and aggregate dynamics. He identifies primitive active and passive forces at the monadic level that are reflected in derivative active and passive forces in mechanics[16], as, in effect, does modern physics. He proposes that monadic units exist at multiple levels of scale[17], as does physics (often not appreciated). He is not afraid to locate monads in space and time with their bodies. Moreover, he makes it clear in New System that his idea of fundamental dynamic units of force or entelechy is informed by empirical work showing that elastic forces determine the collision laws of objects.[18]

Leibniz may be ambivalent. However, I see the present day equivalent of his metaphysical level as *not* dissociated from physics, and certainly not from chemistry. What he has got very close to is what we now understand as the level of quantum field theory (QFT). This is a level without mechanism or 'extension' in the historical sense of antitypy. It involves dynamic units progressing in a spacetime metric in mutual mathematical agreement in a way neatly described as progress in harmony. Moreover, the QFT account always (on average) matches up with the classical

[15] Alfred North Whitehead: *Process and Reality,* New York 1929, p18.
[16] Gottfried Leibniz: *Specimen Dynamicum*, WFT, pp155-159 #6-13.
[17] Gottfried Leibniz: *Monadology,* WFT, pp277-278 #65-70
[18] Gottfried Leibniz: *New System*, WFT, pp143-152.

account of the same events in accordance with the Correspondence Principle. QFT applies at all levels of scale, each harmonising with accounts at levels above and below.

Put differently, Leibniz's choice of the term 'monad', meaning single unit, could well have been 'quantum', if Leibniz had not already used 'quanta' to imply something different in relation to finite quantities and infinitesimals.[19] By monad he was meaning an indivisible dynamic individual that is 'all or none' – the central concept of quantum theory.

In this sense Leibniz's metaphysical level is directly relevant to empirical science. People still often think of quantum theory as esoteric but all chemistry is 'monadic' dynamics. Before quantum theory there was no explanation for chemistry. Now we have a coherent explanation based on modes of excitation of the electron field. At larger scale the statistics of reaction rates and equilibria come in but nothing is mechanical. Chemistry is as telic as Leibniz's light rays.

To summarise on the physics side, I suggest that Leibniz's prediction that the basic dynamic individuals of the universe should behave in an end-related, or 'telic', manner is a triumph of metaphysical reasoning predicting empirical truths. The only problem is that he equivocates between end-entailing and end-directed striving. He says that the monad may not necessarily achieve its end in entirety. That is not the way physics has turned out.

Biological telicity

Leibniz wants his fundamental telicity to underpin Aristotle's telicity – aiming for the other side (or he gives this impression). We often associate that with a concept of active, conscious striving towards an 'end'. We also have a rather different sense of organisms, including plants, showing what appears to be insentient end-directed behaviour.

Leibniz is interested in the human ability to make use of past events to build general truths, used in formulating goals. He is also interested in sentience. His desire to unify monadic telicity with organic telicity seems, however, to be primarily grounded in the broader insentient form of striving. Similarly, although modern neuroscience takes an interest in the specific mechanism of prediction-based action, biology as a whole has engaged in a broader debate about where 'insentient striving' might fit into an explanation of the biosphere and I will address this first.

As indicated earlier, Leibniz is not going to provide ammunition for a case that biology requires a mechanical account plus extras. Much as he might seem to be a teleologist's ally, he shuts the door on getting 'more' from telicity. The part-by-part mechanical account is a complete account of world dynamics, including the organic world. A parallel telic account is required, but at a different level.

As indicated above in relation to chemistry, Leibniz may have missed a trick here. Of the topics of physics textbooks I had at school – *Mechanics*, *Electromagnetism*, and *Heat, Light and Sound*, only mechanics is still physics as Leibniz knew it. The others are mostly explained at the level of (monadic) dynamic indivisibles. Electrical conductivity is explained by valency electron modes. The behaviour of crystals depends on monadic modes of structural order only given by quantum theory. Similar modes are needed to fully explain sound. Leibniz was wrong

[19] See Eberhard Knobloch: Galileo and Leibniz: Different Approaches to Infinity*, Arch. Hist. Exact Sci.* 54 (1999), p94.

about a complete mechanical account. Yet, those who wish to re-introduced telicity to biology tend not to be interested in these examples. They are viewed as 'ordinary physics'. Perhaps it is sensed that it is telicity of the wrong sort.

Teleology and evolution

Fifty years ago the key contribution of Wallace and Darwin was seen as the demonstration that end-striving telicity was redundant. The need for a purpose behind evolution could be replaced by rare random variation within a stable self-replicating chemical pattern. Even Darwin may have hung on to striving more than he should; natural selection has more to do with the *absence* of 'ineffectual' organism within a finite biosphere than with the variety of the surviving ones.

In the last few decades there has been a tendency, particularly in popular science, to suggest that end-striving telicity may be of dynamic importance after all. Just how 'extra' and how 'alternative' is not always clear, as illustrated in Terrence Deacon's book *Incomplete Nature*.[20] Nevertheless, teleology has at times flavoured the mathematical structure of causal theories. The potential pitfalls of a telic account are illustrated by Wilson and colleagues critique of the theory that altruism in insects reflects adult haploidy, showing that 'individual striving'- based models could lead to false mathematical assumptions.[21]

The approved use of teleological phrases in biology is still simply to avoid cumbersome language. To say a woodpecker has a long beak 'so that' it can feed from trees is shorthand for saying that woodpeckers have survived having fed well on trees with a long beak that arose through mutation. There have, however, been suggestions that in addition to the tele*ology* of the description there is a striving component, or tel*icity*, to the dynamics. Dawkins's *The Selfish Gene* may have fuelled the fire, if unintentionally.[22] As Wilson analysis confirms, however, invoking truly telic dynamics is illegitimate. There are minor caveats but for determinate chains of events affecting aggregate structures the idea that cause does not work backwards is robust. Leibniz was a stickler for mechanism, so is unlikely to have bought the telic models that tend to slip in, seeing telicity as another, parallel, description.

Even the putative role of 'struggle for survival' is probably overinterpreted. Since most mutations are disadvantageous, competition may be as much an inhibitor as a driver of change. Every adaptation to a 'function' is a maladaptation to others. Evolution is the result of low-level random variation in self-replicating chemical patterns *in the context* of competition. But how much the two interrelate is less clear. Competition may explain why species become extinct. But the diversification of Galapagos finches from a presumed single pair needed no competition. Variation and segregation only require mutation and survival. And what exactly would be the 'end' if the dynamics were truly telic? We may forget that perhaps 99% of living units fail to give rise to offspring. Consider earthball spores, or white blood cells. Multicellular individuals universally fail to survive even after a bristlecone pine's 4,000 years.

I do not deny that heuristic work may be done by teleological accounts in this area but they are far removed from the fundamental metaphysical underpinning that Leibniz was proposing.

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[20] Terrence Deacon: *Incomplete Nature,* New York 2011, pp107-136.
[21] Martin A Nowak, Corina E Tarnita & Edward O Wilson: The evolution of eusociality, *Nature* 466 (2010), pp1057–1062.
[22] Richard Dawkins: *The Selfish Gene*, Oxford 1976.

Individuals, systems and thermodynamics

Telic accounts of living things are often related directly or indirectly to systems theory, as in Maturana and Varela's conception of autopoiesis.[23] In this approach the organism is seen as forming a 'self-organising' dynamic unit, for Deacon a teleodynamic unit[24], existing in relation to its environment or Umwelt.

Systems theory has the advantage of being cast in terms of dynamic relation. The difficulty is that a multicellular organism is an aggregate of events or processes. It lies on the mechanical side in Leibniz's terms. Moreover, as emphasised by the recent concept of Extended Mind[25], it may have no precise functional boundary. Leibniz avoids this problem by introducing a dynamic indivisible that is *distinct* from the bodily system it inhabits. Whether or not he is successful, at least he avoids a problem that Deacon recognises for the aggregate account.

The central paradox for an aggregate 'system' is how dynamic relations can be both 'within' the system and 'to' the system. Deacon suggests this produces something like the liar paradox ('This sentence is false.') For there to be a relation within a system that is also 'to the system' part of the system needs to relate to the whole, but in what sense can it relate (dynamically) to the whole rather than some locally coupled part? If signals are generated *internally* to carry information about the outside world then we need to stipulate what receives those signals. It is not legitimate to say that 'the system' receives, or 'perceives' these signals because we are dealing with relations at a finer scale. Even if every part of the system is affected by the signals there still needs to be a locus of receiving in the aggregate analysis and then separate explanations of how that 'informs' other parts. There is no formulable account of an aggregate 'system' having a single dynamic relation we might call perception, via signals instantiated in its own components.

This is why Descartes and Leibniz invoked *additional* units they called souls - because they insisted on explicit dynammics. Ryle[26] was right to say this is a hotspot for category mistakes, but Descartes may not be the culprit. Descartes is widely charged with introducing an unjustified step, but systems theory looks even worse. Arguably, almost the entire academic community has swallowed the idea that aggregates can have real dynamic relations to their components, despite no grounding. Maybe we need to take dynamic individuals seriously again.

Leibniz' dynamic soul unit is in addition to the aggregate, with which it harmonises, but following different rules. Being simplistic one might think an indivisible dynamic unit in modern physics belonging to a human body might be just a mode of spinning – a skater twirling on ice. But Leibniz is more subtle, realising that the monadic soul's perceptions reflect not just predominantly the body, but specifically a neural domain. In *New Essays*, he suggests, as metaphor, a cerebral domain like a vibrating canvas, 'diversified by folds'.[27] He is no more explicit but there may be reasons not to dismiss his approach, since the brain is full of membranes diversified by folds – particularly if it is accepted that brain-based perceiving units may be multiple in time and space. How to address this further is not an issue to

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[23] Humberto R Maturana and Francisco J Varela: "The cognitive process", in: *Autopoiesis and cognition: The realization of the living*. Springer Science & Business Media 1980.
[24] Terrence Deacon: *Incomplete Nature,* New York 2011, pp264-287.
[25] Andrew Clark: *Supersizing the mind: Embodiment, action, and cognitive extension*. Oxford 2008.
[26] Gilbert Ryle: *The Concept of Mind* (1949), Reprinted New York 2009, p6.
[27] Gottfried Leibniz: *New Essays on Human Understanding*, English translation by Langley AG. (1896) At https://archive.org/details/cu31924032296422 p147.

tackle here but it is an important alternative to the idea that an aggregate of dynamic relations within the body somehow 'just is' the subject.

Attempts have also been made to relate aggregate dynamic systems, as individuals, to thermodynamics. Deacon considers living systems to violate the second law, calling teleodynamic units 'closed'. However, thermodynamics treats far-from-equilibrium systems like organisms as 'open' or dissipative. The relevant thermodynamic domain is system plus environment and the second law holds. As Vitiello has pointed out[28], this local order can give rise to a phenomenon known as spontaneous symmetry breakage and, notably, this creates *new indivisible dynamic modes* – simple examples being order modes in crystals. Such modes can exist at everyday object scales. This suggests that individuality in this order context may involve new indivisibles, not the aggregates they associate with. However, these indivisibles arise with structural order rather than complex heterogeneous systems. Moreover, what telicity they may show should be the end-entailing telicity of indivisibles, not an end-striving telicity of a 'purposive' sort.

All in all, most attempts to reify aggregate organic systems in general as dynamic individuals that might be seen as purposive look to be bad metaphors for two overlapping realities. The first is the fundamental dynamic unit, which, as Leibniz tells us, must be partless and end-entailing. The second is a sentient subject in a higher organism, which, if we are to believe Leibniz, is also a true dynamic individual, but which has a real sense of purpose based on an ability to simulate future scenarios. I shall now turn to mind-related considerations.

Telicity and mind: meaning, prediction and sentience

If the trend for resuscitating end-striving telicity across biology looks unpromising there are two reasons to think mental processes in humans and animals with nervous systems might need a different analysis. Firstly, memory capacity permits us to model future scenario types based on past experience. Secondly, we have a real sense of end-striving. This may be ill-founded but if so it would be useful to understand why. These two factors may draw on common resources but appear dissociable. In dementia a person may retain a sense of wanting to achieve a goal yet lose the capacity to retain ideas, relating past to future, long enough to grasp what goal they wish to achieve. Conversely, computers make predictions based on past input but may not have a sense of purpose.

I will consider first whether or not mental processes related to prediction need an account of their dynamics not covered by 'ordinary science'. I will then consider the implications of a sense of telicity.

Both our rich percepts and language mediate predictions about future scenarios that allow responses beyond hard-wired reflexes. Prediction involves internal signals having meaning that is 'about' scenarios. Drawing on the evolutionary debate, Ruth Millikan's theory of Teleosemantics suggests that meaning is explained by 'proper function'.[29] A proper function is some dispositional property of a nervous system that exists because ancestors have survived as a result of operation of this function: a function of proven usefulness. Deacon has a rather similar approach to all mind-related aspects and even suggests that sentience itself arises through functioning processes that are telic in the sense of fuelling the 'purpose' of survival.

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[28] Giuseppe Vitiello: *My Double Unveiled,* Amsterdam 2001. pp14-20.
[29] Ruth Millikan: *Language, Thought and Other Biological Categories*, Cambridge MA 1984.

These theories may make just as illegitimate use of telic concepts as may studies of bees. It may be, however, that meaning and aboutness need telic explanations because they are not covered by ordinary physics. Leibniz's strictures about using telicity to explain bodily movement need not apply. This might herald problems if we believe that meanings and perceptions cause behaviour, which they seem to, but that could be legitimised by a necessity to switch account types. As proposed in Davidson's anomalous monism, we may have to be careful not to conflate two incompatible accounts (mental and physical)[30], even if they deal with the same reality.

So Millikan and Deacon might be describing legitimately at a telic level, even if there are significant worries about confusing end-entailing and end-striving. Deacon argues that nothing beyond ordinary physics is going on, that he is not suggesting a magic ingredient. He makes the cryptic suggestion that something less than ordinary physics is going on. He only wants to use telicity to account for properties of the world like meaning, intentionality and sentience that are somehow less than physical.

I doubt this special pleading is justified, however. If we use the language of dynamic relation and disposition that Leibniz shares with orthodox present day science and allow for generalisations over types and the existence of complex patterns of disposition that can act as 'formal causes' I see no real difficulty with fitting semantic content and aboutness within ordinary science, even if these are dispositional properties based on hideously complicated input-output rules in vast numbers of neuronal units.

The real problem for Millikan's Teleosemantics is that the first person to acquire the ability to form a percept or use a word with a certain meaning through a genetic mutation is in the same boat as Davidson's 'Swampman'. For Teleosemantics, an exact replica of Davidson emerging from a swamp after random molecular combination with no evolutionary history would speak meaningless words and think meaningless thoughts. Yet in dynamic terms we can predict that Swampman will respond to being asked what he sees in the sky with 'clouds'. He will use words meaningfully. The real equivalent in evolution (the first carrier of a mutation that allows a meaning function) must equally be debarred meaning by Teleosemantics, and if meaning provides function there is no function to promote survival and explain meaning in descendants. The theory crashes.

Some regard meaning as mysterious, but I am not sure why. Semantic meaning and the 'aboutness' (or 'intentionality') of language and percepts must be based on a disposition of internal events to co-vary reliably both with antecedent events and consequent events and thereby mediate prediction. (Trivially, if I say there is a dog in the hall it is likely that I saw a dog in the hall and also that a dog will be found in the hall later.) This co-variation will be achieved by something analogous to the way a lens focuses light so that a pattern falling on an electronic sensor co-varies with a scene, and the way a projection system can output another co-varying pattern, but the neural 'focusing' mechanisms will be vastly more complex– which is why it seems ingenuous to think there might be a simple operational definition of meaning. It is also likely to be error prone, working on a 'best available hypothesis' basis.

It might be argued that this analysis is incomplete, lacking an account of how meaning can be true or false, as in misrepresentation, illustrated by Fodor's worries about whether signals in a laboratory frog's eye are about flies or dots and confusing

[30] Donald Davidson: Mental Events, in: *Actions and Events*, Oxford 1980.

cows and horses on dark nights.[31] The answer would seem to be in Leibniz's analysis of truth. Meaning will be truth evaluable to the extent that there are other routes, such as touch, or hunger satiety, with which to make a comparison to see whether predicates inferred by one route match up with those entailed by a concept based on input via another route.

The irony of invoking evolutionary telicity in the explanation of 'purposeful' mental phenomena is that evolution does not provide the basis for that purpose. The co-variance of meaning in the ancestor did not anticipate future survival, it just survived. One adaptation does not anticipate further adaptation in some stepwise progress towards a function or goal. Telicity and dynamics never meet up. The teleo- is like a sauce described on a menu but not served on the plate!

Sentience may seem alien to physics but I am not sure it is. Physics makes the assumption that somewhere inside us there are events that give rise to the phenomenal experiences we call observations, the contents of which are determined by the laws of physics plus internal correspondence rules that are obscure for ascertainment reasons but can usually be bracketed out by external calibration. The sophistication of the content is explained by the complex 'focusing' or inferential capabilities of neuronal networks that feed relevant events. Rather than needing an external explanation based on evolutionary history or new causal laws all that seems required is to pin down where the correspondence of dynamics and reportable experience occurs. Defining the local correspondence laws may be a long way off, but that is another matter.

It seems reasonable to say that our experiences can have rich contents because they are based on complex systems that arose from very many chance mutations in a self-replicating type, all of which had the good fortune to survive. But to say, as Deacon appears to, that sentience itself is dependent on some goal-directed process over evolutionary time seems hard to justify. It makes Swampman a true philosophical zombie and sounds close to the magic extra explanation we want to avoid. Evolution is the wrong place to look for striving. Striving is the place to look for striving and the dynamics are consistent with ordinary science: fundamental end-entailing and aggregate mechanism. But maybe there is another step to consider.

Striving versus entailing

After extended deflation of end-striving telicity in biology we are still left with something compelling. There does seem to be a *sense* of a striven-for end. If ordinary scientific dynamics are to account for everything, at least at some level, then this sense should be founded in those dynamics (if science offers monadic dynamics, all the more so). Somehow 'ordinary science' has to be compatible with such a sense arising from some dynamic relation within science. I am not confident that a good explanation is at hand, but some preliminary analysis may be productive.

It may be useful to explore further the distinction between an actual end, that might be entailed, and a striven-for end or purpose. One worry might be that a striven-for end might not directly involve the striver, as when Wilberforce strove for slaves' freedom. There may be complexities here but I suggest that an end is just a terminal scenario in either case. More importantly, an entailed end is a dynamic token, whereas a striven-for end is a type, or member of a set of possible ends in a type of situation. An entailed end can simply be defined as the terminus of a designated biography. No

[31] Jerry Fodor and Massimo Piatelli-Palmerini: *What Darwin Got Wrong*, Picador 2011.

descriptive predicates are needed. For a striven-for end specific dynamic predicates are needed for conception. Consequently, in the two categories the proposition 'the end is achieved' leads to two different sorts of truth evaluation. For end-entailment the truth is necessary. In fact, 'the end is the end' barely tests the spirit of Leibniz's truth; there are no specified predicates to entail in the subject. It is empty tautology. In contrast, in the end-striving case, we have a contingent truth that must be formulated in terms of defining predicates. These are likely to involve vagueness or arbitrariness. Moreover, in Monadology Leibniz says that partial satisfaction may occur[32].

We then have to consider what might be evaluating the truth of 'the end will be achieved' - the mindset of striving. A striven-for end is a conception of a type of scenario that is compared with inferred dispositions of a current type of situation to judge if this proposition is 'true'. This is truth in Leibniz's terms of comparison of ideas rather than a relation to a defined reality, which for the future is unavailable. It is likely that truth evaluation of an adequate type can only exist in the context of the very complex patterns of co-variance between neural events and types of dynamic pattern that allow concepts to be about types of scenario or episode. If Tulving is right a full appreciation of end-striving might be unique to a human faculty of episode-based concepts.[33] So end-striving appears to be a pattern of dynamics found only in complex aggregates – not a feature of monadic units.

What remains missing from the analysis is any explanation for the sense of striving: the value-laden concept of 'appetite'. That seems altogether more difficult. Moreover, if it is part of a relation of perception it *would* appear to belong to a monadic unit. So perhaps it is time to turn to Leibniz again.

Leibniz and sense of purpose

If end-entailing and end-striving are distinct is there anything to rescue from Leibniz's attempt to relate purpose to monadic dynamics? I think there may be. If we take seriously Leibniz's idea that a point of view must belong to a monadic unit, on grounds that it is incoherent to make a composite a point of view, then at least a sense or concept of purpose should be some real aspect of a monadic relation to the world. William James may have seen no way for a conscious percept to be a 'physical fact' in a brain.[34] Now that physics allows monadic dynamics at larger scales than atoms, however, Leibniz's model may not be so impossible, even if the units involved are yet to be defined. Moreover, if we accept that monadic dynamic relations are now seen as telic in an end-entailing sense then maybe a sense of purpose has some, if distorted, relation to a relevant reality.

This may be being charitable. However, Leibniz stresses that a monad's perception is imperfect. Most of any perception of the universe is confused and even that which is clear, like the phenomena of extended matter, is 'well-founded' but only indirectly reflects fundamental dynamics. Neuropsychology, logic and physics all tell us how confused intuitive realism is.

Leibniz claims that a monad perceives its body, not that it perceives its own internal principle of change or relation to the world. In the perception of purposive striving a monadic unit would seem to be interpreting goings on in the body, or brain,

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[32] Gottfried Leibniz: *Monadology,* WFT, p269 #15.
[33] Endel Tulving: Episodic memory: from mind to brain, *Ann Rev Psych* 53 (2002), pp1-25.
[34] William James: *The Principles of Psychology* (1890), Reprinted, Cambridge MA 1983, pp178-9.

it inhabits. We have a primitive sense of our brain dynamics, at least in time ('train of thought'), even if much of what our brain infers is about the world. So any sense of end-directedness may, by nature, be vicarious.

The most tantalising issue is the sense of appetite, or drive. In theory, as indicated, this should not be a monad's sense of its own internal principle. Perhaps a brain's inferential machinery can be turned back on its own dynamics, especially in humans. If the fundamental world, here the electrochemical world, is based on the dynamic 'appetitions' of indivisible units is it not possible that this is somehow 'leaks through' to the aggregate level, in the way that primitive force leaks through to manifest as derivative force, so that it might at least be confusedly perceived? If the monadic and aggregate accounts are to match up, or harmonise, then presumably there has to be a form of correspondence.

There is no overriding of science's causal laws when a brain engages in 'purposeful thought' because what are interacting in the comparisons made are not actual future steps towards an actual token end but current events with a disposition to co-vary with *types* of potential future event. The reason why the current events model possible actual futures is that they are similarly grounded in monadic relations that are end-entailing. Perhaps end-striving is the only way we can conceive of the implications of end-entailing in terms of our intuitive vision of a world of phenomena interacting mechanically. After all, Leibniz warns us not to mix levels of description.

Even so, it does seem like charity to allow Leibniz to conflate forms of telicity to be metaphysically comprehensive. What may need to be taken into account is Leibniz's overriding philanthropy. Perhaps he compromised. He may have been aware that the common man's idea of moral purpose was flawed in terms of real dynamics, but he may have thought that no good would come of telling people so. This may make him a patronising Dr Pangloss, but perhaps unfairly.

I suspect the truth lies somewhere in between. Leibniz was probably aware of inconsistencies in his account of telicity. On the other hand he may genuinely have felt that his attempt to fit everything together in Monadology was more right than wrong. After all, people are still making a hash of this today. To my mind Leibniz's analysis of the logically necessary differences between accounts of individuals and of aggregates are still ahead of the game.

In 2016 the authority of religious texts has faded to the extent that Leibniz's desire not to rock the boat seems redundant. Leibniz's pragmatism might today have taken a different direction. He might have appreciated that the best possible outcome for the human race needs tough decisions about population growth and environment, for instance. Those decisions will not be aided by fudged dynamics. They might benefit from monadic grounding, but one that makes a clear separation between end-entailing and end-striving.