**Unbelievable similarities between R. E. Kastner’s ideas (Univ. of Maryland, USA) (2016) and my ideas (2002-2008)[[1]](#footnote-1)**

The title of Katner’s article is “Beyond Complementarity” (R. E. Kastner 6 March 2016 Foundations of Physics Group, University of Maryland, College Park, USA)

In this paper, there are quite many ideas similar to my ideas. The main ideas are the following:

* Bohr’s complementarity does not work: “’Complementarity’ cannot consistently account for the emergence of classicality from the quantum level (p. 1)
* It is argued that ultimately this problem arises from Bohr’s implicit assumption that all quantum evolution is unitary; i.e., that there is no real, physical non-unitary collapse. (p. 1)

In my works 2002-2008 and later (2010-2106), I argued exactly the same ideas. The non-unitary phenomena in quantum and in the relationship between quantum and classical phenomena means exactly the EDWs!

Our world of experience is clearly classical in that we can legitimately consider our lab and macroscopic measuring instruments as inhabiting a well-defined inertial frame. *But these are the very phenomena that cry out for explanation in view of that fact that the microscopic quantum objects upon which we experiment, according to the theory describing them, do not inhabit well-defined reference frames. (pp. 3-4)*

“Our world of experience” means exactly the macro-EW vs. the micro-EW. However, we have to pay attention that “quantum world” means the micro-EW (for particles) and the wave-EW.

In section 4, Kastner investigates the “unnecessary” Bohr’s “epistemological and methodological assumptions”. If the reader will read the entire section will have the sensation of reading one of my works! In 2007, and 2008, I analyzed exactly the same notions with almost the same verdict!

Firstly, while Bohr’s insistence on the “necessity... of taking the whole experimental arrangement into consideration” is well known, and is often taken as a benign statement of ‘quantum wholeness,’ it is actually a very

strong (and, I will argue, unnecessary) prohibition on taking any degree of freedom as physically specifiable independently of macroscopic phenomena. (p. 7)

This paragraph, which is against the “quantum wholeness”, indicates exactly the EDWs!

Overall, Bohr’s quoted statement assumes that unambiguous physics only obtains in the context of a ‘measurement,’ where that term is considered to be definable only in terms of a macroscopic experimental arrangement leading to an ‘observation’ or ‘phenomenon’. This use of the term ‘measurement’ is a conflation, ongoing in much of the literature, of two distinct ideas: (i) the intervention of an observer whose intent is to gain determinate knowledge about something under study; and (ii) the existence of a fact of the matter – or determinate a value of some property – whether or not anyone has intent to discover it (or whether or not it results from a macroscopic ‘phenomenon’). The preceding two different notions of the determinacy obtaining in measurement (but not necessarily confined to a knowledge-gathering measuring operation) can be labeled as (i) epistemic and (ii) ontological, respectively. Bohr’s pronouncement of course denies (ii) by asserting that it is only through an in-principle macroscopic ‘phenomenon’ that any physical quantity is well-defined, and that the quantum formalism is not even interpretable outside that condition. But this denial can and will be questioned. (pp. 7-8)

Again, it seems as if this paragraph was written under the EDWs perspective! Few words later:

Yet clearly Bohr needs D’s uncertainty to be epistemic rather than ontic in nature to avoid a Schrodinger’s Cat situation; while on the other hand, since he views any attributes of a quantum system such as S in need of (at least) irreversible amplification [10] in order to be considered determinate, the uncertainty pertaining to S cannot be considered epistemic. However, the theoretical description provides no justification for attributing different sorts of uncertainties to S and D. (p. 8)

We are already within the EDWs perspective! (The reader has to remember that, in my previous works, I denied the distinction between ontology and epistemology…) Next Kastner’ sentence:

Ultimately, Bohr’s response to this conundrum is to deny reality to quantum objects, and to assert by fiat that at some point in the (assumed as linear) evolution, a determinate world of experience occurs and classical ‘reality’ begins – since we routinely see objects like D with determinate position and momentum. This is not an explanation of classical emergence, but rather an equivocation concerning the application of quantum theory. A crude analogy is that the unitary quantum evolution is like a car engine engaged via the clutch with the gear shaft (which carries the entanglement of the relevant degrees of freedom); but at the point in which we find ourselves empirically describing objects that are classically determinate (or, in which the dimensions of the experiment are much larger than Planck’s constant), we disengage the clutch. This is an *ad hoc* move; there is no consistent theoretical account for suspension of the unitary evolution. (p. 8)

From a long time, the reader has been already within a paradigm very similar to my EDWs paradigm! Do you want more details that are UNBELIEVABLE similar to my ideas? Exactly next sentence, Kastner rejects the pragmatism![[2]](#footnote-2) At page 10, Kastner quotes Stachel’s work who claims that “Bohr’s later approach places primary emphasis on four-dimensional processes; from this point of view, a ‘state’ is just a particular spatial cross-section of a process, of secondary importance: all such cross-sections are equally valid, and any such sequence of states merely represents a different ‘perspective’ on the same process.” ([12], p. 1, preprint version.)” (Kastner 2016, p. 10) I have not read Stachel’s article but it seems that he has very similar ideas to my ideas! Next sentence:

It should however be noted that such an approach – dissolving the measurement problem by noting that some outcome always in fact obtains at the phenomenal, classical, spacetime level – amounts to an epistemic interpretation of the quantum state. That is, the quantum state and its unitary evolution are taken as describing only our limited perspective on a process that is assumed to be complete as an element of a classically determinate block world. In this approach, the classical world of phenomenal experience does not emerge from the quantum level. It is taken as ontologically given and primary, with quantum theory relegated to a partial and perspectival description of that classical reality.4 (Kastner 2016, p. 10)

Again, it is very clear that we are in a paradigm very closed to the EDWs perspective! Later, Kastner investigates the problematic Bohr’s relationship between a microparticle and a wave.

In an epistemic approach to the quantum state, Bohr could finesse the inconsistencies described above by saying that we can suspend unitary evolution when it is no longer useful because we now have access to information that we lacked previously. Thus, neither the quantum state nor its unitary evolution ever directly described objects that physically existed. All that exists is the phenomenal, classical level of experience. But again, this leads Bohr to his ultimately antirealist view of quantum entities; i.e., to his utterance that “There is no quantum world. There is only an abstract quantum mechanical description.” If there is no quantum world, then we need not give any account of classical emergence from such a world, since all that exists is the classical world of experience. (p. 13)

Again, this investigation seems to be realized within the EDWs perspective!!! I drew exactly the same conclusion within my EDWs in 2006, 2007, 2008 and later!

In section 4, the first paragraph:

The above-discussed apparent discrepancy between theory and observation, to which Bohr’s Complementarity and its attendant antirealism about quantum objects is sometimes taken as a perplexing but inescapable response, is not a necessary one. The problem arises from demanding that all interactions between physical degrees of freedom are unitary ones. This is the key assumption that leads to the measurement problem and the “shifty split” between the quantum and classical realms, expressed in the *ad hoc* suspension of the unitary evolution and quantum-entangled state when it obviously no longer correctly describes the situation at hand. If nature in fact involves real non-unitary processes of a well-defined sort – including the circumstances that give rise to them – then the chain of unitary correlations is broken, and real physical collapse occurs, resulting in determinacy. Thus, the present author suggests that what Bohr needs to avoid the dilemma of theoretical inconsistency on the one hand, and antirealism about quanta on the other, is genuine, non-unitary physical collapse. (p. 14)

I am sure the reader who had written some of my works will had the feeling that this paragraph was from one of my works!!! “If nature in fact involves real non-unitary processes of a well-defined sort – including the circumstances that give rise to them – then the chain of unitary correlations is broken, and real physical collapse occurs, resulting in determinacy.” “Nature”? that is the EDWs, of course…

Other paragraphs that seems to be written under the EDWs perspective:

However, despite this apparent initial openness to allowing physical existence to non-classical, unobservable entities, Bohr steadily evolved toward a form of antirealism that denied reality to objects not in-principle capable of a classical description, i.e. “which cannot be visualized in the ordinary sense”, as his above-quoted assertions clearly demonstrate. (p. 15)

Thus, there is a real physical, nonunitary collapse in this model. There is also a clear physical referent for the “photon” concept independently of whether any macroscopic, observable “phenomenon” (involving an observer) results from it. (p. 16)

It is the fact that the coherent state is an eigenstate of the field destruction operator that allows it to function in this way; the repeated absorption of photon(s) from the field does not change the field state, which is what allows a detectable classical field to be sustained. So the photon as a physical entity remains quite meaningful – even crucial – in the quantum coherent state. (pp. 16-17)

Since a macroscopic object is a nexus of frequent and persistent transactions giving rise to well-defined spacetime intervals, macroscopic objects can be described by simultaneous spacetime (x, t) and dynamical (E, P) descriptions,

and as such are clearly distinguished from quantum systems described by quantum states, which are elements of an underlying substratum. Thus we have classical phenomena in PTI as well; they are simply a naturally emergent result rather than a necessary starting point in interpreting the theory. (p. 17)

Concerning the matter of contextuality: Bohr was of course correct that one cannot simultaneously define incompatible quantities when dealing with quantum systems. In terms of PTI, that is because determinate physical quantities only obtain as a result of actualized transactions. The latter occur by way of specific interactions between an OW and its responding CW. Confirmations define the basis for the measurement, by setting up the applicable mixed state (for example, two weighted projectors corresponding to each of two detectors in an interferometer experiment). Only the projectors in that mixed state are eligible for spacetime existence (i.e. as transfers of detectable energy, momentum, etc.); so quantities corresponding to noncommuting observables are simply not in play at that point. The CW thus constitute the physically well-defined “contextuality” that Bohr felt forced to define only with appeal to final, external observations – “phenomena”.

To emphasize the fact that such contextuality has nothing to do with macroscopic “phenomena,” an example of a well-defined physical quantity under PTI is the energy/momentum of a photon emitted from an excited

state atom and absorbed by a ground state atom, regardless of whether that single photon is ever amplified to the level at which it could in principle be perceived by a scientist in a laboratory. All the objects involved are quantum

systems, all described by quantum mechanics, and Planck’s constant plays a crucial role in the interaction. Yet there is an unambiguous interpretation of the quantum formalism, applying to the degrees of freedom described by the formalism. No appeal to “the entire experimental arrangement” or necessarily observable “phenomenon” is required for this interpretation. The context consists of any forces acting on the photon offer wave (i.e., the applicable Hamiltonian) and the set of advanced absorber responses to the photon offer (the latter being described by the usual forward-propagating quantum state). The context is entirely physical. The transactional process, which heralds the advent of classicality (because it confers determinate properties on the degrees of freedom involved) occurs at a microscopic level, independently of whether any particular scientist is able to identify any macroscopic phenomenon arising from it. (p. 18)

In conclusion Kastner writes:

Complementary cannot help us to explain measurement or the nature of physical reality in a consistent fashion unless we can explain why the quantum formalism applies correctly to quantum degrees of freedom (such as the “quantum particle” S in Bohr’s thought experiments with S and D) but not to macroscopic objects; that is, why the ontic uncertainty of quantum objects does not “infect” macroscopic objects such as Bohr’s diaphragm D, and why we can view the latter’s uncertainty as being epistemic. If we include absorber response, we have a way forward to make this distinction in physical terms. Bohr was unable to do this through Complementarity alone, and he lapsed into instrumentalist and anti-realist utterances as a result. (pp. 18-19)

Similarly, it is reasonable to take the success of quantum theory as evidence for the existence of additional structure in nature that gives rise to the kinds of phenomena predicted by the theory, even if it is difficult (or even impossible) to visualize this structure “in the ordinary (classical) way ” (p. 19)

Finally, the proposed PTI picture of an intrinsically unobservable, prespacetime quantum substratum giving rise to an empirical, classically determinate realm of experience may seem startling, even farfetched. But it does provide a clear physical referent for the quantum formalism (at least in a structural sense, [33, 34]), and a well-defined basis for the emergence of classical determinacy – describable by classical physics – from that formalism. In that regard, I have noted elsewhere ( [21], Chapter 7) that the PTI ontology provides a natural correspondence for Kantian “noumenon” as describing the quantum level and “phenomenon” as describing the classical level. (p. 20)

Is it VERY, very clear the UNBELIEVABLE similarities between Kastner’s ideas (2016) and my ideas (2002, 2003, 2005, 2006, 2007, 2008, until 2016)?[[3]](#footnote-3)

1. I wrote this chapter in August 2017. [↑](#footnote-ref-1)
2. At page 10, Kastner quotes Stachel’s work who claims that “Bohr’s later approach places primary emphasis on four-dimensional processes; from this point of view, a ‘state’ is just a particular spatial cross-section of a process, of secondary importance: all such cross-sections are equally valid, and any such sequence of states merely represents a different ‘perspective’ on the same process.” ([12], p. 1, preprint version.)” (Kastner 2016, p. 10) I have not read Stachel’s article but it seems that he has very similar ideas to my ideas! [↑](#footnote-ref-2)
3. Reading this paper, I realized that there would be other authors who published, after 2014, very similar ideas to my idea! [↑](#footnote-ref-3)