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Perspectives on Gender, Science and Technology in Brazil

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My aim with this 'perspective' paper is to situate the matters discussed in this Special Issue within a broad map of the current debates on gender, science and technology in Brazil. This mapping is by no means exhaustive and some areas, authors and particular works will fail to be included, as the range of issues addressed in the burgeoning literature in, and on, Brazil is much wider. Here I am only able to account for the broad picture illustrating the areas selected with some references. I identify three key areas currently presented in the literature on gender, science and technology in Brazil:

1. History of the representation of women in the field, and the careers developed by women
2. Adaptation of general theories to the studies of technology and science (STS) field
3. Development of particular fields within a STS concern: health, education, information technology and some emerging concerns linked to social media, the environment, sexuality/reproduction and others.

Concerns with gender analyses date from the 1970s and emerged in tandem with the repercussions that second wave feminism made in Brazil. Academic production has focused on gender, science and technology as a particularly named area of interest since the late 1990s. I outline below the three themes on which I concentrate for this overview of developments in the Brazilian academic context, considering the current picture, what have been their main foci, and what the main current concerns are.

IDENTIFYING GENDER DIFFERENCES, WOMEN'S PRESENCE AND CAREERS

On the basis of data on Brazil from the Organization for Economic Co-operation and Development (OECD, 2012), Carlos Orsi (2012) notes that, in 2010, 63% of all undergraduate degrees were obtained by women, concentrating in the areas of Education, Arts and Humanities, Health, Social Sciences, Law and Administration as well as Services Provision.Women were a minority in Engineering, Manufacturing and Construction (28%); Science (38%) and Agricultural Studies (41%).

However, this greater number of women with academic degrees (12% of women against 10% of men), does not translate into a similar representation in the labour market:91% of men with higher education degrees were employed compared to 81% of women in the same category. Brazilian women with university degrees earned 61% of what men earned.[1] These data are corroborated by that presented by Nanci Luz (2009) on the basis of the national Annual Relations of Social Information (Relacoes Anuais de Informacoes Sociais, RAIS) Census. She finds that women usually earn less in the same salary bracket. Even among Mathematicians and Statisticians – occupations that present a more egalitarian gender distribution – the gender income distribution shows a higher number of men in the upper salary bracket earning more than 10 times equivalent to the minimum wage (Table 1).

Table 1 - Income by gender in selected high occupations: Brazil – 2006

Occupation	Earning more than 10 times the minimum wage (%)	
	Women	Men
Mathematicians, statisticians	40	56
Physics, chemistry	46	64
Engineers, architects	49	65
University/College Professors	15	29

Source: Luz (2009), data from RAIS 2006.

Gender inequality is prevalent in social life in general, as well as race hierarchies. In 2009 all white women employed and over 16 years old had been in school for 9.7 years, while black women had had schooling for 7.8 years. This compares with 8.8 years of schooling for white men, against 6.8 years for black men. Like among the academics, this general higher education of women did not translate into higher earnings. In total, in 2011, among the economically active population, women earned about 70% of men's earnings. There were more women among the unemployed: 9.2% of white women and 12.5% of black women, against 5.3% of white men and 6.6% of black men (Luz 2009, Menicucci 2012:12-13).

Data from the Centro Nacional de Pesquisa Cientifica (CNPq), the major academic funding and regulating body, were analysed by Cristina Rocha and Nanci Luz (2011) revealing a similar distribution of men (51%) and women (49%) in overall academic areas. However, the gender division shows women predominate in the Humanities (59.3%) and Health Sciences (60.4%) while men are predominant in Engineering (72.7%) and Agrarian Sciences (62.1%) (Table 2). Men also are a majority in leadership positions of academic research groups: 33% of men against 27% of women in 2008.

Concerning women's work in scientific fields, findings show a gradual and persistent increase of women's participation in science, and this has been an important area of investigation in the field. In Luzinete Minella's (2013)

assessment of the priority themes addressed by studies on gender and science in Brazil, based on 78 studies, three themes stand out: [2] (1) The focus of half of the papers is on women's participation in academia, and access to higher education, scientific careers, scientific production and professional associations. (2) Just under a quarter qualify as critique on the basis of impact of science and technology over women's jobs and health. (3) The remaining papers – just over a quarter – are concerned with the history and trajectory of women scientists and travellers in previous centuries.

Table 2 - Researchers by gender and area of knowledge – CNPq Census 2008

Selected Areas and total	Women	Men	Total
Agrarian Science	4,633 (37.9%)	7,604 (62.1%)	12,237 (100%)
Health Science	12,803 (60.4%)	8,394 (39.6%)	21,197 (100%)
Humanities	13,675 (59.3%)	9,399 (40.7%)	23,074 (100%)
Engineering	4,151 (27.3%)	11,046 (72.7%)	15,197 (100%)
TOTAL	57,662 (48.9%)	60,291 (51.1%)	117,953 (100%)

Source: Rocha & Luz (2011), data from Census 2008, CNPq

Minella's (2013) outline shows that in the 1970s and 1980s some studies on this field were done by researchers at Fundacao Carlos Chagas, in Sao Paulo, for example, Carmen Barroso and Guiomar Mello (1975a) on women's access to higher education, and Cristina Bruschini (1978) on the labour market participation of women as engineers, nurses and teachers. The journal *Ciencia e Cultura* (Science and Culture), founded in 1948 and published by the Brazilian Society for the Advancement of Science (Sociedade Brasileira para o Progresso da Ciência, SBPC) had scant interest in gender though women's work in scientific fields made it into their pages (Barroso 1975, Barroso and Mello 1975b). What concerned these studies was gender inequality in pay, skills and professional opportunities.

As Minella notes (2013: 102-3), 'the emergence of the field of gender and science proper dates from the end of the 1990s with the pioneering initiative of the academic feminist refereed journal *Cadernos Pagu*, which published in 1998, a special (double) issue (number 9/10) on the theme of 'Gender, Technology and Science'. Elizabeth Bortolaia Silva, thus created 'the first publication in Portuguese language dealing with connections between these themes' (Silva 1998a:5, Silva 1998d). This special issue assembles studies on the relationship between women's lives and gender dynamics concerning technologies for the household, for reproduction, for information, for manufacturing, and also specific

historical accounts of women's scientific production and academic careers. A second special issue of *Cadernos Pagu* (number 15) was published in 2000, guest edited by Maria Margaret Lopes with the title 'Gender, Sciences, History', centred on the pioneering insertion of women in scientific fields (natural sciences, medicine, astronomy, geography) in Brazil, elsewhere in Latin America and offering some comparison with studies published in English on these fields. A third special issue, also guest edited by Lopes, was published in 2006 (number 27) as 'Gender in Science'.

At the Technological University of Parana (UFTPR), two publications were launched in 2005, the *Revista Tecnologia e Sociedade* and the *Cadernos de Gênero e Tecnologia,* publishing a total of 18 papers up to 2009, considerably widening the scope of the field (Minella 2013: 110). Still from the southern State of Parana, the collection organized by Lucy Woellner dos Santos and colleagues (2006) assembles important contributions in this field. The productive *Revista Estudos Feministas* also registers some important contributions in this area (Rial et al. 2006; Rocha et al. 2009). Nowadays, commercial publishers are found to list titles on this subject (Taback 2002 by Garamond, Blay and Lang 2004 by Humanitas). However, production remains overwhelmingly concentrated within Gender and Feminist Study Centres, funded through academic or academic-related institutions. Institutions in the south of Brazil are more prominent in this area of study, following their general dominant university presence. A notable exception is the collection by Ana Alice Costa and Cecilia Sardenberg (2002) published by Rede Feminista Norte e Nordeste de Estudos e Pesquisas sobre a Mulher e Relacoes the Gênero (REDOR) and Nucleo de Estudos Interdisciplinares sobre a Mulher (NEIM), in the Northeast of the country.

The significance of these efforts is twofold: (1) They give shape to the scattered concerns placing them in a common field under a specifically recognised label. (2) They present and interrogate the debates, happening in English language and in other Latin American countries (but also in Spain and Portugal), within the context of the Brazilian production and concern for this area of studies. The publication of studies on the themes proliferated and Minella (2013) counts 24 papers published in the key journals between 1998 and 2009, 18 of which are fresh empirical contributions by Brazilian authors. She notes, however, that her assessment leaves out feminist scientific journals (of which there aren't many), conference proceedings and books, as well as PhD Theses and Masters' dissertations.

GENERAL THEORIES: APPROPRIATION AND LOCAL PREOCCUPATIONS

According to Minella's (2013) assessment, the major inspiration for the Brazilian studies on gender and science derived from the works by Evelyn Fox Keller (the history and politics of women's participation in scientific fields), Helen Longino, Sandra Harding (critique of traditional philosophy of science), Luce Irigarai, Donna Haraway (in particular the discussion about the cyborg and 'situated knowledge'), and Londa Shiebinger (effects of feminist critique upon scientific knowledge). American feminism is thus prevalent in its influence on Brazilian studies. This is shown in the translation of papers published, citations, and the presence of some of these academic writers at conferences as keynote speakers. The appropriation of these general theories served to address in Brazil concerns about the ways in which gender hierarchies generate particular directions in

scientific knowledge and research, questioning the social construction of concepts (exemplars are Lopes 2006b, Cabral 2006 and Carvalho 2011).

Apart from publications, a particularly important initiative to foster the development of academic concerns with the area of gender in science and technology has been the Jornadas Latino-americanas de Estudios Sociales de la Ciencia y la Tecnología (ESOCITE) organized by a pool of Latin American countries, including Brazil, Mexico, Uruguay, Argentina, Venezuela and others, but also Spain, which in 2013 ran its ninth gathering. In this context, discussions about situational knowledge, within a broader frame of postcolonial studies, have made some presence, although this is surprisingly small. A paper by Silva (2005a), originally discussed at a round table on gender at ESOCITE 2000, questions the dominance of conventional methodological approaches, supporting the notion of situated knowledge as a productive tool for grasping the modes of knowing related to women's everyday lives (also Silva 2005b). While a desire to expand knowledge on a local basis is manifested, the approaches to do so do not encompass theoretical or methodological reflexions, in particular in view of Latin American specific needs to address inequality, economic growth and democratization. This is illustrated in the presentation of the programme of the 2010 event (ESOCITE 2010): the outline of the stream related to methodological debates shows no paper specifically advancing discussion related to gender.

Despite being not explicit and direct, the ways in which gender theory and situational knowledge inform research on science and technology, is a relevant concern in empirical explorations and case-studies. While I am unable to account for the myriad manners in which STS work have been informed by gender, evidence of its strength is clear. For instance, only two of the major ESOCITE events list round tables to discuss gender specifically, in 2000 and 2004, yet, gender appears as a concern in various disciplinary areas. While translations of general theories, as situated knowledge, and methodological interventions seem to have remained as somewhat isolated concerns, developments in specific field are most directly locally situated, as I outline below.

Lately, emerging from postcolonial engagements, intersections of gender and race have been addressed in studies of uses of technology in the home (Pinho and Silva 2010, Silva 2010), in the presence of black women in higher education (Silva 2008) and in ethnic identity creation via technological scripts in movies (Santos and Berardo, 2012). However, race is a longstanding concern in the work of Fatima Oliveira (1996) on reproductive technologies. A key remark made by Minella (2013) following her assessment of the priority themes on the ways gender appears linked to science and technology is that race and ethnicity are disregarded, which, broadly speaking, resonates true.[3]

FIELDS OF CONCERN: SITUATING KNOWLEDGE

It is in the areas of education, health and information technology that the majority of Brazilian academic research concerned with gender, science and technology is concentrated. More recently, investigations have branched into newer areas and, interestingly, these appear to both dissolve the concentrated effort to focus on science and technology and, at the same time, to make the focus on science and technology more attractive.

Education and women's access to scientific knowledge and technological innovation, production and management have been dominant concerns of studies. This resonates with the traditional focus on women's career in science mapped by Minella (2013). Studies have focused mainly on the means of inclusion of women in particular disciplinary areas like the humanities and health services, and the notable exclusion from those more strongly associated with men, like mathematics, physics, engineering (Lombardi 2002, 2008) and architecture (Bruschini and Lombardi 1999). Both formal education and labour market practices are emphasized to account for the patterns of access of women to education (Velho and Leon 1998; Vasconcelos and Brisola 1999). Class and regional divisions are accounted for in the patterns discerned by most studies (e.g. Blay and Lang 2004). More recent contributions address social divisions on the basis of race (Gois 2008) noting the low participation of black students who fail to get access to higher education due to poverty and social devaluation, marking the absence of black women in postgraduate studies (Weller and Silveira 2008), and in academic jobs (Lopez, forthcoming 2014).

Health is another very strong area focused on reproductive technologies, sociocultural constructions of the body and of illnesses and allocation of medical resources. Medical practices investigated, chiefly determined by men, include Caesarean section, contraceptive methods (sterilization, pill), abortion (Vianna 1996), nursing and midwifery training (Faria 2006). Conservative values have been noted in the practices and interventions in human reproduction (Minella 2005, Tamanini 2009, Rohden 2009). Medical careers are also found to favour the advancement of men (Santos 2010). Class, and in particular a concern with poverty, is prevalent in this area of studies (e.g. Scavone 1997). The mapping of sexual differences in varied science fields (genetics, chemistry, and anatomy) is another theme (Citeli 2006).

Women are investigated as users and producers of information technology (IT) in various fields, including computing (Rapkiewicz 1998), technology in the home (Silva 1998b and 1998c) and management (Rocha 2006). Studies engage with, probe and debate the common assumption of techno-scientific female incompetence. Women's technological competence is viewed as weaker, or is often invisible, when linked to supposedly feminine areas like the home, while their incompetence is stronger when applied to areas where men prevail like, for example, in military engineering (Lombardi 2002). Overall, women are mostly portrayed as losers when involved in IT.

It is notable, although still sparse, that investigations have currently focused new areas, which, reflecting broader social matters, are linked to environmental concerns, nutrition (Bustos 2011), social media (Rocha 2006) and women's entry into some traditional areas of concern like housing, water supply (Aray et al. 2011), agribusiness and ecology (Almeida 2012, Vasconcellos and Velho 2010) and sustained arts and crafts (Lopez, forthcoming 2014). Images of women in the media and the ways in which behaviour is emphasized, reinforced, transgressed and contested, with a strong focus on sexuality, also constitute an area of study. The most significant aspect of current studies is the embeddedness of research on gender, science and technology within theoretical and methodological approaches informing social sciences debates in broader areas. This is relevant for the papers assembled in this special issue (Bonaldi and Silva 2014, Castro 2014, Silva 2014, Agostinho et al. 2014), and they offer

a relevant illustration of an innovative approach to carrying out work in the field, with their foci on the higher education practices in engineering, the industrial relations and everyday arrangements of employees in Information Technology, the access and use of mobile telephony by women and men in a poor neighbourhood, and the outcomes of practice and policy of technology incubator companies. In their concerns they merge long standing ones and current postcolonial preoccupations. Their use of secondary data analysis, qualitative interviews, electronic surveys, ethnographic accounts and participant observation engaged with comparative dimensions both across sectors and international contexts contribute to the current innovative approaches in the field both regarding methodological and theoretical engagements.

ENDNOTES

[1] The figure is larger than for most developed countries. In the UK in 2013 women graduates earn about 20% less than men. See http://www.independent.co.uk/news/education/education-news/graduate-pay-gap-same-degrees-same-jobs-but-for-women-still-not-the-same-pay-8523471.html

[2] A very helpful and extensive review of themes related to gender and science in Brazil is found in Minella, 2013. I draw from her mapping of the field.

[3] Race and ethnicity is a clear omission given that in the 2010 demographic census more than half of the population self-classified as of African origin. See http://www.theguardian.com/world/2011/nov/17/brazil-census-african-brazilians-majority

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