Engineer's Ecoskepticism as an Ethical Problem

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Abstract	The graduate engineers' attitude towards environmental issues differs profoundly from that of their fellow citizens. This is what we have found out when comparing the answers given by 27,000 graduates to an original survey we conducted in 2011 with those of a representative sample of French people who participated to the "European value survey". The engineers' attitude is also very different from those of business managers and executives. It also differs from those of other master's degree graduates. Contrary to our expectations, the demographic change observed in the profession (growth, place of women, development of new educational tracks) has little influence on the professionals' attitude. The engineers' attitudes toward environmental issues seem to depend more on their professional position than on their individual traits. While the younger generation seems a little bit more pro-environment than their seniors, females do not differ significantly from their male colleagues on that topic. By contrast, we found out that the engineers' attitude towards environment is strongly related to their attitude and values in general and their political, ethical and religious attitude in particular.
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Keywords Engineers' attitude • Environment • Engineering ethics • Politics • Religion

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Introduction

The degradation of landscapes by steam-powered industrial technology has emerged as a social concern since the nineteenth century. Soon the first national-scale environmental laws were voted in several countries. But, it took a century for environmental protection to become a global issue. New words needed to be coined, like "Ökologie" by the German zoologist Haeckel in 1866 and "ecosystem" by the English botanist Tansley in 1935; the principles of ecology had to develop and the science of ecology to emerge as a distinct discipline. Ecological thought and environmental concern expanded in the twentieth century and the first global initiative appeared in the 1970s with the UN's first major conference on international environmental issues. Since the 1987 Brundtland Report, a new concept has been proposed and widely accepted to combine in a single expression developmental and environmental issues: "sustainable development". Proposed by experts and defined as a development which "ensure[s] that it meets the needs of the present generation without compromising the ability of future nations to meet their own needs", it was popularized at the 1992 Rio Summit. Since then, it has disseminated rapidly among laypeople and been included in educational programs all over the world. The 36th chapter of the Agenda 21 on "Education, Public Awareness and Training" was 1 of the 4 among 40 chapters to be singled out at the UN Commission for Sustainable Development for special work programs. Today, this goal is pursued by most educational programs in the world, also in engineering education. Since the turn of the twenty-first century, companies, and especially multinational corporations, have been considered as unavoidable sustainable development actors. It is also widely accepted that industry is highly concerned and that the engineering profession can play a key role in delivering sustainability.

Although definitions of the engineer differ from one country to another, there is sufficient commonality to assess that the members of this profession are directly concerned with the challenges of sustainable development. While some surveys have been made to determine what engineering students know about sustainable development (Azapagic et al. 2005), there is a lack of information about the engineers' attitudes once they have left university.

Our research goal intends to fill this void. It is based on an extensive survey conducted online, in 2011, by the French National Council of Scientists and Graduate Engineers (CNISF, called today IESF). Of the 39,000 survey respondents, 27,000 engineers answered to an optional part of the questionnaire, which we have designed, dealing with social, ethical and professional values. The data were analyzed with SPSS.

In this chapter, we focus on the items dealing with environmental issues, and particularly with six statements, which belong to the "revised" New Ecological Paradigm (NEP) (Dunlap et al. 2000). These statements, which constitute a "short" NEP (Bozonnet 2010) have been included in the fourth wave of the European Values Study (EVS, called previously European values Survey), in 2008. EVS is a large-scale, cross-national and longitudinal survey the first wave of which was in 1981.

[AU1]

The French part of the 2008 survey was conducted by Pierre Brechon (Bréchon and Galland 2010). In the first part of this chapter, we present the outcomes which confirm our first hypothesis on the specificity of engineers' attitude in comparison which their fellow citizens. In the second part, we show evidence in favor of rejecting our second hypothesis on the influence of the graduates' demographic characteristics on environmental attitudes. In the last part, we show that there are strong links between environmental attitudes and the engineers' attitude to other fields of values like political and religious values.

Research Questions and Hypotheses

Since the 1970s, the environmental issue has become a central concern throughout the world, thanks in part to a better understanding of the interconnection between environment, economy and quality of life (Carson 1962). Besides, major technological disasters generated awareness amongst the public of the dangers posed to the natural environment by human activity (Lagadec 1981). In the late 1970s, the first green parties were founded. In countries all over the world, departments and ministries were created dedicated to this cause. This period also saw the birth of a new field of investigations in the social sciences: environmental sociology (Dunlap and Catton 1979).

Since 1987 and the publication of the Brundtland Report by the World Commission on Environment and Development, a new phrase has become the slogan of our contemporary societies: "sustainable development" (Brundtland 1987). The ideas covered by this new concept were not entirely original, but the expression and the definition proposed in the UN report disseminated widely. Since the Rio Summit in 1992, sustainable development has become a global cause and the phrase "think globally, act locally", the new mantra of the late twentieth century.

Because of its complexity, sustainable development requires to be dealt with by a set of very different actors and not only government and experts. Yet, after the Rio Convention, it took 10 more years (until the Johannesburg Summit, in 2002) for the business world to be recognized as a major player in this field. The UN report has put forward in a new way the responsibility of the business world – alongside that of government – in the implementation of a more sustainable development.

If the business world is called to be concerned about its environmental and social impacts, the industrial world is even more concerned because technical development is at the roots of many environmental problems. Although definitions of "the engineers" (who they are and what they do) may vary from one country to another, the type of knowledge and activities of engineers, as well as their work environment make them appear as actors "involved" in the environmental issues. They are not necessarily personally sensitive but they cannot, as members of their professional group at least, escape their responsibility. Obviously, engineers are aware of this unique position. This is evidenced by the presence of environmental topics in major engineering conferences and in most training for more than 30 years.

In the United States, the first codes of ethics for engineers have existed since the beginning of the twentieth century. They have long concerned solely internal issues within the profession. The environmental issue first appeared in 1977 in the code of ethics of the American Society of Civil Engineers (ASCE), in a very modest way. New proposals to transform this recommendation into a stronger commitment in 1985 and 1995, met strong resistance from the profession. The 1996 version introduced a reference to sustainable development in canon 1 along with "their" definition of sustainable development (ASCE 1977, 2006).

> Engineers shall hold paramount the safety, health and welfare of the public in the performance of their duty (fundamental canon 1, ASCE code of ethics, 1976)
>
> Engineers should be committed to improving the environment to enhance the quality of life. (provision set forth in paragraph (f) in the guidelines to practice for canon 1)
>
> Engineers shall perform services in such a manner as to husband the world's resources and the natural and cultured environment for the benefit of the present and future generations (canon 8, proposed in 1984 but not included)[1]
>
> Engineers shall perform services that help sustain the world's resources and meet long-term human needs, while protecting the natural and cultural environment (revised canon 8 proposed in 1995, but again not included)
>
> Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of their duty (fundamental canon 1, ASCE code of ethics 1996)
>
> Sustainable development is the challenge of meeting human needs for natural resources, industrial products, energy, food, transportation, shelter, and effective waste management while conserving and protecting environmental quality and the natural resource base essential for future development. (definition adopted by ASCE in 1996)[2]

Environment has also been mentioned, since 1990, in the code of ethics of the world's largest engineering association by members: the Institute of Electrical and Electronics Engineers (IEEE 1990). It is still present in 2006, when the code was revised, with no change in the first article.

> We, the members of the IEEE, in recognition of the importance of our technologies in affecting the quality of life throughout the world, and in accepting a personal obligation to our profession, its members and the communities we serve, do hereby commit ourselves to the highest ethical and professional conduct and agree: (1) to accept responsibility in making decisions consistent with the safety, health and welfare of the public, and to disclose promptly factors that might endanger the public or the environment

[1] This canon was proposed by the ASCE's Environmental Impact Analysis Research Council, but not proposed to the Board of Directors because the Professional Activities Committee voted against (ASCE 2006).

[2] In October 2009, the ASCE Board of Direction adopted a new definition: "Sustainable Development is the process of applying natural, human, and economic resources to enhance the safety, welfare, and quality of life for all of society while maintaining the availability of the remaining natural resources".

The first code of ethics of the European Federation of National Engineering Associations (FEANI), in 1992, includes an article dealing with environment. The version adopted shortly after by the French National Engineers Association (CNISF, today IESF) was more cautious. The "*Charte d'éthique*" which replaced in 2001 the "*code de déontologie*"[3] evokes environment in a more straightforward way in several articles.

> The engineer takes into account the health and safety of the public and contributes to environment protection in a reasonable manner (*une protection raisonnée de l'environnement*). (CNISF 1996, translation by the authors)

> The engineer is aware and makes the public aware of the impact of technical achievements on the environment. (CNISF 2001, art. 3)

> The engineer acts according to the principles of 'sustainable development'. (CNISF 2001, art. 4, translation by the authors)

From this evolution, we come to our research question: "to what extent have French engineers (not just their official spokespersons) adopted the view of the CNISF/ IESF Charter?" In a hypothetico-deductive approach, we propose to observe the relationships between dependent and independent variables corresponding to specific hypotheses that we seek to test or to invalidate (Popper 1973). So, what do we know about the engineering profession in France and what hypothesis can we formulate?

1. Engineers have a special position in the social and the economic world, also in the relationship between society and its natural environment. Their professional group is considered to bear responsibility for many environmental problems, and sometimes also for solutions: in both cases, engineers are supposed to know and be able to do what a laymen might not know or not be able to do, or to a lesser extent.
2. Previous research suggests that engineers are more optimistic than their fellow citizens about the social impacts of technology. Indeed, a survey "Engineering Science and Society" (ISS) conducted in 1999 showed that 68 % of French graduate engineers considered that technical progress brings more good than harm to humanity (2 % believe that progress brings more harm and 28 % that it brings almost as much harm as good) (Didier 2008b). A survey by the Centre for the Study of French Political Life about science conducted at the same period shows that, among the French, more than half of the respondents considered that science brings as much good as bad and 45 % that it does more good than harm (CEVIPOF 2001).
3. The analysis of the codes of ethics promulgated in various countries shows an emergence, among the engineering profession, of a concern for environment, although it is prudent and rather late in comparison with the rest of society.

[3] Both expressions are translated by "code of ethics" in English, but the expression "*code de déontologie*" is usually reserved in France for a professional code which is legally binding.

So our first hypothesis is:

Hypothesis 1 The engineers' environmental attitude differs from those of the French and is marked by greater optimism vis-à-vis the environmental impact of technical development.

For the development of the second hypothesis, we start from the observation that the engineering profession in France has undergone profound changes over the last 20 years:

1. The engineering profession is still largely masculine. It is estimated that nationally, the proportion of women among practicing engineers is 17 %. But things are changing and the profession feminizes. The share of female graduates among engineers who are under 30, is estimated at 26 % (Darsch and Longuet 2011b).
2. The flow of graduates increases and tends to accelerate. There are more and more young engineers (under 30). This may generate a generation – or age– effect, particularly since the environment issues are still quite recent.
3. The way to access to the engineering degree has evolved over the past 30 years. In 2010, 85 % of graduates obtained their grade through initial training, with an increase of students coming through the parallel admissions track, enabling university students to enter engineering schools; 11 % became engineers through continuing education and 5 % in apprentice status, which has been proposed since the 1990s only.

Hence our second hypothesis:

Hypothesis 2 as young people have been sensitized to environmental issues since their youth and women are supposed to be more sensitive to environmental issues than other members of our societies (because they are supposed to hold more holistic views), young engineers and female engineers express a greater sensitivity towards the environmental impact of techniques than their colleagues.

Finally, the ISS survey conducted in 1999, with French graduate engineers, highlighted strong links between the political and religious attitudes of respondents and their professional ethics (Didier 2008b).

1. Practicing Catholics Engineers (22 % of respondents) appeared more sensitive to social issues but less sensitive to environmental issues, than their colleagues;
2. Left-wing engineers (26 % of respondents) seemed more concerned about the potential negative impacts of technology and they agree more often with the environmental and anti-nuclear movements than their colleagues; they seemed to have more confidence in the capacity of democratic debate to guide the country's technical choices.

So our third hypothesis is:

Hypothesis 3 The values that carry engineers – in the field of morality, religion and politics – affect their environmental attitudes.

To test our research hypotheses we have developed a series of questions that were included in the annual survey of the French National Council of Scientists and

Graduate Engineers conducted in April 2011. More than 39,000 graduate engineers responded to the general survey, and more than 27,000 to the optional module on the values that we designed. This part consisted of 50 variables dealing with opinions and behaviors on ethics, morals, religion and politics. Ten variables were explicitly devoted to environmental attitudes including the 6 among the 15 items which compose the "revised New Ecological Paradigm." To make comparisons with the attitudes of French in general, we relied on the European Values Study (EVS) conducted in France in 2008.

Specific Traits of the Engineers' Environmental Attitudes

Although our investigation focuses on the contemporary period, it seems useful to recall the evolution of French public opinion about the environment over recent decades. Most investigations dealing with the French and the environment show a high stability in attitudes over the past 15 years. More than eight in ten French say they are very sensitive or rather sensitive to the environment. If we look closer at those who are very sensitive or if we use a finer indicator, such as the "deep sensitivity" (11 % of the French in 2001) we observe an overrepresentation in this category of executives, graduates and households with the highest incomes (Bigot 2002). Social status, education and income appear to be linked with environmental deep sensitivity. How about French engineers who are all graduates of higher education, benefit from rather high social status and come for many of them from well-off families?

The outcome of our research is that the graduate engineers' attitude towards environment differs from that of the other French people and that the variations we observed are highly significant (Table 13.1). But although engineers share the social characteristics of people with deep sensitivity to environmental issues, they don't share their opinion. Overall, engineers appear much more confident in "the ability of the genius of man to maintain our Earth viable", which is consistent with their training and profession. More surprising is that they reject more the idea the "destiny of man is to dominate nature" although they contribute to make this domination possible. Regarding the fragility of nature, which is evoked in items 2 and 4 (two items which are negatively correlated in the French population), the attitude of the engineers is again very different from that of the French. While an overwhelming majority of French (95 %) are concerned about the consequences of human activities and while only a small minority of them (16 %) believes that nature is able to cope with the damage, the engineers' opinion is divided on both issues (51 % agreement for the two items which are negatively correlated). Finally, the engineers' answers also differ from those of the French about the two items concerning the future (the inability to support population growth and the fear of the occurrence of a major ecological crisis): engineers are much less concerned by the occurrence of an environmental catastrophe if any change is made to the current development

Table 13.1 Agreement of the French and engineers with six items on environment

		French 2008	"Cadres" 2008	Eng. 2011
1	We are approaching the limit of the population number the earth can support (Overpopulation)	48	45	67
2	When humans interfere with nature it often produces disastrous consequences (Disaster)	95	93	51
3	Human ingenuity will insure that we do not make the earth unlivable (Ingenuity)	51	57	87
4	The balance of nature is strong enough to cope with the impact of modern industrial nations (Strength)	16	16	51
5	Humans were meant to rule over the rest of nature (Domination)	23	21	8
6	If things continue on their present course, we will soon experience a major ecological catastrophe (Catastrophe)	89	83	14

Table 13.2 Correlation matrix for the European values study using Somer's D (Bozonnet 2010)

French (EVS)	Variables					
Variables	Overpop.	Disaster	Ingenuity	Strength	Domin.	Catastr.
Overpopulation	1	0.20	-0.03	-0.04	0.03	0.16
Disaster	0.15	1	-0.08	-0.23	-0.16	0.34
Ingenuity	-0.02	-0.11	1	0.34	0.24	-0.19
Strength	-0.03	-0.28	0.30	1	0.35	-0.33
Domination	0.02	-0.21	0.23	0.38	1	-0.18
Catastrophe	0.14	0.40	-0.17	-0.32	-0.16	1

(14 % versus 89 %). However, they are much more worried than their fellow citizens by the impacts of population growth (67 % versus 48 %) (Tables 13.2 and 13.3). [AU2]

So, the engineers' attitude differs from that of the French in general. It is marked by a strong optimism towards technical development and the strength of nature. But it also differs from that of the French "*cadres*" (executives). What is striking at first glance is the proximity of the answers given by the executives in the 2008 European Value Study with the answers given by the French in general, in the same survey. The executives trust a bit more than the other French on the ingenuity of man to solve environmental problems and believe a little less that an ecological disaster will come if nothing changes (with a rate which is very high compared to engineers). When comparing the engineers and executives, engineers appear significantly less pessimistic concerning major ecological disasters, and much more confident in human abilities. Not only the risk of disturbing nature appears less problematic to them (51 %, versus 93 % of executives), but they also believe more in the genius of man to keep Earth livable (87 % versus 57 % of executives). Much more than executives, they think there's more to worry about population growth (67 % versus 44 % of executives). Optimistic regarding techniques, they appear more pessimistic in the other fields.

The correlation matrix reveals important links between "Overpopulation", "Disaster" and "Catastrophe" on the one hand and between "Ingenuity", "Strength"

Table 13.3 Correlation matrix for the engineers survey using Somer's D (in the 2011 survey)

Engineers (IESF)	Variables					
Variables	Overpop.	Disaster	Ingenuity	Strength	Domin.	Catastr.
Overpopulation	1	0,10	0,15	-011	-0,23	-0,17
Disaster	0,11	1	0,25	-0,25	-0,17	-0,14
Ingenuity	0,08	0,12	1	-0,13	-0,25	-0,18
Strength	-0,12	-0,25	-0,27	1	0,32	0,30
Domination	-0,08	-0,05	-0,17	0,11	1	0,14
Catastrophe	-0,10	-0,07	-0,19	0,15	0,21	1

and "Domination" on the other. To agree with these last three items is to show confidence in the future and in humans' ability to "manage" the environment. However to agree to the other three items "Overpopulation", "Disaster" and "Catastrophe" is to demonstrate pessimism or at least anxiety. The negative correlation between the two groups of items means that not only do they constitute different elective universes but also, these worlds appear in opposition

The attitudes of the engineers are characterized by trust and optimism towards technical development. The millenarian discourse about the end of the world due to environmental catastrophes, where the disastrous consequences of human intervention seem decisive, has little effect on them. Their attitude towards environment is in clear dissonance compared to other occupational groups, including executives (*cadres*) which they belong to. It should also be noted that not only their opinions differ greatly from those of their fellow citizens, but the very structure of their environmental attitudes is different: two items that are the most linked among engineers are among those that repel most among French people: "The balance of nature is strong enough to cope with the impact of modern industrial nations" and "If things continue on their present course, we will soon experience a major ecological catastrophe".

A Low Correlation with Demographic Variables

Among the hypotheses that we have formulated, some concern the impact of demographic diversity on environmental attitudes. One can indeed wonder how feminization, rejuvenation and diversification of routes into the profession are likely to generate specific environmental attitudes?

While differences of position with respect to the items of the New Environmental Paradigm between men and women are not very significant for the French population as a whole, it is quite different among executives (Table 13.4). Indeed, for four items on the 6, there is a difference of more than 4 %. Thus, women executives believe less than men in the capacity of human ingenuity to maintain our Earth livable (−13 %). They show less agreement with the idea that "If things continue on their present course, we will soon experience a major ecological catastrophe" (−12 %). Finally they believe less than men that "the balance of nature is strong

Table 13.4 Answers to the NEP according to gender

	French sample EVS 2008			Sample of "Cadres" 2008			Graduate engineers 2011		
Overpopulation	Average	M	F	Average	M	F	Average	M	F
Disaster	48	49	48	45	45	45	67	67	68
Ingenuity	95	94	96	93	93	94	51	51	51
Strength	51	50	52	57	62	49	87	87	88
Domination	16	16	16	16	18	11	51	51	50
Catastrophe	23	24	22	21	23	19	8	9	7

enough to cope with the impact of modern industrial nations" and that "Human were meant to rule over the rest of nature" (−7 % for both items).

Overall, women executives seem to be less confident in the capacity of nature or of the human genius. This may explain that they believe less than men that the human destiny is to master nature and they fear more the possibility of a technological disaster. One explanation may be advanced. Women who work as executives are better educated than other women. They may have a more critical eye over the relationships between humans and nature and take more distance from the dominant model valued by males. These results lead us to believe that the acquisition of a higher social and cultural status allows women to situate themselves in terms of environmental attitudes outside the dominant male model. This explanation is consistent with many studies on the importance of work in the emancipation of women.

However, the next step of our analysis provides more surprises. Indeed, the differences between the attitudes of men and women disappear completely when analyzing the data from the engineers' survey. The difference between male and female engineers varies up to a maximum of 3 % (for the item "disaster") and the average variation is 1.33 (for all the items)[4] which is less than the variation for the entire population (1.83) and much less than that of the *cadres* (6,16). In other words, while belonging to the professional group of *cadres* generates different environmental attitude depending on gender (women appear less confident in human ingenuity and in the strength of nature, more dubious about the mission of human to dominate nature and more aware of the risks of an environmental catastrophe), belonging to the engineering profession annihilates this gender difference. Within the engineering profession – with a high education and techno-scientific expertise, and largely male – the difference of opinion regarding indicators of NEP disappears between male and female. Of course, the elements of explanation are plural and it is not ours to decide. However, we are inclined to believe that the engineers' workplace influence and the predispositions for science that led them to undertake engineering studies are two important explanatory factors of female engineer professional identity – and ethos.

If gender generates little difference among engineers with respect to environmental attitudes, age proves slightly more discriminating. Younger engineers appear

[4] The average is calculated from the absolute differences.

a bit more sensitive to environmental issues. This is also what sociologist Jean-Paul Bozonnet observed by analyzing the effects of age on the responses to NEP in the French part of EVS in 2008 (Bozonnet 2010). Younger people are more skeptical about the balance of nature (48 % under 30 believe that the balance of nature is strong enough to cope with industrial damage, versus 58 % of those over 60). They agree less than their elders with the statement that the destiny of humans would be to dominate nature (8 % versus 11 %). However, they are less worried about the possibility of a major disaster (13 % under 30 versus 19 % over 60). Overall, even if the amplitude of the variations is low, the engineers under 30 appear more concerned about environment than the engineers who are older than 60. Because they were born at the same time as the concept of sustainable development and its widespread distribution, they were sensitized early to the environmental issues, which have been debated a lot in the public arena. Concerning the social diversification of the engineering population linked to the multiplication of access ways into the profession, we just note that the engineers who graduated from the most prestigious schools (called group "A+"[5]) differ from their congeners. They are less trustful than the other engineers in the ability of human ingenuity to insure that we do not make the earth unlivable, but are more confident in the capacity of nature to regenerate itself. In addition, they agree more often than the other engineers that if nothing changes, a major ecological catastrophe could occur (Table 13.5).

Regarding the influence of the type of educational route, variations are not very significant (except for items "Strength" and "Catastrophe"). We note however that the attitudes of the engineers who entered engineering school through parallel admission (i.e. after a first degree at university rather than after a preparatory class) are opposite of those of graduates from the most selective schools (A+). A link seems to appear between the symbolic hierarchy of the engineering schools and the "best way" to get into engineering education and the graduates' environmental attitudes. The more their study profile approaches the traditional and historical "best way" *(voie royale)* to the diploma (i.e. scientific preparatory class followed by an engineering program in a A+ school), the less they seem concerned about nature, the more they trust in human ingenuity to keep the Earth habitable and paradoxically, the more they are concerned about the occurrence of an environmental catastrophe.

Thus, neither the gender of the respondent, nor their age, appears to be factors that explain their environmental attitudes. We observe, however, some variation related to the type of engineering educational track, even if they are not all significant. Hypothesis 2 is therefore not confirmed.

[5] In the annual list published by the magazine *L'Etudiant*, the group of engineering schools called "A +" is composed mainly of Parisian very prestigious schools. They represent 18 % of the engineering students population.

Table 13.5 Respondents' agreement with the 6 NEP items

	A+[a] (Eng. school	*Prepa* before school	Aver-age	Other Eng. School	Parallel access to Eng.
We are approaching the limit of the population number the earth can support (Overpopulation)	68	68	67	67	67
When humans interfere with nature it often produces disastrous consequences (Disaster)	50	51	51	52	53
Human ingenuity will insure that we do not make the earth unlivable (Ingenuity)	80	86	87	88	88
The balance of nature is strong enough to cope with the impact of modern industrial nations (Strength)	58	53	51	49	47
Human were meant to rule over the rest of nature (Domination)	10	9	8	8	7
If things continue on their present course, we will soon experience a major ecological catastrophe (Catastrophe)	19	15	14	13	12

[a] In this table, "A+" and "Other engineering schools" refers to the question "from what school did you graduate?" where we distinguish the graduates from the most prestigious schools from the others. "*Prepa* before school" and "parallel access" refers to the question "what was your training before entering the engineering school?". We have grouped graduates who went through a traditional or an integrated preparatory class from those who have entered the engineering degree in other ways (i.e. after a first cycle at university, or after a 2 years programs in a technical school). 24 % of the students belong to this second group

The Engineers' Environmental Attitudes and Their Others Values

Is the way people conceive good and evil related with the world of environmental attitudes? In our survey, a question was asked about moral attitude.[6] This variable provides enough evidence of correlations with environmental attitudes. Within the population of engineers, 15 % believe that in moral matters there are clear lines that are valid in all situations ("hardliners"), 62 % think it depends on the circumstances ("conditional") and 23 % are not found in either of the two proposals ("moderate"). The "hardliners" are less alarmist against the risk of overpopulation (63 % versus 68 % of all engineers and 48 % of French) and more likely to agree with the idea that the destiny of Man is to dominate nature (13 % versus 8 % of engineers and 23 % of French). Their view is close to that of the French in general about these two

[6] The question the respondents had to answer, was: *"Here are three statements which people sometimes make when discussing good and evil. Which one comes closest to your own point of view? (1) There are absolutely clear guidelines about what is good and evil. These always apply to everyone, whatever the circumstances. (2) There can never be absolutely clear guidelines about what is good and evil (3) I disagree with both statements."*

Table 13.6 Moral type, religious attitude and the NEP items

	Overpop.	Disaster	Ingenuity	Strength	Domin.	Catastr.
Average	68	52	87	51	8	14
Hardliner	63	45	84	60	13	23
Moderate	71	48	84	49	7	14
Conditional	68	54	88	50	8	12
Religious	64	43	86	59	10	21
Non religious	69	54	88	51	7	11
Atheist	70	58	86	44	8	11
French	**48**	**95**	**51**	**16**	**3**	**89**

items (Table 13.6). However, they have different opinions about the strength of nature (60 % think it is strong enough to compensate for the industrial damage versus 51 % of engineers and 16 % of French) (Table 13.6).

The engineers' religious attitude generates differences of environmental attitudes. Engineers who define themselves as being religious are less concerned than other engineers by the risk of overpopulation. They are also less concerned about the environmental risks that may result from human actions than the "non-religious" and even less than "atheists". They are more likely to believe that nature is strong enough to compensate for the damage caused by the industrialized countries than "non-religious" and even more than "atheists" (59 % versus 50 % and 44 %).[7] They are however, more sensitive to the risks of a major ecological disaster (21 %) than "non-religious" and "atheists" (11 %). It should be noted that these four environmental variables, the correlation with the subjective religious feeling is greater than the previous one about moral attitude and far higher than the demographic criteria.

The choice between freedom and equality is highly correlated with people's symbolic universe.[8] Engineers who prefer "equality" (and represent 45 % of the population) are much more sensitive to the risk of overcrowding that those who value more "freedom" (76 % show concern versus 61 % of the "pro- freedom"). They give slightly more credence to the ingenuity of man to solve environmental problems and have less confidence in the soundness of Nature (45 % versus 57 %). Rejecting the idea that the destiny of man is to dominate nature, they are also less pessimistic than the average about the risk of ecological disasters. They promote an "ecological discourse" based on greater solidarity and human intervention in the process of evolution of the planet. They seem both more concerned over the current

[7] This result is consistent with the trends of greater technical optimism among practicing Catholics engineers compared to other engineers in the ISS survey conducted among engineers in northern France (Didier 2008b, p. 160; Didier 2009).

[8] The question the respondents had to answer, was:"*I find that both freedom and equality are important. But if I were to choose one or the other: (1) I would consider personal freedom more important, that is, everyone can live in freedom and develop without hindrance (2) I would consider equality more important, that is, that nobody is underprivileged and that social class differences are not so strong; (3) I don't know.*"

Table 13.7 Political attitude and the 6 NEP items

		Overpop.	Disaster	Ingenuity	Strength	Domin.	Catastr.
Average		68	52	87	51	8	14
Equality		76	52	89	45	6	11
Freedom		61	51	85	57	11	17
Engineers should engage	++	74	48	87	54	8	17
	+	69	53	87	52	8	14
	no	47	53	81	48	14	16
Political interest	+, ++	69	50	85	54	9	17
	–,—	66	54	90	48	7	11
French		**48**	**95**	**51**	**16**	**3**	**89**

situation and future but also more confident in the ability of man to face the situation (Table 13.7).

The most politicized engineers are less often than the average concerned about the risks of natural disasters caused by human activity. They are also less confident in the genius of human to protect the environment but believe more in the ability of Nature to compensate for the errors caused by the industrialized countries. Finally, they are much more likely to believe in the possibility of a major ecological disaster (17 % versus 11 % of those who reported "little" or "not interest at all" for politics). Moreover, a large majority of engineers who responded to the survey agree with the statement that "the engineer must commit to a transformation of society" (85 %, including 21 % who say agreed "strongly"). These "pro-commitment" engineers show a strong concern about population growth (74 % versus 47 % of engineers who answered "no" to this question) and to a lesser extent, they have confidence in the ability of nature to absorb damage due to industrial development (54 % versus 48 %). Moreover, they believe a little more than the average engineer in the ingenuity of Man (87 % versus 80 %) and do not agree at all with the statement that the destiny of man would be to dominate nature (8 % versus 14 %).

On a number of aspects, one could highlight the influence of the religious attitudes of respondents on their environmental attitudes. Variations also exist when considering the criteria of political interest and commitment of engineers to transform society. The engineers who are more interested in politics – and those who advocate greater involvement of the profession in the res publica – have a conception of the relationship of men to the environment which differs from other engineers. They believe that the balance of nature is strong enough to withstand industrial damage while worrying about the possibility of a major ecological catastrophe "if thing continue on their present course". Overall, subjective criteria seem most relevant to explain the different environmental attitudes within the engineering profession that demographics. They offer an intensity of correlation two to three times higher than the demographic criteria. From this fact, we can conclude that the ethical stance, the preference of the respondents for liberalism or egalitarianism, as well as their religious and political attitudes are important variables to take into account

to understand the environmental attitudes of French engineers. Hence, hypothesis 3 is confirmed.

Conclusion

Our research question finds, at the conclusion of this article, an affirmative answer. All hypotheses lead to conclude that environmental dynamics occur at different levels. On the one hand, engineers, differ about environmental attitudes from both the average French and the executives. On the other hand, engineers are driven by values. The different dynamics at work, not exclusive of each other, have their genesis in a series of factors – more endogenous than exogenous – probably joining them in a complex manner to form a symbolic system capable of structuring intensely the universe of representations, beliefs and behaviors related to the environment. We believe we have helped to show some kind of pluralism in a profession dominated by the scientific paradigm, and often seen as homogeneous or monolithic.

Regarding the explanation of the singularity of the attitudes of engineers, the analyses presented here have eliminated assumptions rather than offered immediate response. The lack of gender variation leads us to say that the singularity of the engineers' attitude cannot be explained by the strong masculinity of socio-professional group (83 % men). Another outcome is that the feminization of the profession is unlikely to produce a transformation of the environmental attitudes of the engineers, because their attitudes do not seem to differ from those of their colleagues on that topic. The strong correlations between moral attitudes, religious and political engineers and their environmental attitudes made us update a relative pluralism within the profession. They do not allow us to advance causal explanations of environmental attitudes. Finally, a draft analysis of the respondents' attitude according to their type of engineering education – although not at the heart of this work – opens up new avenues of research. It may contribute to better understand the profession's environmental attitudes.

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