Relativism vs Quantum Relationalism – Using Bohr's Concept of 'Phenomena' for a Relationalist Understanding of Reality

> *One could take an example of a substance (let us say a drop of blood on a finger), place it under the microscope and discern the snowflake of haemoglobin with the iron atom in the middle and the lace of oxygen and hydrogen around it, but the observation itself would create the structure, and only locally; not one single drop of all cubic kilometres of blood in all living creatures would have this appearance.*
>
> Mircea Cartarescu[1]

Acknowledging the relation

In the above quotation, Romanian fiction writer Mircea Cartarescu beautifully expresses the view that what we see is not something external and pre-existing, but something relational. A similar view is propounded by the physicist Karen Barad. In the introduction to her essay "Meeting the Universe Halfway: Realism and Social Constructivism Without Contradiction", Barad describes how she had the opportunity to see individual carbon atoms in a sample of graphite through a scanning tunneling microscope, hexagonally structured exactly as theory predicts. But, still, she is unrepentant in her view that scientific knowledge is constructed, stating that the "fact that scientific knowledge is socially constructed does not imply that it doesn't 'work', and the fact that science 'works' does not mean that we have discovered human-independent facts about nature"[2].

Barad repeats the same tale in a later text[3] where she avoids the adjective "social" as a qualifier of constructivism. In a note she explains that she choose the subtitle for the earlier article in an effort to "destabilize the realism-versus-constructivism debate", mainly because of "the futility of a debate centred on terms that are indeterminate"[4].

[1] The quote is from Mircea Cartarescu, *Orbitor. Aripa stinga* (1996), in my own translation of the Swedish translation of the Romanian original, *Orbitór. Vänster vinge,* Uddevalla 2008, p 91.
[2] Barad 1996:162.
[3] Barad 2007:39f.
[4] Ibid:408n1.

Relativism – an indeterminate term given a minimal definition

The above mentioned indeterminacy of the terms "realism" and "constructivism" also applies to the term "relativism"[5]. Both relativists themselves and their opponents use the term with different meanings. Generally relativists stress historicity, change and the unavoidability of a perspective, while their critics use descriptions like nihilism and "anything-goes".

As a minimal definition I will suggest that relativism is the repudiation of absolutist conceptions of reality, truth, and knowledge. In her book *Relativism*, Maria Baghramian thinks that "the cost of countering absolutism by relativis[m] […] is too high", and claims that relativism leads to "either intellectual or moral paralysis" or "parochialism and ethnocentrism"[6]. Baghramian's way out is what she calls "a conceptual pluralism", holding that "in many domains and situations there can be more than one correct *context-independent* evaluation and description"[7].

Instead of building a case against Baghramian's criticism of relativism, a futile enterprise due to the above mentioned indeterminacy of the term, I will venture a different route, trying to present a relationalist understanding of reality, based on the Danish physicist Niels Bohr's concept of *phenomena*. This understanding shares relativism's repudiation of absolutism, but from a relationalist standpoint, that questions not only the possibility of an absolute observer-independent truth, but also the idea of separateness by and large, including Baghramian's idea of context-independency. The relationalism presented also affects relativist positions that are founded on the idea of separateness.

[5] See for example Margolis 1986, Haack 1996, and Baghramian 2004.
[6] Baghramian 2004:304.
[7] Ibid:9.

Quantum relationalism I – Bohr´s concept of 'phenomena'

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 – 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, discussing 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, has ontological implications, questioning the physical reality of such attributes of the object as momentum and position.

To Bohr the properties '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"[8].

A major point for Bohr was 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". 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*"[9].

According to Bohr there is no 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, Baghramian's idea of "context-independence" is a chimera.

[8] Barad 2007:179 (italics in the original).
[9] Ibid:170 (italics in the original).

A property (or a measurement value) cannot be attributed to an observer-independent object. Neither is it possible to see the property as *created* by the measurement (which would fly in the face of any sensible meaning of the word "measurement"). What empirical properties refer to are *phenomena*, that is, in the Bohrian meaning of "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"[10].

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. But if this is the case, how are we then to interpret the wave-particle-dualism?

In his book on Bohr's philosophy of physics, Dugald Murdoch shows that the intrinsic properties theory is compatible with a *synchronic* interpretation of this dualism, according to which microphysical objects have at *all* times both sorts of characteristics. However, according to a rival interpretation of the wave-particle-dualism, the *diachronic*, particle and wave characteristics are *manifested* in different situations, at different times.

The diachronic form of the dualistic interpretation is an *ontic* (as far as I can see Bohrian) interpretation of wave-particle complementarity. According to Murdoch "[i]t has little to recommend it"[11], but the only argument for this dismissal that he produces is that it "creates the further problem of explaining the sudden transformations of characteristics". But if the characteristic *x* only *exists* at the time *T1* when it is manifested as a particular instance of wholeness, then there is nothing context-independent and fixed *there* to be "transformed" for the characteristic *y* to be manifested at the time *T2*, as *another* particular instance of wholeness. Murdoch's objection presupposes the intrinsic-properties view, which is renounced by the diachronic interpretation. Another way of putting it is that Murdoch's objection presupposes an ontology of separateness, which is questioned by Bohr's relationalist outlook.

[10] Ibid:127.
[11] Murdoch 1987:246.

A similar misconstrual of Bohr's position from a perspective alien to his thinking is produced by Henry J. Folse, who claims that "Bohr's view that different phenomena provide complementary evidence about the same object makes sense only if that object is distinguished from the phenomenal object"[12]. Bohr does *not* speak of the reality of objects apart and separated from or preceding the interactions with the agencies of observation. Here Folse fails to see Bohr's relationalist approach, although he has some pages earlier written correctly on Bohr's view on entanglement and "the denial of separability": "Each object we observe is given the character it has by the phenomenon in which that object is observed. We cannot speak of choosing to make one or the other of two different observations on the 'same' object […] Thus the description of these phenomena as different observations of the different properties of a particular object in effect refer to different objects"[13]. This amounts to the position that there *are* no other objects than the phenomenal objects, and that the intrinsic properties theory fails.

To Bohr a phenomenon is "objective" in its being intersubjectively valid, and since there is no explicit reference to any individual observer, *not* because it reveals a pre-existent property of the object. As an alternative to the intrinsic properties theory, Murdoch mentions the relational-properties theory, and describes this as a "very plausible construal of Bohr's position". The relational-properties theory holds observable 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 very difficult to reconcile with quantum physics. The choice of separateness or relatedness seems to be *the* basic ontological divide. The position outlined in this paper is an onto-epistemology of relatedness.

[12] Folse 1989:271n10.
[13] Ibid:266.

Quantum relationalism II – Barad's elaboration of Bohr's concept of 'phenomena'

According to Karen Barad, American feminist and physicist, Bohr is more specific on epistemological than on ontological questions. She therefore presents her position as an elaboration of Bohr's, although she holds it to be consistent with Bohr's opinions on the matter. Her "agential realism" ties together epistemological and ontological questions, and she uses the term *ontoepistemology*. She also writes that what we need is an "*ethico-onto-epistem-ology*", that does justice to "the entanglement of ethics, knowing, and being"[14]. Thus *agential realism* stresses the necessity of an "ethics of knowing", that reality is not independent of our exploration of it – neither epistemologically nor ontologically or ethically. In this paper, however, I have to restrict my attention to the ontological and epistemological aspects.

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"[15]. These material-discursive practices themselves are phenomena, as well as people and animals etc.

To Barad, phenomena are "neither individual entities, nor mental impressions, but entangled material practices"[16]. She means that the concept of phenomena makes it possible to "get the referent right"; the objective referent being the *phenomena*, and not an object. Barad makes clear that she uses the concept of 'phenomena' in another sense than phenomenologists do, for "what we take to be real", and not for "the way things-in-themselves *appear*"[17].To separate herself from Kant, she points out that it is meaningless to talk about independently existing things as in some way behind or causing phenomena. The phenomenon constitutes the smallest ontological entity in her system, and in a note she writes that "[in] a sense there are no noumena, only phenomena"[18].

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:

[14] Barad 2007:185.
[15] Ibid: 334.
[16] Ibid:55f.
[17] Ibid:412n30.
[18] Ibid:429, n 18.

> 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).[19]

The view that we cannot have access to an observer-independent reality, means that we must accept that our thinking lacks a solid foundation. But, according Barad, scientific knowledge is no haphazard construction that is independent of what is 'out there', since this is not separated 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 reality. On the contrary, given that there *is* no observer-independent reality, holding on to this *belief* is what threatens to undermine this possibility.

Barad's solution to the problem of objectivity lies in her view of referentiality that she sees as an integrated part of Bohr's epistemology, namely that the referent is not an observation-independent object, but a phenomenon"; this Barad sees as "*a condition for objective knowledge*"[20].

The point, according to Barad, is that "phenomena constitutes reality". That is, reality in itself is material-cultural; it is not "built by things-in-themselves or things-behind-phenomena, but of things-in-phenomena"[21]. And it is the fact "that scientific knowledge is socially constructed that leads to reliable knowledge and reproducible phenomena"[22]. Science gives us no information about an independent reality.

Agential realism is a form of constructivism that is not relativist, but *relationalist*, that is, building on the idea of an intra-active interdependence between man and reality, that makes both parties contribute to the "construction" of the other[23]. It is *not* relativist in the sense that "anything goes", but it *is* relativist according to the minimal definition given above, in that it repudiates absolutist conceptions of reality, truth, and knowledge. But instead of calling the position *relativist*, with the problems of the indeterminacy of this term, and instead of label it as a version of *realism* (as Barad chooses to do), a term with the same problem of indeterminacy as relativism, I label it *relationalist*.

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[19] Ibid:422, n15.
[20] Barad 20:198.
[21] Ibid.
[22] Barad 1996:186.
[23] Barad stresses the importance of a posthumanist stance, and expands the concept of agency to other than humans. For the sake of brevity I leave out this aspect here.

A relationalist understanding of reality

In a relationalist perspective, there is no observer-independent reality, but there is, in a qualified meaning, something "out there", offering resistance, kicking back. How are we to understand this "something"? One way of answering the question is by saying that the "something", "out there", in each and every moment, is the latest phenomenal articulation of the world. However, the words "something" and "out there" are misleading; the world is not a "something", but a continuous relational intra-active process, and neither is it something "out there", separated from us; we are part of the world and the world are part of us.

The stubborn question about how the phenomena are related to the "real" world behind or beyond the apparent is posed from a rivalling basic ontological outlook. According to a relationalist ontology there simply *is* no such "real" reality, as separated from the phenomenal.

Distinct agencies emerge through the ongoing intra-action, but they are only relationally distinct – the relation is a mutual ontological interdependence of relata. One could say that given the procedures *p* and the equipment *e*, *x* emerges as an iron atom with a certain structure. But *x* is not a pre-existing noumen of which the so structured iron atom is the phenomenon. Therefore it is more correct to say: given *p+e*, the structure of the iron atom emerges, is materialized or manifested, that is, through the arrangement *p+e*, the world articulate itself as *x*, not a certain *noumenon* appears as a *phenomenon*. There is no solid pre-existing *x* there to appear *as* something, rather the phenomenon is *the-emergence-of-x*, with the agencies of observation as part of the phenomenon.

Take the haemoglobin with the iron atom and its lace of oxygen and hydrogen, in the introductory quote from Cartarescu: what is possible to see in the microscope is not simply *there* as it is seen through the microscope before and independently of its *being seen* through the microscope. The observer, the microscope and the procedures and know-how that is needed to see the structure of the haemoglobin, are among the elements that constitute the agencies of observation, and these, according to relationalism, are part of the phenomenon. Thus, a phenomenon is, in Bohr's words, "a particular instance of wholeness". In and through the phenomenon the particular (in this case the specific structure of the haemoglobin) emerges. This structure is a relatum, and "relata do not pre-

exist relations; rather, relata-within-phenomena emerge through specific intra-actions"[24]. *Intra-action* is a neologism coined by Barad to underline the mutual constitution of subject and object, that is, that they only are relationally distinct and do not exist as separate individual elements.

Cartarescu writes that it is the observation that creates the structure, and if we emphasize *creates* it is important also to emphasize *structure*. The *specific structure* that emerges through the specific observation is not there before and independently of the observation. In a similar way Barad insists that scientific knowledge is constructed, and that the hexagonal structure of carbon atoms in a sample of graphite, as seen through a scanning tunnelling microscope, is no human-independent fact. How then are we to understand the relation between the emergent structure and the process through which it emerges? Without the agencies of observation there would be no structure there. But is there a *causal* connection between the observation and the phenomenon? And if so, what kind of causality could this be, if the agencies of observation itself is part of the phenomenon?

In Bohr's view the inseparability of the object from the phenomena 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"[25].

The ground for another way of looking at causality is that Bohr and Barad deny 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. Bohr's concept of the "agencies of observation" as part of the phenomenon rules out a clear cut subject-object distinction.

Phenomena, like the haemoglobin's iron atom with its lace of oxygen and hydrogen, or the graphite sample's hexagonally structured carbon atoms, are produced through specific causal intra-actions.

In a relational understanding of the concept of 'phenomena', phenomena are ontologically primitive relations – 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.

This relationalism comes close to Joseph Margolis' "internal relativism", as presented in his *Pragmatism Without Foundations* (with the subtitle *Reconciling Realism and*

[24] Barad 2007:334.
[25] Ibid:129, and Bohr 1963.

Relativism). But while Margolis stresses the need for an integration of ontic and epistemic internalism with an ontic externalism, according to which there is some mind-independent reality, this idea of independency – mind-independency and/or context-independency – has no place in the relationalist position I have been trying to outline in this paper. There is no independent or separate "something", "out there", because there is nothing "there" as a determinate "something", before or independently of its being articulated in and through a phenomenon, of which the agencies of observation are an inseparable part. In my view Margolis' internal relativism (like Putnam's internal realism) is an interesting effort to reconcile realism and relativism. But a viable alternative to combat absolutism without giving up the possibility of objectivity is a relationalism that not so much reconciles as transcends the realism-relativism-debate, by renouncing the ideas of separateness and context-independency, using 'phenomena' as described in this paper as a key concept.

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