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The distribution of ethical labor in the scientific community

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ABSTRACT
To believe that every single scientist ought to be individually engaged in ethical thinking in order for science to be responsible at a collective level may be too demanding, if not plainly unrealistic. In fact, ethical labor is typically distributed across different kinds of scientists within the scientific community. Based on the empirical data collected within the Horizon 2020 'RRI-Practice' project, we propose a classification of the members of the scientific community depending on their engagement in this collective activity. Our classification offers, on the one hand, a model of how the ethical aspects of science are taken into consideration by scientists and, on the other, some indications on how to institutionalize ethics in science.

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Introduction

Science and technology have the power to shape the future and transform the world we live in. Societal needs and common values evolve under their influence. Some become completely or partly obsolescent, e.g. human face-to-face contact with the invention of the telephone, or voice communication with the advent of instant messaging. At the same time, new and often unexpected needs and values come to the forefront, e.g. preserving human genome intact from technological intervention. Ethical thinking aims at making sense of these transformations. All people, in particular scientists, are able to, and indeed often do, engage in ethical thinking either explicitly or implicitly.

The transformative power of science and technology and their potential impact on society are also addressed by various past and current governance approaches aimed at institutionalizing ethics in research-performing organizations. They form a central, but not the only, element of, e.g. Ethical, Legal and Social Implications (ELSI)[1], Technology Assessment (TA)[2], or Responsible Research and Innovation (RRI).[3] That the individual ethical reflection is framed in such ways expands its scope to a collective and political phenomenon in contemporary science. This phenomenon, based on an unceasing tension between the individual reflection and the collective assignments of responsibility[4], is denoted in this article by the term *ethical labor*. Introduced by Nagel (1995) in the broader context of the reconciliation of collective aims and individual standpoints through the design of internally diversified institutions, ethical labor is used here, in

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contradistinction to ethical reflection, in order to emphasize the collective aspect of the scientific institution.

As we will argue in Section 2, many of the current debates focus on the ethical problems of the scientific enterprise in general but fail to address actual agents (i.e. scientists and engineers) who are supposed to reflect upon and then solve such problems. This does not help to clarify the difference between individual and collective dimension of science. Following from there, we claim in Section 3 that ethical labor is distributed unevenly across the scientific community, much in the same way as scientific knowledge and expertise are not possessed in equal measure by every individual scientist. In Section 4, we distinguish four different kinds of scientists on the basis of whether, and how much, they engage in ethical thinking. By doing so we follow a virtue ethics approach: ethical thinking is seen as a virtue by many but not all scientists, while the observers external to science tend to believe that it is a universal value that should be equally desirable by all. In section 5, we detail the connection between our classification and the wealth of empirical data that inspired it, provided by the twelve national reports of the H2020 'RRI-Practice' project.[5] We explain that the four types of scientists that we identify are similar to the Weberian 'ideal types': although these model descriptions never fully correspond to reality, they are inspired by empirical data and they can be used to comprehend both data and reality. We also discuss methodological limitations and future prospects for empirical studies of ethical thinking within the scientific community. This leads us, in section 6, to several concluding remarks on how ethical reflection in science should be institutionalized.

The moral responsibility of science and scientists' ethical thinking

The relation between science and technology, on the one hand, and ethics, on the other, is complex and multi-faceted. There exist multiple ways to address it. In philosophy of science, for example, the relation between ethics and science is often discussed within the debate on the so-called 'value-free ideal' of science. For the supporters of the value-free ideal, non-epistemic (moral, social or political) values should have no role in the justification of scientific findings: the epistemic authority of science comes, and should come, exclusively from its strive for objectivity and impartiality. The value-free ideal has been endorsed by scientists and philosophers for a very long time. In the words of Henri Poincaré,

> Ethics and science have their own domains, which touch but do not interpenetrate. The one shows us to what goal we should aspire, the other, given the goal, teaches us how to attain it. So they never conflict since they never meet. (Poincaré [1920] 1958, 12)

However, numerous philosophers and STS scholars argue that moral and political values are constitutive of the scientific activity: science is value-laden. Supporters of the value-ladenness thesis argue that, if science is to preserve its authority, then it must be responsible and, therefore, driven by ethical values.[6]

The debate about the role of non-epistemic values in science can surely provide suggestive insights for a better conceptualization of the idea of responsible science. Such a debate, however, seems to be mainly concerned with the specification of different kinds of non-epistemic values, and with how or to what extent such values may drive science. The problem of finding out *who* or *how many*, within the scientific community, are driven by such values is rarely considered. This is also the case for those philosophers who attempt a less 'disembodied' approach such as, for example, Douglas (2003, 2009). In her view, apart from conducting research for epistemic reasons, scientists also have the moral obligation of considering the potential impact of their work in society. Such a moral obligation is not something which is added over and above the normal scientific work: following some of the early insights of Rudner (1953), Douglas holds that scientists *qua* scientists make value judgments, especially in calculating the possible consequences of error. Thus she maintains that scientists are both epistemic and moral agents: there is no real separation between the scientist-as-researcher and the scientist-as-advisor. Douglas also argues that the only people possessing the necessary competence to consider potential errors and their consequences are often scientists themselves. They are 'reasonable', as she says, in the sense that they are capable of foreseeing and assessing the consequences of their choices. We believe that this is a far-reaching idealization. Although Douglas's work is commendable for its attempt to bridge the gap between science and ethics, it seems that the conclusion she draws is not entirely realistic.

This critique has already been expressed by Lefevere and Schliesser (2014), who also criticise Douglas' model for one further reason. They believe that characterizing the scientific community as a benchmark for reasonable foreseeability, as Douglas does, contains the risk of uncritical self-affirmation. Similarly to Kuhn ([1962] 1996), Lefevere and Schliesser demonstrate how research in mature sciences is often conducted in the light of a dominant paradigm and without considering potentially valid alternatives. Pluralism in science, they claim, is not only epistemically fruitful but also morally desirable. Douglas introduces an ideal 'reasonable person' who 'represents an objective standard to measure the actions of a real person against' and she also argues that every single scientist is both an epistemic and an ethical agent. By contrast, Lefevere and Schliesser claim that, although scientific pluralism reinforces the collective responsibility of science, not every single scientist needs to be a pluralist. In their view, only those working on research policies ought to be engaged with ethical thinking. Despite their criticisms, Lefevere and Schliesser agree with Douglas on one important point: 'It should still be scientists who judge scientific claims'. They remain silent on whether the people potentially affected by a policy decision should be included in the broader policy discussion.

Even though we endorse the critical points raised by Lefevere and Schliesser, we should also highlight some limitations of their position. First, they argue that the self-legitimated standards of a discipline should be questioned by looking for alternatives in the history of that discipline. Some cutting-edge emerging disciplines, however, may be too young: their history would not contain enough 'suppressed alternative paradigms'. The assessment of the potential impact of science and technology on society is a future-oriented activity: ethical thinking should be supported by the knowledge of history, but history of science alone remains insufficient for it.

Moreover, although Lefevere and Schliesser are quite right in their critique of Douglas' idealized view of a 'responsible scientist', their own limitation of ethical thinking to scientists working as policy-makers appears too restrictive. In fields such as genome editing, or artificial intelligence ethical concerns are ubiquitous. Scientists working in these disciplines often find themselves engaged in ethical thinking or decision-making implicitly or explicitly, even if they are not policy-makers.

Is it correct, as Lefevere's and Schliesser's claim, that not every single scientist ought to be engaged in ethical thinking? We submit that this is indeed the right position and we therefore take up the structure of ethical labor in the scientific community.

The structure of scientific communities

During the last decades it has become commonplace to study scientific knowledge production as a collective enterprise. Since no single individual scientist can possess all the necessary knowledge and skills to make the advancement of science possible, many scholars claim that the scientific community, with all its endemic diversity, is not only the locus but also the agent of scientific knowledge production (Longino 1990, 2002; Solomon 2001).

Here we shall not open a debate on what exactly scientific knowledge is, how it is produced, and by whom it is possessed. For our purposes, it is enough to say that the collectivist view on knowledge production has prompted several detailed descriptions of the structure and function of the scientific community. In recent years, models of the so-called 'division of cognitive labor' across the members of the scientific community have been developed (Kitcher 1990; Strevens 2003; Weisberg and Muldoon 2009; DeLanghe 2014). In these models, the scientific community is characterized as being composed by a mixture of different kinds of scientists: this endemic diversity allows science to accomplish its epistemic aims.

In a model proposed by Weisberg and Muldoon (2009), the scientific community is composed of both 'mavericks' (scientists who tend to be more explorative and often pursue new lines of research) and 'followers' (scientists who tend to expand on the original work produced by others). Weisberg and Muldoon argue that communities with a majority of followers are too slow in discovering the epistemically significant parts of the 'landscape of science'. Communities with a majority of mavericks are much faster, but the mavericks' sense of competition and desire of discovering new things would imperil further development and application of new knowledge. Weisberg and Muldoon conclude that scientific communities containing a good balance between mavericks and followers are the ones that are best equipped to make progress. A number of recent works have extended or criticised this and similar models (Grim et al. 2013; McKenzie, Himmelreich, & Thompson, 2015; Thoma 2015; Pöyhönen 2017; Bedessem 2019; Hessen 2019; Avin 2019). Common to all these works is the aim of understanding how different individual agents contribute to the accomplishment of epistemic aims at the collective level.

We draw from this debate an inspiration for considering how ethical labor is carried on and distributed across the scientific community. The ideal view of a solitary scientific genius, while pleasant and poetical, is certainly unrealistic; the same is true about a solitary, wise and superbly moral scientist. Individual variations in epistemic attitudes, cognitive abilities and skills are beneficial for science and contribute to its overall cognitive labor. We purport to extend this state of affairs to ethics in science. Science as a whole can be responsible as a result of the scientists' individual variations in their engagement with ethical thinking. In other words, we argue that ethical labor, like cognitive labor, is distributed across the members of the scientific community.

To conclude this section, we note that the term 'labor' itself is philosophically charged. For instance, Arendt (1958) distinguishes it from work and action. In her view, labor is an activity carried on by individuals, which is necessary for their survival. Without delving into the philosophical depths of her view, it suffices to say that, unlike Arendt, we are talking about ethical labor at a collective level. However, much like in Arendt's categorization, we submit that both cognitive and ethical labor are necessary for the survival of science as a social institution.

Ethical thinking and the types of scientists

We present in this section a classification of scientists with regard to ethical labor and, in the next section, we discuss its empirical foundation in the results of the project 'Responsible Research and Innovation in Practice' (RRI-Practice). RRI is a science policy framework which aims at achieving research and innovation outcomes that will influence society in a sustainable and ethically desirable way (Von Schomberg 2013). It seeks to engage science and technology stakeholders together with the public in a responsible, multi-dimensional dialogue along five axes called 'RRI keys': ethics, science education, open access, gender equality, and societal engagement.

Our classification follows a virtue ethics approach (Grinbaum and Groves 2013): we do not assess whether scientists follow specific rules, as deontologists would, nor do we evaluate the consequences of the scientists' actions, as consequentialists would. We classify the members of the scientific community in four categories: heroic scientists, Golem-makers, Promethean scientists, and Faustian scientists, according to the values they implicitly or explicitly possess or endorse.

Heroic scientists

Some scientists are merely unaware of the ethical issues surrounding the scientific activity. They are to be found among the researchers who display unusual eagerness to work and, overwhelmed by their own enthusiasm, rush to produce new knowledge or artifacts. They consider research a struggling but ultimately rewarding and almost epic activity. Others are located at the opposite end of spectrum: they are not interested in anything but executing the tasks given by their superiors and fulfilling the obligations assigned by their role. We call both *heroic scientists.* Whether passionate or disaffected, they are like the heroes in ancient Greek mythology: they operate through strength and determination. However, heroic figures like Hercules or Perseus are not particularly wise or selfless. In contradistinction to thoughtful characters like Nestor, Palamedes or Ulysses, who appear much later in mythological time, these heroes rarely if ever have second thoughts. Change of mind or repentance (*metanoia*) was for them a weakness prompt to be satirized (e.g. *Batrachomyomachia* 70); it only began to be seen as a virtue at the time of Thucydides's account of *the Peloponnesian War* (3, 36) and, several centuries later, by the Judeo-Christian authors. Similarly, heroic scientists regard themselves as living simply in the pursuit of scientific knowledge without being aware of the moral complexity of the world.

Heroic scientists are among those who implicitly endorse the value-free ideal: without reflecting on the problem, they regard science as a purely epistemic enterprise. This endorsement of the value-free ideal may be reinforced by the institutional culture, e.g.:

> A main barrier in ethics as a reflexive process is cultural and inter-organisational in nature. […] As such, it is felt [by interviewed persons] as if ethical reflection is 'out-sourced' to a specific programme, but it is not integrated throughout all the research activities. (Hahn et al. 2018)

It is possible that such a barrier to ethical reflection may be overcome through education. Some would argue, in fact, that the endorsement of the value-free ideal by heroic scientists is a sheer consequence of their unawareness of the ethical implications of science, which in turn depends on a lack of training. On this view, proper ethical education will take heroic scientists out of this category. In this context, ethical education (which we equate with training to think, in particular training to reflect upon one's research activity) should not be confused, not reduced to, practical training aimed at acquiring a particular set of skills. Oftentimes, training is taken to be

> about practice, about skill, about learning how to do things. Education is about fostering the mind, by encouraging it to think independently and introducing it to knowledge of the physical and cultural world. It's about theory, understanding and a sense of values. (Rickman 2004)

What many scientists receive is precisely such practical training reduced to giving out general information about scientific integrity or the rules of conduct in a research institution. Scientific integrity, however, is not the same as the activity of thinking, especially if it taught as a set of formal rules imposed in a top-down way. What is needed is a different conception of what ethics training should consist of: a training to reflect upon one's work in a larger context. As recently argued by Mejlgaard et al. (2019), junior scientists should be educated in order to provide them with the tools necessary for responsible conduct under uncertainty and societal controversy. In other words, ethics training should teach what Aristotle defined as *phronesis*: the virtue which allows to reflect upon how to accomplish the ends necessary for the good life. Whether virtues can actually be taught is open to debate, but even if they can, one of the problems with the scientists' ethics training is with following a teaching methodology that would take them out of the category of heroic scientists.

Training in ethics can also be ineffective when organized through supplementary pathways such as online modules, off-the-clock briefing, or an occasional seminar. Again, ethics presented through such pathways may result in a passive and uncritical learning of formal rules without promoting individual reflection (Grinbaum and Politi 2019). In many institutions, the lack of a systematic approach as well as a high turnover of researchers with temporary contracts makes it difficult to establish and maintain a culture of ethics. We now examine how scientists can be classified *after* they have become aware of the existence of ethical issues.

Golem-makers

Although it may lead to raising their awareness, training in research ethics does not provide a guarantee that every scientist will become actively engaged in ethical thinking. Some researchers will remain largely indifferent: they know but do not care, or do not care enough. We call these scientists *golem-makers*. The golem legends are often employed in the discussions of potential risks associated with technological progress (Collins and Pinch 1998, 2002; Sherwin 2009; Grinbaum 2010).

The golems are legendary artificial creatures made by several rabbis as a demonstration of their knowledge and power. In the best known version, rabbi Loew of Prague successfully built a golem in order to protect the Jewish community of that city. This narrative is very unusual: other, much older golems were not built with a specific purpose in mind. In one legend, prophet Jeremiah succeeds in building a perfect human-like golem, which is also able to speak. As it talks to Jeremiah, the golem warns him about the confusion he had brought unto the world: 'When a man meets another man in the street, he will not know whether you made them or God made them' (Atlan 2010). Jeremiah is portrayed as a man of immense knowledge and wisdom, who felt the urge to demonstrate his knowledge in practice: he builds a golem because he can do it. However, he fails to envisage an ethical problem raised by his creative activity. Like Jeremiah, golem-making scientists seek above all to obtain new knowledge; they are so overwhelmed by the enthusiasm of makers that they forget to take the time to reflect on ethics.

The main difference between heroic scientists and golem-makers is that, morally speaking, the former are simpletons, while the latter are not moral ignoramuses: they *can* think about ethics, but they do not. Ethically unaware heroic scientists may become golem-makers even as a result of training in ethics: awareness does not automatically lead to active engagement with ethical thinking. This is maintained by one of the respondents at the University of Queensland:

> I think people are more aware of [the ethical problems in science], there is certainly more emphasis from the funding agencies, but in terms of how people naturally think about things or broader conversations on campus about what does it mean to be an ethical researcher? I don't think we have those conversations. (Sehic and Ashworth 2018)

Golem-makers are more commonly found in the cutting-edge fields of research, e.g. synthetic biology, in which they feel a strong pressure to produce innovative results in the near future. Researchers at the Biodesign Institute at Arizona State University (ASU) seem to exemplify this attitude:

> Researchers at the Biodesign Institute are described by one interviewee as understanding ASU to be the 'wild west of science, [and] that they could do things here that they weren't permitted to do anyplace else'. Accordingly, a tagline used for communicating the culture of the Institute is "the official home of the 'why not?'" This implies an intentional eschewing of popular norms and limits to scientific research. Of course, the 'wild west' was not a terribly ethical place by today's standards, but that reality does not come through as part of the institutional culture of pushing boundaries and transforming the world. Published promotional materials express a similar cultural value, declaring, "this is a no holds barred culture, where curiosity and creativity are on overdrive". (Grinbaum and Politi 2019; see also Doezema and Guston 2018)

However, while some regard their field of research as a sort of wild territory to be explored with a 'why not?' attitude, the Biodesign Institute itself promotes a different image. As stated on its website, the research conducted at the Biodesign Institute appears to be embedded in, and driven by, ethical principles: all the core objectives are directed at social well-being. Despite these statements at the collective level, many individual members of the Institute resemble golem-makers.

At other organizations, institutional culture does play a more significant role. In fact, it sometimes helps to reinforce the golem-makers' attitude of indifference. This is the case in RRI-Practice studies in which it has been revealed that ethics is believed to be a 'brake' impeding the development of science and technology, rather than its 'steering wheel'. If an organization takes ethics to be in deep conflict with innovation, then it will not be regarded as anything more than a matter of compliance with laws and regulations. The golem-making attitude is pervasive in such an environment.

Our judgment on golem-makers is however far from negative. One of the main motivations for pursuing a scientific career is enthusiasm and curiosity. Even after a training in ethics, the majority of scientists will follow these values rather than be converted into philosophers or social thinkers. This is a fundamental hierarchy of values, which we observe in the RRI-Practice studies and do not attempt to criticize. Institutional culture may be a consequence, not a cause, of this hierarchy. At the same time, such an institutional culture provides negative feedback to the members of the organization by reinforcing their disinterest in ethics. This thorny relation between the collective and the individual is crucial to understanding the concept of ethical labor.

Prometheans

There are scientists who place a higher interest, e.g. that of humanity, of a nation or of a religion, above the pursuit of knowledge. For them, good science must be morally good: it should serve the interests of non-scientists and contribute to their flourishing and well-being. We call these scientists *Prometheans*.

In ancient Greek mythology, Prometheus is a Titan who steals fire from the gods and gives it to the mortals. By doing so, he incurs the rage of Zeus, who decides to punish him. Many interpretations of the myth focus on its 'political' aspects, e.g. Prometheus challenges the authority of Zeus in an act of social rebellion. In other interpretations, his behavior would not be very different from that of the golem-makers: Prometheus does something spectacular in a risky and thoughtless way, just because he can. In this interpretation, the myth of Prometheus would be yet another cautionary tale about the unintended consequences of innovation.

Here we follow here a different interpretation. A golem ought not to be released or made free to the public; by contrast, fire is given to humans who own it and use it as they please. The rage of the gods against Prometheus has nothing to do with the well-being obtained by the mortals through the possession of fire but depends solely on *phthonos*, jealousy of the gods, which in turn is connected with *koros*, the idea that men will perform better than the gods themselves (Grinbaum and Groves 2013). In this regard, Prometheus, like Ulysses later on, acts on his *philotimia*, the love of great achievements, and the myth can be used to describe moral ambiguity necessary to achieve technological progress.

The figure of Prometheus is morally ambiguous in many ways. Bachelard claims that 'the Prometheus complex is the Oedipus complex of the life of the intellect' (Bachelard 1964). Although Prometheus could be portrayed as a champion of humankind, he could also have tricked and challenged Zeus as a mere display of his own ingenuity. His psyche remains a mixture of various feelings. Similarly, at a close inspection, Promethean scientists may be driven by personal ambition, the desire of recognition, prestige or career advancement as much as other scientists are. This is a matter of psychology; that ethics can be reduced to psychology is a controversial stance which we do not intend to discuss here. It would be enough to point out that, even assuming that a scientist is driven by selfish reasons or mundane desires, she becomes a Promethean on the basis of how she decides to act upon her desires. In other words, if a scientist aims at obtaining success and recognition by taking the road of progress and human flourishing, then she is a Promethean irrespective of her personal desires.

Promethean scientists should be distinguished from another figure described in the RRI literature: the so-called 'RRI champions' (Wittrock and Forsberg 2019). These are individuals who champion responsible research and innovation and have the power to change their organization. They are different from Promethean scientists in two respects. Firstly, RRI is said to contain five keys: ethics, science education, open access, social engagement and gender equality. While an RRI champion is expected to care about all five, we characterize scientists solely on the basis of their ethical thinking. Secondly, RRI champions found in research-performing and research-funding organizations may not be scientists at all but high-level managers. It is worth noticing, however, that the focus in both cases is on individuals:

> The discussion of the role of impactful individuals in innovation and development goes back to early literature on the topic, and the consensus has fluctuated as a pendulum between giving such individuals much weight, to seeing innovation and change efforts as predominantly a communal enterprise. (Wittrock and Forsberg 2019)

The tension between this individual focus and the collective ethical labor will be discussed below.

Faustian scientists

Certain scientists may lean towards immorality: scientific research is beyond good and evil, or perhaps there are no such things as 'good' and 'evil'. Like Prometheans, they are driven by ambition and desire; but in their case the desire to be the first in their profession is particularly strong. What makes them different is that, even though they know that the price of their actions could be very high, they continue to pursue their work with whatever means they have at their disposal. Potential costs to be incurred later do not matter. They have deliberately dismissed the necessity and the importance of ethical thinking. We call such scientists *Faustian*. In the German legends and in literature, Faust is a knowledgeable, apparently successful but dissatisfied intellectual, who goes as far as to sell his soul to the Devil in exchange for unlimited knowledge and power. Faust's readiness to break moral codes has made him a symbol of overambitious and ruthless intellectual.

Faustian scientists are the only category not to be found in the empirical data collected by the RRI-Practice project. No immoral scientist would normally be willing to publicly disclose their own inclinations. A Faustian scientist, therefore, may be compared to the man who found the legendary ring of Gyges, as recounted by Glaucon in Plato's *Republic*. Glaucon's claim is that whoever had the fortune of finding the charmed ring, which grants the gift of invisibility, would start abusing its power. Glaucon explains: there is nothing inherently 'good' or 'bad' in the world, and ethics is only a social convention. Whoever has a chance of escaping the judgment would behave without consideration for the socially constructed moral codes:

> Suppose now that there were two such magic rings, and the just put on one of them and the unjust the other; no man can be imagined to be of such an iron nature that he would stand fast in justice. No man would keep his hands off what was not his own when he could safely take what he liked out of the market, or go into houses and lie with any one at his pleasure, or kill or release from prison whom he would, and in all respects be like a god among men. Then the actions of the just would be as the actions of the unjust; they would both come at last to the same point. (Plato, *Republic*, 360b–d)

Faustian scientists seem to believe that if 'invisibility' were granted to other scientists, they too would behave immorally. In other words, they do not believe in scientific integrity: from their perspective, deep inside themselves every scientist is immoral. As the Comedian says in the Prelude of Goethe's *Faust*: 'A man sees in the world what he carries in his heart' (Goethe [1808] 1851).

This belief in hidden immorality of all scientists may further drive the ambition and the desire of the Faustians to 'get there first'. If a scandal does occur and they are found out, they would merely believe that they were unlucky. Like the possessor of the magic ring of Gyges, they may move on with their research in unethical ways as long as they feel they have the power to go 'invisible'. The occurrence of a scandal may be a deterrent but will hardly change their moral stance.

Faustian scientists, therefore, pose a methodological problem: it is very difficult to recognize them or to count their number. That a scientist is immoral, in fact, is often understood only after a scandal has occurred. And scandals of this sort do occur: real cases provide sufficient evidence for our argument, even though we have not found any self-proclaimed Faustian scientists among the participants to the RRI-Practice project. A recent example is He Jiankui, a Chinese researcher who announced in November 2018 that he had used a gene editing technique known as CRISPR-Cas9 to alter the genetic make-up of two twin girls, in order to disable the genetic pathway that the HIV virus uses to infect cells (Larson 2018). He Jiankui has innovated in biotechnology but he also violated the 'soft laws' of scientific conduct and was jailed for three years for 'seeking fame and wealth' (Farrer 2019). He has become a celebrity but his work has caused worldwide indignation and significant reputational damage to his country and institution.

At this point, there is a significant problem. On the one hand, Promethean fire-bestowers crave, too, for prestige and recognition: as Oedipus, they may want to 'kill their fathers' and gain power, but they choose to do so by investing in projects oriented towards doing good. On the other hand, it cannot be excluded that the results of the Faustian scientists will turn out to be beneficial years later: ruthless desires and immoral conduct may lead to progress in knowledge or technology after all. Ironically, although in the distribution of ethical labor in science they occupy the opposite sides of the spectrum, Promethean and Faustian models cannot always be told apart in real individuals. This is so because immoral scientists may display good intentions and describe themselves as working for the good of society, e.g. giving progeny to people with HIV. If one day the work of He Jiankui is considered useful and beneficial, a Faustian scientist will turn out to have behaved morally. This is a consequentialist perspective. At present, however, we are concerned with a virtue ethics categorization.

Ethics in science: taking stock of the agents of science

Within the scientific community, different types of scientists may have different systems of ethical values. Considering the agents of science reveals a vast middle ground between the extremes of the 'value-free' and the 'value-laden' ideals. To conclude our classification, we emphasize in this section the key characteristics that separate the categories.

Heroic scientists endorse the so-called value-free ideal. In their view, science and ethics are completely separated: they are concerned only with the former, never with the latter.

Golem-makers, by contrast, do not necessarily think that science and ethics are completely separated. They believe, however, that the pursuit of scientific truth always corresponds to the pursuit of the highest good. In other words, doing scientific research corresponds to doing something good for society. While heroic scientists regard epistemological and ethical problems as completely separated, golem-makers regard ethical problems as being exhausted and resolved within the epistemic and scientific sphere.

Promethean scientists are closer to Douglas's ideal of a responsible scientist: they incorporate ethical reflection in their research activity. Faustian scientists, by contrast, do not even believe in the possibility of ethical issues: they are immoral in the sense that they place themselves beyond good and evil or, perhaps, for them there is no good or evil.

While Faustian scientists, if and when they are found out, should be punished, constructive ethical labor in the scientific community is distributed among golem-makers and Prometheans. However, we contend that a realistic approach towards the institutionalization of ethics in science should take into account the existence, not just of these two types, but of all four.

Describing ethical thinking within the scientific community: methodological challenges and future prospects

As noted, our classification is grounded in the trove of empirical data collected in the project 'Responsible Research and Innovation in Practice' (RRI-Practice). An important specification is here in order. The RRI-Practice organizational studies consisted in a series of semi-structured interviews of researchers, managers, and policy-makers at various levels. These interviews were part of larger studies, which also involved the analysis of relevant documents, strategy reports, organizational policies, annual reports, mission statements, and regulations such as codes of conduct. The resulting national reports contain a wealth of information but they do not necessarily provide a complete representation of the structure of the scientific community. Our classification, in fact, is an idealization extrapolated from the empirical data. Such an idealization is not problematic for at least two reasons.

First, our classification is as much an idealization as are those models that take every scientist to be engaged in ethical thinking at all times. Rudner and Douglas submit that every scientist *qua* scientist makes value judgments, but we submit that this claim is more of a normative statement than an empirical observation. By contrast, we do use empirical findings in our classification, although we too cannot avoid an element of idealization.

Second, our model is not a greater idealization than the ones present in most models of the distribution of cognitive labor. For example, Weisberg and Muldoon's 'mavericks' and 'followers' can hardly be *really* found in an actual scientific community, since at different stages of career or research activity each scientist may embody traits of both types. Moreover, talking about 'the' scientific community is already an idealization: depending on the field of research, from pure mathematics to high-energy physics or biologists working at Antarctic outposts, the group structure may vary very significantly. Idealization in itself is not an insurmountable methodological problem: the models of the distribution of cognitive labor are considered to be useful starting points for understanding how science accomplishes its epistemic aims. Similarly, the idealized classification we provide should be seen as an invitation to consider how individual variations in ethical thinking may lead to responsible science at the collective level.

In other words, heroic scientists, golem-makers, Promethean and Faustian scientists are to be considered as Weberian ‘ideal-types’. For Max Weber, who was heavily influenced by Kant’s study of the pure categories of human reason, social reality cannot be described by exhaustive models capturing all of its aspects: such models, necessarily highly complex, would not lead to any progress in the understanding of society. Weber proposed to make abstract and purified models which are, on the one hand, grounded in empirical data and, on the other, capable of explaining them. In Weber’s view, such abstract models should employ what he called ‘ideal types’:

> An ideal type is formed by the one-sided accentuation of one or more points of view and by the synthesis of a great many diffuse, discrete, more or less present and occasionally absent concrete individual phenomena, which are arranged according to those one-sidedly emphasized viewpoints into a unified analytical construct […] In its conceptual purity, this mental construct […] cannot be found empirically anywhere in reality. (Weber 1903–1917/1949)

Ideal types arise from the inspiration of empirical data, but they are never to be fully instantiated in reality: one has to ‘elevate’ themselves from the empirical level.

A further issue makes the comparison between cognitive labor and ethical labor problematic. While scientists are often eager to talk about their discoveries and scientific conundrums, they can be reluctant to speak about ethics in public or even among peers (Wolpe 2006). They may refrain from doing so because of the lack of proper philosophical training or due to a conviction that science has little to do with ethics. Some scientists believe that reflection on the ethical aspects of science is not a part of their professional obligations. Not speaking about ethics in public does not imply that no researchers reflect on the ethical issues surrounding their professional activity: most scientists in our classification are not morally blind.

The chasm between what scientists declare in public (or what they stay silent about) and what they actually think poses at least two problems. Firstly, as already mentioned, some individuals may be difficult to recognize as belonging to a particular category. Secondly, scientists in general are not used to talking explicitly about the ethical standpoints that they endorse. Ethical norms governing a scientific community may often be implicit and difficult to discern and to evaluate. In short, what many scientists outside the heroic category may lack is not a rudimentary capacity for ethical reflection *per se*—i.e. the activity of thinking about the ethical dimensions of their work—but the habit of explicating and publicly discussing their ethical standpoints and intuitions. In the absence of such a habit, scientists’ ethical thinking may remain unclear or confusing even to themselves.

This issue has already been discussed by Kempner, Perils, and Merz (2005), who interviewed forty US-based scientists working in various biological and biomedical disciplines. They report that scientific research is slowed down and limited, not only by formal constraints, such as governmental policies or codes of conduct, but also by informal constraints, which tacitly forbid scientists from engaging in research that has the potential to spark moral outrage:

> Respondents at once decried external regulation and recognized the right of society to place limits on what and how science is done. They stated that scientists are “moral” and “responsible,” but acknowledged cases in which scientists were sanctioned for acting outside the

> mainstream of their disciplines. They also said that, although information and "truth" had inherent utility, full and open publication was not always possible. Whereas most respondents worked hard to avoid controversy, others relished it. (Kempner, Perils, and Merz 2005)

Empirical evidence, including the findings of the RRI-Practice project, shows that some scientists are engaged in ethical reflection, albeit in an implicit and rudimentary way. In this way, it suggests that a view which is still very popular among many philosophers, and which can be summarized by Heidegger's well-known maxim 'science does not think' taken simplistically at face value (Heidegger 1968), is wrong. However, science performing ethical labor at the collective level does not imply that each individual scientist is, or should be, involved in ethical thinking in equal measure. Some philosophers believe that science was solely devoted to the procedural mechanics of making: it was 'thoughtless' (Arendt 1981) because it did not seem philosophical or political enough. By contrast, we find that scientists of particular types do think about the potential impacts of their research on society. Some scientists, but not all, 'walk the walk' even if they do not 'talk the talk'. That only a fraction of scientists does so, and that the structure of ethical labor need not imply its universal appeal for each individual researcher, needs to be both better studied empirically and better conceptualized philosophically in the future.

Ethics in science: descriptions to prescriptions

Although our classification describes the current landscape of scientific research, our aims are not sociological or merely descriptive. We also wish to provide a normative contribution to the ongoing discussion about the institutionalization of ethics in science. To be viable, however, prescriptions must take the current state of affairs into consideration.

As Cartwright and Hardy (2012) explain, policy-makers must always keep in mind that what has worked 'here' will not necessarily work 'there'. This is because contextual factors may hinder the success of newly developed policies. Understanding the social and cultural settings, including people's agency and values, is necessary for the implementation of successful policies. This is why a failure to consider the actual agents of science, their values, and the degree of their engagement with ethical thinking could lead to serious problems in the institutionalization of ethical reflection.

Many researchers fear that what is marked as 'ethics' within the new science policy frameworks is nothing more than yet another bureaucratic hurdle imposed in a top-down fashion. Another risk is that the agents for whom the policy is designed may not wish to engage with a policy labelled as 'new' and susceptible of changing the *status quo*. This inertia, a resistance-by-default mechanism, makes ethical thinking an institutional challenge. Reducing ethics to 'ticking the boxes' does not encourage deep reflection and may not be sufficient to overcome these barriers.

Some organizations in the RRI-Practice project established research units to carry out ethical reflection (Grinbaum and Politi 2019). While the absence of such dedicated units does not necessarily imply the absence of concerned scientists at an institution, their presence does not guarantee that ethics will actually be reflected upon, or even acknowledged, by the scientists doing laboratory work. There is a risk that the ethics of science will become a specialized occupation in its own right. This delegation of ethical labor is a serious institutional gaffe: as a consequence, individual ethical reflection might be diminished or dismissed altogether, either through the reduction of ethics to a bureaucratic exercise or its transfer into the hands of a few specialists. We suggest, therefore, that the institutionalization of ethics in science should come from *within* the scientific community itself, and not be delegated to external specialists. The expertise of philosophers or social scientists is a welcome addition to, not a replacement of, the scientists' and the engineers' own ethical thinking.

Our classification distinguishes scientists who are not engaged in ethical reflection from the ones that are. It may still be claimed that an ideal scientific community should contain a strong prevalence of Prometheans over the other types of scientists. In our view, this cannot be but one side of the whole picture. Surely Prometheans are needed. However, the fact that they may remain a minority is not problematic in principle, since it does not appear necessary that every individual scientist be equally engaged in ethical reflection for science as an institution to be collectively responsible. Ethical diversity of types, like the diversity of the types of cognitive labor, is both realistic and regulative in the community. Nevertheless, measures should be taken to permit Prometheans to express their ethical expertise without other scientists posing obstacles to them.

Clearly, Faustian scientists are not socially acceptable in the scientific community. Their elimination is a matter of disciplinary procedures, if not jurisprudence. Heroic and golem-maker scientists, however, are not purely evil from the society's point of view. They pursue different values: their value hierarchy is different but it can be morally justified as well. For them, the aims of science are epistemic.

The cognitive labor of scientists is heavy and time-consuming and, as the models of its distribution across the scientific community show, it requires a coordinated effort of different types of individuals, each possessing different skills and competences. It is often the case that the most groundbreaking discoveries and advancements in science are made by a few individuals, while the majority is engaged in the equally important tasks of confirming and applying new theories. As with the division of cognitive labor, it may even also be the case that responsible science should rely on a minority of reflecting individuals, who carry out ethical labor, while the others are left to the heroic stance. Rather than being negatively criticized a priori, this heterogeneity deserves to be understood and analysed: it may turn out that, for science to be collectively engaged in ethical labor, not every single member of the scientific community needs to engage in ethical thinking in the same way. Only further analyses will reveal whether and how ethical labor, similarly to cognitive labor, should be distributed across the individual members of the scientific community for science to be collectively responsible.

To conclude, we suggest that the institutionalization of ethics in science should appreciate the ethical expertise of Promethean scientists without trying to make every single scientist a Promethean. Allowing Prometheans to display their belonging to this category, understanding how they engage in ethical thinking, and enabling them to make their own ethical thinking explicit and public may be crucial for overcoming the barriers to the institutionalization of ethics in science.

Notes

1. For an introduction to ELSI on the example of genomics, see https://www.genome.gov/10001754/elsi-planning-and-evaluation-history; for some discussions, see Balmer et al. (2016), Fisher (2005).

2. For an introduction and some discussions about TA see, among the others, Grunwald (1999, 2018), Rip, Misa, and Schot (1995), Schot and Rip (1997).
3. https://www.rri-tools.eu
4. E.g. a form of political collective responsibility identified as 'being held responsible for something one has not done'. For further discussion, see Grinbaum and Groves (2013).
5. Funded by the Horizon-2020 programme of the European Commission under grant agreement 709637. The project analyzed the barriers and drivers to successful implementation of RRI both in the European context and internationally, promoting reflection on organisational structures and cultures of research-performing and research-funding organisations, identifying and supporting best practices to facilitate the uptake of RRI. It had participants from twelve EU and non-EU countries: Australia, Brazil, Bulgaria, China, France, Germany, India, Italy, the Netherlands, Norway, UK, and USA. The deliverables of the project include a set of organizational studies on how the five RRI 'keys' of ethics, science education, open access, gender equality, and societal engagement are perceived, conceptualized, and enacted within current organisational practices and cultures as well as a set of comparative reports across nations. In this article, we draw from these national case studies as well as from the comparative report on the RRI key of ethics. All the national case-studies produced in the RRI-Practice project, as well as the comparative analyses on each of the RRI-keys, are available at https://www.rri-practice.eu/publications-and-deliverables/.
6. For some recent discussions about the value-free and value-laden ideals of science see, among the others, Kincaid, Dupré, and Wylie (2007); Douglas (2009); Elliott (2017).

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