



Ethical dilemmas of the citizen Geoscientist doing science, technology, and profession.

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Protagonists of this story are citizens who had the privilege, after much effort, to get specific education becoming Geoscientists or Natural Scientists in general. They can act in three different spheres: doing science, developing technology, or applying as professionals the knowledge developed on the first two spheres [1]. Each sphere has different ways of generating, developing and applying knowledge. The main goal of science is to know, and the new knowledge acquired is an 'intellectual artefact'. This artefact is the result of solving unknown problems by formulating and testing original hypothesis which, when proved, may be expressed in the form of laws or principles that aim to be the more general and perhaps deep scientific truths. When Geoscientists act at the technological sphere, their main goal is to propose or engineer original 'technological artefacts' in the form of devices, protocols of actions and/or processes, as a machine to produce electricity from new sources, or an innovative protocol to protect a given area from natural hazards. Technologists investigate original hypotheses, their main goal is to produce previously unknown devices or action plans to solve practical problems, intended to control the real world. Success is measured by the 'general efficiency' in solving such problems. According to our terminology, professional Geoscientists are those 'in the field', having the direct responsibility of controlling the more or less complex and wicked systems on Earth using 'professional artefacts'. They apply technologies to control specific processes in the real world, solving the problems without the need of developing original hypotheses or technologies but based on the confirmed ones. Their success is measured by the 'local efficiency' at applying the solutions originated in science and technology. Each sphere, although having overlaps, has particular ethical dilemmas: science is not ethically neutral; technology can be applied for the good and the evil; and the professional can act ethically or not for the society and the environment. Some ethical dilemmas for the Geoscientists appear, however, as conflicts of interests between their professional duties and convictions as citizens. Although Geosciences can offer answers to some epistemological questions on the meaning of knowledge, Geoscientists, as citizens, will not have easy ways to explain what makes justified beliefs justified when the decisions will affect the environment or the social network in ways where individualistic or holistic viewpoints will promote or suggest different approaches/solutions. The Imperative of Responsibility[2] has subtle different meanings at each sphere, and a Zero Imperative is to know in what sphere we are located in a given moment. These dilemmas have not easy solutions and, giving the complexity of the world around us, a systemic[3] Geoethical approach would be the right one to confront the ethical dilemmas in the Geoscientists' four spheres of action.

[1] Marone, Eduardo, and Luis Marone. 2018. https://doi.org/10.1163/9789004380271_008

[2] Jonas, Hans. 1984. "The Imperative of Responsibility." ISBN: 9780226405971

[3] Bunge, Mario. 2000. [https://doi.org/10.1016/S1053-5357\(00\)00058-5](https://doi.org/10.1016/S1053-5357(00)00058-5)