

Are Objects Ontologically Dependent on Processes?

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Things vs Processes

Traditional substance-based ontology sees processes as dependent on things:

Thing	=	“First-class” ontological element
Process	=	A thing undergoes change*
Change	=	A thing has different properties [†] at different times

Process ontology seeks to reverse the dependence:

Process	=	“First-class” ontological element
Thing	=	(Relatively) stable configuration of processes

* Including motion

† Including position

This Talk

I *lean* towards a Process Ontology in preference to Substance Ontology; but I do not yet feel able to endorse it fully.

In this talk I will

- ▶ Present a *negative* case for Process Ontology by arguing that Substance Ontology is problematic (or even untenable).
- ▶ Present a *positive* case for Process Ontology by indicating some of its advantages over Substance Ontology.
- ▶ Present a process-oriented OBJECT image-schema to provide a possible basis for establishing a cognitively-founded Process Ontology.

Change as Succession of States

On the cinema screen we think we see *moving pictures*. But nothing moves: it is just a succession of still frames.*

As such, cinematographic motion may be regarded as “illusory”.

Most accounts of substance ontology depict “real” motion and change in much the same way:

- ▶ *Time is a succession of instants at each of which various static properties hold;*
- ▶ *Change consists of different static properties holding at different times.*

This is **The Cinematographic Model of Reality (CMR)**.

Whereas in the cinema the succession of instants is discrete, in the CMR it is often assumed to be continuous (more on this later).

* There *is* motion, but it is in the projector, not on the screen

Problems with the Cinematographic Model of Reality: I

According to CMR, “ X is moving at t ” reduces to something like

At times arbitrarily close to t , X 's position differs from its position at t .

If this is the case then you cannot use the fact that it is moving at a certain time to explain why it is in a different position a little later: the “explanation” collapses into a tautology.

This means that in the CMR, motion (and change generally) can play no role in providing explanations of what happens in the world.

Problems with the Cinematographic Model of Reality: II

According to CMR the history of the world may be conceived as a mapping from times to world-states.

Any such mapping must be highly constrained to do justice to the way the world appears to be: Changes in the real world are, at least for the most part, *continuous*.

And continuity is often invoked as a necessary condition for the persistence of *identity*.

What must a mapping from times to world-states be like in order to capture the continuity of change in the world?

Standard Mathematical Answer

The mapping must be such that, **by concentrating on a short enough time period we can make the change we see as small as we like**. This is expressed by the standard definition of a continuous function from numbers to numbers:

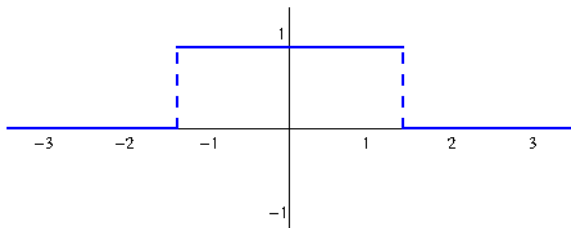
$$\forall \epsilon > 0 \exists \delta > 0 \forall h (|h| < \delta \Rightarrow |f(x+h) - f(x)| < \epsilon).$$

But this only gives us something that resembles the continuity we think we see in the physical world if the functions are applied to the mathematical continuum, i.e., the ordered set $(\mathbb{R}, <)$ of *real numbers*.

This is because when the continuity condition above is applied to other sets of numbers such as the *rational numbers* $(\mathbb{Q})$ or the *integers* $(\mathbb{Z})$ it does not correspond to our intuitive understanding of what a continuous mapping “looks like”.

Continuity on the Rational Numbers

Example: Graph of the function $f(x) = \begin{cases} 1 & (\text{if } x^2 < 2) \\ 0 & (\text{otherwise}) \end{cases}$



If the number line is represented by $\mathbb{Q}$ (the rational numbers), then this is a *continuous* function.

If we want our mathematically continuous functions to model true physical continuity, we must use the *real* numbers ($\mathbb{R}$) to model time, distance, and other measurable quantities.

Why is this a problem?

There are two undesirable consequences of representing physical continua such as time by the mathematical continuum $\mathbb{R}$:

- ▶ It forces us to accept *actually existing infinite totalities* (e.g., the instants falling within an interval). It is more comfortable to follow Aristotle in insisting that the only application of the notion of “infinity” in the real world should be *potential*, not *actual* infinity.
- ▶ It forces us to accept the idea that *duration* (of time intervals) and *extent* (of spatial regions) is the result of summing together an infinite collection of instants or points that individually have no duration or extent.*

* It's no good saying: “but it's a *non-denumerable* infinity”, as if that made a difference—however many zeros you add together it is impossible to get anything other than zero.

Mathematical vs Physical Continua

The mathematical continuum is a theoretical construction, not something we could possibly discover empirically. It is useful because it supports the mathematics needed to formulate and solve the equations needed in our scientific models.

It is one source of the “unreasonable effectiveness of mathematics” as a tool for understanding the physical world — but that effectiveness comes at the cost of shackling us with a highly dubious metaphysics.

Let us accept it for what it is: as a *practical tool* which in certain domains (but not all) can be devastatingly effective — but not as providing a viable account of the “true nature” of reality.

And yet, the CMR depends on it . . . If CMR falls, what happens to Substance Ontology?

That is my negative case — arguing against the tenability of the Substance Ontology on the assumption that this is (at least implicitly) committed to both the Cinematographic Model of Reality and the continuity of physical change.

I now consider some positive arguments in favour of Process Ontology.

A view of time, change, and process

If the CMR is to be jettisoned, what can take its place?

- ▶ The essence of time is *duration*, which cannot be obtained by summing durationless instants.
- ▶ The essence of duration is *change* — without change, how is one part of a duration to be distinguished from another?
- ▶ *Processes* exist as givens in the world, not to be reduced to the possession by various objects of different properties at different times.
- ▶ The *present* is inherently dynamic, containing processes as well as (or instead of?) things.
- ▶ At least some objects are *constituted* by processes going on within them.

Process Ontology is neither Endurantism nor Perdurantism

- ▶ **Endurantism** is the traditional substance ontology, in which change is reduced to objects having different static properties at different times. There are no real processes.
- ▶ **Perdurantism** is “four-dimensionalism”, according to which the only real entities are the contents of various “chunks” of space-time. Change is reduced to differences amongst the “temporal parts” of such a chunk. Again, there are no real processes.
- ▶ In a true **Process Ontology**, processes are primitive givens, not to be explained away in terms of changelessness. That something has different properties at different times is a result of its enacting some process, not the other way round.

Dual-aspect Phenomena

There are many phenomena, particularly on a geographical scale, which we seem to be able to view with equal facility as either processes or things. Examples include *rivers*, *ocean currents*, *waterfalls*, *whirlpools*, *tornadoes*, and *hurricanes*.

THING-LIKE

They have size, shape, position, and can move. They come into existence, endure for a longer or shorter period, and then cease to exist. At any time they are constituted by quantities of matter (air or water).

PROCESS-LIKE

They consist entirely of the coordinated motions of masses of air and/or water. If the motions stopped, they would cease to exist.

Dual-aspect Phenomena (continued)

Both aspects of a dual-process phenomenon involve both processes and things:

	PROCESS ASPECT	THING ASPECT
PROCESSES INVOLVED	The highly coordinated small-scale internal motions of water, air, etc, which perpetuate the existence of the phenomenon.	The large-scale motion and behaviour of the phenomenon as a whole, including its interactions with its environment.
THINGS INVOLVED	The particles of water, air, etc, which participate in the internal processes.	The phenomenon as a whole, considered as a continuant entity in its own right.

Living Organisms

The description of dual-aspect phenomena on the previous slide seems to apply equally well, if not better, to living organisms.

[T]he material parts of which the organism consists at a given instant are . . . only temporary, passing contents whose joint material identity does not coincide with the identity of the whole which they enter and leave, and which sustains its own identity by the very act of foreign matter passing through its spatial system, the living form. It is never the same materially and yet persists as its same self, by not remaining the same matter. Once it really becomes the same with the sameness of its material contents, . . . it ceases to live; it dies . . .

Hans Jonas The Phenomenon of Life (1966)

Do objects exist?

Of course!

But examples such as living organisms and dynamic meteorological and hydrodynamic phenomena suggest that the traditional substance view needs to be replaced by a more sophisticated understanding of what it means to be an object.

For radical processism we need to extend this to objects such as *tables* and *lumps of rock*.

Is a lump of rock processual in nature?

A rock's claim to being a unitary object rests on its coherence in the face of diverse environmental circumstances:

- when you push it, it moves (as a whole)
- when you twist it, it turns
- when you drop it, it falls

In every case it retains its form largely unaltered.

This is due to its being a structured aggregation of many atoms in constant thermal motion whose mutual interactions prevent them from moving apart: numerous low-level processes combining to form a higher-level process, the continued existence of the rock.

But the processes which sustain the rock are themselves enacted by its constituent atoms (etc.).

Towards Pure Processism

I would like to propose that *all* objects are dual-aspect phenomena.

Whether we treat them as objects or processes depends on how visible, at human time- and space-scales, the processes constituting the process aspect are.

My original dual-aspect phenomena (mostly meteorological or hydrological in nature) are ones which are delicately poised between the two aspects — we can with equal facility view them either way.

For pure processism, the process aspect needs to be accorded ontological priority over the object aspect. In order to do this we need to be able to characterise our concept of “object” in terms of processes.

What is an object?

According to

A. Galton and R. Mizoguchi, 'The water falls but the waterfall does not fall: New perspectives on objects, processes and events', *Applied Ontology*, 4 (2009), 71–107:

an object is

“the *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”.

“Consider a situation from which we can isolate two collections of processes, called $\mathcal{I}$ and $\mathcal{E}$, with the following properties:

(1) The collections $\mathcal{I}$ and $\mathcal{E}$ are disjoint.

(2) There is a level of description at which the situation can be coherently described as containing the processes in $\mathcal{I}$ but not those in $\mathcal{E}$.

(3) There is another, higher level of description at which the situation can be coherently described as containing the processes in $\mathcal{E}$ but not those in $\mathcal{I}$.

(4) The processes in $\mathcal{E}$ are causally dependent on the processes in $\mathcal{I}$.

In this case, we say that there is an object, o , such that

(5) $\mathcal{I}$ is a collection of internal processes of o .

(6) $\mathcal{E}$ is a collection of external processes of o .

(7) o enacts each of the processes in $\mathcal{E}$.

(8) o is sustained by the processes in $\mathcal{I}$.

(9) For each of the processes in $\mathcal{I}$ we can define a role in the internal description of o , and for each such role there is either a (functional) part of o or an auxiliary object which enacts it. “

Galton & Mizoguchi, 2009

Image Schemas

An **image schema** is a recurring semi-abstract pattern by which we can mould our raw experiences into a structured understanding of the world:

Image schemas operate at a level of mental organization that falls between abstract propositional structures, on the one side, and particular concrete images, on the other.

Mark Johnson, *The Body in the Mind* (1987)

Johnson includes PROCESS and OBJECT in his list of image-schemas, but he does not say much about them.

“The OBJECT image-schema is experientially grounded in our physical and social interaction with our own bodies and with other discrete entities in the world:

- a) We can move and manipulate objects in different ways, which may modify their properties as well as their relations with other entities.*
- b) Objects are typically perceived as unified wholes which, on closer inspection, may be mentally divided into parts in order to reason about their physical arrangement and functionality.*
- c) . . . , loss of integrity may result in the destruction of the object.”*

This seems to be limited to a narrow conception of ‘object’ as prototypically middle-sized, solid, inert, and manipulable.

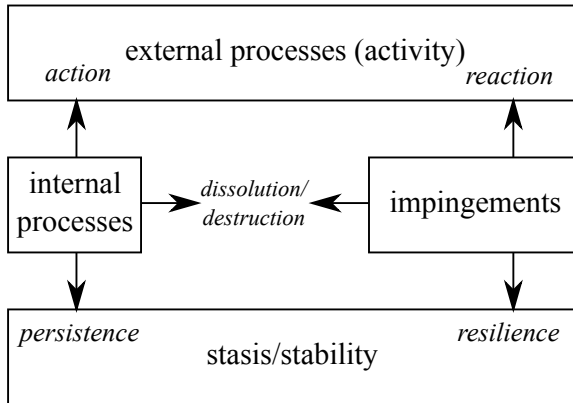
Aleksander Schwedek, 'The OBJECT image schema'
(www.academia.edu/31630572/The_OBJECT_image_schema)

- ▶ Distinguishes *static* and *dynamic* object-schemas,
- ▶ The dynamic schemas are ENABLEMENT, ATTRACTION, REPULSION, APPROXIMATION [i.e., APPROACH], RECESSION, BLOCKAGE, DIVERSION, COUNTERFORCE, BALANCE, and PATH.
- ▶ These all relate to the external processes of objects and do not support the idea that objects may be inherently processual in nature.

Can we do better than this in support of process ontology?

A process-oriented OBJECT image-schema

- ▶ INTERNAL PROCESSES, considered to be enacted by parts of the object but not by the object as a whole.
- ▶ IMPINGEMENTS, i.e., environmental processes acting on the object
- ▶ STABILITY, comprising
 - ▶ PERSISTENCE, of matter or form, achieved through a balance of internal processes.
 - ▶ RESILIENCE, the ability to maintain stability in the face of impingements.
- ▶ EXTERNAL PROCESSES, or ACTIVITIES, considered to be enacted by the object as a whole, including
 - ▶ ACTIONS, caused by the object's own internal processes
 - ▶ REACTIONS, caused by impingements from the environment.
- ▶ DESTRUCTION or DISSOLUTION resulting from the either failure of the internal processes to maintain balance, or impingements which overcome the object's resilience.



A pure process ontology would consider objects to be entirely constituted by process-complexes of this form. It remains an open question whether this is a viable ontological model.

**THANK YOU FOR
LISTENING**

Any Questions?