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Service Ideal: Origins of philosophical inadequacy of engineering

Dany Mauricio González Parra*
Diego Fernando Jaramillo Patiño**
Álvaro González Osorio***

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* (E) PhD in Philosophy. Master’s Degree in Philosophy. Professor of the Philosophy Program of the University of Quindío. Leader of the research group Reasons and Actions. Email: dmgonzalez@uniquindio.edu.co

** Master’s Degree in Philosophy. Professor of the Electronic Engineering Program of the Universidad del Quindío. Email: diegojaramillo@uniquindio.edu.co

*** Master’s Degree in Philosophy. Professor of the Philosophy Program of the University of Quindío. Email: agonzalez@uniquindio.edu.co

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Abstract

Engineering, as a profession, faces the difficulty of combining its body of knowledge with its ideal of service; relation that is clear in traditional professions such as medicine or law. This inadequacy is one of the main causes of the difficulty that is faced when trying to define engineering. In the present work it is argued that the origin of the inadequacy lies in the way in which it has been assumed that it should be carried out the reflection in the field of engineering ethics, which lacks from an axiological foundation and transcends the curricula of the different engineering programs. In order to support what is stated in the paper, (1) some of the main definitions of engineering are analyzed, (2) it is explained the aforementioned inadequacy, (3) it is presented the relation of this inadequacy with the absence of an axiological foundation of the reflection around the ethics of engineering.

Keywords: Ethics, service ideal, inadequacy, axiology, engineering.

Introduction

During the twentieth century, science was consolidated as a legitimate object of philosophical research, as evidenced by the works of Popper, Carnap, Reichenbach, Kuhn, Feyerabend, Lakatos, Hacking, Suppes, Sneed and Moulines, among others. Something similar happened around technology (Durbin, 1991, 2007, 2010, Idhe, 1995). Engineering is the opposite case. The philosophical reflection around engineering has been reduced to secondary references within the philosophy of engineering or technology or, at most, to issues related exclusively to ethics: the ethics of engineering education and ethical dimensions of engineering.

In light of this void, the need for greater interaction between philosophers and engineers has been recently observed. This, with the aim of establishing a field of philosophical reflection in engineering and consolidating a coherent research agenda shared by the academic community of engineering and engineering philosophy. It is in this sense that the research project “Philosophy of Engineering: a field under construction” was proposed and developed. In this paper, the researchers set out to show that the philosophy of engineering, unlike the philosophy of science and the philosophy of technology—which are well-established professional philosophical disciplines—is a professional philosophical discipline under construction. As evidence of the

emergence of engineering as a legitimate object of philosophical reflection, that is, of the philosophy of engineering as a real field of philosophy, we show that, in effect, it has an academic community, a research agenda—ontological, epistemological, ethical and social problems are part of this emerging agenda—and organs of dissemination of scientific work, such as serials, forums, conferences, workshops, among others. The scientific impact of the work developed lies in two basic aspects, namely: due to the almost total ignorance about the field of engineering philosophy in our environment, presenting it is already a significant contribution to the philosophical and engineering studies in the country; besides that, given its recent appearance in the international spectrum of philosophy and engineering, the field allows new contributions. In terms of its social impact, reflection on the philosophical problems associated with engineering should be able to contribute to the effective improvement of their professional practice, as well as to the training of new engineers. It is just in relation to this last point that occurs the first drawback: the reflection about engineering. Engineering, at first glance, appears as a profession among many others. However, as a profession, it faces the difficulty of combining its body of knowledge with its ideal of service. Relationship that is clear in traditional professions such as medicine or law. This inadequacy is one of the main causes of the difficulty that is faced when trying to define engineering. In the present work, it is argued that the origin of the inadequacy is in the way in

which it has been assumed that reflection should be carried out in the field of engineering ethics, which suffers from an axiological foundation and transcends the curricula of the different engineering programs. To support what has been proposed in the paper, (1) some of the main definitions of engineering are analyzed; (2) the inadequacy indicated is explained; (3) some of the reflections related to the ethical training of engineers and engineers are presented; (4) it is finally shown why an axiological foundation of the reflection around the ethics of engineering is necessary.

What is engineering?

One of the main challenges that engineering represents for philosophical reflection is precisely its definition. What is engineering? It is a question whose answer is not at all easy to achieve. This, beyond the spread of engineering itself as a profession. One of the main contributions to address this point is found in some of the work of Carl Mitcham (2008; 2009). One of the first that Mitcham collects can be found in the Encyclopedia of Science and Technology McGraw-Hill (Parker, 2008), according to which, engineering is the art of “directing the great sources of energy of nature for the use and convenience of humans.” A definition that, as noted by Mitcham himself, is not far from the one offered by Tredgold, who defined it as “the art of directing the great sources of energy of nature for the use and convenience of man”. One of the aspects to highlight of the definition of Tredgold is the nuance that supposes to put to the man like the aim of the engineering work, which is highlighted by the contrast that represents the one that soon is not spoken of *man* but of *humans*. It is noteworthy because it shows, given the connotation of *man* at that time, the fact that the benefits of engineering were aimed at the owners of resources, and not at humans. Beyond this, the point is that in almost two centuries (the definition of Tredgold dates from 1828) two ideas have remained: (i) that engineering is something that is done; it calls attention to the fact that both are alluding to its development as art; and (ii) that engineering is an art whose products should be at the service of people, be they a limited set of individuals, or humanity in general.

Michael Davis (1998) maintains the core of these two elements of the engineering definition. However, the notion of art is displaced by the specialized knowledge that characterizes the engineer. Thus, according to its proposal, engineering is characterized by: (i) a specific knowledge (specialized or technical); and (ii) its commitment to use this knowledge in a certain way. This determined way obeys, according to Davis, to the established in the codes of ethics of engineering. Davis himself (quoted by Mitcham, 2009) will offer a definition with a clear pragmatic cut. According to this, an engineer is nothing more than an individual who does what engineers do and, consequently, is recognized by his fellow engineers (other engineers) as such. Beyond the circularity of this definition, the idea is that engineering is reduced to the group of people historically constituted by people who determine what counts as engineering. That is, there is no definition of engineering prior to the engineering activity as such, but throughout history there has been a group of individuals whose work is recognized as engineering by other individuals who do the same and who have identified themselves as members of such a community. From these already classical definitions within the reflection on engineering, there can be drawn several conclusions related to the attempts to define engineering; conclusions that, as it will be seen in the next section, are directly related to what Mitcham called the philosophical inadequacy of engineering. In the first place, the definitions offered by both Tredgold and Davis highlight the bipartite nature of every profession: the body of knowledge and the destination of that knowledge to its use in a certain way. On the other hand, and this is a common aspect to the three definitions, although it is more evident in the last one of Davis, it is the same community of engineers that defines what engineering is and what is not. In the first two ones (Tredgold and Davis in 1998), the way in which the body of knowledge should be allocated is determined by the codes of engineering ethics; in the third one (Davis in Mitcham, 2009), the engineering community.

Philosophical inadequacy of engineering

The inadequacy of which engineering is accused has a double aspect, each one related to each of the definitions presented above. On the one hand, there is an inadequacy that affects engineering as a profession, that is, the relationship between the body of knowledge that constitutes its training nucleus and the engineer's practice. On the other, such lack or weakness (Mitcham, 2008) is directly related to the definition of engineering, and it could be summarized by saying that the term to be defined is included in one way or another in the definition: engineering is what engineers do and recognize as their chore.

As noted above, according to a first definition, engineering is characterized by (i) a specific knowledge (specialized or technical); and (ii) its commitment to use this knowledge in a certain way. A way that obeys to what is established in the codes of ethics of engineering. Specific knowledge is represented by what in faculties and engineering schools constitute areas such as mathematics, physics, biology, chemistry, etc. Areas that historically are the backbone of what is recognized both inside and outside of engineering itself as the core of engineering. The commitment related to the determined use of this knowledge is what has been called the ideal of service. This ideal, as the Mitcham survey (2009) shows, has been assumed as the advance of commercial and industrial interests, a conception of the Tredgold era; then, as its destination to human use and convenience; and, finally, as directly related to the health, safety and well-being of future generations, as well as to the ideals of public safety, health and welfare. Whatever the conception of the ideal of service that is adopted, engineering has an inadequacy in its conception: there is a clear disconnection between its two components. The relationship between the body of knowledge and the ideal of service that is supposed to define engineering is not clear. Just based on this gap, Mitcham (2008) calls engineers to strengthen (philosophically) their field; a call for which he uses, as reference points, professions well established and without such inadequacy, such as law and medicine (Goldberg, 2013). In the case of law, for example, it is easy to recognize

the knowledge that a professional should acquire: a lawyer must know the codes and laws of the system within which he must develop his work. This is the body of knowledge of law. On the other hand, their ideal of service is identifiable with equal clarity: the administration of justice.

The body of knowledge of law is framed in the laws that its professionals must know in order to administer them in the search for justice. It can be said that the period of training of a lawyer consists of the professionalization, the acquisition of mastery by the law student in the recognition of a set of rules, laws and codes that allow to establish what is fair and what is not (at least in procedural terms). It is not unknown at this point the difference between legal and fair, understood this last concept in what could be called a philosophically strong sense; it is only attended the fact of, whatever is understood by justice, the judges (lawyers) are the ones responsible for administering it and guaranteeing it. The case of medicine is similar. The training period of a medical student consists basically in the knowledge of the human body in order to recognize the healthy body, the one that is not, and promoting the former.

So law and medicine have no major problem in terms of the relationship between their bodies of knowledge and their ideals of service. The relationship between one and the other is more than clear. The situation of engineering in this respect, on the contrary, is far from being clear. The idea of what appears next is to show that this characteristic inadequacy of engineering has, as one of its main reasons, the absence of axiological reflection, that is, around the values that guide the actions of engineers. A reflection that makes it possible, fundamentally, to give clarity to the relation body of knowledge-ideal of service in engineering.

Engineering inadequacy: of axiological origin

According to the above, the ideal of engineering service has been assumed as the advance of commercial and industrial interests; then, as its destination to human use and convenience; and, finally, as directly related to the health, safety and well-being of future generations, as well as to the ideals of public safety, health and welfare

(Mitcham, 2009). However, the relationship between this ideal and the body of knowledge of engineering is not clear. The purpose in this section is to point out what could be assumed as one of the origins, perhaps the main one, of the inadequacy indicated: the absence of an axiological reflection at the core of engineering itself. That is, a reflection about the values that determine good engineering.

The absence of axiological reflection around engineering is evident in the limitation of this element in the study plans to what is stated in the different codes of ethics. If is taken into account the role that elements such as safety, health and well-being play within the definition of engineering, it can be understandable that the different codes base their guidelines on their acceptance (Copnia, 2003; Center for the Study of Ethics in the Professions); what does not fit is the fact that both these codes and the different reflections advanced around them do not carry out a foundation of what is to be understood as public safety, health or welfare (vgTakahara and Kajiwara, 2013; Schmidt, 2014; Han, 2015).

Conclusions

The absence of axiological foundation is not exclusive to engineering. However, it is precisely the importance of its development, as well as the complexity that appears to be its object, which makes it more pressing to carry out the same. The reason why the need for this reflection is indicated here as an initial step to face the indicated inadequacy lies in the idea that the proper development of any of the human activities, and especially the professional ones, depends on the related values with the activity itself. Just as beauty must govern the actions for the artist, health for the doctor, and justice for the lawyer, it should have to be determined the values that determine the correct actions of engineers; and they, as professional engineers, should have a clear idea about them. Whether that value be understood as an unreal quality, as an entity that functions as an adjective of objects that are considered goods (Fronzizi, 1958), or as the characteristic by which an object is the term of a favorable attitude (Villoro, 2012), the only clear thing is that values and

their study (axiology) is not reduced to ethics or codes of conduct. On the contrary, axiology is the foundation of ethics itself, but not only of it. Engineering and, in general, any human activity, is related to a series of values whose dimension is not reduced to ethics or adherence to a moral code by the subjects who develop such activity. It is practically impossible to contemplate the possibility of determining which body of knowledge contributes more adequately to the realization of an ideal of service if there is no clarity about that ideal, constituted fundamentally by values. In some way, the conceptualization of engineering has advanced at a different pace from that which has governed the very development of the curricula of engineering schools.

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