

Relationality is Not Enough: The Organization of Dynamic Structures

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Abstract

The interactivist model (Bickhard, 2009b) posits action and, importantly *interaction* to be the key notions based on which a wide array of phenomena are understood better than traditional models of representation, cognition, perception etc. The metaphysical foundations on which it rests comprise both dynamic process philosophy and a strong relational framework. The paper intends to demonstrate that these two pillars are not accidentally meeting each other on this fundament. Interactivism requires that processes demand relationality, and relational structures need a dynamic interpretation. This latter conceptualisation of structures as dynamic, labelled here a metaphysics of dynamic structures, has only recently gotten some traction. I explore some programmatic ideas and consequences while calling for further investigation into these dynamic structures.

1 Shift to Relationality

It is a relatively uncontroversial claim that physics throughout the 20th century has puzzled and even troubled our ordinary thinking of how the world is. The nature of space, time, entanglement, objective probability, and the rise of field theory all challenge fundamental ideas of traditional physics and our understanding of it.

Somewhat more controversial (but still almost entirely agreed upon) is the observation that many of the new theories and ideas shift away from individual and independent particles to relations, systems, and structures of those.¹ Entities formerly thought to be self-sufficient ultimate "building blocks", like the atom, space or particles, could

¹Structures and systems are understood to denote the totality of entities involved, including the connecting relation. This mathematics-inspired definition means to be innocuous and broadly applicable to all types of examples and sciences. Following the definition, every structure involves a relation, and every relation induces a structure. For this reason, the "shift to relationality" is synonymous with a "shift to structures" and a "shift to systems". Furthermore, I will use the terms "relationality", "structural", and "systematic" interchangeably.

either be dissolved further or are now understood only in the system they are embedded in and often relative to further constraints.

Just to sketch two examples: In the good-old Newtonian world with absolute space and time, there was a sense in which an object, a particle, is moving - independent of any other thing. But the relativity of space makes it necessary for at least one other object to exist. It is only with respect to this other object that the former can change position relative to and therefore move. The spatial position and movement, formerly conceived of as absolute notions, now involve a relation to other entities essentially. Things become even more intricate with the introduction of spacetime.

The other example concerns quantum mechanics: The mathematical framework in quantum mechanics yields the wave function as the description of how the system develops over time. The classical analogy for such a function is a function that describes the behaviour of the constituting particles. In the classic-mechanical framework, it makes sense to think that the particles are the fundamental objects and the function is the derivative description of their behaviour. The particles are in a certain state, and the function describing the system merely sums up the individual states into a system description.

However, in the quantum mechanical setting, it is difficult to uphold that individual particles constitute the system in every scenario.² Some authors argue that instead, the wave function is what is truly real.³ Again, the supposedly independent,

²This has partly to do with the problem that the traditional means of individuating them are failing. In his article Muller (2015) echoes the undercurrent of a major debate in the philosophy of quantum mechanics and physics in general, namely that the strong sense of individuality, and absolute discernibility, cannot be upheld in all scenarios of modern physics. His solution will be that there are distinct particles involved but that they have to be re-characterised as relationals - repeating the alleged general shift here.

³Compare David Albert's summary of the development of

self-sufficient particles on the new picture can *only* be understood in their position within the system as arguments in the wave function. They are essentially related to one another concerning this system description.

I would like to label the supposedly very general shift, from constituents to the structures thereof, as the shift to relationality. The shift to relationality will be short for the general advance of the idea that the former basic, independent entities now are taken to be related so strongly that they essentially involve the structure, the system they stand in.⁴

2 Internality of Relations

Never mind the accurateness of the history of science thesis. Maybe relations have always played an important role, or perhaps the alleged shift is not as pervasive as suggested. Regardless, in the promising framework of Interactivism (Bickhard, 2009a) and akin ideas like the enactive approach (McGann et al., 2013) relationality features prominently. Interactivism evolved as a model of representation (cf., Bickhard (2009b, p.548)) where the core or "minimal model of representation" (Bickhard (2009b, p.570)) form anticipatory activities which have truth-value (cf., (Bickhard, 2009b, p.570) and (Bickhard, 2009a)). On the basis of "interactive goal-directed systems" (Bickhard (1998a, p.212)) doing those anticipatory activities emerge the multi-level phenomenon of representation (cf., (Bickhard, 1998a) and (Bickhard, 1998b, p.6)).

In this model, representation emerges naturally in the problem of the selection

the GRW interpretation: "And this new approach very naturally brought with it a new and more straightforward and more flat-footed and more traditionally scientific way of thinking about the wave-function *itself*. This *new* way of thinking turns everything about the foregoing tradition elegantly inside out: The wave-function is not an abstract mathematical representation of the states of concrete physical systems, but (rather) the unique fundamental concrete physical stuff of the world *itself*. First-quantised non-relativistic quantum mechanics is not a theory of the 3-dimensional motions of *particles*, but (rather) of the 3 *N*-dimensional *undulations* of a concrete physical field – which is nothing other than the wave-function itself – where *N* is a very large number that corresponds, on the *old* way of thinking, to the number of elementary particles in the universe. And once this new picture is fully taken in, there are no longer any such metaphysical conundrums in the world as indeterminacy or superposition or non-separability:[...]" (Albert, 2019, p.92-93).

⁴Of course, recursion is allowed. The systems themselves may be integrated into even larger systems, and supposing that the interdependency among the systems is strong enough, one may go on to put that even larger system at the basic level.

of actions and interactions by agents – it is an interactive model of representation. (Bickhard, 1998b, p.3)

The model not only meets a meta-epistemological criterion as well as the normative criterion, which are hardly even addressed by competing accounts (Bickhard (1999, p.435)). It also fulfills the crucial desiderata of a model of representation (Bickhard (2009b, p.569)). While representation is where Interactivism started, the model developed into a much more encompassing model, including related phenomena such as cognition, language and normative biological functions (Bickhard (2009b, p.548)). To Interactivism, the metaphysical foundation is of crucial importance. It subscribes to a more general shift towards processes metaphysics throughout the sciences (cf., (Bickhard, 2019, p.228)) and contributes to it by aligning representation and cognition with this general shift.

Interactivism also features relationality, where relationality is more than the mere acceptance of relations. Arguably, relations in some way or other do play a role in systems that do not stress relationality as much. Billiard balls, mathematical points and qualities considered "entirely loose and separate"⁵ do feature in the respective systems as *relata*, e.g., as causal *relata*. One billiard ball and its motion can cause the other billiard to roll; two electrons are in a specific distance relation (say $5, 2 \times 10^{-11}$ m apart). Crucially, when considered "loose and separate", they could also not be related in that way or even not at all. Their being does not necessarily involve any connection.

Conversely, in a relational framework such as Interactivism, entities involve (at least some) relations essentially (Bickhard (2009a) and Bickhard (2019, p.230)). Relations of that kind are "internal" relations. They are "intrinsic to the nature of one or more of the *relata*. They are a kind of essential relation, rather than an essential property." (Bickhard, 2003, p.1)

⁵It is no coincidence that a quote from Hume (2007, p.58) enters the picture here. Nowhere but in Humean metaphysics we find the opposition to relationality expressed as strongly. "Humean supervenience is named in honor of the greater denier of necessary connections. It is the doctrine that all there is to the world is a vast mosaic of local matters of particular fact, just one little thing and then another.[...] And at those points we have local qualities: perfectly natural intrinsic properties which need nothing bigger than a point at which to be instantiated." (Lewis, 1986, p.ix-x).

Circumventing some worries about "intrinsic"⁶, the notion can be cast into a semi-logical formula:

(Internality) R is an internal relation $=_{df}$ $(\forall x_1) \dots (\forall x_n)$ if $Rx_1 \dots x_n$ then necessarily $((x_1 \text{ exists} \leftrightarrow Rx_1 \dots x_n) \& \dots \& (x_n \text{ exists} \leftrightarrow Rx_1 \dots x_n))$ (Schaffer, 2010a, p.349).

An internal relation allows to infer from the existence of any of the relata the holding of the relation. In that sense, the relation "flows" from the nature of their relata. But a word of caution is advised. Internality should not be confused with the idea that relations reduce to monadic properties.⁷

An example helps to illustrate that point. If there are two mountains, each being 5000m high, they stand in the relation of "being of equal height". The relation flows from their nature in that it is reducible to the monadic properties. In virtue of having the properties, the relation holds. Yet, this relation is not internal! We cannot deduce that the relation holds from the existence of one of the mountains. The other mountain may be of a different height or not exist at all.

The example demonstrates an important consequence of internal relations too. Internal relatedness leads to interdependence.⁸ From the existence of one of the relata in an internal relation, we can infer the relation holding, from which, in turn, we can infer the existence of the other relata. And vice versa. Neither relata can exist without the other because of their strong structural connection. Interdependency is an immediate consequence of having relations in the nature of the relata.

To Bickhard, who makes a very strong point, that process metaphysics is the proper foundation for Interactivism, processes are such relata. Processes are related to one another in terms of Organization (cf., Bickhard (2009b, p.554).) and "[a] process, however, has whatever properties it has, including causal properties, in virtue (in part) of its organisation: new organisations may generate new (causal) properties [...]. "(Bickhard, 2011, p.7)

⁶Schaffer makes the valid point that instead of intrinsic, the proper internal notion should be in terms of essentiality, cf., Schaffer (2010a, p.348-349).

⁷The reducibility of relations to monadic properties is sometimes confused with internality. Yates in (Yates, 2016) clearly distinguishes between the two. Moreover, in the course of this paper, it will become clear how internal relations may just as well be fundamental, say in the case of the discussed Ontic Structural Realism (OSR).

⁸Again compare Yates (2016) and Schaffer (2010a).

The burning of a candle is organised with the inflow of fresh oxygen, melting of wax and the oxidation of the wick. If these other processes were different, the burning of the candle would be different. Suppose the oxygen inflow was to speed up by some variant of a chimney effect. Consequently, the burning of the candle would drastically alter its characteristics, getting much hotter and brighter and causing the melting of wax and oxidation of the wick to speed up. The burning of the candle involves those other processes essentially, making it and its characteristics dependent on them.

Relationality, i.e., the internal relatedness, demands a perspective where the structure (the organisation or network) the entities are embedded in is of critical importance. Entities are partly constituted by their relations and interconnections promoting the overall structure. Where formerly structure, or the whole, really was an abstract conglomerate of "local matters"⁹ these "local matters" now depend on the global network in which they are. Metaphysically speaking, the structure is no longer derivative to the individual particulars and their intrinsic characteristics. From the relational view, the structure is at least as fundamental as the structured content itself.

There is a worry to be addressed here with the formulation of the fundamentality of structure. Starting with processes and emphasising their interconnection, one need not necessarily end up with a picture where a structure is considered a separate entity. Therefore, the identification of relationality with the thesis claiming that structure is fundamental is ill-conceived. That is because there may not be "a structure" on the list of beings which then gets awarded with fundamentality. While that is true, it does not change much regarding the upcoming argument. Relationality claims that something about the relata (the processes) is such that you cannot understand them without embedding them into the relations with other relata. At the very least, that suggests that there is a part of each of the relata which is essentially connected to other relata. Structure can then be understood to be short for all these parts. By relationality, we know that such parts are not derivative to other (intrinsic) aspects of the relata. The fundamentality of structure need not amount to more than this.

⁹Compare footnote 5.

3 Static Relationality, Static Structures

At least two prominent positions have addressed relationality in the same way as it has been treated here so far: Priority Monism and Ontic Structural Realism (OSR).

Priority Monism

According to Priority Monism the relational character of the interdependent particulars makes it necessary to see the whole as more fundamental than its parts (Schaffer, 2010a). While any part is a dependent entity, the whole, the sum of all parts and thereby including structure, is not dependent in the same way. All the dependencies are "resolved" within the whole, all the parts depend upon the whole but not the other way around.

The monist holds that the whole is prior to its parts, and thus views the cosmos as fundamental, with metaphysical explanation dangling downward from the One. (Schaffer, 2010b)

Arguably, one can also imagine that there are levels in the Priority Monism picture. Physical particles may depend upon one another, and the larger whole could be protons, and neutrons, so physical particles of higher complexity. Those higher complexity particles may again depend upon another and jointly be parts of the larger whole, specific atoms, which again depend upon another to make up molecules etc. Given such a chain, only the most extensive whole is fundamental, even if for the dependency to end, such a largest whole could be the entire universe consisting of literally everything there is.

Bradley famously thought so, as according to him, everything was related internally to everything else and recently, Jonathan Schaffer has defended priority monism on similar grounds (Bradley (1897), Schaffer (2010a), and Schaffer (2010b)).

Ontic Structural Realism (OSR)

Ontic Structural Realism (OSR) assumes too that relata can only be understood in terms of the relations and thus their connection to other relata. Yet, the position is slightly more radical. Not only are some aspects of the relata derivative to structure, but everything about them. The understanding of any aspect of a relatum requires the reference to relations. In consequence the entities are nothing but relata, points in a web of relations.¹⁰

¹⁰Compare as examples, Ladyman et al. (2007), French

Ontic Structural Realism (OSR) is the view that the world has an objective modal structure that is ontologically fundamental, in the sense of not supervening on the intrinsic properties of a set of individuals. According to OSR, even the identity and individuality of objects depend on the relational structure of the world. Hence, a first approximation to our metaphysics is: 'There are no things. Structure is all there is.' (Ladyman et al., 2007, p.130)

Structuralism traditionally was advocated mainly in the fields of philosophy of language and mathematics (cf., Shapiro (1997)). But it has had a career as an interesting realist position in philosophy of science as well.¹¹

Relationality is the idea that structure is non-derivative - it is at least as fundamental as its relata. On Priority Monism and OSR that idea is taken even further, namely that structure or the whole is even more fundamental than the relata. Here, the relata are derivative to the network. Nevertheless, there is no denying that both Priority Monism and Structuralism incorporate relationality.

The central argument of the paper at hand is that relationality can both be developed in a static form and a dynamic form. The next section will tackle the dynamic form of relationality and explore the notion further. Here, however, it is argued that the relationality provided by Priority Monism and OSR *can* be understood as static. Neither Priority Monism nor OSR is a Process Philosophy.¹² On the contrary, they share many, albeit not all, presuppositions with the opposing substance paradigm.¹³ That is not to say that they cannot have processes as their relata. Instead, the crucial point is that structure itself is not dynamic.¹⁴

(2014) and Muller (2015).

¹¹See footnote 10.

¹²To be more precise, the dominant variants of these theories are not Process Philosophies. As this article intends to show, there is a way of reading structure dynamically and thereby integrating the structural priority with the fundamentality of processes. Some deviant forms of structuralism have also noted this connection, cf., (Ferrari, 2021).

¹³For a characterisation of that paradigm see Seibt (1990, Appendix).

¹⁴Arguably, Structuralism and Priority Monism are well within their right to also integrate dynamic structure, rendering the verdict of static against them empty. Part of the argument of this article was to point out that relationality does not by itself lead to a dynamic process view. For that, it suffices that Priority Monism and OSR are at least compatible with a static

The traditional conception of structure is reflected in the foundations of classical logic and set theory. Structure and relations are in essence sets of a specific form. Regardless of the exact items within the set, A , the relation is but a mere subset of $A \times A$. The usual attributes of the relation, e.g., reflexivity, transitivity and symmetry, are then but specific demands on which pairs in $A \times A$ have to be included or must not be included in the subset. Due to the definition by extension, if any of the pairs were added or subtracted from the relation, it yields a different relation. Relations cannot "change" or be brought about. It is only the items that can undergo change and thereby exemplify new relations or structures.

Coming from mathematics and language, structuralist use this abstract and static conception of structure to interpret the physical world. Only recently, some non-classical branches in logic and alternatives to set-theory in mathematics are making way to explore on an abstract level the dynamicity of structure (cf., (Baltag and Smets, 2011)). Notwithstanding, the predominant conception of structure is one without the possibility of a dynamic interpretation.

And since structure on these relational views is fundamental, fundamentality points away from dynamicity. On the ultimate fundamental level, there are no dynamic but static entities, namely the structure or the whole.

Consequently, relationality leads to a systematic/structural view compatible with a static substance paradigm. Even more, many systematic views derive their appeal within the substance paradigm by providing even more stability than their particle-view competitors. The structure is deemed to be even more stable and permanent than its residents (cf., French (2014)), which is why many substance metaphysicians could cast their metaphysical quest as the inquiry into the "most fundamental structure of reality" (Lowe et al., 1998, p.1).

Furthermore, this compatibility of systematic views with static paradigms holds, even if the entities within the systems and structures are processes. Because of the relational character, an advocate of the substance paradigm may uphold that structure understood as something static is fundamental, whereas the processes involved in those structures

substance view, which is how they are usually perceived. The argument did not intend to demonstrate that any specific view is not able to move to a more dynamic view on structures.

may be dynamic, but *derivative* entities.

4 Dynamic Structures

Interactivism, on the other hand, strikes me as a fundamentally dynamic view. Not only are important features, like emergence supposedly dependent on a process metaphysics¹⁵, but also the view in itself puts activity (change, dynamicity) before stability, objects and substances.¹⁶ The same goes for the enactive approach to cognitive science, where "the mind is seen not as inhering in the individual, but as emerging, *existing dynamically* in the relationship between organisms and their surroundings (including other agents)" (McGann et al., 2013, p.203, my italics). To dynamic views of that kind change and processes feature on the fundamental level of reality, they are not to be reduced to states, properties and substance.

However, in the previous section, it was argued that one way to understand structure is in terms of a static system of relations. On such a static account, the fundamentality of structure, deriving from the relational character of processes, is in stark tension with the dynamicity of the view. After all, now something static underlies the character of the processes defining their being essentially. Following the static conception of structure, we run into a conflict between the "inter" (relationality) and the "activism" (dynamicity). Accordingly, the solution is to pursue a non-static, dynamic conception of structure, where not only the relata are dynamic but relating is a process.¹⁷ Thereby, the superficially supposed conflict between "inter" and "activism" is dispersed.

To Bickhard, there is no tension between dynamicity and relationality, but rather the shift to relationality is a strong argument in favour of dy-

¹⁵An argument by Bickhard made in several articles, compare for instance Bickhard (2019) and Bickhard (2009b).

¹⁶"For a substance metaphysics, stasis or inertness is the default. Change requires explanation. In contrast, process is inherently and always changing - a return to Heraclitus, if you will. Change is the default. In such a view, any stability of organisation or pattern of process requires explanation - and we will find that the kinds of these explanations can be of fundamental importance." (Bickhard, 2011, p.6).

¹⁷I echo here something very similar to the point De Jaegher, Peräkylä and Stevanovic make in distinguishing coordination in interactional sociology from coordination in enactivism. "Unlike interactional sociology, which highlights the structures that facilitate coordination, enaction describes interactional organisation in terms of dynamic, emergent processes of coordination." (De Jaegher et al., 2016, p.4) However, I believe that Luhmann, in contrast to Goffman, may have had this dynamic aspect of organisation more in mind.

namicity.

"As mentioned above, it is this relationality that I will be arguing is most important in the shift to a process framework." (Bickhard, 2011, p.13)

The two "pillars" of interactivism are not an arbitrary selection but a natural fit. Yet, this line of reasoning from relationality to the process framework only holds with the dynamic conception of structure and relations working in the background. It is this assumption, the dynamicity of structure, that the paper at hand intends to draw attention to. Without the assumption, relationality and priority of dynamicity are in tension instead of overlapping. However, even with the assumption there is the threat of circularity.

The inference from relationality to the process framework only holds with the assumption of dynamic structures which already seems influenced by the priority of dynamicity. I can see two possible replies: (a) One is to embrace the critique and drop the argument from relationality to the process framework. Instead, one could defend relationality by itself and the process framework on other grounds. Then the dynamic account of structures would drop out as a consequence of the combination of these two pillars. (b) The other option is to challenge the critique. The auspicious exploration of dynamic accounts of structures may find that this conception of relation is fruitful and promising in its own right without presupposing the priority of dynamicity. It is but a somewhat recent trend that dynamic logic with a focus on action instead of propositional descriptions draws attention (cf., (Baltag and Smets, 2011, p.287)). Again some of the driving factors for such a trend-shift are coming from the many problems that the application of "static" views brings in many areas of modern science (cf., Baltag and Smets (2011)). While Process Philosophers and Interactivists alike should welcome such dynamic shifts, there is still a lot of work to do, and dynamicity itself has to be spelt out further so as not to become an empty phrase. The shift to relationality plus independent reasons for conceiving relationality as dynamic leads to a process framework. Either way, the dynamic account of structures and relations requires further investigation.

Organization

While the overarching paradigm still is Process Philosophy, I want to label such special

positions "metaphysics of dynamic structures". On such views, processes are not cast into pre-shaped moulds but rather woven into a fabric where thread and fabric are coming into being as processes.¹⁸ Aligning with the Interactivist-picture we can call such a fabric-process: "organization" (Bickhard, 2009b, p.554). The term resonates nicely with Whitehead's "philosophy of organism" (Whitehead et al., 1978) as well as Luhmann's view on Systemtheory (Luhmann et al., 2013)¹⁹, the latter of which gives an insightful example to the view:

The structures can only be built through the system's own operations. It is a circular process: structures can be built only through the system's own operations because the system's own structures in turn determine operations. This is obvious in the case of the biochemical cell structure, for the operations simultaneously contribute to the build-up of the programs – in this case, the enzymes – in accordance with which the cell regenerates structures as well as operations.(Luhmann et al., 2013, p.76)²⁰

Within the cell, the processes (the "operations") relate internally via the programs which organise them. However, the programs stemming from this organisation are "simultaneously" built up by the processes. The "building" metaphor is slightly misleading, one could think of the structure to be a static product of a dynamic construction process. That is not what is meant here. The structure is inseparable from its constituting process, namely the dynamic bringing about of structure, *is* the structure. The example further shows that organisation need not necessarily be a separate process from the processes organised. It could be an aspect of

¹⁸In Sellars's words: the world is "the ongoing tissue of goings-on"(Sellars, 1981, p.81).

¹⁹That interactional sociology is coming from a very similar perspective, has not gone unnoticed. In (De Jaegher et al., 2016) some of the parallels are worked out.

²⁰Identifying the operations with the related processes makes the apparent parallel to Luhmann striking. Never mind the idea that the system by itself must produce both those operations and structures, which is a consequence of the idea of closed systems. The important point to notice here is that both structure and operation must be produced and that they mutually determine and create another. Luhmann too calls the production of structure "organisation" (and in the theory of closed systems, therefore "self-organisation" (Luhmann et al., 2013, p.70-71)).

such processes in some cases, and then that aspect can bear the name organisation. For current purposes, the important idea is merely that *relating* is understood dynamically.

Complexity - General Process Theory

One immediate consequence of the idea is that (at least some) processes are complex. In so far as they constitute the weaving of other processes into the fabric, they need to be sufficiently intricate. Process Philosophy and, more specifically, the General Process Theory (GPT) by Johanna Seibt has been aware of that special process.

GPT is a mono-categorical domain theory whose one basic category is called 'general process' or (for expository purposes also) 'dynamics.' This category is defined in terms of a new configuration of familiar category features: dynamics are concrete, non-particular, non-countable (in the traditional sense of countability that implies necessary uniqueness, i.e., particularity, yet countable in the way in which we count kinds), more or less indeterminate or determinate, independent, dynamic individuals. The core claim of GPT is that whatever we reason about in common sense and science can be described as a type of dynamics. (Seibt, 2018, p.138)

The non-particular nature allows for the processes ("dynamics" in the quote) to be multiply occurrent. They not only "stretch" across a certain spacetime region, but the region they exist in could be disconnected. Such processes are well suited to bring about structure, as this allows for the processes to relate without requiring immediate vicinity. Processes can literally recur, allowing structuring processes to be present throughout their relation.

In GPT structure of processes and within processes play an important role throughout. Dynamics have a mereological signature, a participant structure, dynamic composition, dynamic shape and context (cf., (Seibt, 2018, p.141)). All these spell out different structural notions, and as they are aspects of dynamics, different structuring notions.

It is no coincidence that Seibt's framework seems particularly fit to model the new "troublesome" (from the viewpoint of traditional particle/substance metaphysics) physical entities, e.g.,

those arising from Quantum-Field-Theory (QFT). Echoing earlier sections of the paper, that too is a domain where the "loose and separate"-ness makes way in favour of a more systematic approach. Cutting some more detailed and sensitive analysis short, GPT (back then under the name of APT (Axiomatic Process Theory)) offers complex processes, "the interaction of component processes [...]. [...] a dynamic "mixture" of dynamic "stuffs" [...] as assistance to the interpretation of QFT" (cf., Seibt (2002)). Thereby the interconnectedness and relationality are paid tribute to, yet the structure itself is understood to be dynamic, a complex process.

In a text on Sellars, Seibt addresses that structure in a process ontology should be understood dynamically: "Since pure processes are occurring-suchly's or *modes* of spatiotemporal occurrence, in a process ontology the mode or configuration in which processes occur is itself a process." (Seibt, 2016, p.196) And further in the footnote on that sentence: "E.g., a vortex is the mode in which certain other processes (movements of water molecules) occur, photosynthesis is the mode (configuration) in which other processes occur, and so forth. [...] the dynamic organisation of processes can count as a process itself." (Seibt, 2016, Footnote 20)

The enormous task of developing a complete metaphysics of dynamic structures still lies ahead. This small paper can but draw attention to the need for further work and the promise such work holds. Confined in analysing one well-developed process metaphysical application, Interactivism, a programmatic emphasis was put on the conceptualisation of structure as dynamic. With its many variants and applications, process philosophy should welcome such insights - insights stemming from one of its applications and then inducing feedback for the overall view. Not only Interactivism, but process philosophy, in general, can only gain by further developing an account of dynamic structures.

At this point, the departure from "static" conceptions of structure allows for two minor remarks about their place in this new framework.

The first remark is that arguably not every relation needs to be understood processual. The alleged shift to relationality and the Interactivist perspectives feature central constitutive relations. Those are the relations essential to the entities, and those, I argued, require a dynamic interpretation within the Interactivist model. Still, other relations may enter as surplus structures but not play such consti-

tutive roles. Those relations need not necessarily be understood dynamically.

Other entities may derive from the "ongoing tissue of goings-on" that is, the fundamental processes and structure. Simons has an account of processes according to which static objects can be thought to be derivative patterns of processes, thereby accomplishing everything static substance metaphysics does while still having processes at rock bottom (cf., [Simons \(2018\)](#)). In such a case, relations and structure holding between the derivative static objects too will be derivative. Those relations and structures need not necessarily be conceptualised dynamically. Because these are derivative to the "Final Realities" ([Whitehead et al., 1978, p.22](#)) which are dynamic in nature, their static character poses no threat to the fundamentality of dynamicity.

Some relations were argued to be essential to processes, those constituting parts of the actual concrete world of becomings. The other relations owe their existence to higher degrees of abstractness, where we move away from the fundamental concrete constituents to broader patterns, kinds and relationships between those. So, again, there is the option to include these in the picture but not have them as residents on the ground floor.

The other place (or rather time) for static structures and relations is in the past. While the world is "the *ongoing* tissue of goings-on" ([Sellars, 1981, p.81, my italics](#)) one could imagine that this dynamic happening leaves a trail. The activities ongoing now pass into the past and are no longer ongoing, but rather *have gone on*. Retrospectively processes are still activities with temporal extension, but they are no longer dynamic in the sense of being currently ongoing. From the time of finishing onwards, they will always remain exactly what and where they are. I believe that those with sympathies for the recent revival of the Growing-Block view of time (cf., [Correia and Rosenkranz \(2018\)](#)) may be interested in that application of the dynamic structure view outlined here.

The growing block view can be summed up by the principle that what the widest quantifier ranges over always increases. The totality of existence forms a four-dimensional block, where entities are located at their respective space and time. Yet, on the "edge" of the block (defined by those entities which do not have anything later than them), new slices are coming into being, increasing the block

in the direction of time. This growth constitutes the block as all parts of it once were created due to that process of growing. Combining it with the dynamic structure view here, one could say that processes are considered ongoing at the edge, and their activity is fundamental. As these processes were argued to stand in some internal relations, these relations too are processes ongoing at the edge of being. In contrast, the processes that *have gone on* are now located in the past. They may still be related, but the involved relations are not something ongoing and need not be further conceived of as dynamic. The residue of the ongoing process of becoming are entities that have become and no longer need the dynamicity of that process.

Both the integration of abstract static relations and the combination with a growing-block view of time are mere options the dynamic structure perspective offers for accommodating their static counterparts. By no means is one obliged to follow these tracks but coming from the discussion of static structures, it may present a valuable perk to the view to be able to integrate them.

Conclusion

Relationality features prominently in both scientific theories and philosophical interpretations and approaches. When taken seriously, entities can no longer be studied separately and individually but must be seen in the nexus from which they were taken. Some have drawn radical consequences from this interrelatedness, like OSR and Priority Monism. This paper argues that for dynamic views, which put processes before substances, an account of relations and structure must be spelt out, reflecting said dynamicity. Relations need to be understood as processes of relating, lest they challenge the fundamentality of processes, creating a hiatus between "inter" (representing the relationality) and "activism" (the undercurrents of Process Philosophy). I called attempts of such nature "metaphysics of dynamic structure" and explored some accounts and consequences.

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