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# On the Concepts of Trans-action and Intra-action

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## 1. Introduction

Using the two concepts "trans-action" and "intra-action", I will outline a dynamic relationalist perspective, which aims not so much at reconciling realism and relativism, as at providing resources to transcend the realism-relativism debate. John Dewey uses the term trans-action predominantly in *Knowing and the Known*, written together with Arthur Bentley in 1949. The term intra-action is coined by the American feminist and physicist Karen Barad and is a key concept of her agential realism as developed in *Meeting the Universe Halfway* from 2007.

Relationalism challenges the very basis for the traditional debate between realism and relativism by cutting across the alleged divide between these two perspectives. In the relationalist perspective outlined, it is the relational intra-activity that constitutes reality and defines subject and object.

Is this, then, a way to understand reality, or is it (just) a way to understand our *understanding* of reality? That is: are we dealing with ontology or epistemology? Possibly the safest route would be to restrict the claim to the epistemological (like Dewey does in *Knowing and the Known*), but with the aid of Barad's thinking, presenting the key elements of her agential realism, I dare to make it into an *onto-epistemological* claim.<sup>1</sup>

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<sup>1</sup> Barad uses the term "onto-epistemology" to mark "the inseparability of ontology and epistemology" (Barad, 2007, 409, n10). Although most often treated as separate concerns today, the understanding of ontology and epistemology as inseparable has prominent advocates in the history of philosophy (as Aristotle, Kant and Husserl). Barad radicalizes the

## 2. Stating the problem

Let us start with very briefly stating the problem to which a relationalist approach is a possible solution. In his *Pragmatism without Foundations—Reconciling Realism and Relativism*, Joseph Margolis sets out, as the subtitle tells us, to reconcile realism and relativism. What is needed, according to Margolis, to secure the possibility of objectivity and thereby the reliability of science, is an integration of ontic and epistemic internalism with an ontic *externalism*, according to which there is some mind-independent reality. Margolis calls his position “internal relativism” (Margolis, 1986, 289). This position has much in common with, but is also contrasted to Putnam’s internal *realism*.<sup>2</sup> Margolis presents Putnam’s position at length, describing it as “misleading”, but at the same time “helpful”, as it helps us to see “what more is required”. This search for a way to secure the possibility of objectivity seems to be the main goal for efforts like Margolis’ and Putnam’s, and it is also an often used argument against relativism and pragmatism that these rule out this possibility of objectivity. But there are ways of keeping the possibility of objectivity and the reliability of science without resorting to ontic externalism.

## 3. Dewey’s concept of trans-action

Another way of solving the problem of objectivity (although this is not what he explicitly sets out to do) is offered by John Dewey’s use of the concept of *trans-action*, which opens a possibility of ensuring a minimal scientific objectivity, without having to rely on the notion of ontic externalism. In Dewey’s trans-actional perspective there is no place for the idea of something mind-independent in the world of man, and still there is a possibility for knowledge and science.

Dewey contrasts the transactional perspective with the antique view of self-action and the inter-actional view of classical mechanics: *Self-action* means that an object is “viewed as acting under its own powers”; *inter-action* means that object is balanced against object “in causal interconnection”; while *trans-action* means that

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idea of this inseparability. For support of the idea of onto-epistemological inseparability in the context of modern physics, see for example Anton Zeilinger (2010).

<sup>2</sup> The concept is introduced by Hilary Putnam in (Putnam, 1981), and is later used by Putnam in, for example, *Representation and Reality* (1988, 114), where he also writes that he wish he had rather called his position “pragmatic realism”.

systems of description and naming are employed to deal with aspects and phases of action, without final attribution to 'elements' or other presumptively detachable or independent 'entities' [...] or realities.

Dewey, 1949, 132f

The fundamental difference is that in the *transactional* perspective, no radical separation is made between the subject and the object of knowledge, between the observer and that which is observed; the determination of objects as themselves is trans-actional. This means that knowing is cooperative, open and flexible in character, in a way that excludes assertions of fixity, and that knowledge is viewed as "itself inquiry as a goal *within* inquiry, not as a terminus outside or beyond inquiry" (Dewey, 1949, 97).

Dewey demands a treatment of all of man's "behaviors, including his most advanced knowings, as activities not of himself alone, nor even as *primarily* his, but as processes of the full situation of organism-environment". An "object" is to be seen as an "unfractured observation", which is neither existing separately apart from any observation, nor existing only in our head "in presumed independence of what is observed" (Dewey, 1949, 131).

The term "transaction" is used early by Dewey to better bring out the systems aspect than is possible using the alternative "interaction". It is introduced in the paper "Conduct and Experience" from 1930 (published in *Psychologies of 1930*), where he writes:

The structure of whatever is had by way of immediate qualitative presences is found in the recurrent modes of interaction taking place between what we term organism, on one side, and environment, on the other. This interaction is the primary fact, and it constitutes a trans-action. Only by analysis and selective abstraction can we differentiate the actual occurrence into two factors, one called organism and the other, environment.

Dewey, 1930, 411 <sup>3</sup>

It is not enough to consider the organism-as-a-whole, what is needed is to consider the organism-*in-environment*-as-a-whole. Dewey admits that the transactional point of view may be difficult to acquire at the start:

If we watch a hunter with his gun go into a field where he sees a small animal already known to him by name as a rabbit, then, within the framework of half an hour and an acre of land, it is easy—and for

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<sup>3</sup> Even if Dewey did not use the term by then, the necessity of a transactional seeing together of man-environment and stimulus-response was already a pivotal idea in his article "The Reflex Arc Concept in Psychology" (Dewey, 1896).

immediate purposes satisfactory enough—to report the shooting that follows in an interactional form in which rabbit and hunter and gun enter as separates and come together by way of cause and effect. If, however, we take enough of the earth and enough thousands of years, and watch the identification of rabbit gradually taking place, arising first in the subnaming processes of gesture, cry, and attentive movement, wherein both rabbit and hunter participate, and continuing on various levels of description and naming, we shall soon see the transaction account as the one that best covers the ground.

Dewey 1949, 141f

According to Dewey, transaction represents a “level in inquiry in which observation and presentation could be carried on without attribution of the aspects and phases of action to independent self-actors, or to independently inter-acting elements or relations” (Dewey, 1949, 136). In a transactional perspective, Dewey stresses, there is

no basic differentiation of subject *vs.* object [...] no knower to confront what is known as if in a different realm of being [...] no ‘entities’ or ‘realities’ of any kind intruding as if from behind or beyond the knowing-known events [...] [no] constituent can be adequately specified as ‘fact’ *apart* from the specification of other constituents.

Dewey 1949, 136f

In *Knowing and the Known*, Dewey underlines physics increasing use of the transactional perspective and gives a brief sketch of the history of physics from Aristotle’s physics built around self-acting substances, via Galileo’s and later Newton’s inter-acting particles, to Einstein’s physics which brought time and space into the investigation, using the transactional approach, a seeing together of what earlier had been seen in separation—a physics in which “a particle by itself without the description of the whole experimental set-up is not a physical reality” (Dewey, 1949,135)<sup>4</sup>

When it comes to the question of how we are to understand the concept of “physical reality”, Dewey refers to a discussion between Einstein and Bohr from the 1930s, and makes the remark that Einstein, “[i]n contrast with his transactional [...] treatment of *physical* phenomena [...] remained strongly self-actional [...] in his attitude towards man’s activity in scientific enterprise” (Dewey, 1949, 135). Dewey contrasts this position with Bohr’s “much freer view of the world that has man as an active component within it, rather than one with man by fixed dogma set over against it” (ibid). Dewey’s explicit preference for Bohr’s approach

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<sup>4</sup> Dewey quotes, with approval, from Philipp Frank’s *Foundations of Physics*.

makes it eligible to take a closer look at Bohr and his concept of "phenomena", which will eventually lead us to the second of the two key concepts of this paper: intra-action.

#### 4. Bohr's concept of the phenomenon

The Danish physicist Niels Bohr developed a philosophy-physics as a response to the enigmas accentuated by the developments in theoretical physics at the beginning of the 1920s. By then the wave-particle duality was an established quandary for physics not only concerning the nature of light, but also concerning the nature of matter (or even the nature of nature) showing that the nature of the observed phenomenon changes with corresponding changes in the experimental apparatus.

The wave-particle-dualism was solved in two different ways by Bohr and Heisenberg in 1927. Bohr's solution was the principle of complementarity, Heisenberg's was the uncertainty principle. The uncertainty principle is *epistemological* in character, focussing on what knowledge we, under specific circumstances, can have about a particle's properties; a question of being *uncertain* of a value, existing independently of, but rendered impossible to attain accurately due to, the measurement.

Bohr's principle of complementarity, in contrast, is *ontological* in character. To Bohr properties like "momentum" and "position" *have* no observer-independent physical reality, and "'wave' and 'particle' are classical descriptive concepts that refer to different mutually exclusive *phenomena*, not to independent physical objects" (Barad, 2007, 179).

A major point for Bohr, as for Dewey, is that we are ourselves *part* of the reality we are investigating, and that there is no definite and self-evident *cut* between ourselves as investigating subjects and the world as investigated object. According to Bohr the object and the agencies of observation constitute a whole, and he uses the term "phenomena" to denote these, what he calls, "particular instances of wholeness" (Barad, 2007, 119). The interaction between the object and the agencies of observation constitutes, according to Bohr, an inseparable part of the phenomenon, and it is to these phenomena that observations refer, not to "*objects in an independent reality*" (Barad, 2007, 170). This position is very similar to the one expressed by Dewey in "Conduct and Experience":

There is something in the *context* of the experiment which goes beyond the stimuli and responses directly found within it. There is for example, the *problem* which the experimenter has set and his *deliberate*

arrangement of apparatus and selection of conditions with a view to disclosure of facts that bear upon it. Dewey, 1930, 411f

Like Dewey, Bohr does not acknowledge any given distinction between the object and the agencies of observation; each measurement or observation implies a choice of the apparatuses of observation, made for the specific occasion, that provides a constructed cut, separating "the object" from "the agencies of observation". This specific cut is only applicable in a given context, it delimits and is part of a specific phenomenon. Thus, the idea of "externality" and "context-independence" is a chimera.

A property or a measurement value cannot be attributed to an observer-independent object, nor be seen as *created* by the measurement. What empirical properties refer to are *phenomena*, understood as "particular instances of wholeness", where the measurement interaction is part of the phenomenon. Bohr questioned Einstein's view of physical reality as something *separated* from the agencies of observation, and stressed that the agencies of observation "constitute an inherent element of the description of any phenomenon to which the term 'physical reality' can be properly attached" (Barad, 2007, 127, Bohr, 1935, 700).<sup>5</sup>

The Bohr-Einstein debate can be judged as a philosophical dispute concerning the truth of the intrinsic-properties theory; a theory that presupposes a clear-cut separation between the subject and the object of knowledge, that there are properties of an object there, in a fixed state, before and independently of the agencies of observation.

According to Bohr, we cannot speak of the reality of objects *apart* and *separated* from or *preceding* the interactions with the agencies of observation. Bohr renounces the idea of separateness, and holds that each object we observe is given the character it has by the phenomenon in which that object is observed.

Still, to Bohr, a phenomenon is "objective" in its being intersubjectively valid, since there is no explicit reference to any *individual* observer, *not* because it reveals a pre-existent intrinsic property of the object. This *relational-properties* theory holds properties to be *objective* but not absolute, that is, they are things-in-phenomena, not observer-independent things. Everything hinges on the question of separateness or relatedness. Einstein never abandoned his ontology of separateness, an ontology that is

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<sup>5</sup> This is Bohr's solution to the so called EPR-paradox, a challenge raised against Bohr's understanding of quantum mechanics by Einstein, Podolsky and Rosen, who were unwilling to let go of the separatist idea of a one-to-one correspondence between physical theory and pre-existing properties or entities of physical reality.

very difficult to reconcile with quantum physics. The choice of separateness or relatedness seems to be *the* basic ontological divide. The position outlined here is an onto-epistemology of relatedness.<sup>6</sup>

## 5. Barad's concept of intra-action

*Intra-action* is a neologism coined by Barad to underline the mutual constitution of subject and object, that is, that they are only *relationally* distinct and do not exist as ontologically separate individual elements. A suitable starting point for an effort to come to grips with the idea of intra-action is the first passage dealing with the concept in Barad's magnum opus *Meeting the Universe Halfway*:

The neologism 'intra-action' *signifies the mutual constitution of entangled agencies*. That is, in contrast to the usual 'interaction', which assumes that there are separate individual agencies that precede their interaction, the notion of intra-action recognizes that distinct agencies do not precede, but rather emerge through, their intra-action. It is important to note that the 'distinct' agencies are only distinct in a relational, not an absolute, sense, that is, *agencies are only distinct in relation to their mutual entanglement; they don't exist as individual elements*.

Barad, 2007, 33; Barad's emphasis

Of central importance for an understanding of her thinking are the two lines italicized by Barad, both expressing the idea of "the mutual constitution of entangled agencies", that is, that the constituents of the relation do not pre-exist as individual elements; they are distinct, but in a qualified meaning, only in a relational and not in an absolute sense. Or, more to the point, expressing both the relational and the active, agential aspect: they are made to emerge as distinct in the context of a specific phenomenon, through an "agential cut," a term Barad uses as a contrast to what she calls the "Cartesian cut", the latter signifying the idea that there is an inherent pre-existing cut separating subject and object. According to Barad

the agential cut enacts a resolution *within* the phenomenon of the inherent ontological (and semantic) indeterminacy. In other words, re-

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<sup>6</sup> There are, admittedly, different interpretations of quantum mechanics. I side with the relationalist interpretation, since I find it the most plausible (see for example Mermin, 1998 and Rovelli, 1996). Barad gives several examples of how this relationalist understanding has been corroborated by experiments that in Bohr's and Einstein's days had to be restricted to so called *Gedanken*-experiments, but today can be performed in the flesh, as it were (Barad, 2007, 289–317). To my mind the non-relationalist interpretations of quantum mechanics all have their root in the old separatist dogma.

lata do not preexist relations; rather, relata-within-phenomena emerge through specific intra-actions. Crucially, then, intra-actions enact *agential separability*—the condition of *exteriority-within-phenomena*.

Barad, 2007, 140; Barad's emphasis

Replacing the idea of ontological separateness with the idea of agential separability is a key factor of Barad's agential realism, on a par with, and intimately related to the replacement of interaction with intra-action:

The notion of agential separability is of fundamental importance, for in the absence of a classical ontological condition of exteriority between observer and observed, it provides an alternative ontological condition for the possibility of objectivity. ibid.

The view that we cannot have access to an observer-independent reality, means that we must accept that our thinking and knowing lack the kind of solid foundation searched for by philosophers like Plato and Descartes. But, according to Barad, scientific knowledge is no haphazard construction that is independent of what is "out there", since this is not separate from us, and given a specific set of constructed cuts, some descriptive scientific concepts are well defined and can be used to reach reproducible results. But: These results cannot be decontextualized. The possibility of objectivity does not hinge upon the belief in an observer-independent external reality. On the contrary, given that there *is* no observer-independent reality, holding on to the dogma that observer-independency and externality is a necessary prerequisite for objectivity is what threatens to undermine the possibility of objectivity.

## 6. A solution to the problem of objectivity

Barad's solution to the problem of objectivity lies in her view of referentiality that follows from the intra-active perspective, namely that the referent is not an observation-independent object, but a phenomenon; this Barad sees as "*a condition for objective knowledge*" (Barad, 2007, 198). The point, according to Barad, is that "phenomena are constitutive of reality", that is, reality in itself is material-discursive; it is not built by "things-in-themselves or things-behind-phenomena, but of things-in-phenomena". Science does not give us any information about an independent reality; it is the very fact "that scientific knowledge is socially constructed that leads to reliable knowledge and reproducible phenomena" (Barad, 2007, 140).

Barad's intra-active agential realism is a form of constructivism that is not relativist, but *relationalist*. It agrees with relativism in its repudi-

ation of absolutist conceptions of reality, truth, and knowledge, but rejects relativism's typical one-sided over-emphasis of the constitutive role of the human subject. Instead it shares and, through its post-humanist stance, radicalizes Dewey's trans-actional idea of the entanglement of the organism-in-environment-as-a-whole. Barad declares that "humanism is based on ontological and epistemological presuppositions that are challenged by the quantum theory," among these the idea that "the notion of the 'human' is a well-defined concept that refers to an individually determinate entity with inherent properties", prominent among which is her cognitive agency, through which she is held to "make the universe intelligible" (Barad, 2007, 352).

Barad's agential realism provides an alternative to the mainstream metaphysics of separateness, an intra-active relational metaphysics, according to which the ontological primary is not pre-existing ontologically separate things or objects, but agentially produced *phenomena*. A phenomenon is an entanglement of intra-acting 'agencies', marking the ontological non-separateness of observer and observed. Contrary to the pervasive individualism and atomism of mainstream metaphysics, with its obvious-matter-of-fact view of *relata* as prior to relations, the agential realist perspective is that "*phenomena are ontologically primitive relations, relations without pre-existing relata*" (2007, 139). An important consequence of this is that distinction presupposes relation (not vice versa as in the interactive perspective). This distinction-in-intra-active-relation Barad expresses by her understanding of the agential cut as a "cutting together-apart" (Barad, 2012, 7). Thus, Barad does not rule out difference and differentiation, but in her intra-active perspective "differentiating is not about othering or separating but on the contrary about making connections and commitments" (Barad, 2007, 392).<sup>7</sup>

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<sup>7</sup> The relational perspective outlined here differs from the relationalism elaborated by the Indian philosopher Joseph Kaipayil. He maintains the supremacy of "the continuants (things)", and states that *relata* precede relations. This makes his relationalism interactive. According to Kaipayil, "there cannot be process without objects acting" (Kaipayil, 2009, 25). *Prima facie* this seems to be a sound argument, but it all depends on what you *mean* by the terms "objects", "process", and "action". Of course there cannot be process without action, because process *is* action, and action *is* process. But does action or process really require objects understood as entities existing separately before the action, or can the objects be understood as objects-in-phenomena? Kaipayil writes that "relationalism recognizes that events and relations cannot occur without some continuants (entities with some enduring existence and identity) as agents" (*ibid.*), and in his view continuants are *precursors* of events and relations. In the perspective outlined here the existence of objects is not denied, but they are not seen as precursors but as *perspects* of relations (cf. Oliver, 1981), that is, there

Important to notice, however, is that this rejection of ontological separateness does not mean that the binaries nature and culture, epistemology and ontology, etc., are conflated or collapsed. Nature and culture, epistemology and ontology, are still different, but intertwined and mutually co-constitutive, that is, intra-actively entangled. And the means to *make* a difference is the above-mentioned agential cut that “cut things together and apart” (Barad, 2007, 381).

The ontological non-separateness of the object from the phenomenon and the agencies of observation amounts to “a final renunciation of the classical ideal of causality, and a radical revision of our attitude towards the problem of physical reality” (Barad, 2007, 129; Bohr 1963, 59f). The ground for another way of looking at causality and reality lies in Dewey’s, Bohr’s and Barad’s denial of the usual assumption that there are separately existing entities preceding a causal relation, where the one pre-existing entity causes some effect to another pre-existing entity. The concepts of trans-action and intra-action, and the view of the “agencies of observation” as part of the phenomenon, rules out a pre-given subject-object distinction.

## 7. Measurement as actualization through perception

The notion of the agential cut enacting a resolution of an inherent indeterminacy is to be understood as a measurement that actualizes a possible aspect of reality. While Bohr focused on physical-conceptual agencies of observation and laboratory-style apparatuses, Barad uses the concept of agencies of observation and apparatuses more *generally*, to denote “open-ended and dynamic material-discursive practices through which specific ‘concepts’ and ‘things’ are articulated” (Barad, 2007, 334). This makes the concept of “measurement” in Barad’s agential realism applicable also outside the scientific laboratory - as Joseph Rouse has remarked: “Any causal intra-action is implicitly a measurement in Barad’s sense” (Rouse, 2004, 158, n8). This means that Barad’s theorizing about relations, relata, and phenomena has relevance also for extra-scientific intra-activity, and I suggest that all perceptions can be considered as measurements in this broad sense. The agential cut enacting a resolution of an inherent indeterminacy is to be understood as a measurement that actualizes a possible aspect of reality.

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are no enduring entities existing before and independently of the relational whole in which they partake.

The measurement (the perception) does not *create* the "object"; it is not the human subject that measures the world into existence. Heidegger's remark that "the actuality of what is perceptible as such does not lie in enactment of perception" points to the importance to discriminate between the actuality of perceptibility and the actualization through perception (Heidegger, 1995, 172). Through our perceptions/measurements we (and other forms of existence) actualize some of the World's possibilities. A measurement does not measure something non-existent into existence; it actualizes one of the existing possibilities of the perceptible.

To Barad, phenomena are "neither individual entities, nor mental impressions, but entangled material practices" (Barad, 2007, 55f), a position that comes close to Dewey's understanding of the object (referred to above) as an "unfractured observation", which is neither existing separately apart from any observation, nor existing only in our head "in presumed independence of what is observed" (Dewey, 1949, 131).

## 8. Getting the referent right

Barad means that the concept of phenomena makes it possible to "get the referent right"; the objective referent being the *phenomenon* (in the sense here explained), and not a pre-existing object. The relationality that the wave-particle-dualism bears witness to, does not concern a particular aspect or property of nature, but, in Barad's words: "the very nature of nature". It is a question of ontology:

nature's lack of a fixed essence is essential to what it is. That is [...] nature is an intra-active becoming (where 'intra-action' is not the classical comforting concept of 'interaction' but rather entails the very disruption of the metaphysics of individualism that holds that there are discrete objects with inherent characteristics).

Barad 2007, 422, n15

In a relational understanding of the concept of "phenomena", phenomena are ontologically primitive relations without pre-existing relata, thus the relata are not prior to the relation, they emerge through it, and they are *in* and simultaneous *with* the phenomena.

## 9. A viable alternative to combat absolutism

While Margolis stresses the need for an integration of ontic and epistemic internalism with an ontic externalism, according to which there is

some independent reality, this idea of independency (mind-independency and/or context-independency) has no place in a relationalist perspective. As stated by Bohr in his above mentioned answer to the challenge posed by Einstein, Podolsky and Rosen, there *are* no independent or separate pre-existing properties "out there", before or independently of its being intra-actively articulated in and through a phenomenon, of which the agencies of observation are an inseparable part. And it is only to phenomena thus engendered that "the term 'physical reality' can be properly attached" (Barad, 2007, 127; Bohr 1935, 700).

In my view Margolis' internal relativism is an interesting effort to reconcile realism and relativism, however, it is ultimately flawed by holding on to the dichotomy that Putnam once declared as "utterly indefensible", the one "between what the world is like independent of any local perspective and what is projected by us" (Putnam, 1990, 170). As I have tried to show above, Barad's stance is not tantamount to a relativist anti-realism. Her relational agential realism represents a viable alternative to combat absolutism without giving up the possibility of objectivity. It offers a relationalism that not so much reconciles as provides resources to transcend the realism-relativism-debate by renouncing the ideas of separateness and context-independency, using intra-action as its key concept.

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