

At Home in a Super-Copernican Cosmos, Part II: The Nature of the Observer and Wheeler's 'It from Bit'

Stefano Furlan¹ and Daniele Puleio²

¹Universiteit Utrecht, Utrecht & Max-Planck-Institut für Wissenschaftsgeschichte, Berlin, s.furlan@uu.nl.

²Liceo "Giuseppe Parini", Venice & Pontificia Università Lateranense, Rome, daniele.puleio@gmail.com.

Abstract: After his controversial speech in honor of Copernicus in 1973, John Wheeler's new ideas about the observer-participator and our place in the cosmos underwent more than a single metamorphosis. During the 1980s, they would flow into the grand (and admittedly sketchy) vision labeled by the famous slogan "it from bit". In this contribution, we will document how, in the late 1970s, Wheeler's views about the role of consciousness and of the observer in quantum physics became more and more de-anthropomorphised, but also how, at the same time, did not result in a demotion of mankind to a marginal accident in the universe.

Keywords: Cosmology, Geometrodynamics, Quantum Mechanics, Super-Copernican Principle

We had the experience but missed the meaning, And
approach to the meaning restores the experience In
a different form

T.S. Eliot, *Four Quartets*, *The Dry Salvages*

1. Introduction

In a previous contribution ([Furlan & Puleio, 2024](#)), we outlined the genesis of John Wheeler's idea of "participatory universe" in the early 1970s and explained the meaning of the later enigmatic expression "super-Copernican", which refers to the effect that, according to Wheeler, the community of observers across spacetime is supposed to have on cosmogony itself. As detailed in the aforementioned paper, the adjective "super-Copernican" is meant to imply that, as Copernicus freed us from "here-centredness", now it is time to get rid of "now-centredness". After all, Wheeler had come to believe, as a result of two decades of work in general relativity (or "geometrodynamics") and its implications, that time could not be a fundamental concept and that a deeper "wiring up" of what we commonly refer to as past and future, no matter how remote, was at play in the genesis of the universe itself. A central role was ascribed to the loop involving the cosmos and the observer (the observer-participator, as Wheeler put it), which are responsible, in a time paradox, for each other's existence. This, of course problematic, proposal is also to be associated with a fundamental change in Wheeler's attitude toward natural inquiry, as symbolised in his own words by Leibniz ([Furlan, 2020](#)): no longer would he naively think of uncovering the fundamental elements of the universe out there, but he would take into account the role of the observer in any physical experience we put at the basis of our knowledge. We then hinted at a change in Wheeler's views, which somehow made such claims less extreme and emphasised instead the polycentrism of a community of observers-participators across space and time. If, at this point, we focus on the late 1970s and the 1980s, we can notice a series of subtle shifts in Wheeler's ideas, which however seem to be characterised by a double tendency. On the one hand, when the "observer" is placed within the context of quantum foundations, Wheeler was clearly leaving behind a form of Wigner-like consciencialism (as well

as anthropomorphism) that had some influence on him in the early 1970s. On the other hand, however, consciousness and mankind were not demoted or downgraded to a marginal accident in the economy of the universe, but remained a crucial link in what Wheeler now called “the meaning circuit”. In this contribution, we will better contextualize and clarify these tensions and, at the same time, we will get further insights on the slogan that would summarize Wheeler’s late vision: “it from bit”.

2. “Solipsism, no; communication, yes”: toward the super-Copernican community

In the very same speech in which Wheeler began to speak about the new “Copernican” revolution, he also evoked “the Merlin principle” (Wheeler, 1974, p. 690), namely the quantum principle. The phrasing is, needless to say, odd and idiosyncratic, but even the expression “quantum principle” is no less tricky than Merlin. Wheeler’s *quête du Graal*, at that point, aimed at identifying and understanding a core idea of quantum physics, somehow laying at a deeper level than all quantum formulations and interpretations¹, and accounting for them. It was, in other words, a comparative analysis, seemingly (and *de facto*) rather ecumenic, but mainly aimed, heuristically, at going beyond each one of these forms of the quantum principle, as elusive as Merlin the magician and shapeshifter. From that moment on, “How come the quantum?” (Wheeler, 1986) would become Wheeler’s refrain till the end of his days. It was an approach, or better an attitude, quite resonant with American pragmatism:² Wheeler’s chase of Merlin was after new insights on how the central notions of quantum physics work, rather than an elucidation of the ontology implied in its various versions³. This attitude helps explain Wheeler’s changing positions about the nature of the observer, too. As a matter of fact, already a few years after the Copernicus speech, the results of this comparative work were starting to show: Wheeler’s Varenna lectures in summer 1977 (Wheeler, 1978) represent a crucial document to understand the development of his reflections. What particularly concerns us here is the section that Wheeler dedicates to his friend Wigner’s ideas about the role of consciousness in the process of quantum measurement (Wheeler, 1978, p. 19, *passim*), how he compares them to other views, notably Niels Bohr’s (pp. 18-19, *passim*), and how he also wonders about the role that computers or similar devices could possibly have in replacing the conscious observer (pp. 20-21). Wheeler is now clearly stating that the core of “the quantum” has not to do with consciousness: a rather neat shift from his previous conflation of anthropic considerations, the “mystery” of consciousness, and the role of the observer in quantum mechanics and even in cosmogony. A couple of years later, in 1979, after finding himself, due to a misunderstanding, in the midst of a parapsychology conference, Wheeler would reiterate his position much more assertively: “Not Consciousness but the Distinction between the Probe and the Probed as Central to the Elemental Quantum Act of Observation” (Wheeler, 1981).

Although Wheeler was clearly deflating his previous (tentative) assumptions, or more specifically de-anthropomorphizing and de-conscientializing them, his *suite du Merlin* would be no less imaginative in its phrasing or metaphors than his former phase. His “upgraded” monadology (Furlan 2020; Wheeler, 1982) can be seen as a step in the same direction: even in Leibniz, after all, monads are not characterised by an anthropomorphic kind of consciousness. Wheeler’s new *mantra*, after the Varenna lectures, became Bohr’s “no elementary phenomenon is a phenomenon until it is an observed phenomenon” (Wheeler, 1978, p. 17): anything that could work as a centre of registration *lato sensu* (“monads”, even when referred to Leibniz’s thought, are often characterised somehow as centres of representation) is enough.

¹ Wheeler did not make such a distinction, putting on equal footing the Heisenberg picture, the Schrödinger picture, von Neumann and Birkhoff’s attempt at formulating a quantum logic, Everett interpretation, and so on.

² Some other work will be dedicated, in the not-too-distant future, to Wheeler’s references to Peirce, James, and other pragmatist thinkers.

³ Only later - eschatologically, so to speak -, once we are able to answer “How come the quantum?”, will we also know “how come existence”, in its more radical form of “Why something instead of nothing?” – and why *this* something (Wheeler, 1986).

The process of quantum measurement seems thus a natural phenomenon among others, *sic et simpliciter*.⁴ Was Wheeler, then, going back to a naturalistic outlook, forgetting about the loop in which the mind of the “observer” was involved? Why, then, persisting in emphasizing the importance of our role in the cosmos? And does there not seem to be a tension, at the very least, between a picture of the universe as a computer, impersonally processing information (as the common way of thinking about “it from bit” would suggest), and a worldview in which we are “at home in the universe” (Wheeler, 1994)? It would be ironic if someone like Wheeler, who had made the act of pushing ideas to their extreme consequences – “daring conservatism” – the trademark of his heuristics, had been so inconsequential, or possibly even consolatory. Perhaps we should make a further hermeneutic effort to understand what he was trying to say. Framing Wheeler’s shifting opinion on the nature of the observer (who or what to assign that role to) as an ontological question would be partly misleading, because of the clear pragmatist tones we have already highlighted. Rather than asking what the observer is, he rather seemed to be guided by the question “What can work in a quantum process of observation?” Realizing that he did not need consciousness or some “classically” macroscopic apparatus, Wheeler was just taking a step toward a more radical “relational” view. The move he made, actually, can already be seen, for instance, in Bohr’s answer to Einstein-Podolsky-Rosen (Bohr, 1935, p. 699), since Bohr explicitly applies the same considerations first to a case in which there is a just single particle plus a diaphragm with a slit, and then to the EPR case in which there is a second particle instead of the slit. It is also clear that Wheeler’s move does not amount to getting rid of the observer *tout court* and to flattening the indispensable epistemological considerations to a naive pre-Kantian naturalism⁵: it is the experimenter that decides to use one of the two particles as “probe”, to say it in Wheeler’s later lexicon. This element of decision is even more evident in the famous delayed-choice experiment that Wheeler proposed toward the end of the 1970s (Wheeler, 1978, pp. 47-ff). Although the experimenter’s gestures, so to speak, could be replaced even by a servomechanism (Wheeler, 1978, p. 162), the “interpretive” element should not, according to Wheeler, be thrown outside of the picture: there must be a community of observers-participants that gives rise to “meaning”, beyond flat “information”. That was reason enough for him to try and articulate the crucial role played by a community of interpreters – another pragmatist idea⁶. As Wheeler is reported to have said, bizarrely taking his cue from a modern version of Frederick II’s alleged experiment on language,

The Los Angeles girl locked from babyhood to age 13 (when the neighbors found out and called the police) in an attic room, given food but never spoken to, had by that time lost the power not merely to speak, but even to think. There is not a word we utter, a concept we use, an idea we form, that does not directly or indirectly depend on the larger community for its existence. (Bernstein, 1991, p. 94)

But how to link all this to the grand new plan of physics that Wheeler was trying to envisage? Here again we see the shadow of Bohr:

Physics gives rise... to light, pressure, and sound. They provide means of communication, of the importance of which Niels Bohr notes, ‘... every analysis of the conditions of human knowledge must rest on considerations of the character and scope of our means of communication’. Physics is also the foundation of chemistry and biology, out of which arise communicators. Communicators plus means of communication permit the development of meaning in the sense elucidated by leading English and American schools of philosophy in recent decades, as summarized, for example, by D. Føllesdal: ‘Meaning is the joint product of all the evidence available to those who communicate’ (Wheeler, 1986, p. 304).

⁴ As suggested in (Furlan, 2020, p. 150), it is intriguing to think of Wheeler’s monadology as a sort of scaffolding that led him in the 1980s to ideas close to that of decoherence, with the role that the “environment” plays therein.

⁵ In other words, even if Wheeler is mainly thematizing the distinction between probe and probed, what he had in mind is actually closer to a Peircean triad, with the additional vertex of an “interpreter”.

⁶ A stimulating topic for further investigation could be whether this emphasis on a community of interpreters got intertwined with coeval attempts, among quantum foundations researchers, at going beyond a “single-user” view of quantum mechanics.

The reader should not be easily fooled by that reference to “meaning” in Anglo-American philosophy: it should be rather obvious, at this point, that Wheeler did not resonate much with the so-called “analytic philosophy” that tried to wink at mathematised sciences (was there any physicist whose relationship with words was more distant than Wheeler’s from a restrained Reichenbach-like conception of language?). Sure, he was interested in how meaning is produced, but the horizons, assumptions, methods, and even historical awareness were very different. In a later paper, Wheeler would make more explicit what he had in mind (and the passage that follows also summarizes, in a sense, our section here):

doesn’t Marie Skłodowska Curie tell us, ‘Physics deals with things, not people’? Using such and such equipment, making such and such a measurement, I get such and such a number. Who I am has nothing to do with this finding. Or does it? Am I sleepwalking? Or am I one of those poor souls without the critical power to save himself from pathological science? Under such circumstances any claim to have ‘measured’ something falls flat until it can be checked out with one’s fellows. Checked how? Morton White reminds us how the community applies its tests of credibility, and in this connection quotes analyses by Chauncey Wright, Josiah Royce and Charles Saunders Peirce. Parmenides of Elea... may tell us that ‘What is... is identical with the thought that recognizes it’. We, however, steer clear of the issues connected with ‘consciousness’. The line between the unconscious and the conscious begins to fade in our day as computers evolve and develop – as mathematics has – level upon level upon level of logical structure. We may someday have to enlarge the scope of what we mean by a ‘who’. This granted, we continue to accept – as essential part of the concept of it from bit – Føllesdal’s guideline, ‘Meaning is the joint product of all the evidence that is available to those who communicate’. What shall we say of a view of existence that appears, if not anthropomorphic in its use of the word ‘who’, still overly centred on life and consciousness? It would seem more reasonable to dismiss for the present the semantic overtones of ‘who’ and explore and exploit the insights to be won from the phrases, ‘communication’ and ‘communication employed to establish meaning’. Føllesdal’s statement supplies, not an answer, but the doorway to new questions. (Wheeler, 1990, p. 320)

Dismissing, at least for the time being, the “semantic overtones” of who the observer is: that seemed indeed Wheeler’s approach, with a clearly pragmatist attitude (and our characterization, evidently, is strongly corroborated by the names he mentioned). “Solipsism, no; communication, yes” (Wheeler, 1988, p. 15). However, we may also ask: are not Wheeler’s words about a community of observers-participants, scattered across cosmic spaces and eons, possibly implying, at least in principle, even “transhumanist” horizons, not anchored by anthropomorphism or consciousness as we usually consider it? Wheeler would not fully take this step, but a few lines make clear that he was also thinking about our expansion and dissemination in the universe: “How far foot and ferry have carried meaning-making communication in fifty thousand years gives faint feel for how far interstellar propagation is destined to carry it in fifty billion years” (Wheeler, 1990, p. 319). Among the references that he gave, we can find, curiously enough, a couple of books about the colonization of space: the fourth edition of his former Princeton colleague Gerard K. O’Neill’s 1976 *The High Frontier* (O’Neill, 1989) and Robert Jastrow’s *Journey to the Stars: Space Exploration - Tomorrow and Beyond* (Jastrow, 1989). Even more explicitly (Wheeler, 1988, p. 14):

Life and mind: for how much can they be conceived to count in the scheme of existence? Nothing, say the billions of light years of space that lie around us. Everything, say the billions of years of time that lie ahead of us. It cannot matter that man in time to come will have been supplanted by, or will have evolved into, intelligent life of quite other forms. What counts – in the ideal view being explored in this paper – is the rate of asking questions and obtaining answers by elementary quantum phenomena, acts of observers-participancy, exchanges of information.

3. The “meaning circuit” and “it from bit”

When we first started to investigate the genesis of Wheeler’s idea of a “super-Copernican” cosmos, we saw how he was trying to kill two, or better three, birds with a single stone: the mystery of the quantum, the mystery of the seeming fine-tuning of the constants in a relativistic universe, and the mystery of consciousness (Wheeler, 1974). It was, admittedly, a heuristic attempt, possibly over-ambitious; nonetheless, thanks to this provocative mental exercise, Wheeler got new insights that he would further elaborate, even after letting go, in a sense, the attempt at solving those three mysteries or puzzles in one go. Iconically but also conceptually, the central idea of the trilogy of papers in which he elaborated on the role of the cosmogonic observer-participator (Wheeler, 1974; 1977; Patton & Wheeler, 1975) is represented by the famous *U* (standing for “Universe”) with the eye of the observer (Patton & Wheeler, 1975, p. 565).



Fig. 1: Wheeler’s iconic *U* diagram, originally referred to the whole universe and the cosmogonic observer-participator, is here multiplied across galaxies to symbolize the “acts of observer-participancy” of the super-Copernican community.

write: “The time-bridging power of the elementary quantum phenomenon warns us today to battle against now-centredness. What counts is the rate of asking questions and obtaining answers by elementary quantum phenomena, acts of observers-participancy, exchanges of information” (Wheeler, 1988, p. 14). The “super-Copernican” overcoming of now-centredness, once again.

In this better articulated sense, the *U* diagram thus provided also the blueprint for what Wheeler, in the 1980s, would call quantum acts of observer-participancy. If the first use of the *U* can even have a solipsistic flavor, in the new framework that Wheeler is trying to elaborate the process of observer-participancy takes place in a vertiginous plurality of centres (Fig. 1). That is why we ended our previous contribution (Furlan & Puleio, 2024, p. 312) with a nod to Giordano Bruno: Wheeler’s new picture has not a single centre, but centres everywhere, and each one is actively contributing to the whole⁷. The resulting vibe of his participatory universe is, from this point of view, more akin to the enthusiasm that permeates Bruno’s universe, with its centre in all places and in no place, teeming with life and activity, than to the hierarchy of a (geo)anthropocentric cosmos, as people wrongly assumed after hearing or reading Wheeler’s Copernicus speech (Wheeler, 1974). It is interesting to add at this point that, after Wheeler’s late-1970s turn regarding the nature of the observer, we can find in his notebooks a meaningful variation on the *U* diagram (Fig. 2a), which at first may seem even more perplexing, but actually reflects the development of Wheeler’s reflections as we have just sketched. The *yin-yang* symbol – the *taijitu* – is of course not a reference to the *Tao of Physics* and similar vogues, but to Bohr’s coat of arms, where

⁷ This is even clearer (for what a sketchy proposal like Wheeler’s could be “clear” in a scientific sense. . .) if we keep in mind, as we have already remarked, that Wheeler was also thinking in terms of a monadology. Perhaps the so-called “new materialism” of recent years, with its “overcoming” of a “passive” conception of matter, could take note of these developments, instead of referring to cheesy authors with little or no credibility in physics.

In light of our previous considerations, we can now see how, in a sense, the symbolic *U*, all its provocative and anthropic flavor notwithstanding, metamorphosed into the delayed-choice experiment, which can be however taken as “just” highlighting, in a thought-provoking way, a feature of quantum physics. When the photon in the experiment is supposed to have been emitted from a quasar billions of light-years away, we are indeed reaching a scale close to that implied by the cosmogonic observer-participator; and the temporal scale involved makes us understand why Wheeler could

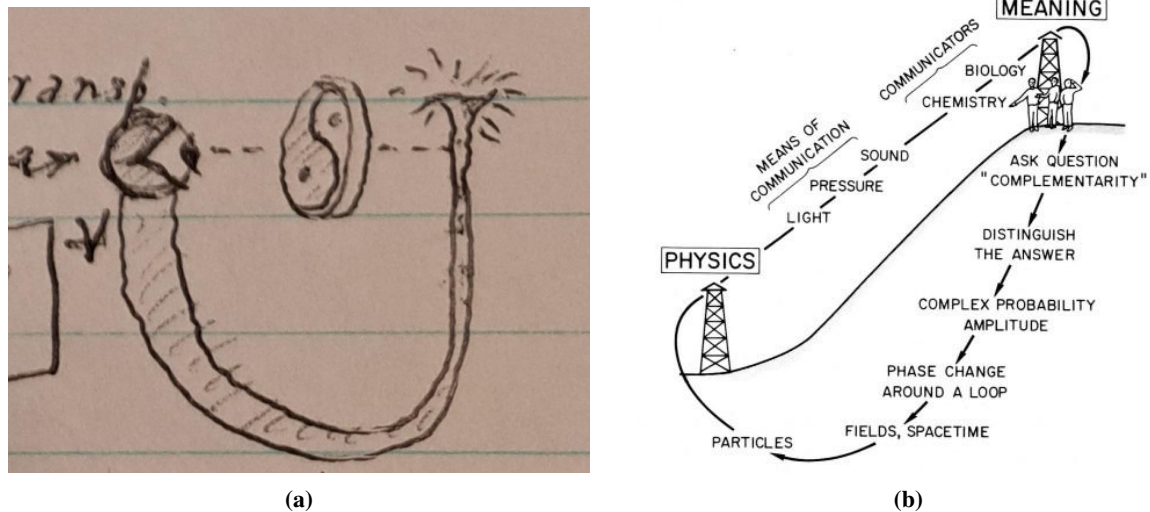


Fig. 2: (a) Research Notebook 71 (June 1983-June 1984), p. 151, John A. Wheeler Papers, American Philosophical Society Library, Philadelphia. (b) The “meaning circuit”. Source: (Wheeler, 1986, p. 305).

it stood for complementarity. That on the line of sight of the “eye” there is now that symbol is meant to say that the perceiving eye or consciousness does not have a direct effect: “in-between” the observer and the observed system there is the choice of the experimental apparatus⁸. Possibly in order to avoid further misunderstandings (after his experience at the parapsychology conference!), Wheeler does not seem to have made public use of this modified diagram, but we can see that its content, so to speak, is encapsulated and further articulated in the “meaning circuit” (Fig. 2b). This “circuit”, in a sense, is the arrival point of Wheeler’s reflections that had started with first use of the *U* and the “Leibniz logic loop” (Wheeler, 1974, p. 689), namely the need to take into account the role of the observer *ab initio* instead of postulating a given ontology “out there”. As usual, Wheeler never threw entirely away his ideas, not even the most outlandish ones, and thanks to his rich archival material we can follow their maturation into something else over years, if not decades. We are now in a position to clarify an often misunderstood point: that is, the nature of the “bits” in “it from bit”. This by now famous slogan has not to be taken as the “assertion” that somehow everything consists of ontologised bits, perhaps in their qubit version. That would be a form of naïve naturalism with a problematically reified concept of information at its basis – and all of Wheeler’s criticism against any given ontology or his insights from the mid-1970s on would thus be thrown away. Had Wheeler’s point been merely the “emergence” of spacetime and bodies from something deeper, he would have just repeated what he was saying already in the late 1960s and very early 1970s. This gross misunderstanding does not only reveal that the readers of Wheeler’s papers have had, typically, little historical sense of how his ideas and his whole “philosophical” attitude were changing in the phase we are examining here (and one does not really need archival research to realize that...): it is a blatant example of how a lack of understanding can be superseded by the ostentatiousness of technicalities somehow related to information theory or similar areas, projected or back-projected onto a case that, thus, loses all its interesting specificities. We could avoid such self-assured and misleading “explanations” simply by wondering why, in the speculative papers where Wheeler sketched the view underlying “it from bit”, he never mentioned Shannon once, for instance (Wheeler, 1986; 1988; 1990). His path to the “bit” had been very different from, and more complex and fascinating than, a rather trivial,

⁸ In the “limiting” case (which, of course, is actually a very different perspective) where the *taijitu* is superposed to, or better conflated with, the eye, we get back to Wheeler’s anthropic position of the mid-1970s and we thus find an unexpected link, so to say, between two of the most controversial ideas in 20th-century physics: complementarity and (some form of) the anthropic principle. It is as if Wheeler, in a paper like (Patton & Wheeler, 1975), is assigning to our consciousness the role of a filtering setup which, for us, is fixed, and we have to take note of that.

and conceptually problematic, reification of some abstract unity of “information”. Wheeler’s very notion of information, rather than a mathematical import, seems a conceptual hybridization between different insights. There is not enough space here to detail the various elements that flowed together into Wheeler’s vision, from Leibnizian suggestions to engineering-like considerations, not to omit, of course, physical and mathematical clues (Furlan, 2020; 2024). We should nonetheless remark that Wheeler’s bits, in a sense, are not given, but produced; or better: they are the result of a process. Which one? Obviously that of observer-participancy in quantum measurements, as we have been discussing in these pages. The simplest experimental situation conceived by Wheeler was that of a quantum system offering just a binary answer to a measurement question: hence the suggestion of a fundamental binarity or bit. The choice and preparation of the experimental setup (“asking a question”, or the place of complementarity in the “meaning circuit”) unequivocally speaks of the active, constitutive, participatory role of the questioner-observer. “It from bit” is thus a view of the cosmos markedly characterised by processuality and, far from evoking an impersonal computer inexorably processing information, it insists on the active and necessary role of a community of interpreters across space and time.

Nowadays, Wheeler’s “epistemological” reflections, or at least questions, seem often superseded by sensationalistic proclamations about exotic ideas that, not rarely, he himself had already had as early as the 1950s and 1960s – see for instance (Halpern, 2024) for some proto-concept of “multiverse”. Likewise, we have lost count of the number of different versions of the “anthropic principle”⁹, whose origin is usually traced back (with rather superficial and commonplace narratives, by the way) to the exact same context Wheeler’s Copernicus speech (Wheeler, 1974) belongs to. Perhaps, to dispel some of the clichés and offer new perspectives, we can recall, not in vain, how Wheeler’s reflections had quite a different degree of complexity and charm, and how he himself saw them when compared with trends in vogue more recently:

There operates on such an ensemble of universes, Charles Pantin argued in 1951, something ‘analogous to the principle of Natural Selection, that only in certain Universes, which happen to include ours, are the conditions suitable for the existence of life, and unless that condition is fulfilled there will be no observers to note the fact’. This ensemble concept is common to many of today’s versions of the cosmological anthropic principle, reviewed in the comprehensive book of John D. Barrow and Frank J. Tipler. The contrast between the two views could hardly be greater: selection-from-an-ensemble and observer-participancy. The one not only adopts the concept of universe, and this universe as machine, it also has to postulate, explicitly or implicitly, a supermachine, a scheme, a device, a miracle, which will turn out universes in infinite variety and infinite number. The other takes as foundation notion a higgledy-piggledy multitude of existences, each characterized, directly or indirectly, by the soliciting and receiving of answers to yes-no questions, and linked by exchange of information. (Wheeler, 1988, p. 15).

In a sequel to this paper, we will highlight how Wheeler’s less taken road has recently had some unexpected (and illustrious) supporters. For now, let us just summarize what we have clarified in these few pages. Wheeler’s emphasis on the participatory role of the observer, together with the “super-Copernican” horizons of his reflections, freed from now-centredness, ultimately led him, after bold speculations, to his famous delayed-choice *Gedankenexperiment*, not confined to a laboratory but referred to a cosmic scale. This, together with his renewed consideration of Bohr’s complementarity and his distancing from Wigner’s consciencialist views, prompted him to realize that he did not need consciousness in the process of quantum measurement, but, nevertheless, the choice and preparation of measurements implied the role of an interpretive community scattered (mainly in the future) across galaxies and eons. This view on the delayed-choice experiment and the observer’s role is thus the physical basis, so to speak, of Wheeler’s not-nitidly-defined distinction between information and meaning, with the latter being “the joint product of all the evidence available to those who communicate”, to echo Føllesdal (to whom Wheeler gives, in

⁹ Even in this, nevertheless, Wheeler displayed his creativity: only in his research notebooks, for instance, can we find a “retroanthropic principle”, to which we will return in the next installment of this series of papers.

any case, a more pragmatist and possibly even futuristic twist). All this gets synthesised in the “meaning circuit”, which in a sense represents a more sophisticated (and tenable) version of the “Leibniz logic loop” and of the *U* diagram of the mid-1970s. In the light of these considerations, it is simply self-evident how much Wheeler’s “it from bit” differs from cheap views on the universe as a computer – which, by the way, he, once again, had already used as a metaphor well before these more recent fashions (Wheeler, 1982). Likewise, his vision of our being “at home in the universe” (Wheeler, 1994; 1974) is much more refined and intriguing than some consolatory and reactionary *Weltanschauung*. To borrow a few words from T.S. Eliot’s *Four Quartets* again, “the past experience revived in the meaning / is not the experience of one life only / but of many generations”.

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