WHY USUAL ASSUMPTIONS SHOULD BE QUESTIONED\textsuperscript{1}

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\textbf{ABSTRACT:}

Even if usual hypotheses in gender and science research are well established and useful, we want to question some of them in order to move towards new more complex and qualitative research questions and deepen the existing knowledge in this field. In this paper, we propose to question five issues in an exploratory way: the proportion of female students in relation to cultural change, the impact of role models on female recruitment, the work-life balance issue in relation to attractiveness and retention of female professionals, belonging to a network and being included in it, single-sex education issues.

\textbf{KEYWORDS}: Women and Excellence; Critical Mass; Cultural Change; Single-Sex Education; Role Models; Work-Life Balance; Networks.

\textsuperscript{1} Paper presented at the final conference of the study “Meta-Analysis of gender and science research”, 19-20 October 2010, Brussels (Belgium).

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INTRODUCTION

European research in the last years (FP5, FP6, FP7) has designed research topics according to some assumptions from the literature. Even if those hypotheses are well established and useful, we want to question some of them in order to move towards new more complex and qualitative research questions in gender and science and deepen the existing knowledge in this field. In this paper, we propose to question five issues in an exploratory way:

A. A high number of female students or scientists expands the fishing pool for possible careers and is supposed to create a “critical mass” which provokes a cultural change in the discipline. A comparison between chemistry, medicine, mathematics, engineering, philosophy, social sciences, languages, law and business shows that “critical mass” does not imply an automatic cultural change.

B. “Role models” play an important role in the literature, but some disciplines became very “feminine” with few or no female role models. Through comparisons between various disciplines, we will explore the impact of role models.

C. “Work-life balance” issues play an important role in career choices; however, some careers without a satisfying work-life balance are popular among young women: for example executive jobs occupied by former business school graduates in global companies or traditional feminine jobs such as nursing. Some studies show that successful women present the family as a support and not as a burden (Husu & Koskinen, 2010). These facts suggest the need for a more qualitative way of exploring careers and cultural representations to explain differences that cannot be explained by rough facts.

D. We usually think that belonging to a network or an institution means being included in it and many efforts are focused on “attracting and retaining women”. The biographical study of some careers suggests that belonging is a first step, but is not enough to be included even if the discrimination may be very subtle.

E. Single-sex education is sometimes presented as a solution to attract and retain more women scientists. If we look closer at existing cases of single-sex education, we observe a complex picture and advantages and drawbacks. A study of the case of the Ecoles Normales Supérieures in France provides an overview of issues raised by such institutions. In 1985, ENS became co-ed, the proportion of women recruited in natural sciences and mathematics dropped.

When we look closer at various examples, we observe that the causal effects presented as unambiguous have many counter-examples. This leads us to a more complex approach of those issues: we should question the conditions under which the causal relations are true. Obviously other factors have an impact of the final
result and we cannot expect that the increasing proportion of women will automatically trigger off a gender cultural change or that improving the work-life balance issue in a profession will automatically attract young women professionals.

We will provide a critical perspective on each of these topics. First, we will study some counter-intuitive facts. Second, we will suggest some new research questions to better understand the social mechanisms behind gender issues and a given scientific discipline.

Even if the literature often considers natural sciences only plus mathematics, technology and medicine (STEM stands for “Science, Technology, Engineering, Medicine”), “Sciences” are considered in this paper in a broad sense as all academic disciplines.

1. THE “CRITICAL MASS”

1.1. DOES A “CRITICAL MASS” OF FEMALE STUDENTS LEAD TO A CULTURAL CHANGE?

A high number of female students or scientists expands the fishing pool for possible careers and is supposed to create a “critical mass” which provokes a cultural change in the discipline. Usually when we compare women at the top, there are more women where there was a higher proportion of students, as the pool was bigger. Anyway, if we compare the chances to be promoted for men and women, women do not always have better chances where they are numerous. A comparison between chemistry, medicine, mathematics, engineering, philosophy, social sciences, languages, law and business shows that “critical mass” does not imply an automatic cultural change.

The source for Figure 1 is She Figures 2009 p.51 and p.79. We used numbers for EU-27. Education field is absent on p.79, and numbers are from different years, 2006 and 2007. So our comparison is not perfect but we can observe some trends.
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FIGURE 1.

We compared the proportion of female PhD graduates (in dark gray) to the proportion of female grade A staff (in medium gray). We divided the percentage of PhD graduates by the percentage of grade A staff (in light gray). A result of 3.06 means that the proportion of female PhD graduates is 3.06 times the proportion of female grade A staff.

First of all, it is clear that in all fields, the proportion of women is decreasing: it is divided by 3.47 to 1.93 from PhD student to grade A staff. This is a first reason to consider gender equality issues in all fields and not only in SET.

Even if social sciences and humanities have a higher proportion of female grade A staff with a lower proportion of women PhD graduates than medical sciences and agricultural sciences, we can observe that there is more or less a correlation between the fields where the proportion of female students is high and the fields where the proportion of female academics is high. This can be explained by the pool size: the bigger the pool is, the better the fishing is. The literature therefore usually assumes that women have better chances to make a career where the proportion of women is high.

But considering rough proportions is not enough. A closer look at chances to reach the next career step provides a completely different picture. Proportions refer to the percentage of men and women in a field, we refer to “chances” or “opportunities” as the ratio between the proportion of women at one career step and the proportion at the next step. If there were equal opportunities, this ratio should remain the same. If the proportion of women from one step to another drops dramatically, it means that they had no equal opportunities or chances, even if the proportion remains high in
comparison to another field. Proportions and chances do not represent the same actual opportunities for an individual. Looking at the two graphs, we see that chances of men and women to get to the next career steps are not equal from one field to another, and that there is no correlation between a high proportion of women students and better chances for them to get to the next step. “Better chances” on this graph, means that the proportion of women does not dramatically drop from one stage to the other. When the proportion of women is divided by 2, they have better chances than when the proportion is divided by 3,5. In agricultural sciences and in medical sciences, female PhD graduates form a majority with proportions of 51% and 54% respectively. However, the proportion is divided by 3,04 for agricultural sciences and by 3,18 for medical sciences, which is very high.

Proportion of students, by field, at each stage of a typical academic career, from ISCED 5A to grade A would have been useful, but chapter about seniority in She Figures 2009 provides no information split by fields (see p.73). For example, it would be interesting to know where the holes are located in the leaking pipeline. If humanities seem a rather friendly field for women in the table, it is because all the female students who dropped off before PhD are not represented. Comparisons by narrower fields, including non-SET fields, would be interesting too. Inside “social sciences” we can suspect that “economy” and “sociology” have very different profiles, same for chemistry and physics or literature and philosophy.

We made the same graphic with numbers from France (Figure 2 ; source : Etat des lieux, les femmes dans la recherche, 2007).

**FIGURE 2.**

In all disciplines the proportion of women is decreasing from licence to PhD except in sport sciences! Again, there is no correlation between the proportion of women
and their chances to move to the next step: best chances are in Sport sciences (32%, 0.91), Natural sciences (29%, 1.04), Literature and art (73%, 1.12), Languages (75%, 1.14) and worse chances are in Humanities and social sciences as pluridisciplinary degree (71%, 1.39), Law and political sciences (66%, 1.38), etc.

This situation implies that the effort for gender equality should not be limited to fields where women are a minority in numbers as in SET (3,06 and 3,47), it should be extended to fields where even if they are numerous, they face barriers that prevent them from having equal chances to make a career as in agricultural sciences and medical sciences (3,04 and 3,18). The societal impact of such a gender gap is not less important than the lack of female SET professionals. Cultural bias attached to the gender gap in law or sociology may be damageable for the society as a whole: there is a risk that some key issues remain invisible. For example, Margaret Maruani (Maruani, 2002) has demonstrated how a male bias provides a very biased perspective on unemployment issues, as if male unemployment was more important for society than female unemployment. In the educational field, Françoise Vouillot (Vouillot 2009) proposes a new perspective on the statistical data on career choice where she shows that the imbalance between fields is due to an imbalance in boys’ career choice and not to one in girls’ career choice. As a result, she concludes that efforts should concentrate on the diversification of boys’ career choices more than on the promotion of scientific careers among girls.

A second consequence is the need to question the relation between the gender gap in the fishing pool and gender equal opportunities and to identify other factors, in relation to numbers, that influence equal opportunities and cultural change. The case of Russia has been well analysed by Mongili (Mongili 1998, pp 72-74): During the communist period women were numerous in SET fields, but with much less responsibilities and career opportunities that men. After the end of the communist period, resources for the research sector dropped dramatically and researchers tried to escape to more attractive and lucrative sectors of the economy (Graham & Dezhina 2008). As Uvarova and Godfroy-Genin have explained (Godfroy-Genin & Uvarova, 2009), thanks to their good connections with the business sector, many male researchers dropped out and began a new career in business. Female researchers remained more often in the laboratories because they had fewer opportunities to move, and many of them took responsibilities, because somebody had to do so. When the situation improved, male researchers came back and again took the top positions. Similar changes have been observed in the Eastern European countries: those countries have a high proportion of women students and academics in SET, but not for very good reasons. SET prestige as well as SET salaries are low, SET image is associated to the former regime, so SET is not an attractive sector and tends to be a second choice, left to women.

Reasons to explain the high proportion of female students in humanities and human and social sciences in France are of the same kind: in many cases, these fields are a second choice for those who do not feel strong enough to choose something else (Godfroy, 2010). They are considered as fields with a poor socio-economic reward and few opportunities to move to another field. As girls are less confident in their SET skills, it is not a surprise to find many of them in human and social sciences. Prestige and attractiveness are very efficient to explain women’s success or failure.
This important parameter has to be crossed systematically with the search for a large female fishing pool. Having large female fishing pools in second choice fields cannot be a solution to improve gender equality.

The high proportion of women should not be an objective per se, reasons to explain it are very important to take into consideration before making it a political target.

2. THE “ROLE MODELS”

“Role models” play an important role in the literature, but some disciplines became very “feminine” with few or no female role models. Role models in law, medicine, art, literature or philosophy are very few. How many famous women lawyers? How many famous women medicine doctors? How many famous women artists (some but much less than men artists)? How many famous women writers in the school curricula? How many women famous philosophers except Arendt? The situation is in fact not better in a very “feminine” discipline than in SET disciplines where the “role models” discourse is very pregnant. Despite Ada Lovelace in ICT and Marie Curie in Physics, ICT and Physics remain most of the time male dominated.

In France, the literature curriculum presents very few women writers you could identify with; anyway the proportion of girls in the “Humanity and language” option of the “baccalaureat” at the end of high school is very high (close to 80%). Agronomy, architecture, business, law, medicine became very popular among female students with almost no role models.

Nonetheless, it is true that women writers or women artists are now included in the curriculum, in exhibitions (Women artists exhibition at Centre Pompidou in 2010 in Paris for example), etc. but this change happened after women had occupied those fields and it had no impact on recruitment. Even if women artists are better known, museum directors, art critics, recognised artists (with few exceptions) remain mostly males. The structure of the domain is not changing: many women considered as “amateurs” remain at the bottom and many men gatekeepers at the top.

Questioning the role of role models in career choice leads to two research questions. First, role models are supposed to change representations and speed up cultural changes, but obviously, the process is not an automatic one and we must question the idea that it always creates a better situation for women. An in-depth comparative study of the domains where women are now numerous (as humanities, law or medicine in France, for example) would provide a better comprehension of the ongoing processes when women enter massively in a new domain. Those processes are probably not unique and depend on some factors we should identify. Delphine Gardey’s work (2001) on professional typists is a good illustration of the potential of such studies.

Second, if some domains became very attractive towards women without any role models, it means there are other factors that determine the engagement of women in some domains, and we should identify them. We must especially pay attention to the fact that those factors may be positive or negative regarding women. In some cases,
women became dominant because men left the field, as it was the case for research in Russia right after the end of communism. The field did not become attractive; the lack of opportunity for women combined here with the lack of professional perspective in the research sector so that many women were stuck in the field when men were able to escape to more attractive sectors (Godfroy and Uvarova, 2009).

To sum up, we need to understand which factors are impacting the success of role models, how some fields became attractive without role models, even with a poor female success rate in their careers. Furthermore we need to understand how “role models” are interacting with other factors as curriculum, profession, images, etc. We must also investigate what is behind the role model and compare between fields and images of the fields (sometimes not corresponding to reality).

3. “WORK-LIFE BALANCE” AND CAREER CHOICES

Work-life balance is an important factor for attractiveness and success. This is confirmed by many case studies and plays an important role in career choices; however, some careers without a satisfying work-life balance are popular among young women: for example executive jobs occupied by former business school graduates in global companies or traditional feminine jobs such as nursing. Moreover, studies have demonstrated that in some cases singles have mediocre careers compared to married people even if they are supposed to experience easier work-life balance issues (Marry, 2004). On the reverse, some studies show that successful women present the family as a support and not as a burden (Husu & Koskinen, 2010). These facts suggest the need for a more qualitative way of exploring careers and cultural representations to explain differences that cannot be explained by rough facts.

Obviously, work-life balance in itself is not the only criteria. Work-life balance is not specific to women. Men express the same concern, but do not make the same career choices. We must question the other criteria, and how they combine with work-life balance: freedom, autonomy, personal satisfaction, career perspectives, wages, etc.

We should study professions with many women and bad work-life balance and question their motivations. Again confronting representations and reality could be useful. Why so many women in business schools and so few in engineering schools in France when jobs and careers are more or less the same as potential managers in the same companies, with slightly better opportunities for engineers? Work-life balance is obviously not the first criterion here, culture, career representations, curriculum content have an impact too. Work-life balance can also be a trap and work-life balance does not automatically imply career success even if sometimes it implies overall job satisfaction. The case of the French company EDF3 ten years ago

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3 “EDF” stands for “Electricité de France”. In 1946, 1450 energy companies in France were nationalised and merged in a State-owned company to provide energy at national level. EDF had the monopoly of energy in France. In 2004, the market was opened to concurrence and EDF became a private company even if the French State is still a major stakeholder. Today, with 160.000 employees, it is one of the biggest companies in the world in the energy sector. (Source EDF website:
was interesting regarding work-life balance: EDF was one of the preferred companies of French employees (men and women) because of a good work-life balance. Anyway, only men educated in a few “grandes écoles” (especially at the Ecole Polytechnique) with a specific career profile as regional manager, supposing a high mobility between 25 and 40, had chances to get to the top. The required mobility was a handicap for women’s career, but was not perceived as such. Most women were very satisfied with jobs with a good life-work balance and poor career perspectives. We can observe the same kind of perverse effect of the work-life balance priority in the Nordic countries where horizontal segregation between sectors is very high with most women employed in the public sector, in care and education professions (Méda et Périvier, 2007).

To sum up, even if work-life balance is a universal aspiration of all workers, we cannot consider work-life balance as a systematically positive factor towards gender equality. Determining in what context it is positive and how it is combined with other criteria is essential.

4. BELONGING AND BEING INCLUDED

Belonging to networks, being an alumnus or an alumna is often considered as a crucial factor for careers. Studies have demonstrated the importance of networks and they inspired measures focused on “attracting and retaining”. But, if biographical stories confirm the importance of networks, they demonstrate that networks are not enough. In an organisation, all fellows are not equal. The biographical study of some careers suggest that belonging is a first step, but is not enough to be included even if discrimination is very subtle.

The case of Simone Weil is a good illustration of the fact that belonging is not equal to being integrated. Apparently, she was well integrated: as “normalienne” and “agrégée” in philosophy, two very masculine institutions in the ‘30s, she belonged to the right networks to become a famous philosopher and a university professor. On the other hand, philosophy remained one of the most masculine disciplines at that time (Mosconi, 1994). In fact, she was not really integrated. She was paradoxically better included in the mathematicians’ networks through her brother André than in the philosophers’ networks. Looking at her activity, there are no letters with former classmates who had a position at the university in Philosophy (Sartre, Aron), no participation to conferences, no access to academic research, no position in the academia or in preparatory classes (Godfroy, 2010). She was very active in the circle of former students of Emile Chartier4, but instead of having a “normal” career as academic philosopher, or as professor in preparatory classes as many other former students of Chartier, she developed informal and interdisciplinary topics, out of usual academic classifications.


4 Emile Chartier (1868-1951) was a well-known professor of Philosophy. In 1909, he became professor of philosophy at lycée Henri IV preparatory classes and had a strong influence on many former students: Raymond Aron, Simone Weil, Georges Canguilhem, André Maurois, etc. He published many books under the pseudonym “Alain” and is also known under that name.
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Of course, efforts to attract and retain women are useful but not enough. We need a better comprehension of inclusion issues and the functioning of networks. Biographical stories and ethnographic methodologies could be the starting point for such studies.

5. SINGLE-SEX EDUCATION

Single-sex education is sometimes presented as a solution to attract and retain more women scientists. If we look closer at existing cases of single-sex education, we observe a complex picture and advantages and drawbacks. A study of the case of the Ecoles Normales Supérieures in France provides an overview of the issues raised by such institutions. A very high proportion of currently active female full professors are “normaliennes” (alumnae of one of the ENS). As ENS were single-sex between 1940 and 1985 (except ENS de Cachan), the ENS recruited each year the same number of men and women in all disciplines through separate competitive examinations. But the prestige of the female ENS was much lower: the usual career perspective was secondary school teacher, not researcher or professor as in the male ENS. Nonetheless, if the future of women students was mostly secondary school teacher, many of them became researchers and professors (Mosconi, 1994; Ferrand, Imbert & Marry, 1999). We should explore what networks supported them, what networks they created themselves, assuming that they benefited of better opportunities than other women academics, if we consider the high proportion of “normaliennes” among top women academics. In 1985, ENS became co-ed, women accessed to the same status as men, but the proportion of women recruited in mathematics and natural sciences dropped. In parallel, the proportion of female professors dropped after 1985. This case illustrates the benefits and the drawbacks of co-ed and single-sex education in an elite school. Effects may be rather different in other contexts as demonstrated by Petra Jordanov’s study of the single-sex engineering education programme in Stralsund in Germany (Jordanov, 2006).

CONCLUSIONS

Even if usual assumptions are useful and have been the starting point of many excellent findings, we need to move beyond them. They hide many complex issues about prestige, hidden hierarchies, clichés, images, personal motivations, networks, (changing) construction of excellence, etc. The interactions between attractiveness, funding and excellence in a gender perspective would be especially interesting to investigate. Another key issue is studying unusual paths: the linear paths are well described, other paths are poorly taken into account in career descriptions, we need to include the non-linear path in the conceptualisation of career studies. A last point refers to the need to systematically study causation issues: if A does not always imply B, then why? Is it because the relation is valid under some conditions, in that case under which ones? Is it because B was not caused by A, but by some other issue, then which one? Or because A implies C instead of B, or implies B and something else? Then what is C? And what relation to B?
We finish with some suggestions for further research in a sort of manifesto:

- Do not take for granted usual assumptions.
- Take into account complexity, non-linear paths and overlaps: interdisciplinary, international, inter-sectorial.
- Study counter-examples if any, even if they are not in natural sciences or technology and/or if women are well represented in the field.
- Changing scale provides new perspectives, detailed studies and exploration of informal discourse may provide new materials. Develop ethnographic studies.
- Question assumptions through comparisons to other fields, especially out of the “pipeline”. The reverse side may be very informative. Try a new conceptualisation framework.
- Develop longitudinal and long period studies.
REFERENCES


