Breaking the vicious cycle of gender stereotypes and science

Francesca Molfino and Flavia Zucco,
Associazione Donne e Scienza, Italia.

Introduction

Over the last thirty years many scholars have claimed that any form of knowledge and culture has been accomplished by a western male gender subject and this idea inherently conveys self-reinforcing codes strictly related to how the male subject has defined himself in organisations and related institutions. Hence, if a female gender subject wishes to share, for example, scientific knowledge, it is necessary to determine what excludes her in the institutions, identifying the areas of science that are common to both. For example, the laboratory and everything directly connected to experimentation, theory and most technologies belong to human beings, whereas the selection of research fields, application of technologies, funding, access to scientific knowledge, academic institutions and the same scientific organisations come under the umbrella of a "scientific culture" that is connected to other forms of culture and contains the same forms of gender discrimination.

The issue of stereotypes in gender discrimination is a very crucial one, because their roots are deeply embedded in the history, culture, education and psychology of individuals in western countries. In scientific research, stereotypes are also present because social roles and values are not influenced by the features at the roots of this activity: objectivity and scientific rationality. In fact, data have shown that gender horizontal discrimination in disciplines, vertical discrimination in career progress and exclusion from decisional boards are widely present in science and technology areas.

A recent study (2010) conducted under the Meta-analysis project (ref 1) funded by the European Commission reported that issues on science and gender stereotypes were considered fundamental because 2458/4549 entries in a database of literature about women in science are related to stereotypes and identity. Most of those studies were conducted in Germany, Sweden and UK[1].

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[1] The amount of literature has changed over time. The period in which the literature on "Stereotypes and Identity" has been analyzed, shows that the gender perspective has emerged especially in the last twenty years. From the 1970s on, with the beginning of the women's movement and growing feminist/gender awareness, more literature emerged. The number slowly increased in the 1990s, and doubled between 2000 and 2007. In

The conclusion of Meta Analysis states that "Stereotypes are shared social beliefs, values and norms which reflect the roles assigned to men and women. **They are the product of particular historical, cultural and social contexts**."[2] But we think there is more to it than that. Social models explain that most gender differences result from the adoption of gender roles which define appropriate conduct for men and women. Gender roles are shared expectations of men's and women's traits and social behavior, and are internalized early in development. But there is a ongoing controversy over whether they are purely cultural creations or whether they reflect preexisting and natural differences between the sexes in abilities and predispositions, as they have been present in most cultures for many centuries

The issue of stereotypes has been discussed in detail by us (Molfino,2006), by European Researches (see Prages (2009), Meta- Analysis (2010) and genSet (2011), thus this paper will only highlight the ongoing tendency to inadvertently reproduce them today and the difficulty to build others that can sink long-lasting roots and not be merely efficacious, but short lived, slogans.

Moreover, we believe that "gender stereotypes" in science go hand in hand with "scientific culture stereotypes" and that it is ineffective to change stereotypes unless the traditional way of conceiving and working in science is changed. In this sense, the articulations of such culture in the different organizational structures have to be looked at in detail.

This is the goal of the GenisLAB project (http://www.genislab-fp7.eu/).

We believe that claims such as:

- " gender as a critical success factor for innovation",
- "gender should always be included as a dimension of scientific quality and as an integral part of the scientific knowledge creation process",
- "gender is an important dimension of innovative creativity and should be included in the innovation cycle"

are valid drivers of an ideology of social justice but do not fully link up general claims and real situations.

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fact, during the last twenty years "Stereotypes and Identity" (SI) has become a very prominent topic. (Meta An. p.8)

[2] Meta An p.65

Thus, it is necessary to identify crucial switchovers where gender discriminations, based on existing stereotypes on science and women's ability/readiness to practice them, are activated.

Gender stereotypes: origin and peculiarities

The term "stereotype," (from Ancient Greek stereòs, solid, firm, model, mold) was coined in 1798 by the French printer Didot, as a technical term for the casting of multiple papier-mâché copies of printing type from a papier-mâché mold. These stereotypes were made to produce duplications of printed images.

In 1922 the journalist W. Lippmann used the word in his book *Public opinion*, (New York, Free Press, 1965) when referring to the processes involved in forming public opinion. Today the cognitive nexus with reality is not always based on direct individual experience, but mediated by images that have to be very simplified and clear in order to foster and promote comprehension of the world in all cultures. According to Lippmann, stereotype application is likely to occur when a perceiver lacks the time or cognitive capacity to think deeply about others.

The original use of the word in Lippmann's work and its current importance are connected to a specific feature of present day communication, i.e. the need to spread information as widely as possible. Thus, *repetition* requires *simplification*. Both features are core elements in building stereotypes that do not contemplate differences in single experiences. Repetition has replaced the truth of the facts. It must be kept in mind that today two concomitant operations are activated when making a rational-comprehensible-shareable statement. On one hand, one may criticize stereotypes while, on the other, new generalizations are created, generalizations whose content has to repeated until it becomes a stereotype. In this sense, advertising, political propaganda and stereotypes are often allies. However, the new gender stereotypes we will discuss later have not taken root in experience and so can be uprooted in practice.

Young children need stereotypes to build cognitive maps that are accompanied by pleasant and unpleasant experiences and by emotional and moral judgments. Stereotypes arise when self-integration is threatened. They are part of our way of dealing with the wavering of our perception of the world, and hence we have to deal with them. Nowadays, increased experience and greater information on cultural diversities can lead to more flexible categorizations that can be changed by experience. However, it must be kept in mind that as soon as controllable situations that threaten the identity of a group or an individual occur,

they are promptly utilized intransigently to single out, and ward off, diversity holders. Nationalistic rallies in various countries are an example of this.

Educational disparities and some cultural and social boundaries have almost disappeared in western countries. However, in an age of information overload, "nutshell" stereotypes encapsulate information compactly and efficiently and thus possess an undeniable survival value. Admittedly, many stereotypes are self-reinforcing, self-fulfilling prophecies.

Thus, all stereotypes are assertions, or rather fixed, repeated generalizations that can be used to distinguish and amalgamate different categories, and above all to judge groups or individuals positively or negatively (pre-judices).

Traditional displays of prejudice have not disappeared, but rather contemporary forms of prejudice are often difficult to detect and may even be unknown to the prejudice holders.

Generally speaking stereotypes are a way to explain and establish male-female diversity in opposite yet *complementary* categories. This differentiates gender stereotypes from racist stereotypes that generally have prevalently oppositional and negative features based on prejudice and the refusal and rejection of individuals in the stereotyped group. In gender stereotypes possible clashes with the other sex and diversity had to be resolved to save the species, so the positive features attributed to the female and maternal role of women were linked to the "reassuring" feature of inferiority to prevent the violent suppression impulses triggered off in cases of different populations.

Because deeply rooted gender stereotypes have been acknowledged, the literature has reported their "unconscious" feature, i.e. their unconscious and involuntary activation of stereotyped judgments[3] which has a dual effect: stereotypes are particularly difficult to wipe out and are attributed to biological or cultural and psychological differences. Stereotypes could be defined as implicit empathy, immediate understanding, a sharing of common beliefs;

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[3] In 1995, social psychology researchers Anthony Greenwald and Mahzarin Banaji proposed the extension of ideas already existing in cognitive psychology to social psychology. They asserted that the idea of implicit and explicit memory can apply to social constructs as well. If memories that are not accessible to awareness can influence our actions, associations can also influence our attitudes and behavior. Thus, measures that tap into individual differences in associations of concepts should be developed. This would allow researchers to understand attitudes that cannot be measured through explicit self-report methods due to lack of awareness or social desirability bias. In research, the IAT(Implicit Association Test) has been used to develop theories to understand implicit cognition (i.e. cognitive processes of which a person has no conscious awareness). These processes may include memory, perception, attitudes, self-esteem, and stereotypes. (from wikipedia).

they are the core of the "common sense"and persons who do not share it are traditionally considered mad.

Old stereotypes can change as a result of the advent of new stereotypes or their transposition to other fields. Indeed, unlike in the past, today the capacity to remain typically "female" (being responsible to others, favouring relations between colleagues rather than competing for power) may be considered innovative contributions in the social and scientific fields. But enhancing them means also reactivating the traditional image connected with them coupled with all the ensuing and conflicting emotional reactions with positive and negative judgments. The fact that stereotypes, above all gender stereotypes, give access to communication, to belonging to a collectivity, must not be overlooked. New and different types of stereotypes have a hard time asserting themselves, one of the reasons being the "individualistic culture" that emerged in the 20th century and focused on individual's values and identity. And it was in this culture that liberation movements, including women's liberation, produced as unwanted effect and came to a standstill. Now it seems difficult to move on from single experience to collective sharing, thus public space is filled by old stereotypes.

Attacking and changing the" common sense" that is the repository of gender stereotypes is not a linear process (Molfino F. 2008, Il Soggetto femminile tra subordinazione, potenza, potere" (2008); *Genere e Potere*, S. Bisi, Bonanno editore, Roma) as revealed, for example, by the difficulty women face in reconciling a scientific career and family, a task that generates a feeling of ongoing ambivalence especially when they live in a traditional culture[4].

Gender Stereotypes and careers

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[4] I A recent " genSET European research" (2011) confirmed that: "women holding a university degree present a relatively high degree of attitudinal ambivalence between, on the one hand, whether working for pay is as fulfilling as being a housewife, and on the other, whether children and family life suffers if mothers work. Another finding is that there is also ambivalence regarding whether family life suffer if mothers work and whether preschool children suffer if mothers work. There is a cross-national variation in the attitudinal ambivalence (Portugal and Spain give twice as many ambivalent responses in comparison to Sweden and Norway). These differences are explained through the cultural lag: the greater the 'lag' between rates of change in female educational attainment and in institutions that might reconcile paid work with motherhood, the greater is attitudinal ambivalence with regard to gender roles (Sjöberg O. (2010) Ambivalent Attitudes, Contradictory Institutions Ambivalence in Gender-Role Attitudes in Comparative Perspective, *International Journal of Comparative Sociology*, vol. 51, no. 1–2, pp. 33–57).

Such difficulties emerge in the field of social roles pervaded by this complex tangle of old and new gender stereotypes. For example, attempts are made to harness and export the positive caring and minding features of women to define positively the presence of women in organizations with respect to men. In scientific research the different relationship men and women have with work is usually seen as follows:

Work: for men it overlaps with the social role; for women it is part of <u>life's wider idea</u>;

Career: for men it is based on competitiveness; for women is based on <u>competence and scientific interests</u>

Hierarchy: for men it is seen as gaining power; for women it is seen as acquiring <u>responsibility</u>;

Time: for men it is evaluated in economical terms and personal success; for women it is evaluated in terms of product <u>quality</u> ;

Objectives: for men they are reached by fighting; for women they are reached by acquiring <u>autonomy</u> ;

It is noteworthy that this is also a sort of stereotypical statement as sums up the findings of at least two decades of studies.

However, those statements may help advocate new models for those involved in research and also help eradicate the limiting concept that the field of science is a male domain. Besides it is widely acknowledged that research needs ideas to be shared and different creative approaches to achieve innovation.

Within the framework of studies on the influence of gender in working organizations (?), social research has explored gender effects on leadership through a wide variety of methodologies in many hundreds of studies (Eagly, A. H., Johannesen-Schmidt, M. C., & van Engen, M. (2003*). Transformational, transactional, and laissez faire leadership styles: A meta-analysis comparing women and men*. Psychological Bulletin, 95, 569–591.). This has given rise to a new leadership model (transformational leadership) that conveys features that are no longer traditional male ones, but ones that respond to female traits.

In order to become good leaders, today managers are advised to reduce hierarchy, to encourage team work in research, to focus on supporting, fostering and stimulating researchers, to create harmony in a group, etc.. In this case female leaders are engaged in

more of the contingent reward behaviors (i.e., exchanging rewards for followers' satisfactory performance) than their male colleagues. All this is required to meet fast developing technologies, to expand geopolitical confines, and also to manage the increasing number of workers belonging to different cultures, the extraordinary levels of complexity and interdependence, and to achieve greater competition.

The incongruities between old and new stereotypes play a major role in reaching positions of power. A female leader can be rejected either because she is too proactive or is not proactive enough, in the sense that she is too *masculine* or too *feminine*. Consequently, they encounter more dislike and rejection than men do for showing authority, expressing disagreement, or being highly assertive or self-promoting.   Women's competence is often questioned and, if recognized, it is considered inappropriate and inconsistent with the female image.

A woman is required to blend male and female aspects smoothly, whereas a man is not. Indeed, "*feminization*" on a man's part is considered a weak point, or the failure of the positive male role. Thus, only women are asked to: "to combine agentic behavior with warm, communal behavior, which seems to mitigate suspicion of agentic women. This will increase their liklebleness and influence by ''feminizing'' their behavior and displaying increased warmth or cooperativeness, whereas men's influence does not depend on displays of communality" ((A. H. Eagly, L. L. Carli, *The female leadership advantage: An evaluation of the evidence*, The Leadership Quarterly 14 (2003) 807–834).

In order to reach positions of power women have to be extremely competent, and at the same time reassure others they conform to expectations concerning appropriate female behavior. They have to overcome their traditional roles while merging them with roles that have long been considered "non" female, and successfully doing so without feeling lost or in danger. New female models mean that women have to ponder over the oppositional aspects of the definitions of male and female and continually cope with the unsolvable ambivalence between what are considered male and female decisions.

Men and women alike find the transition between old and new stereotypes difficult to handle, and the latter may feel their identity threatened by the changes in role, image and stereotypes. Female leadership is a solitary and eccentric position (i.e. outside the system) and the difficulties encountered in fighting two battles result in the problem being denied. This is why young female researchers in particular say that gender discrimination is not present in their

organizations. We must not be mislead by such claims because if we examine the presence of women leaders in scientific organizations where merit seems awarded more to the person rather than gender, it is evident that such are not gender-fair.

So far we have discussed gender stereotypes in organizations in general. Nevertheless, the data acquired over the many years show a low percentage of women in leading positions in scientific institutions and organizations. For this reason we would like to look into how stereotypes influence scientific organizations and, vice versa, how certain ways of conceiving science can reinforce gender stereotypes.

Looking at gender stereotypes in scientific culture

The vast number of publications addressing the issue of gender stereotypes and science with reference to male and female identity in the second half of the 20th century should make us realize that we are faced with something that we are not able to suppress. One of the reasons is that while stereotypes are subject to changes regarding the male and female roles, they are also advanced by the media that continually reiterates certain information and images on science and scientists to build public opinion that lets itself be led by objective and incontrovertible realities of science.

The Report of Meta-Analysis on stereotypes and identity describes the conceptual framework adopted to analyze the literature: 1. Inborn cognitive abilities in males and females; 2. Stereotypes and career choices in adolescence; 3. Social construction of science.

The concept that gender stereotypes are a result of biology and physiology has always been the main stumbling block hindering a change in gender role. The mental idea that one belongs to a sex, i.e. the Gender, is one of the most – if not the most –**biologically** primitive and important social categories. This would explain why it is the first social category that humans are able to discriminate (as early as nine months of age) and, consequently, why gender-related stereotypes are among the first stereotypes that humans learn (as early as the of age two). Not only do we need to represent the two sexes to recognize ourselves and others, but right from birth we come into contact with men and women through direct experience or representations of the family environment.

Cross-cultural studies could provide crucial evidence on the relative importance of biological versus cultural factors in gender differences in personality traits. If they are indeed

biologically based, the same differences ought to be seen in all cultures, so pan-cultural gender differences would provide evidence for a biological basis. This might consist of direct effects on personality traits, mediated through neurological or hormonal differences between the sexes. But it is also possible that pan-cultural gender differences result from universals in learned gender roles. For example, because men in all cultures are physically stronger than women, they may universally be assigned roles as leaders, and in these roles may learn to become more assertive than women.

Though the biological implication of the sex difference is important in treating the gender concept, it does not solve the problem. The numerous studies on "different skills" between boys and girls have come to the conclusion that the differences are negligible[5].

There are still researches on 'inborn cognitive abilities' or on the influence of the role of hormones with reference to the two sexes[6], and they currently represent a limit of our knowledge on gender. Although these influences can be defined in the future, this does not mean that such can be turned into discriminatory prejudices. Moreover, recent studies have shown that the sexual biological differentiation process involves a myriad of factors and is no longer a question of merely differentiation of the XY chromosomes. Oppositional or complementary features should not longer be used to define a man or a women. They should be replaced by distinctions, grades, unprejudiced descriptive differences, power diversity and a society that has turned difference into marginalization. As a result gender stereotypes

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[5] "The findings suggest that widely reported **differences between girls and boys in mathematical performance and science aptitude are too small and inconclusive** (Hedges and Nowell, 1995; Geary, 1996; Gallagher, Levin and Cahalan, 2002; Hyde, 2006; Strand, Deary and Smith, 2006). Similarly, the study of Hyde et al. (2008), based on standardized tests of a sample of more than seven million primary- and secondary-school students in ten states of the USA, indicates that sex differences are statistically irrelevant. Most of the literature has focused on similarities and differences in average scores on different cognitive measures. While females excel at many memory tasks including memory for objects and location, episodic memory, reading literacy or speech fluency, males stand out in visuospatial transformations, especially mental rotation, science achievement and certain mathematics tests. However, according to Hyde and Mertz (2009), most results present much between-sex overlap in cognitive abilities and performance, as girls are now performing as well as boys on standardized tests. Additionally, among the mathematically talented, even if a gender gap is more apparent, it is closing quickly in many countries and is nonexistent in others. In summary, the studies do not show conclusive biological differences between men and women in performance in science and mathematics. Moreover, most research not only concludes that no scientific experiment has ever proved differences between women's and men's cognitive capacities, but also questions the so-called science-based ideological claims of female inferiority as being close to very traditional biological determinism (de Cheveigné and Muscinési, 2009)." In: Meta-Analysis.....

[6] "A body of research has explored the **role of hormones in cognitive differences.** Researchers have identified critical periods when the release of sex hormones (e.g. during prenatal development or puberty) contribute to both sex and brain differentiation (Halpern, 2004). Evidence appears to suggest that androgens (e.g. testosterone) do influence certain cognitive abilities, at least for certain spatial tasks." In Meta-Analysis.....

constructed on various dichotomies, oppositions or complementarities could no longer be based on biology.

Regarding the second point of the Meta-Analysis (Stereotypes and career choices), data shows a comparatively low number of studies focused on primary as well as secondary education. This means that during the research period analyzed, early childhood and adolescence have featured less despite their importance in terms of gendered educational and professional choices. On the contrary, most studies investigated the early career of scientists, especially in higher education. (Meta An p.10.).

We focus on the third aspect of the Meta-Analysis Report: social construction of science. We will address the issue of stereotypes in post-academic science and point out that the changing context may help readdress the issue so that women in science may rely on a positive role in contemporary research.

Back in the 1980s, E. Fox Keller (Fox Keller Evelyn, 1985 *Reflections on Gender and Science.* Yale University Press) clearly described why women were not considered able to practice science. Their lack of objectivity, due to their essentially empathic approach to the world, would have biased their objectivity . Their thinking was based on feeling more than on rationality, as well documented in the book "The mind has no sex?" by L. Schiebinger (Schiebinger Londa L**.** *The Mind Has No Sex? Women in the Origins of Modern Science,* Cambridge: Harvard University Press,1989). Even outstanding protagonists (Voltaire, Kant etc.) of the Enlightenment shared this opinion, despite personal relationships with "femmes savants". Some motivations of women's marginality in science were underlined by Fox Keller as gender stereotypes in science.

1. Science is neutral: science deals with things (objectivity) and women with persons (subjectivity).
2. Female identity is bound to the natural world; male identity is based on the dualism of human species and nature and on search to dominate and control nature;
3. Male knowledge is more scientific, analytical and objective; female knowledge is based on intuition.
4. Science is rationality completely separated from feelings: science is tough and rigorous while women are irrational and emotional.
5. Science is the search of power, while women search for harmony.

The only positive stereotypes in science were masculine and the only choice for women scientists was identification with masculine role models. It is proved that when male and female describe the **ideal self** they use relatively more masculine features Therefore, it appears to be a general tendency for both men and women to wish to be more "masculine" than they are. Nowadays the greatest change is the increase in masculine personality traits in women. This change is arbitrary, but reflects the association of male-dominated occupations with masculine personality traits and the access of women to these occupations. Therefore "even given steady social change, in 2050, women will still be somewhat overrepresented in roles traditionally held by women. (p.1184)" (B. Diekman , A. H. Eagly (*Stereotypes as Dynamic Constructs: Women and Men of the Past, Present, and Future Pers. Soc. Psychol. Bull.* 2000, 26, 1171-1186)). This claim not only highlights how difficult it is and how long it takes to bring about change, it also shows just how important it is not to refer to and describe the environment, roles, and science itself, with "male" characteristics any longer.

Thus, the components of the organizational and relational "context" of institutional life have to be underlined, i.e. those resulting from changes in scientific culture that call for new tasks in research linked to other individual and collective qualities.

We believe it is important to build a map locating possible barriers to greater female presence. When assessing organizational structure, for example, the so-called **cold criteria** influencing the structure of work have to be analyzed:

- Staff, professional figures, divisions in departments/laboratories (related functions)
- Contractual position: career progression, salaries, bonus, mobility, contracting, consultancies.
- Family policy
- Workplace safety.

Thereafter, the so-called **hot criteria** have to be examined usually together with the women involved

- Degree of interaction among units (assemblies, seminars, collaboration)
- Size of units, distribution of spaces and other resources
- Distribution of informal tasks (laboratory and equipment maintenance)
- Details of how daily work is organized (duties: e.g. running virtual library)
- Decision sharing and transparency within the units
- Assessment of research (publications official statements, training)

Indeed, this is where stereotype activated traps often interiorized by the same female researchers, are concealed.

As previously mentioned, the relationship between scientific culture and gender stereotypes is always two-way and now we shall see how scientific culture can influence gender stereotypes.

The new context in science

The new context of science is characterized by no longer being mainly restricted to academy, but by being strictly bound to the market: innovation has replaced discovery since the main aim of research and its economic implications are the drivers of funding. Technology, or as it is called, the side-out-puts, are the most interesting products of a study. In this context time is money, and this is why research is moving fast and becoming more and more competitive.

All that means that the statute of scientific knowledge has changed. Elaboration of theories is no longer the core of the knowledge process, but has been replaced by data acquisition and, as the genome project clearly demonstrated, its interpretation is secondary. Or, it may never occur because urgency is elsewhere, indeed the word *innovation* is the major tenet. This change impacts on the perception of science and has implications for society and the future .

People are starting to be aware that the meaning of human experience has completely changed. The most innovative technologies have produced de-materialisation and de-synchronisation of human experience, we no longer have close and direct contact with our physical and natural environment ..

Becoming the humankind a human/machine aggregate, ethical and aesthetic value are expelled from our male or female subjectivity, being technology, by definition, accepted as neutral. The intrinsic value of a product is identified with its immediate efficacy and not for its effects on the underlying values of individual dignity or social responsibility. For ethics, nowadays, it is impossible to engage a confrontation with science, because the latter is always beyond. Its duty is to try to hinder the technological possibilities (of course not all possibilities should became actual). One question is being asked more and more frequently: will the *cyborg* be compatible with democracy? Have we managed to develop new rules or new values to tackle the changes of a long life, a life where birth, somatic genetic traits, and also death can be decided? Do we know how to curb the harmful effects of technology?

There are desperate needs to let humanities and science develop together[7]. In particular, we suggests that philosophy should provide tools to help people ponder over the implications produced by blindly adopting any technology :

- Need of holistic vision of the world;
- Need for time and space for philosophical/ethical thinking;
- Need for free minds able to locate them on the interdisciplinary borders;
- Need for a responsible dialogue with the society;
- Needs for intuition and imagination (not only creativity for innovation);
- Needs for subjects less contaminated by the dominant cultural trend: these are indeed able to formulate new hypothesis, to look at the world with different eyes, to propose new conceptual models.

The last point is particularly relevant concerning women's role in science, in fact, it seems that while **assertiveness** and **single mindedness** (highly evaluated in classical scientific endeavour) are under criticism, **flexibility, diplomacy, curiosity, motivation, dedication** acquire increasing value *(Beyond bias and barriers, 2006, NSF).* On several occasions outstanding scientists have stated that the complexity of contemporary scientific activity requires multitasking qualities (in addition to scientific competence). It is noteworthy that the former characteristics have usually been assigned to men and are highly sought-after, while the latter refer to women, being low ranking in the qualities requested in professional scienceIn contemporary science the increasingly sought-after factors are indeed those indentified with women's qualities.

Regarding scientific excellence as prerequisite, recent statistical data strongly support the broad presence of women and their success in science. Moreover, women have always shown they have a more holistic vision of their research activities, moving across disciplines and often placing their work on the boundaries between them more than men do. That may also explain the minor Impact Factor (IP) obtained by women's publications. In effect, interdisciplinary journals usually have a lower IP than long-established, mono-disciplinary journals.

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[7] C.P.Snow, *The need of closing the gap between sciences and humanities*: *Two cultures and the scientific revolution*, Cambridge University Press, 1959.

By and large women show keen ethical responsibility and are concerned about research conduction (resources management, mentoring etc.) and consistent research results. This may explain why women take more time to publish their results, a problem that was unresolved by Zuckerman Cole investigations (ref. ..). Moreover, their ethical responsibility is also evident in their different roles insociety: teaching in primary and secondary schools, mentoring, science communication (public lectures, art work etc.) In workplaces, the role of newly promoted women in integrating the members of the old team is generally noticeable, effective and beneficial **(Creating a Team)**. Other examples show that women are better at giving student researchers the freedom they need than are men. Consequently, students are more self confident than when they are constantly led by the hand in their research or are used as purely executive staff (research proletarization) **(Giving Student Researchers the Freedom They Need)**

As new entries, women are less contaminated by the dominant cultural trends: they are able to formulate new hypotheses, look at the world with different eyes, propose new conceptual models. In other words, they may redirect contemporary science to include again the knowledge driven process, by creativity, imagination and other characteristics than not just the pure rationality.

It may be appropriate to cite Pierre-Gilles de Gennes (Nobel prize in Physics 1991) on the issue of Keeping Egos in Check. *Lastly, the Latin races have this obsession with intelligence….. They want to be seen as clever and this is not very good…… Women are less prone to want to shine in their presentations, to claim to know everything, and that lends them weight. On the other hand, as well as a sound grasp of things, they have the quality of a human touch and a sense of reality: things that every team needs if it is to succeed. Women are more pragmatic than men in science .*

Women have shown to be excellent in abstract thinking, but they may be at the very place in the contemporary science where more inductive capabilities are also needed, together with accuracy, patience and *methodicalness in data elaboration.*

We would like to mention that strong resistance to change is harboured in the criteria used for assessing excellence and is due to the cross between gender stereotypes and scientific culture stereotypes. These criteria will be revised on the basis of the new findings.

Changing gender stereotypes

Gender stereotypes have always been, and still are, linked to the different spaces and social roles of men and women. The migration of the two sexes in these different territories can represent an attack against the fixedness of stereotypes. At present this flow is mainly one-way, and consists of women migrating from the family to social work and trying to find elbow room in the dominant male culture. Today gender-related jobs have been transformed and the importance of individual traits with regards to the community have totally overturned generalizations regarding males and females and, instead of being cognitive maps, the role of stereotypes now is resistance to change.

There are meta-analyses summing up the numerous researches carried out over the recent decades on the change in gender stereotypes at an individual level (Lenton A.P., Bruder M., Sedikies C.,A Meta-Analysis on the Malleability of Automatic Gender Stereotypes, *Psychology of Women Quarterly*, 33, 183-196). According to the authors, the results of the various attempts to change stereotypes "have been successful overall, although the average effect size is small."

Researchers have examined different kinds of interventions for changing automatic attitudes:

 - to distract or redirect perceivers' attention prior to category activation.

- to prevent or inhibit stereotype expression, but not necessarily stereotype activation. That means explicitly advising people to 'just say yes' when they were presented with gender-stereotypical combinations of photos and words, or to suppress their gender stereotypes .

Distraction and heterogeneity interventions were both more effective than suppression at reducing automatic gender stereotypes, but the effects of distraction and heterogeneity interventions were not significantly different from each other. Thus, manipulations involving either distraction or directed attention to a particular (diverse) aspect of the stereotype had significant reductive effects overall, and were reliably more powerful than those aiming at stereotype suppression.

The authors suggest that suppression of stereotypes is ineffective because it is intentional, whereas stereotypes are automatic and not under rational control.

From this perspective, we might advise equality campaigners either to (a) invent ways to distract individuals from processing information about a social category in an elaborate manner immediately prior to making a judgment about members of that category, or (b) instruct individuals to 'think counter-stereotypical thoughts' about category members before making judgments about them.

Thus, for whom had hoped for a fast and simple way to change other people's stereotypes about women and/or men, these findings represent both good and bad news. Still, it remains unclear whether there are substantial boundaries to the malleability of automatic responding or, more mundanely, whether researchers have not yet identified the most powerful means for automatic stereotyping reduction.

Moreover, learning is a long lasting process and a single experience with a stereotype-reduction intervention is unlikely to change the connection weights to any substantial degree. Long term approaches and continuative intervention in the organisations wishing to achieve change are recommended for researches on this issue.

This may be why the number of articles on GS and Identity has fallen since 2007 (MetaAn. Report. p.8), whereas attention has been focused on changes involving individual, cultural and structural planes.

As mentioned previously, gender stereotypes present different traits than other stereotypes. Men and women are defined as complementary in a way that is unlike most other contrasting social categories (e.g. European vs. other ethnic groups).

The similarity of the two subjects (male-female) and the need for differentiation results in gender stereotypes being concomitantly oppositional and complementary. Because of the fear of being confused and overwhelmed by the other sex, gender roles are primarily oppositional. Men are characterized as aggressive, forceful, independent and decisive, whereas women are characterized as kind, helpful, sympathetic and concerned about others. At the same time members of one sex are seen as lacking what is thought to be prevalent in members of the other sex. The opposite traits have been reinforced by the different roles, tasks and spaces assigned and also by the power differential. Over the centuries, complementarity has been the representation of the physical union that produces a human

being: the result of a dialectic process. Yet, we are aware of the weight of male power over female power in how breeding was socialized instead of being the union of two equal peers who need each other. This between-group complementarity contributes to the maintenance of gender inequality in social field. For women, male complementarity is connected to the idealization of men, i.e. women consider male subjects who possess traits that are mostly the opposite to theirs as superior persons. In order to maintain female complementarity socially so as not to consider them rivals, men place women in an inferior position and do not assume female traits.

Women are fighting to change their gender role, but we can find only few ways out :

- to adopt male traits (androgyny). However, woman's emacipation would induce us to continue to idealize male values even if it overturned social roles. The goal of reducing differences between the sexes, minimizing gender distinctions, looks like a loss for women, as it minimizes or undervalues their essential mothering capacity. From this point of view "the reproduction of mothering" should give way not to the production of androgyny but to an appreciation of mothering. Androgyny then looks like an invitation to women to assimilate into masculinity.

- to combine and integrate male and female traits and make men adopt female traits and roles. This would be an invincible solution for women, but the reason and benefits inducing men to relinquish supremacy and power are not clear. Above all, the fact that this would require a real and proper clash between the sexes is overlooked. It must be kept in mind that no researches on men have focused on the change of automatic stereotypes over the years. Female participants are prevalent in the experiments on gender stereotypes [8].

- to put individual skills above gender in order to break out of the binary representations of men and women. This position seems more akin to the ideas of young researchers, backing gender aspects with respect to individual capacities. Today gender clashes are considered outdated. Problems are addressed to technological solutions and the long-lasting effects of stereotypes on the collectivity overlooked. A body with particular sexual traits and functions, childbearing for women and strength for men, that were the basis of stereotypes is now transformed into a "technological,

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[8] Lenton, A. P., Bruder, M., & Sedikides, C. (2009). A meta-analysis on the malleability of automatic gender stereotypes. *Psychology of Women Quarterly, 33*, 183-196

cyborg machine", removing much of the biological substrate from gender stereotypes, but not their cognitive functions and instinct.

We are speaking on an individual level, but a change in intergender relations is unthinkable unless we involve the institutional /structural levels , which implies social re-organization. The symbolic/cultural one which informs languages, norms, values which is also crucial: absolutely no positive action has long-lasting effects without changes at this level.

Conclusions

The ongoing process to change stereotypes started over a century ago. In scientific culture it only initiated in the last decades but is becoming established thanks to various realities that have emerged:

- The falseness of some gender stereotypes, such as the weight of abstraction (mathematic skills) or the weight of empathy in research dedicated subjects in achieving successful scientific undertakings.
- The change in post-academic science and the new way of viewing or imaging science itself.
- The hiring of more and more women in decision-making roles.
- The exigence to yield investments in women school education
- The assessment that gender bias limits excellence in science and technology, and therefore reduces the benefits that research and development brings to society (as in medical research data).
- The different descriptions of excellence regarding the central role of technological innovation in countries' economic growth.

For these reasons we propose different strategies to change stereotypes:

- to sever the reciprocal influence of gender stereotypes and social gender roles.:

- to promote awareness on this issue and counter-stereotypical thoughts on gender and science

- to propose new transient generalizations (non so permanent as stereotypes) and new appealing models of women scientists .

We also suggest that distraction-type interventions may ultimately be more effective at reducing automatic stereotypes than those that try to make counter-stereotypes salient. It also does not seem to matter whether the intervention aimsat changing only female stereotypes or at changing gender stereotypes more generally: both intervention types are equally effective.

However, given the dearth of studies in which researchers have attempted to alter only the male stereotype, at this stage it is still not possible to determine conclusively whether male and female stereotypes are equally susceptible to interventions.

Gender stereotypes are linked to the roles and tasks society assigns to men and women, but in the scientific field they are also strengthened by ideas, by expectations in science. For example
- that scientific field requires a lot of time that women aren't willing to deprive from their family.
- that research is a vocation that demands attachment and dedication, which put in conflict loyalty to the children.

Hence, we can just say that organizations that do not employ an adequate number of women in top positions have a traditional scientific culture where social injustice against women is certainly present.

Since stereotypes have always existed, and will always do, until there is a radical change in the vision of roles or at least in the value of roles in culture in general (with a broad men partecipation), being able to refer to positive elements for the role they are about to cover will facilitate the new generations of young women accessing scientific research.

Society has to become aware of changes in science and gender roles, but the same researchers have to be informed without having to agree with it *in toto*. If this vision of women in science is accepted and acknowledged for what it is, i.e. beneficial to women researchers, beneficial to society, and functional to contemporary science, then also the procedures to assess excellence in scientific avenues has to be revised using different parameters. But this is another story that we shall address later.

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Bibliografia

Meta-analysis of gender and science research
www.genderandscience.org/

PRAGES - Guidelines for Gender Equality Programmes in Science
www.retepariopportunita.it/Rete_Pari.../**prages**/**prages**guidelines.pdf

genSET Gender in Science
www.genderinscience.org/news.html