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Developing an Organic Strategy of Change to Challenge Gendered Stereotypes around the Technological (In)Ability of Women in Architecture

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Architecture is characterised by a lack of women in the profession and a significant drop–out after qualification all over Europe, despite decades of policies of inclusion.

The practice of architecture requires the use of specialised instruments and technologies that often collide with the social assumptions and stereotypes around the conflicted relationship between women and technology. Women are socially perceived as inadequate users of technology in terms of: knowledge of the specific characteristics of objects, ability to use an instrument other than for its basic outcomes, and capacity to use technology in collaboration with co–workers.

What can be done to challenge this widespread social perception? The suggestion offered here is to develop an organic strategy of combined actions able to foster a simultaneous change on different levels: individual, relational, cultural and structural. The paper offers an outline of a possible framework of analysis to be initially applied to the architectural field as a specific case study, with the possibility to subsequently adapt it to other STEM sectors. The framework draws upon the concepts of Technologically Dense Environments and Integral Theory's AQAL method, used respectively to collect and organise empirical data.

***Keywords**: Women in STEM; women in architecture; gender and technology; gender stereotypes; technologically dense environments*

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1. Introduction

The architectural sector is marked by a lack of women throughout the profession, as demonstrated by research conducted in 2014 by the Architects' Council of Europe on 26 European countries (ACE–CAE, 2015). Today, in the UK, 46% of architecture students are women, whereas only 25% of chartered architects are female (Royal Institute of British Architects, 2015), highlighting a considerable drop–out after education. In Italy, however, 40% of architects are women – proportionally more than in the UK – but, despite the higher presence, they still earn 37% less than men (CSAPPC–CRESME, 2013). Many studies have been carried out in the last 15 years on the topic (Caven, 2004; Fowler and Wilson, 2004; Powell and Sang, 2015) and almost all of them suggested, among other factors mainly related to the dominant masculine culture of architecture, a strict relationship between this trend and the technological expertise required to practice the profession. Architecture is not considered a traditional STEM (Science, Technology, Engineering and Mathematics) field, however, both its discipline and practice include some aspects typical of various STEM sectors, such as the study of mathematics, physics, statics and technological applications, to name a few. Furthermore, in 2012 architecture was added by the US government as a STEM occupation in the Standard Occupational Classification (SOC) system (Bureau of Labour Statistics USA, 2012) and, more recently, to the STEM Designated Degree Program List (Immigration and Customs Enforcement, 2016).

In the first part, this paper will offer a summary of the existing literature about the relationship between gender and technology, with a particular interest in the implications of policy–making that arise from different theoretical approaches. The main objective of this paper, discussed in the second half, is to outline a methodological framework of analysis aimed at developing an organic strategy of change able to challenge gendered stereotypes about the women–technology relationship in architecture. The framework is comprised of two main phases: understanding how these stereotypes have been created and are reproduced, through the collection of original empirical data; and organising these data in order to evaluate the most efficient way to develop systematic strategies of change on different levels: individual, relational, cultural and structural. The two parts of the analysis are drawn respectively from the concepts of 'Technologically Dense Environments' (Bruni, Pinch and Schubert, 2013), focussed on understanding the gendered power dynamics occurring in the architectural

field, with particular respect to technology; and Integral Theory's AQAL model (Esbjörn–Hargens, 2010).

In particular, this framework is designed to analyse the architecture field as a case study, but it could be subsequently adapted to other STEM sectors, in order to have a comprehensive general insight of the women–technology relationship in different technology–related fields.

2. Gender and technology

The main approaches used to analyse the relation between technology and gender are based on two different positions: technology defined as inherently masculine, or as gender–neutral (Grint and Woolgar, 1995). The first approach considers technology as designed and created with a masculine user in mind, both in terms of physical aspect and applications (Oldenziel, 1999; Wajcman, 2001). This would explain the lower presence of women as effective users of technology, which is practically and conceptually distant from them. The other approach considers technology as gender–neutral. However, society is structured in a way in which women have a lesser access to technology, thus explaining their lower presence. Eventually, this view offers an outcome similar to the one suggested by the previous approach.

This difference should not be understood exclusively in terms of ontology and theoretical perspective; rather, the use of one model of gender–technology relation over another has a direct influence in the design and application of practical policies of change (Grint and Woolgar, 1995). For example, in order to aspire to gender equality, the first approach would lead to policies that would enable women to develop their own technology, as a parallel to the male one: if a masculine technology exists, then a feminine technology should also exist. In fact, the latter does already exist, but it is not as mainstream and influential as the male one (Oldenziel, 1999). It is present, but only in the social and working realms traditionally associated with women and femininity, for example, in household appliances (Chabaud–Rychter, 1995) or in machinery associated with typical women's labour – textile, fabrics, etc (Rostgård, 1995). In other cases, technology is able to swap 'gender' over a period of years, such as the computer programmer, which originated as female labour and subsequently was perceived as male (Light, 1999). By contrast, other jobs have been subjected to the phenomenon of feminization (Bolton and Muzio, 2008), such as typing (de Groot and Schrover, 1995).

The second approach, probably more popular in technology and gender literature (Ahuja, 2002; Cheryan, Master and Meltzoff, 2015; Lu and Sexton, 2010; Phipps, 2008; Sang and Powell, 2012), suggests that many policies can be adopted in order to reach gender equality: widening participation projects in school, mentoring support, discrimination laws in the workplace, gender quotas, disruption of stereotypes, etc. These policies, following a process of analysis and understanding of the cultural and structural forces involved in the oppression of women, would be able to address and, possibly, resolve the gender imbalance. The organic strategy of change proposed in this paper draws upon this latter approach.

2.1 Barriers to a full participation of women in STEM fields

Numbers speak clearly about a constant and worrying underrepresentation of women in STEM across Europe (Office for National Statistics, 2015; WISE, 2014). Several studies have outlined the conflicted relationship between women and technology as the main barrier to the full participation of women in the field (Cockburn and Ormrod, 1993; Elkjaer, 1992). Thus far, some of the main factors which have been identified as contributing to shaping this relationship negatively are: personal and cultural stereotypes, the environment, and the presumed technological inability of women (Cheryan, Master and Meltzoff, 2015).

Female employment, particularly in scientific fields, is influenced by *stereotypes* that unconsciously lead both employers and women themselves to consider men as more adequate for certain kind of jobs or more worthy of reaching high positions (Barreto, Ryan and Schmitt, 2009). Skeggs (1997), in addition, argues that official institutions, such as the state and the educational system, legitimate structural domination by unconsciously leading women to internalise their subordination. On the other side, it can be argued that women in STEM seem to be able to deal with jobs perceived as masculine better than they can cope with the culture, values and expectations of professions created by men for men (Evetts, 1998). This happens because they do not lack the technical skills required to perform the job, but rather 'a whole set of properties which the male occupants normally bring to the job […] for which men have been tacitly prepared and trained as men' (Bourdieu, 2001, p. 62).

Furthermore, another set of stereotypes appears to discourage women from initially choosing a career in STEM fields: stereotypes around the culture of STEM. These stereotypes operate on three main levels: the people in the field, the work itself, and the values of the field (Cheryan, Master and

Meltzoff, 2015). People in tech, specifically in computer science, are portrayed as socially isolated, interested only in tech culture, characterised by a specific 'nerdy' appearance (Cheryan et al., 2013), and these stereotypes are promoted and repeated by media representation on TV or online. The standard technology user seems to be a white–cis–heterosexual–young male, therefore tech culture is dominated by a univocal hegemonic masculinity. Some recent studies, like Dunbar–Hester's work on radio activism, stressed the fact that, given this common assumption, technical skills are not 'desirable and commensurate with a feminine identity' (2014, p. 66). Therefore, only women who are already challenging traditional feminine presentation of the self are likely to also challenge the dominant gender identity associated with technology (Dunbar–Hester, 2014).

Moreover, work in STEM fields is perceived as not collaborative, a characteristic that various authors (Diekman et al., 2010; Dixon, 1998; Thornham and McFarlane, 2011) have problematised as incompatible with women's sociability and their need to fulfil communal goals. However, this view risks limiting, in essentialist terms, the understanding of various women's interests, and relies on a form of biological determinism difficult to prove empirically. Finally, Cheryan, Master and Meltzoff (2015, p. 2) identify as 'values of the field' specific cultural aspects such as typical masculine interests and the stereotype of the inherently 'genius' nature of men, needed to succeed in these fields.

Moving beyond stereotypes, recent studies are exploring the relationship between the physical *environment* and the interest of women in technological fields (Cheryan, Meltzoff and Kim, 2011). The argument is that stereotypically 'geeky' classrooms and working spaces are able to discourage the initial interest of young girls in scientific fields.

Finally, it is necessary to stress the importance of the assumed technological *inability* of women as perceived by the whole society, women included. This assumption is deeply rooted to the point that, sometimes, women perform a 'habitual 'feminine' position of incompetence' (Walkerdine, 2006, p. 526). From their cross–generational study about women in the gaming industry and teenagers' choice of workshops, Thornham and McFarlane found a common pattern according to which both women and young girls 'are actively excluding themselves from (technological) activities using gendered discourses of sociability and incompetence' (2011, p. 68). The reasons behind the employment of this particular practice may be interpreted as the performance of what others

expect from women, and women's fear of being considered less feminine because of their ability in a field dominated by men (Thornham and McFarlane, 2011).

3. Developing an organic strategy of change

In this second part of the paper I will outline concepts and methodologies useful in outlining a new methodological framework of gendered analysis, aimed at developing strategies of change addressed at challenging gendered stereotypes about the women–technology relationship. In particular, I will focus on the architecture sector as a case study, but the framework could be easily adapted to other technology–based fields.

In order to develop an effective organic strategy of change, some operations of data collection and analysis need to be previously planned. Firstly, it is important to understand how stereotypes about women and technology have been created and are reproduced and, secondly, it will be essential to plan a compelling way to address these stereotypes and challenge them in different areas of social interaction.

3.1 Stereotypes about women and technology in architecture

Architecture, as a profession in the construction industry, can be considered based in two main work settings: the office and the construction site (Watts, 2009). Women's interaction with other actors in these two environments is shaped by stereotypes about their appearance, their physical strength and adequateness, their ability to cope with technology and with the culture of a masculine profession (Caven, 2004; Sang, Dainty and Ison, 2014). Cynthia Cockburn, in some of her studies on the importance of holding technological mastery (1985; 1991; 1993), suggests that often these stereotypes are indirectly reproduced by men, in order to maintain male dominance in workplaces.

In the interest of challenging these stereotypes, it is essential to understand how gendered relationships and power dynamics act in both of these work settings. Therefore, a useful way to gain a deeper insight into how these mechanisms work would be taking into account the concept of 'Technologically Dense Environments' (TDE) and employing it through a gendered lens. A TDE is not necessarily an environment in which technology is present in large amounts (Bruni, Pinch and Schubert, 2013). To meet this specific definition, the technology present in a TDE needs to be more than a

simple tool, and to be able to narrate 'the nature of interactions and work organisation practices' (Bruni, Pinch and Schubert, 2013, p. 55). Drawing upon the way in which Pinch, in the same article, defines the objects employed in everyday life, it is possible to understand to what extent an architecture workplace could be defined as a TDE: making the technological object analytically interesting. What matters are the technological relations (human–object, human–human, individual–community) in a field where technological objects are essential in order to create and show the effort of labour. Employing TDE with a gendered perspective means to consider that the practice of architecture requires the use of specialised instruments and technologies that often collide with the social assumptions and stereotypes around the conflicted relationship between women and technology. Women are socially perceived as inadequate users of technology in terms of:

- *knowledge* of the specific characteristics and components of the means they're using;
- *ability* to use an instrument other than for its basic outcomes – women are expected to use technology as basic and not proficient users;
- capacity to use technology in *collaboration* with co–workers.

A collection of empirical data is essential to an analysis of the gendered relationships that occur in architectural practice. These data about women's technological knowledge, ability and interaction should be gathered through individual interviews or focus groups from different actors involved in the construction industry, such as clients, contractors, construction workers and male colleagues; from representation in the media; and from educational environments, both at school and higher education level. Particular focus should be placed on the technological relations that occur between women and objects, women and other actors involved in the workplace, the construction site or the educational environment, and between individuals and groups. For a gendered understanding of these mechanisms it would be useful to collect and analyse these empirical data using the three main points outlined above, obtained from the concept of TDE (Bruni, Pinch and Schubert, 2013): *knowledge*, *ability* and *collaboration*. Furthermore, and more importantly, the process of analysis and coding of the data should be supported and guided by women in the field themselves, through the understanding coming from their own experiences and perceptions, according to feminist principles of reflexivity (Naples, 2003).

In addition, it would be useful to carry out a process of document analysis on historical accounts regarding female participation in

architectural practices in the past (for example Walker, 1986). The comparison between historical and current practices would lead to an understanding of the changes in the use of technological instruments, with a particular focus on their differential access depending on the user's gender. And the comparison would also offer an insight on the historical development of the gendered relations occurring between various professional figures in architectural practice.

'To look at history from a feminist viewpoint means to redefine in fundamental ways the accepted historical categories and to make visible hidden structures of domination and exploitation' (Federici, 2004, p. 13).

These processes are aimed at obtaining a better understanding of how gendered stereotypes have been created and are reproduced in society, and how power relations involved in the architectural field have been historically gendered, and still are. Ultimately, this understanding would be useful in designing effective policies of change, as explained in the next paragraph.

3.2 Challenging stereotypes

As outlined above, women's technological inability in the architectural field, as much as in other technological environments, could be defined as *perceived* more than *real* (Dryburgh, 1999). It is a societal perception, following decades of male predominance in technological discourses and practices. And it is the perception of women themselves, that they – both actively and not – perform a position of incompetence (Walkerdine, 2006). In this paper, I am suggesting that this widespread social perception could be challenged by adopting an organic strategy of combined actions, able to foster simultaneous change on different levels: individual, relational, cultural and structural.

To organise the data gathered from the previous phase of the methodological framework, I propose to use and adapt Integral Theory's AQAL model, developed by Ken Wilber (Esbjörn–Hargens, 2010). Despite Wilber not being an academic, his research managed to create an instrument able to channel different paradigms and approaches into a singular and comprehensive structure. The theoretical consequences might appear problematic in wider discussions of his whole theory, but here I would like to rely exclusively on the AQAL (All Quadrants All Levels) quadrant model. The quadrant distinctions act on two main axes, the individual–collective and the exterior–interior, eventually leading to four separate areas: intentional, behaviour, culture and social system. The quadrant has received vast interest from different disciplines (mostly

ecology, business, and well–being), specifically because of its simplicity expressed in a comprehensive form.

Therefore, I am proposing to adapt the quadrant with regard to the specific case study of women as technology users in architecture. In addition, actions for change already implemented in the field will also be considered and hence organised and integrated in each section (individual, relational, cultural and structural) with the data previously collected. My suggestion is that considering the most appropriate strategies of action for each level of change and employing all of them at the same time would offer a more effective route to change.

The *individual* level stands for one's personal thoughts, beliefs and values. This aspect, applied to the purpose of challenging women's perceived technological inability, could be translated into strategies aimed at confronting personal stereotypes and developing 'professional role confidence' (Cech et al., 2011). In the case of architecture, for example, role models and mentoring programmes are certainly useful actions, with female architects going to schools to talk about their experiences as architects; or workshops aimed exclusively at girls. One factor to take into account is the importance of having female teachers, in order to disrupt the current duality between *experts*, usually embodied by male teachers, and *novices* (Dunbar–Hester, 2014).

The *relational* level has to do with behaviours and skills one has learned and exhibits, and could be applied into a change in workplace dynamics (relevant to women's feelings of inadequateness) and in the cultural requirement, discussed above, to perform inability. And, by extension, to challenge sexual division of labour and practices. In our case, effective actions could be implemented in mixed workshops run throughout the whole educational path (from primary school to university). Teachers should be trained and prepared to address imbalanced power relations that occur between male and female students: workshops are generally characterised by a marked division of tasks according to presumed associations between male and female qualities or skills.

Cultural is the aspect probably most interwoven with stereotypes and, as previously outlined, includes family and relationships in general. A useful strategy of action would address the reproduction of gender stereotypes, employed in any relational environment, from the family to the educational system. These stereotypes influence more generally social expectations (such as the need to create a family), and more particularly interaction with technology. However, culture is the area where interactions aimed at

change are most difficult to employ. In the architecture case, considerable help could come from women's representation in media and TV: reproduced stereotypes should be called out, and new forms of portrayal should be prioritised. Also the physical appearance of the classroom, as mentioned above, plays a big role in girls' willingness to attend technology training, so schools should make an effort to challenge this visual discrimination.

The *structural* level is concerned with laws, institutions, social services and government. An action for change focussed on this sphere would aim to challenge practices naturalised in educational or other social environments, social services and institutions. Considering this specific case, the institution of education could play a big role in disrupting gender differences in technology pathways, for example by increasing the number of scholarships for women interested in pursuing STEM careers, or providing economic help to all–female start–ups. The sphere of the social system, of the four categories, seems to be the easiest in which to initiate change, because of its institutions and laws, which can be simply promoted and actualised. However, it must be recognised that it would be risky, useless or even counterproductive to force a change from above if the culture of a given population is not ready to accept that change.

All these different actions have already been employed in the architectural field, at different points and in different countries, but their disconnected implementation has hindered significant change so far. Therefore, a plausible solution could be to recognise the necessity of promoting all these actions at the same time, allowing the possibility for each of them to work as a catalyst for others, or to overlap.

4. Conclusions

In conclusion, it can be argued that the relationship between women and technology is problematic, to the point of limiting women in choosing, staying and advancing in STEM careers. This paper represents a brief outline of a methodological approach aimed at developing an organic strategy of change focussed on challenging stereotypes around the perceived technological inability of women in architecture.

After exploring the main literature about the gender–technology relationship, with a particular focus on the policy implications related to different approaches, I summarised the main factors that influence women's self–perception in relation to technology. These factors mainly revolve

around stereotypes, especially those about the culture of STEM fields, their environment, and the (in)ability of women, both perceived and performed.

I then outlined a methodological framework aimed at understanding how gendered stereotypes about the women–technology relationship have been created and are currently reproduced, and how it would be possible to challenge these stereotypes. This approach is comprised of two phases: (1) gathering and analysing original empirical data according to a framework based on the relationship between women and technology, drawn upon the TDE concept; and (2) organising these data according to a quadrant model adapted from the concept of Integral Theory's AQAL model. The final purpose of this analysis is the creation of an organic strategy of change able to work on different levels at the same time: individual, relational, cultural and structural.

To conclude, this approach could be utilised not only with regard to architecture, but could be implemented for other technology–based fields, in order to offer a more general understanding of the women–technology relationship in the broader STEM sector.

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