

TUTORIAL

Objects in a World of Processes

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Heraclitus (mid 6th century BCE)

He is remembered principally for two doctrines:

- ▶ **Fire is the principle of all things**

Diogenes Laertius (3rd century CE) attributes to him the view that '*all things are constituted from fire and resolve into fire*'.

- ▶ **Universal flux**

According to Simplicius (6th century CE),

For the natural philosophers following Heraclitus, having in view the constant flow of becoming and the fact that everything corporeal is coming to be and passing away but never truly is, ... it is reasonable to say that everything always flows [παλντα ρει] and that you cannot step twice into the same river.

Stepping into the River

What Heraclitus said about the river has been reported in various ways:

B 91 '*You cannot step twice into the same river*'

B 12 '*On those who enter the same rivers, ever different waters flow*'

B 49a '*We step and do not step into the same rivers*'

The contradiction between B 91 and B 12 is explicit in B 49a.

A river involves both *water* and a *channel*.

The water *flows* through the channel, so to step twice into the same river is to step into the same channel but not the same water.

In B 91, the river is identified with the channel; in B 12, with the water; in B 91, it is recognized as somehow being both.

Dual-aspect Phenomena

Hydrology and meteorology are full of phenomena which can be viewed in one way as *objects* and in another way as *processes*. As well as rivers, there are

- ▶ Whirlpools
- ▶ Waterfalls
- ▶ Water spouts
- ▶ Ocean currents
- ▶ Jet streams
- ▶ Clouds
- ▶ Hurricanes
- ▶ Tornadoes

All of these exist largely or even solely by virtue of some continuous motion of fluid (usually air or water): if this motion stops, they cease to exist.

A. Galton (2003), 'Desiderata for a Spatio-temporal Geography', in Kuhn, Worboys & Timpf, *Spatial Information Theory: Foundations of Geographical Information Science*, Springer LNCS2825

Geo-processism

- ▶ What gives these phenomena their dual aspect is that their constituent **processes** are coordinated in a *persistent pattern* that enables this ensemble of processes to be demarcated from its environment.
- ▶ This allows them to be identified as **objects**, having a location, a lifespan, and a characteristic form which persists through the changes they undergo.
- ▶ We often given them names:

Rio Amazonas

The Gulf Stream

Hurricane Katrina

The Great Red Spot of Jupiter

Geo-processism: *Many (Most? All?) geographical “entities” are processes primarily and only secondarily objects.*

Bio-processism

At any time, a living body comprises some quantity of matter, organised in a particular and highly intricate way; over time the matter changes completely, but the same organisation is preserved.

That it is a *living* body depends essentially on this process by which it is constantly rebuilding itself; if the process stops, the matter may remain, but the body is no longer living.

The body, *qua* living, is thus better identified with the process than with the matter.

Bio-processism: *Living organisms are processes, not Aristotelian substances.*

A Bio-processist Manifesto

J. Dupré & D. Nicholson (2018), 'A Manifesto for a Processual Philosophy of Biology', in Nicholson & Dupré, *Everything Flows*, OUP.

The reality of metabolism forces us to recognize that organisms, despite their apparent fixity or solidity, are not material things but fluid processes: they are metabolic streams of matter and energy that exhibit dynamic stabilities relating to particular timescales. As processes, and unlike things or substances, organisms have to undergo constant change to continue to be the entities they are.

See also:

- R. Schoenheimer, *Dynamic State of Body Constituents*, Harvard, 1942.
H. Jonas, *The Phenomenon of Life*, Harper & Row, 1966.
J. Dupré, *Processes of Life*, Oxford, 2012.

Radical Processism

Many philosophers have argued that the world is through and through processual in nature—*everything* we would normally call an “object” is ultimately processual in nature.

Twentieth century physics has ... turned the tables on classical atomism. Instead of very small things (atoms) combining to produce standard processes (windstorms and such), modern physics envisions very small processes (quantum phenomena) combining to produce standard things (ordinary macro-objects) as a result of their modus operandi.

(Rescher, 2000)

N. Rescher (2000), *Process Philosophy: A Survey of Basic Issues*, University of Pittsburgh Press

J. Seibt (2016), *Process Philosophy*, Stanford Encycl. of Philosophy.

David Bohm: A holistic processism

Thinking of the world as an aggregate of distinct entities is '*a way of thinking about things that is convenient and useful mainly in the domain of practical, technical and functional activities*' but we should not infer from this that the world itself is '*actually constituted of separately existent fragments*'.

He draws support from General Relativity and Quantum Mechanics, which both, in different ways, see the world as a single undivided whole embracing all parts of the universe, including observers and their instruments.

He calls this '*undivided wholeness in flowing movement*', implying that the flow itself is prior to '*the "things" that can be seen to form and dissolve in the flow*'.

D. Bohm (1980), 'Wholeness & the Implicate Order', London, RKP.

David Bohm (continued)

As with many processist thinkers, Heraclitus's river is not far away:

The best image of process is perhaps that of the flowing stream, whose substance is never the same. On this stream, one may see an ever-changing pattern of vortices, ripples, waves, splashes, etc., which evidently have no independent existence as such. Rather, they are abstracted from the flowing movement, arising and vanishing in the total process of flow. Such transitory subsistence as may be possessed by these abstracted forms implies only a relative independence or autonomy of behaviour, rather than absolutely independent existence as ultimate substances.

(Bohm 1980, p. 49)

Ladyman & Ross: Ontic Structural Realism

Suggested replacement for standard Scientific Realism.

Ontic Structural Realism implies that '*reality is not a sum of concrete particulars*' but rather '*individual objects, events, and properties are devices used by observers . . . to keep cognitive books on what science finds to be sufficiently stable to be worth measuring over time, viz. some but not other patterns.*'

'We can understand what individuals are by reference to the properties of real patterns. Attempting to do the opposite—as in most historical (Western) metaphysical projects—produces profound confusion. (Witness the debates about identity over time, identity over change in parts, and vagueness, . . .).'

J. Ladyman & D. Ross, *Every Thing Must Go*, Oxford 2007

The Orthodox View

Such views run counter to the prevailing orthodoxy which accords ontological primacy not to *processes* but to *things*—Aristotelian substances:

- ▶ **Substances** are *independent entities* on which processes and other occurrent phenomena are dependent.
- ▶ **Processes** arise as a result of various substances manifesting different accidental properties and relations at different times.
- ▶ As such, processes are *secondary phenomena*, dependent on substances and the passage of time.

Substancism vs Processism

Substancism	Processism
A <i>process</i> is something that <i>occurs</i> by virtue of various <i>substances</i> assuming an appropriate sequence of configurations over a succession of time <i>instants</i>.	A <i>substance</i> is something that <i>exists</i> by virtue of various <i>processes</i> interacting in an appropriate way over a <i>period</i> of time.

Terminological variants

Instead of *processism* and *substancism* one sometimes encounters the terms

- ▶ *processualism* and *substantialism*,
- ▶ *process philosophy* and *substance philosophy*,
- ▶ *process ontology* and *substance ontology*.

(Neo-)Aristotelianism is a form of substancism, though Aristotle himself sometimes seems to have had processist leanings.

A Disclaimer

- ▶ Despite appearances, it is not my main purpose to *advocate* Processism.
- ▶ The aim of this tutorial is to explore the *implications* of Processism for an Ontology of Objects.
- ▶ This may help us to decide whether to embrace Processism, and if so, how to modify our ontology to take this into account.
- ▶ First, though, let's examine some obvious objections to Processism.

Against processism I: Argument from Dependence

David Wiggins raises the obvious objection that processes are dependent on substances:

If there is to be weather, there must be not only process but also air or earth or water or . . . some material principle which is other than process.

Wiggins adds as a parenthesis:

Could matter itself amount to no more than a process?

—supposedly a *reductio ad absurdum* of the process view, but in the light of modern physics perhaps not so absurd after all.

D. Wiggins (2016), 'Activity, Process, Continuant, Substance, Organism', *Philosophy*, 91, 269–280

Response to Wiggins

- ▶ Wiggins insists on the existence '*not only of atoms and the rest, but also of re-identifiable organisms and microorganisms*'.
- ▶ But I say: *Admitting the existence of these things does not mean requiring them to be ontologically primary.*
- ▶ For processists, **what it is** for a substance to exist is for there to be a particular configuration of processes having sufficient stability on the relevant time-scale to enable reidentification across times on that scale.
- ▶ Such stable configurations **simulate** classical substances—but never perfectly—which is why identity and persistence are fraught with philosophical puzzles. (Cf. Bohm's remark about identity and vagueness.)

Against processism II: Argument from temporal parts

William Morgan thinks that bio-processists believe that:

[h]uman beings . . . have not only spatial parts such as cells and organs, but also temporal parts such as the first half of one's life—entities that look just like human beings but exist half as long as do the humans of which they are part. They also have foetal temporal parts—entities that span around the first 40 weeks of a human being's life. I was, therefore, never wholly inside my mother's womb, but was only partly there in virtue of having a temporal part that was inside her womb."

He saddles process philosophers with a four-dimensionalist metaphysics. **But this arises from a mistaken view of process.**

W. Morgan (2021), 'Are Organisms Substances or Processes?', *Australasian Journal of Philosophy*, 63, 1–10.

What processes are not

- ▶ A widespread but, in my opinion, mistaken view of processes takes them to be unchanging entities extended in time and possessed of temporal parts.
- ▶ On this view, a process is a species of event—it is the view assumed by Morgan.
- ▶ Against this, Rowland Stout, David Charles, and I have separately argued that processes and events are utterly different kinds of entities:
 - ▶ Events are “frozen” portions of history, with temporal extent and temporal parts.
 - ▶ Processes exist as a whole in the present, undergoing change as time progresses (Stout calls them “*occurrent continuants*”).
- ▶ Continuant-like processes are much better placed to replace traditional substances than event-like processes are.

David Charles (2018): Processes as Continuants

- ▶ Basic facts about processes:
 - ▶ Processes can be *ongoing*.
 - ▶ Processes can *undergo changes* in their properties.
 - ▶ Processes can be *interrupted and resumed*.
- ▶ Charles claims that one cannot account for these facts on the assumption that a process is some kind of event.
- ▶ An ongoing event cannot be identified with the event that will have occurred *either* if the process is interrupted now *or* it is not interrupted: no event can capture *what is happening now*, i.e., the ongoing process that may or may not be interrupted.

D. Charles, 'Processes, activities, and actions' in R. Stout (ed.), *Process, Action, and Experience*, Oxford University Press, 2018.

What Processism is not

- ▶ Processism is not **neo-Aristotelianism**, as espoused by many modern ontologies (such as BFO), for which
 - ▶ Processes are spatio-temporally extended entities with temporal parts (i.e., events);
 - ▶ Objects are only spatially extended, having no temporal parts and therefore existing as wholes at each moment of their existence (traditional substances/continuants/endurants).
- ▶ Processism is not **Perdurantism**, which identifies both objects and processes as four-dimensional, spatio-temporally extended entities. As such, objects and processes are treated as *events*.

Both these views are *incompatible with processism*.

Against processism III: Argument from language

- ▶ Identification of objects with processes looks like a gross **category mistake**.
- ▶ As Wittgenstein might have said, processes exhibit a completely different *“grammar”* from objects.
- ▶ Process-talk is verb-centred but object-talk is noun-centred (although “talk” is a noun as well as a verb, and nouns often surface as verbs).
- ▶ Processes, but not objects, may be “ongoing” or “in progress”; and while an object can “participate” in a process, processes do not participate in anything.

Can We Derive Objects from Processes?

- ▶ On the linguistic evidence, there appears to be a huge gulf between objects and processes.
- ▶ This gulf seems to be totally ignored by the view of processes as continuant-like and of objects as fundamentally processual.
- ▶ Hence an important task for process philosophy is to give a clear and principled account of how continuant concepts can be defined in terms of pure process.
- ▶ This is what we're going to look at next.

Peter Simons: Continuants as Abstractions

- ▶ Peter Simons proposed a programme for deriving objects from processes, by which *'the cognitive operation whereby we recognize continuants amid occurrents will be taken as a species of abstraction.'*
- ▶ But *'it does not follow that continuants are abstract entities in the standard sense of being outside space, time, and the causal order. On the contrary, many physical continuants ... are among the most paradigmatically real and concrete things in the world we experience.'*
- ▶ Continuants are *'precipitates'* of processes: *'they are what abides, as certain kinds of processes continue and develop.'*

P. Simons (2018), 'Processes and precipitates', in R. Stout (ed.), *Process, Action, and Experience*, Oxford University Press, 2018.

Frege's method of abstraction

- ▶ Gottlob Frege (1884): Some concepts X are logically dependent on a prior relational notion Y which, given X , it is natural to describe as *having the same X as*.
- ▶ Examples:
 - ▶ **Direction**: two lines have the same direction if and only if they are **parallel**.
 - ▶ **Number**: two classes have the same number (of elements) if and only if they are **equinumerous**, (i.e., their elements are in one-to-one correspondence).
- ▶ Although 'parallel/equinumerous' means 'having the same direction/number as', the concepts *parallel/equinumerous* are logically prior to the concepts *direction/number*.
- ▶ A direction/number is an **equivalence class** of lines/classes under the relation 'parallel to'/'equinumerous with'.

How to abstract continuants from processes

- ▶ To define continuants in terms of occurrences, Simons uses an equivalence relation called **genidentity**.
- ▶ Genidentity specifies a certain kind of causal connection (not spelt out by Simons) between **process phases**.
- ▶ Putting the cart before the horse, we may say that process phases x and y are genidentical iff they both pertain to the same continuant.
- ▶ To *define* the continuant in terms of the genidentity class of its phases, the latter must be defined independently.
- ▶ How can we tell *which* processes involving a continuant are constitutive of it in the sense that the genidentity of their phases grounds the identity of the continuant itself?

But what is genidentity?

- ▶ Although genidentity* is often taken to be some specific relation between process phases at different times, we shall not assume this.
- ▶ Rather, by genidentity we will understand *that equivalence relation, whatever it might be, which can ground adequate notions of persistence and identity for objects.*
- ▶ If no relation can do this, then genidentity does not exist.
- ▶ If more than one relation is able to do it, then there are different kinds of genidentity.
- ▶ The quest for genidentity is open!

* The term 'genidentity' was introduced in 1922 by Kurt Lewin. It has been used in a number of different ways by various authors.

Some prima facie candidates for genidentity

- ▶ **Spatio-temporal continuity.** Clearly insufficient: *every* continuous time-like path in space-time would correspond to an object!
- ▶ **Material continuity.** Too strong: a person's identity can persist despite e.g., sudden loss of a whole limb.
- ▶ **Continuity of form.** Insufficient to account for persistence of identity in the stages *egg* → *larva* → *pupa* → *adult* of holometabolous insects.
- ▶ **Causal continuity.** Sometimes taken as the definition of genidentity: but a mother is causally continuous with her child!
- ▶ **Cohesion.** Promising, but difficult to define without begging the question.

What is Cohesion?

- ▶ Championed by DiFrisco (2018) and Austin (2020), following Collier (2000). We paraphrase their formulations as follows:
- ▶ An object is *cohesive* if and only if the causal interactions amongst its parts are
 - (1) stronger than the interactions between its parts and the environment,and
 - (2) such as to prevent it from being disrupted by internal and external forces.
- ▶ This definition is *impredicative*: to apply it, we already need to know what '*it*' refers to in the conditions (DiFrisco 2018).
- ▶ To provide a satisfactory definition of identity, cohesion must be defined as primarily a property of a *collection of processes*.

Cohesion of a collection of processes

- ▶ A collection of processes is *cohesive* if and only if the causal interactions amongst processes within the collection
 - (1) are, in aggregate, stronger than the interactions between processes within the collection and processes outside it; and
 - (2) tend, in aggregate, to enable condition (1) to persist.
- ▶ According to Austin* this does not provide a criterion of genidentity between collections of processes identified at different times, even if supplemented by causal continuity.
- ▶ For this reason, he strengthens causal continuity by requiring the processes identified at time t' to be *the constructive products of* those identified at time t .

* C. J. Austin, 'Organisms, activity, and being: on the substance of process ontology', Eur. J. Phil. Sci. (2020), 10:13.

Is this a dead end?

- ▶ I have found it difficult, in all this, to get hold of any clearly definable notion that can serve as a definition of genidentity adequate to derive objects from processes.
- ▶ It is time to try a different approach . . .

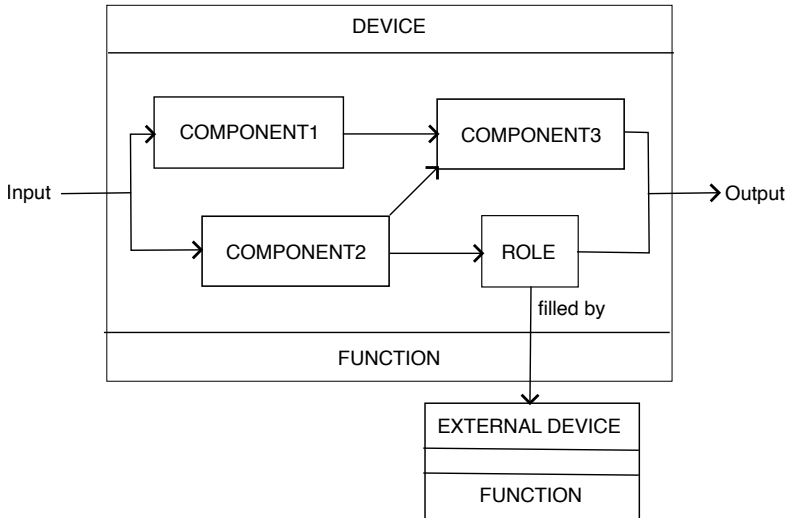
Internal and External Processes

We may distinguish between an object's **external processes**, which are enacted by *the object itself*, and its **internal processes**, which are enacted by *its functional proper parts*:

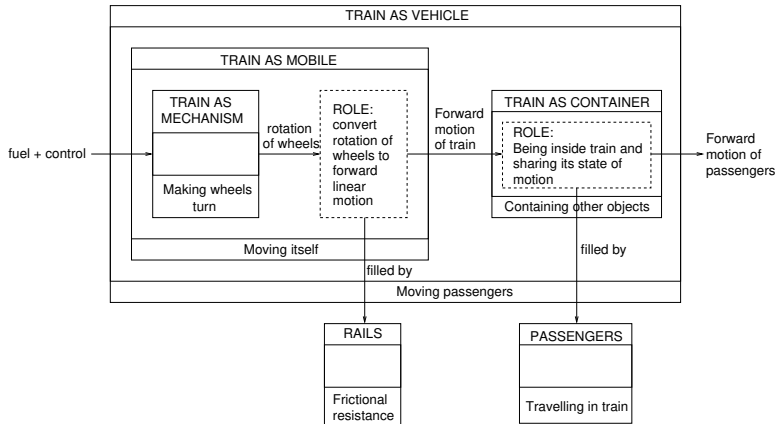
*The internal processes of a human being include ... such things as breathing, digestion, blood circulation. They are internal processes because they support the external processes of the human—speaking, eating, walking, and more generally living. The internal processes are enacted by the lungs, stomach, heart, blood vessels, and the blood itself, and this is why all these things count as functional parts of the body.**

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- * A. Galton & R. Mizoguchi (2009), 'The Water Falls but the Waterfall does not Fall: New Perspectives on Objects, Processes and Events', *Applied Ontology*, 4.2, 71–107.

Objects as “devices”

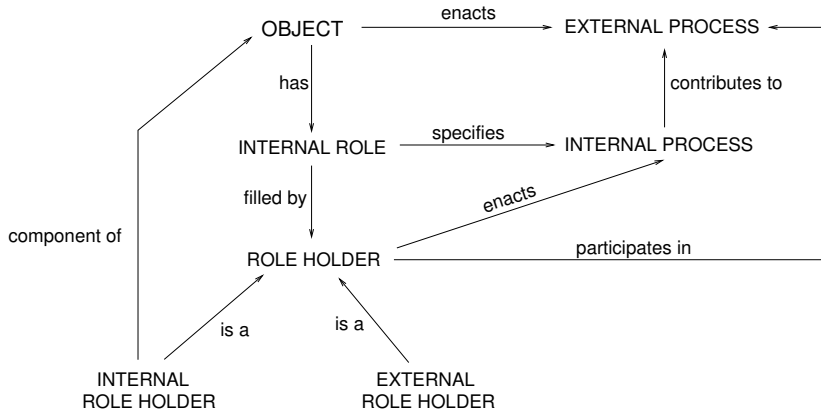


Example: A train, considered as a vehicle



(Galton & Mizoguchi, 2009)

Device ontology: Key concepts relating objects and processes



(Galton & Mizoguchi, 2009)

Object as interface between internal and external processes

- ▶ In Galton & Mizoguchi (2009) we asked *what an object is* over and above the sum of its internal processes.
- ▶ What makes this sum worthy of consideration is that it constitutes a **unity** arising from the fact that it gives rise to other processes which it is said to **enact**.
- ▶ These external processes play an essential role in determining the object's identity.
- ▶ The object itself may be thought of as an **interface** between its internal and external processes.
- ▶ It is '*a point of stability in the world in virtue of which certain processes are characterised as internal and others as external*'.

More formally, we suggested that

- ▶ What it is for there to be an object in a certain situation is for there to be disjoint collections $\mathcal{I}$ and $\mathcal{E}$ of processes we can identify as **internal** and **external** processes respectively.
- ▶ These collections are such that at one level of description the situation can be seen as containing the processes in $\mathcal{I}$ but not those in $\mathcal{E}$, and at another, higher level of description, as containing those in $\mathcal{E}$ but not those in $\mathcal{I}$.
- ▶ The processes in $\mathcal{E}$ are **causally dependent** on those in $\mathcal{I}$.
- ▶ The object **enacts** its external processes and is **sustained** by its internal ones.

This is a start, but cannot be the full story.

How to distinguish Internal from External Processes

Moreno & Barandiaran (2004), 'A naturalized account of the inside-outside dichotomy' (*Philosophica*, 73, 11–26):

- ▶ '*[T]he existence of a physical border built by the system itself draws a net distinction between an 'in' and an 'out'.*'
- ▶ This enables us to distinguish **internal-constitutive** processes going on inside the boundary and **external-interactive** ones which '*although they appear organizationally as prolongations of the system, occur outside its physical boundary*'.
- ▶ They emphasize both the **mutual dependence** and the **asymmetry** between these two classes of process.
- ▶ In particular, internal processes are '*the result of the existence of a strongly holistic network, much more integrated and complex than the interactive processes performed by the system on its environment*'.

[T]he (self) generation of an inside is ontologically prior in the dichotomy in-out. It is the inside that generates the asymmetry and it is in relation to this inside that an outside can be established. The interactive processes/relations are secondary for the maintenance of the system: they presuppose it (the system) since it is the internal organization of the system that controls the interactive relations.

(Moreno & Barandiaran, 2004)

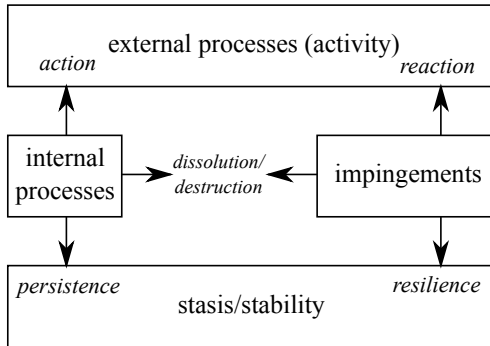
The systems considered by these authors are *biological* systems, for which the inside/outside dichotomy is perhaps most strongly developed. But arguably something analogous applies in some degree to everything we characterise as an 'object'

Towards an Object Schema

- ▶ All this suggests the possibility of defining formal structures to capture the networks of processes in virtue of which objects can be said to exist.
- ▶ In previous work I have likened such structures to **image schemas** (Johnson 1987, Lakoff 1987), which are *recurring patterns by which we mould our raw experiences into a structured understanding of the world*.
- ▶ The use of image schemas to characterize objects should not be taken to imply that objects are cognitive artefacts. Rather they are what enable us as cognitive agents to apprehend real features of the dynamic world.

An Object Schema

The following schema was suggested in Galton (2017a, 2017b):



Any concrete instance of this schema is a **processual complex**. What we call “objects” are, in essence, processual complexes having a sufficiently robust persistence/resilience component.

Processes in the Object Schema

- ▶ **Persistence**—constitutive internal processes by which the network as a whole maintains its own stability.
- ▶ **Action**—external processes caused by autonomous operation of internal processes.
- ▶ **Impingements**—environmental processes tending to perturb the network of internal processes.
- ▶ **Reaction**—external processes triggered by impingements.
- ▶ **Resilience**—non-constitutive internal processes tending to restore stability in response to perturbation by impingements.
- ▶ **Dissolution/destruction**—onset of irrecoverable instability of the network, resulting either from the operation of the internal processes themselves or from impingements too strong for resilient response.

To which we should probably add:

- ▶ **Formation**—the processes by which the stable process network comes into existence.

This is all very general, since it is intended to cover a wide range of different kinds of continuant entity, e.g.,

- ▶ *Chunks of matter*
- ▶ *Assemblies*
- ▶ *Dynamic systems*
- ▶ *Collectives*
- ▶ *Organisms*

I shall concentrate on the first of these.

Chunks of matter

A chunk of matter is an **enduring maximal coherent, continuous, and (more or less) homogeneous quantity of matter wholly bounded by a surface.**

Typical chunks of matter include:

Rocks, pebbles, sandgrains, raindrops, bricks, tiles, nails, screws, ball-bearings, cannonballs, cups, saucers, bars of soap, loaves of bread, sheets of paper, . . .

and much else besides.

Note that they include both artefacts and naturally-occurring objects.

Example: A chunk of rock



A discrete quantity of rocky substance wholly bounded by a **surface**, i.e., a discontinuity between the rocky substance and whatever outer medium (air, water, clay, empty space, ...) it is embedded in.

Processes in the life of a chunk of rock

- ▶ **Formation** Fragmentation of larger piece of rock or conglomeration of smaller pieces.
- ▶ **Persistence** Seething activity at the level of atomic and subatomic structure—ultimately perhaps “nothing but” quantum field fluctuations.
- ▶ **Reaction** Push it and it moves, drop it and it falls, twist it and it turns, strike it and it sounds, rub it and it becomes smoother, heat it and it expands.
- ▶ **Resilience** Squeeze it and it resists, maintaining form through adjustment of balance of internal forces; heat it and the thermal agitation increases.
- ▶ **Dissolution/destruction** Fragmentation, melting, erosion, chemical dissolution, radioactive decay.

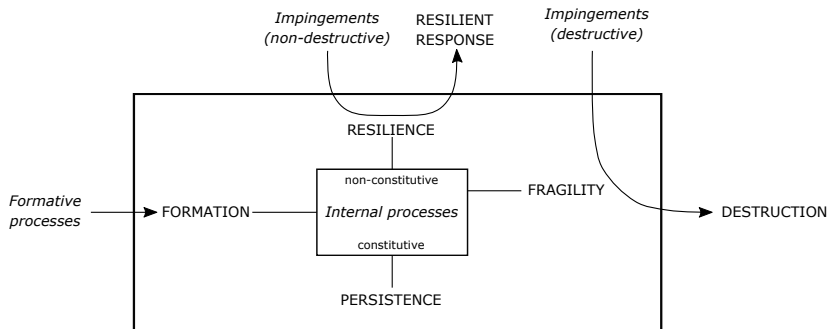
Note: For inert chunks of matter, **Action** is not applicable.

A familiar problem with fragmentation

- ▶ If a rock is divided into two equal pieces, then neither piece can be identified with the original rock.
- ▶ But if a small piece, say 1% of the whole, is broken off, then the remaining 99% can be identified with the original.
- ▶ Yet there is no exact figure between 1% and 50% that marks the cut-off between survival and destruction of the rock.
- ▶ This is important because it shows that the concept of “identity” for chunks of matter is not precisely delineated.
- ▶ This suggests that:

At least some substance concepts are labels of convenience for processual complexes meeting certain incompletely specifiable criteria for persistence.

A Process Schema for Inert Chunks of Matter



A spatially bounded pattern of microprocesses brought into existence by formative processes and maintained over time by resiliently responding to impingements from the environment. It persists until some impingements are too great for it to respond to resiliently, leading to fragmentation of the pattern or its absorption into some larger pattern.

A Physicist's View

The hardest stone, in the light of what we have learned from chemistry, from physics, from mineralogy, from geology, from psychology, is in reality a complex vibration of quantum fields, a momentary interaction of forces, a process that for a brief moment manages to keep its shape, to hold itself in equilibrium before disintegrating again into dust, a brief chapter in the history of interactions between the elements of the planet, . . . a part of a segmentation of the world that depends more on how our bodies are structured to perceive than on the object of perception . . .

Carlo Rovelli, *The Order of Time*, Allen Lane 2018

Assemblies

- ▶ Formation typically by construction following a design.
- ▶ Persistence by forces binding components and responding resiliently to impingements.
- ▶ Replaceable parts
- ▶ Possibility of complete dismantling and subsequent “reincarnation”.
- ▶ No firm criteria of identity—“Ship of Theseus”-type anomalies.



Dynamic Systems

Self-maintaining configurations of flows of matter and energy.

- ▶ Whirlpools
- ▶ Tornadoes
- ▶ Hurricanes
- ▶ The Great Red Spot of Jupiter
- ▶ Stars
- ▶ Flames
- ▶ Atoms?



Collectives

At any one time a collective comprises a set of individual objects (“members”) forming a unity by virtue of some **guiding principle** determining what it is to *be* a member.

Over time, members may join or leave without the collective losing its identity.

Z. Wood & A. Galton (2009), ‘A Taxonomy of Collective Phenomena’, *Applied Ontology*, 4, 267–292.



Processes in collectives

- ▶ **Internal processes** are the members' activities and interactions as members.
- ▶ **Actions** include e.g., performances by a *string quartet*, overall motion of a *flock of birds*.
- ▶ **Reactions**, e.g., a *swarm* of bees attacking to drive away an intruder.
- ▶ **Persistence** is ensured by the guiding principle, which may be
 - ▶ **Endogenous**: A *society or club* which persists by virtue of its members pursuing relevant activities in accordance with the constitution and rules of membership; a *star cluster*, held together by the mutual gravitation of its members; or
 - ▶ **Exogenous**: A *stamp collection*, its persistence and organisation determined by the intentions of the collector; a *flock of sheep*, controlled by a shepherd with a dog.

Organisms

Ralph Schoenheimer (1942), *The Dynamic State of Body Constituents*:

- ▶ The structural elements of the body are in themselves thermodynamically unstable and far from equilibrium.
- ▶ Left to themselves, they start to decay, leading to death.
- ▶ The living body maintains itself by continuous repair and replenishment of its internal structures.
- ▶ The biological system is “*one great cycle of closely linked chemical reactions*”.

Organisms maintain their form through active control of the flow of matter and energy; they are the most complicated form of processual complex known to us.

Are living things ontologically unique?

Two philosophers working in very different traditions both concluded that living things are **the only true composite objects**.

Hans Jonas

The Phenomenon of Life (1966)



Peter van Inwagen

Material Beings (1990)



Hans Jonas

For a non-living aggregate *'its distinct unity as a whole is nothing but the product of our sensuous perception, thus not ontological but merely phenomenal'*.

By contrast, in living things,

nature springs an ontological surprise in which the world-accident of terrestrial conditions brings to light an entirely new possibility of being: systems of matter that are unities of a manifold, not in virtue of a synthesizing perception whose object they happen to be, nor by the mere concurrence of forces that bind their parts together, but in virtue of themselves, for the sake of themselves, and continually sustained by themselves.

Jonas continues:

Here wholeness is self-integrating in active performance, and form for once is the cause rather than the result of the material collections in which it successively subsists. . . . This active self-integration of life alone gives substance to the term “individual”: it alone yields the ontological concept of an individual as against a merely phenomenological one.

Here Jonas ties the identity of a living thing to the continual metabolic activity through which it is able to persist, but in addition insists that the organism is in some sense the agent of this activity.

Peter Van Inwagen

- ▶ Van Inwagen (1990) suggests that most substance concepts can be analysed away: there are no chairs, only collections of non-decomposable particles arranged “chairwise”.*
- ▶ But he makes an exception for living organisms: A collection of *xs* compose something if and only if “*the activity of the xs constitutes a life*”’.
- ▶ He concedes, though, that there is no sharp dividing line between those collections of *xs* whose activity constitutes a life and those whose activity does not.
- ▶ So perhaps the ensemble of processes involved in the persistence of a chunk of rock is also enough of a “life” to justify applying a substance concept to it.

* Note, though, that the idea that there *are* such particles (“simples”) receives no support from modern physics.

What have we learnt?

- ▶ There are *many kinds* of “object”, as testified by the much-branching “is_a”-hierarchies found in ontologies: chunks of matter, dynamic systems, collectives, organisms,
- ▶ If the world is fundamentally processual in nature, then
 - ▶ any given kind of object must be understood in terms of the *processes* by which individuals of that kind come into being, persist, and then disappear.
 - ▶ The object itself exists solely by virtue of the operation of an appropriate regime of interactions between its internal processes, external processes, and impingements upon it: the *stabilised processual complex*.
- ▶ The idea that processes themselves can be analysed away as variation in the arrangement of simples has no scientific justification.