

A



HEIDEGGER'S BEING AND QUANTUM VACUUM

Arturo Tozzi
Center for Nonlinear Science, University of North Texas, Denton, Texas 76203, USA
tozziarturo@libero.it

A dialogue between Martin Heidegger and a theoretical physicist, namely Richie, unveils the striking relationships between the philosophical concept of Being and the experimentally detectable quantum vacuum. We provide an account of long-standing theoretical issues, such Being, Entity, Existence and the unique role of the human Thoughts in the world, and expound their possible physical counterparts.

RICHIE: Hi!

MARTIN: Hi! It has been a long time... How are you? What are you doing?

RICHIE: I'm studying the vacuum.

MARTIN: The vacuum?

RICHIE: Yes. In quantum field theory, the vacuum stands for the state with the lowest possible energy.

MARTIN: Do you mean that the vacuum state stands for an empty Nothing?

RICHIE: Not exactly... It is a mistake to think the vacuum as some absolutely empty void. The quantum vacuum is not truly empty, but contains instead fleeting electromagnetic waves and particles.

MARTIN: You talk about energy, electromagnetic waves, particles....

RICHIE: Yes. The quantum vacuum is the chunk of our Universe where the energy and the matter are the lowest possible.

MARTIN: What do you mean for energy and matter?

RICHIE: The energy and the matter are the "real" part of our Universe. They are just two sides of the same coin. Indeed, in a state of very low energy, particles of matter cannot be produced; however, when the energy increases beyond a certain threshold, a particle is produced.

MARTIN: Are particles and energy characterized by essence? Are they entities? Or what else?

RICHIE: It depends on what you mean... According to you, what is the Being? And the Entity? Does the Being exist, or what?

MARTIN: There is a deep difference among Entity, Being and Existence. Science is able to study just the Entity, not the Being. Indeed, the Entity can be represented and reckoned, while the being is not describable. In my writings, I attempted to turn away from questions concerning Entities to questions about Being, and to recover the most fundamental philosophical question: what does it mean for something to be?

RICHIE: Mmm... difficult, but intriguing... do your Entities exist? What is Existence, according to you? Does Existence mean that a stone, or an animal, or a human being, are located in time? Is Existence correlated with time passing?

MARTIN: Not exactly. I retain the term Existence just for humans. Stones and animals simply Are, while humans do Exist. Existence means to be-into, being-in-the-world. Existence lies into the glade of Being. Existence is a feature just of a human individual able to think, because it means consciousness. Stones and animals do not display consciousness. Indeed, the human thought is the truth of the Being.

RICHIE: You talk about a glade of Being. What about humans and consciousness? Do they stand into such glade? Or they look at it from afar? Where are humans, and consciousness, located? Which is the place of the Existence?

MARTIN: The Being is a glade, where the home of the Language is placed. The human individual lives into the home of the Language. We humans are the gardeners of the Being, we take care of the Being, because we are the sole Entity able to think, although indistinctly, the Being. Through the Language, humans are able to assess just the Entity, while there are no words in order to describe the Being. The Being lacks a representation, contrary to the Entity. The Being does not let himself to be represented as an object does.

RICHIE: In such a vein, I could try to answer to your question about particles and energy. Particles and energy are Entities, describable and quantifiable by the human language and by scientific accounts...

MARTIN: It is reasonable. Indeed, science, and also metaphysics, are able to describe and illustrate the Entity, rather than the Being. The scientific object of investigation is the Entity alone.

RICHIE: However, it's curious... my vacuum is similar to your Being... The quantum vacuum might very well stand for your glade of the Being.

MARTIN: I don't think so. If you, who are a scientist, study the vacuum, this means that the vacuum is not the Being, rather an Entity. Indeed, scientists are able to assess just Entities.

RICHIE: In this case, what you say does not hold true. Indeed, the vacuum displays features that are closer to the Being than to the Entity.

MARTIN: Which ones?

RICHIE: The vacuum, that we scientists compare to a sort of undefined foam, cannot be properly described by the ordinary language. This is because quantum phenomena are weird, beyond the common sense, and escape every possible description. The vacuum obeys quantistic laws... this means that the vacuum cannot be uttered by the human Language. Our verbal skills are simply not fitted to pronounce the mechanisms of quantum dynamics, in the same way as it is unfeasible for humans to describe the Being. The language of Being cannot talk about the unspoken; the unspoken, in this case, is the Language of quanta. Quantum dynamics, as well as the Being, cannot be described through images or words.

MARTIN: Indeed, Existence is a structurally open possibility-for-Being. But... What about time? The Existence is the Being into the history. The human individual is fundamentally structured by its Temporality, or its concern with time.

RICHIE: Good question. Indeed, there is also another relationship between the foam of the vacuum and the glade of the Being. The quantum foam moves relentlessly, but time and causality do not apply inside it. Quantum phenomena are time-reversible and cause/effect associations entirely disappear. We are in front of a timeless foam, where the future and the past are lost into the infinite bubbles.

MARTIN: There is still a problem to solve. A foremost one. The Existence is the Being in the time. The Existence is finite and is into the time. How can you explain the crucial step, from the Being's timelessness to the Existence thrown into the historical Universe? Can such a path be described, when you start from a physical, indescribable Being?

RICHIE: Let me think about... Yes, I think it is possible, through a physical inquiry... Let's see... the microscopic quantum world located in the vacuum stands for the glade of Being, while the matter and energy of the macroscopic world stand for your Entities. The Entities are grounded, encompassed into the Being... and there is, I believe, a physical way to try to describe their strange relationship.

MARTIN: What is it? I'm very curious... And I do not know if I'm happy or I'm not... Indeed, we are trying to give physicality to my philosophy, and I'm not sure I like it...

RICHIE: The vacuum is a very dynamic system. It continuously produces fleeting particles from its energy, but such particles are called "virtual" because they are annihilated almost instantaneously. We are in front of the most counterintuitive, yet, one of the most important principles in quantum mechanics: vacuum is by no means empty nothingness, because it full of various particles that are continuously fluctuating in and out of Entity. They appear, are Entities for a brief moment, then disappear again. Every one blinks into existence with its antimatter counterpart, then both quickly annihilate and fall back into the vacuum. Therefore, the energetic balance inside the vacuum is always zero. It is believed that such vacuum fluctuations, i.e., the constant appearance and disappearance of virtual particles, may have a connection with the "dark energy" that drives the accelerated expansion of the Universe.

MARTIN: If such virtual particles are so feeble that they not reach the status of Entity, how could the Entities in our observable Universe arise from the vacuum?

RICHIE: In very rough words, it has been demonstrated that large energetic fluctuations in the vacuum are able to produce real particles that abruptly appear in our Universe. Some theories state that our Universe might have been generated from the vacuum. This process, called inflation, has been claimed in order to explain the big bang, e.g., the origin of our Universe. An abrupt change in the energy vacuum produced a huge number of particles, the ones we currently see in our Universe. In technical terms, and forgive me for this physical afterthought, it is feasible that a high energetic state of false vacuum abruptly felt towards a lower energetic basin of the real vacuum. This process led to an inflationary mechanism, e.g., the production of a huge amount of anti-gravitational energy which caused cosmic dilation and generation of real particles in our Universe.

MARTIN: Oh. I understand. Therefore, the Being is the Vacuum and the particles are the Entities. This means...

RICHIE: This means that it is possible to generate Entities from the Being. The glade of Being, due to a modification intrinsic to the same Being, is populated with Entities. And also with Existence, e.g., the human individual able to think. There is also another relationship between the Being and the quantum vacuum that must be kept into account. On the one hand the Being displays an infinite set of possibilities, on the other hand the vacuum produces an infinite set of virtual particles. Just a few of them enter the real world in guise of real particles. It resembles the mechanism that gives rise to Entities and the Existence from the Being.

MARTIN: Yes. It fits my framework. The Being is the truth and is also the Possible i.e., the possibility of Entities and Existence. When the finite, time-embedded Existence arises from the vacuum of the Being, it "becomes" something that is still to be exploited, something that can be thought as posed.

RICHIE: But, on the other side, the rise of the Universe is something irreversible. This means a closure of our countless possibilities for being through time...

MARTIN: And this also means the finitude of the time and our Being-towards-death, as I stated more than once...

RICHIE: Yes. As well as quantum dynamics needs an observer to be thought and assessed, the Being set the human individual in order to take care of itself. Both quantum mechanics and the Being require a consciousness able to cope with them, in order to be fully elucidated.

MARTIN: Indeed, Existence is defined by Care, a practically engaged mode of Being-in-the-world. Thinking is thinking about things originally discovered in our practical engagements.

RICHIE: the practical engagement is also the exploration of the vacuum, that involves a truthful relationship to our "thrownness" into a world which we are "always already" concerned with.

MARTIN: The Existence, that finds itself thrown into the world amidst things and with others, is thrown into its possibilities. Human individual needs to assume these possibilities, in order to assess the inmost individuality of the world. If I compare the vacuum with the Being, I lose the primeval openness of the Existence towards the Being. I just achieve the despicable openness to the "will to power" of the scientist and the contemporary human subject...

RICHIE: If you focus less on the way in which the structures of Being are revealed in everyday behavior and in subjects, and more on the way in which behavior itself depends on a prior "openness to being", you achieve what you require, e.g., that the Essence of being human is the maintenance of this openness.

MARTIN: Therefore, Thinking stands for a reflecting upon this more original way of discovering the world....

SPEAKER: ... passengers of the flight 1976 to the Black Forest...

MARTIN: It's my flight. I have to go.

RICHIE: OK. It has been a pleasure to meet you.

MARTIN: I go to think about your quantum vacuum in my beloved Todtnauberg.

RICHIE: and I go to my beloved CERN to think about your Being...

REFERENCES

- 1) DeWitt BS. 1967. *Quantum Theory of Gravity II. The Manifestly Covariant Theory*. *Phys. Rev.* 160, 1195-1239.
- 2) Ellwanger U. 2012. *From the Universe to the Elementary Particles. A First Introduction to Cosmology and the Fundamental Interactions*. Springer-Verlag Berlin Heidelberg. ISBN 978-3-642-24374-5.
- 3) Heidegger M. 1962 (1927). *Being and Time*. SCM Press, London.
- 4) Heidegger M. 2006 (1929). *Che cos'è metafisica?* Adelphi, Milano.
- 5) Heidegger M. 2013 (1946). *Lettera sull'"Umanismo"*. Adelphi, Milano.
- 6) Moreva EV, Brida G, Gramegna M, Giovannetti V, Maccone L, Genovese M. 2013. *Time from quantum entanglement: An experimental illustration*. *Physical Review A* 89,052122.
- 7) Wilson CM, G. Pourkabirian JA, Simoen M, Johansson JR, Duty T, et al. 2011. *Observation of the dynamical Casimir effect in a superconducting circuit*. *Nature* 479, 376–379.
- 8) Zeidler E. 2011. *Quantum Field Theory III: Gauge Theory*. Springer-Verlag, Berlin, Heideberg.