International Journal of Gender, Science and Technology
http://genderandset.open.ac.uk

Discourses of Women Scientists in Online Media: Towards New Gender Regimes?

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ABSTRACT
The under-representation of girls and women among those studying and working in science, engineering and technology (SET) is a well-documented phenomenon. However, despite the widespread use of the internet in most Western societies, there is a dearth of research examining discourses of women scientists in online media. In this paper, we explore how the 'gender regimes' of online SET can be deemed transformative or, on the contrary, reproduce some of the most common clichés about men and women found in the wider 'gender order' (Connell, 1987). To do this, we explore in a systematic manner the construction of women and men in SET within 16 websites, with a particular focus on discourses of women in SET. We argue that the 'gender regimes' of these online SET spaces have failed to generate a more gender equal view of scientists. Yet, we also identify a variety of gender regimes across websites, both in terms of the numerical presence of women scientists and of the way they are represented, something which highlights the egalitarian potential of online media.

KEYWORDS
online media; gender; SET; discourse; women

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INTRODUCTION

In the UK, as well as in most European countries, girls and women are under-represented among those studying and working in science, engineering and technology (SET).[1] This is particularly the case in areas such as physics, engineering and computing (Danielsson, 2009; European Commission, 2009; Murphy and Whitelegg, 2006 ; Phipps, 2008; Walker, 2001). Moreover, women who study a SET subject at university are less likely to take-up employment in this area following graduation and their proportion decreases sharply in the more senior positions (UKRC, 2010).

Previous research has evidenced that the take up of these subjects by girls and women and of SET-based jobs is constrained by a range of structural and cultural factors, with a growing body of literature exploring how the media play out in this process (e.g., Archer and Francis, 2006; Mendick et al., 2008a; Mendick et al., 2008b; Whitelegg et al., 2007). Some of this work has specifically focused on media 'discourses' (Foucault, 1972) of gender within SET and highlighted the tensions between doing science and 'doing' femininity (Flicker, 2003; Haran et al., 2007 ; Kitzinger et al., 2008a, 2008b). However, this work has focused on 'traditional media', a term we use here to refer to those media which existed prior to the digital age, including film, television, radio, and newspapers, with only a few studies exploring discourses of gender in online media (e.g., Carstensen, 2009; Mateos de Cabo et al., 2011). This dearth of research contrasts with the centrality of the internet within late modern societies, with a large proportion of the UK and wider European population now internet users (Internet World Stats, 2011).

By online or 'new media', we mean both traditional media now available on the internet and a range of new genres which are part of 'Web 2.0', such as weblogs (or 'blogs'), wikis (e.g., Wikipedia), social-networking sites (e.g., Facebook) and photograph and video sharing sites (e.g., Flickr and YouTube). The rise of online media has been commonly associated with many societal changes. On the one hand, online media are often deemed to be responsible for the early exposure of young people to violent and/or sexualised images, and to threaten privacy and safety due to the online posting of personal data. On the other hand, a more optimistic line of argument has been that online media can facilitate freedom of expression through the global circulation of knowledge, broaden participation in media production and, ultimately, contribute to a more democratic society (Turkle, 1995). Some feminist scholars have challenged the, often implicit, association between accessing or producing internet content and masculinity (Spender, 1985). Yet, recent trends suggest a shift away from male domination: in terms of access, recent, global figures show that, among young people, girls have caught up with boys and that the majority of blogs are now those written by women, although the most frequently read blogs are written by men (Herring et al. 2004; Hesse, 2008; both cited in Carstensen, 2009). Despite this online female presence, some

feminists have argued that online media contribute to the reproduction of traditional views about men and women (Kendall, 2002; Leathwood and Read, 2008; Mateos de Cabo et al., 2011). Yet, others have suggested that cyberspace has potential for a more equal or a gender-free society (Haraway, 1991), for example, because people can take on new identities which are not always connected to their 'offline' gender identity (Turkle, 1995) or because of the opportunities the internet offers for feminist politics (Floyd et al., 2002; Royal, 2009). Whether or not it is argued that the effects of online media are negative (Boseley, 2010; Livingstone and Haddon, 2009) or positive (Gee, 2007; Johnson, 2006), it is clear that the relationship between online media and gender arrangements is complex. As argued, for example, in a previous issue of this journal, gender remains strongly, socially significant in Web 2.0. However, individuals can experiment online with gender identities in a way which is not always possible in the 'offline' world (Carstensen, 2009).

In this contribution, we want to explore this line of argument and look at how far the 'gender regimes' of online SET spaces can be deemed transformative or, on the contrary, how far they reproduce some of the most common clichés about men and women found in the wider 'gender order' (Connell, 1987-see definition in the next section). We give particular attention to discourses of women in SET as they are more likely than men to occupy dominated positions. To do this, we draw on the findings of a small-scale research project which took place between December 2009 and March 2010, which was funded by the United Kingdom Resource Centre for Women in SET (UKRC). This was the first study conducted in the UK exploring in a systematic manner the construction of women and men in SET within online media and how these constructions interact with young people's constructions of SET fields and people who work in them. In this article, we focus on the former aspect of this study. After a presentation of the theoretical framework and methodology in use, we look at the quantitative presence of women in online SET, before discussing some of the 'discourses' (Foucault, 1972) of gender in online SET identified in our study.

THEORETICAL FRAMEWORK AND METHODOLOGY

This study is informed by a social constructivist theoretical framework, with particular reference to feminist poststructuralist theories. We draw on a definition of gender as 'relational'. According to this approach, the binary opposition between men/the 'masculine' and women/the 'feminine' and the hierarchy between these categories are socially constructed (Acker, 1992; Le Feuvre, 2003). The concepts of 'gender regime', understood as 'the state of play in gender relations in a given institution' (Connell, 1987: 120), and of 'gender order', understood as the wider gender arrangements in place at societal level, are central to this paper. Drawing on the distinction between these two concepts operated by Connell, we argue that each website can be read as having a gender regime of its own, each of these more or less egalitarian and more or less inclusive of different types of masculinities and femininities. This distinction opens some space to understand that regimes of gender at a meso-social level cannot be comprehended as simple reflections of the wider gender arrangements in place at a societal level, and can even subvert these, although they are constrained by this wider context.

This approach also foregrounds the concept of discourse. In this paper we draw on a definition of discourse as a view of the world which *constructs* the phenomena of which it speaks rather than *reflecting* them (Foucault, 1972). In other words, we see discourses as performative rather than descriptive (Litosseliti, 2006). Discourses are also not passively 'absorbed', but negotiated and, sometimes, resisted. This implies that, in relation to online media, there is always room to redeploy or subvert the dominant discourse, sometimes in the same space (for example, when 'readers' are able to comment on a journalist's article), although we acknowledge that imbalances of power imply that all individuals do not have similar resources to challenge dominant discourses or transform minority discourses in so called regimes of truth (Foucault, 1972).

This approach also draws on earlier work by Stuart Hall which helped to recognise the complexity of the way individuals 'read' texts (1973). As noted by Hall: 'Though we know the television programme is not a behavioural input, like a tap on the kneecap, it seems to have been almost impossible for researchers to conceptualise the communicative process without lapsing back into one or other variant of low - flying behaviourism' (Hall, 1973: 5). This argument is also foregrounded by Valerie Walkerdine (2007), when she notes the polarisation of debates on media 'effects', between those who claim a direct causal relationship between representations and behaviours and those who seek to deny all such effects. Thus, although our focus is on online images and texts, we do not assume a direct effect on individuals who 'read' these texts, although we do see them as constraining the cultural resources available to think about gender and SET. In the context of online media, this process of 'encoding-decoding' (Hall, 1973) is further complicated by the increased blurring between production and consumption/use of content, and between professional and amateur authorship. This blurring has been summarised with the use of the words 'produser' and 'prosumers' to describe the hybrid position which we all occupy in this context (Bruns 2007, cited in Wakeford and Cohen, 2008; Gee and Hayes, 2010).

This paper is part of a wider study consisting of two streams of data collection and data analysis: an analysis of online discourses of gender within SET, based on 16 websites and an analysis of the way individuals (re)produce these discourses in their narratives, based on six individual interviews with web producers and six group interviews with 32 web users. The 16 websites were selected on the basis that they were informational, with a large audience and mostly UK-based, although some websites with a distributed global authorship and with a significant audience in the UK were included. A second criteria related to the inclusion of some general and science-specialist, professional and amateur, 'traditional' and Web 2.0 websites. Half of the sixteen sites were large generalist websites and half were science-specialist websites. Five of the generalist sites were tied to 'traditional media' and three were key Web 2.0 sites. The eight science-specialist websites were a mix of science journalism sites tied to 'traditional' media, other specialist science education sites and 'amateur' blogs and forums.[2] More generally, we aimed to construct a sample including websites with a variety of styles and content.

Time constraints and the amount of data available on most websites, meant we could only sample a small section of the content of each of these websites. In selecting the sample material, we focused on recent and popular content, while also including some less used parts of sites which were particularly relevant to issues of gender and SET. The method used to sample particular pages had to be tailored to each website because of the variety of styles and formats of each website. On generalist sites, we used searches and sitemaps to identify areas dealing with SET. For the Web 2.0 sites, we isolated small 'sections' of the websites which enabled us to compare representations of women and men in SET. On the science-specialist sites, we began with the most recent and/or most prominent material. However, we prioritised website-only content and supplemented this with other material that was particularly useful to our focus on women and men in SET, such as the New Scientist's Big Wide World blogs, and posts from six recent science graduates on life after university. When we looked at articles which allowed the inclusion of comments, we analysed both the 'primary' text and user comments.

The website analysis can be broadly described as qualitatively-oriented content analysis. As the division between qualitative and quantitative methods can be problematic (Oakley, 2000), we combined a counting exercise with the collection of qualitative data about the representations of those doing SET within our sample. Using an analytical grid, we monitored all occurrences of men and women doing SET and noted key features of each representation including aspects of appearance and personality, SET area, reason for inclusion in the website, and any markers of status, social class, ethnicity and age. As far as they were applicable, we included the categories employed in earlier work on 'traditional media' (Kitzinger et al., 2008a) in order to facilitate comparisons between representations in print and online media. This dual approach allowed us to quantify the presence of men and women in online SET spaces and to identify which discourses of women scientists are produced through the interactions between authors and readers.

This methodology raised two main challenges. First, it required a working definition of science/a scientist. Although rarely stated explicitly, the definition of a scientist varies significantly across websites. For example, on sites based largely around peer-reviewed articles, the definition of a scientist tended, in effect, to be narrower than on more informal journalistic sites. This is further complicated by the fact that fields of activity such as science policy, outreach, journalism, academic research, private research and management often overlap and people sometimes move between these categories during their career, as well as by the nature of online media. Just as the internet is taking journalism out of newsrooms and newspapers and blurring distinctions between amateur and professional journalists, it is taking science out of laboratories and textbooks and blurring distinctions between amateur and professional scientists. As Donna Haraway observed, albeit at a time which predated the explosion of internet use: 'All the actors in technoscience are not scientists and engineers ... Perhaps most important, technoscience should not be narrated or engaged only from the points of view of those called scientists and engineers' (Haraway, 1997: 50). Similarly, Bruno Latour draws attention to the large number of people involved in 'technoscience' and suggests 'tracing an empirical and variable limit' between those on the 'inside' and the 'outside' (Latour,

1987: 159). Moreover, in practical terms, even if a definition could be agreed upon, websites do not always include sufficient information to establish whether or not a person can be identified as a 'scientist'. As a result, we opted for an open definition, ethnographically oriented, in tune with the meanings in use on each website. A second challenge related to the variety of formats of websites, which meant that a uniform approach to sampling and data analysis was not viable. In a world increasingly differentiated, we realised that this diversity had to be incorporated into the methodology of a research project seeking to explore online territories. The methodology was thus tailored for each website, as discussed above, and each website read as a case study, providing empirical evidence on the gendered constructions of men and women in SET within its gender regime.

DISCOURSES OF WOMEN SCIENTISTS IN ONLINE MEDIA

The Muting Of Women's Voice In Online SET

A key feature of online SET spaces relates to the scarce presence of women doing SET. Women represented a minority of named SET participants on all the websites we analysed, with, however, some important variations across websites. On some sites, we found no occurrence of women in SET at all (but many references to men in SET). Examples of the latter include the RichardDawkins.net website, where all of the 14 people in SET identified on the sampled pages were men, as well as the Channel 4 website, where all of the 29 mentioned on the sampled pages were men. One striking example of this exclusion, taken from the Channel 4 website, is of particular interest. This website included a collection of articles in which scientists were able to contribute ideas to tackle climate change ('Ten ideas to save the planet'). It was claimed on the website that they had emailed 'hundreds of scientists across various fields of expertise to sound out their opinions'. Scientists' answers were described as 'a tsunami of technological thought, which we've been struggling to keep up with'. Despite this, no woman scientist was named in the sampled segments of this collection, apart from an anecdotal reporting of an unnamed female lecturer who had written to say that she would like to circulate the call to doctoral students in her department. On other sites, women represented a significant proportion of those doing SET (for example, the Natural History Museum website, where, out of 25 individuals doing science, 10 were women).

When women were present, their presence was also often characterised by what we call the 'muting of women's voices' (Mendick and Moreau, 2010). Apart from their relative absence from sites, discussed above, this took two major forms. One was the use of pictures of unnamed women, to illustrate a text. An example of this common pattern was provided by the English-language Wikipedia entry on Scientists. A range of pictures were included on the right-hand side of the page, next to the text. The first picture was of a group of white-coated scientists, mostly women, conducting laboratory work. This was a muted presence: the scientists were not named and looked very similar, both in terms of their appearance and of what they were doing. The other pictures on the same webpage all consisted of individual close-ups of named and well-known male scientists. A caption under most of these portraits highlighted their contribution to science. A second form taken by this muting of women's voice was when women scientists were present as

journalists or communicators, and used to present people's (mainly men's) work rather than their own. This means that while they voiced SET developments, their own voice as SET participants was muted. A notable example of such a woman talking about science, taken from the BBC website, is Aleks Krotoski (a psychologist and the presenter of *The Virtual Revolution*, a BBC broadcast about the World Wide Web). Similarly, in the articles/blogs from the New Scientist homepage which we analysed, women were disproportionately represented as science journalists versus scientists. It could be argued here that this trend of using scientists as communicators is not specific to women, as exemplified for example by the popular figure of Brian Cox.[3] However, in contrast with men, women doing SET were disproportionately represented as communicators. Besides, in the case of men scientists such as Brian Cox, their status as scientists remained foregrounded, suggesting a construction as scientists doing media work rather than as scientific communicators.

Although this muting of women's voices established a link between women and SET, it also risks reinforcing oppositions between women and men, associating them with beauty and intellect respectively, thus drawing on an opposition between body and mind that is deeply rooted in Western conceptions of science (Lloyd, 1993). Similarly, the use of women to present other people's voices establishes a connection between women and science, yet, risks reinforcing the position of women as communicators, educators and more generally, transmitters of knowledge, while men continue to be associated with knowledge production. However, it needs to be acknowledged that, while the distinction between knowledge production and transmission may serve a heuristic purpose, these are not completely independent processes. Thus, through their voicing of discourses of science, women are also potentially in the position, to some extent, to 'articulate' new discourses (Hall, 1986).

The Peripheral Positioning Of Women Doing SET In Online Spaces

Our analysis of online spaces also evidenced the peripheral and subordinate positioning of women scientists. In particular, women are more frequently featured as students or early career scientists, with men more likely to be in more established positions, as senior researchers or national/international experts. For example, on the New Scientist's website, mentions of men in SET significantly outnumbered those of women in SET. However, the Big Wide World bloggers featured on this website (all young 'becoming' scientists) included four women and only two men. Further evidence of this subordination was provided by an analysis of 57 of the Diet Coke and Mentos 'experiments' which could be viewed at the time on YouTube. Women did not only represent a tiny minority of those featured, but were, with only two exceptions, taking passive roles (mainly as victims of a prank), while men were overwhelmingly taking active roles as experimenter, prankster, coke bomber or camera operator, in line with commonplace binary oppositions, which associated the passive with the feminine, and the active with the masculine. Similarly, in the articles we looked at on the New Scientist website, 12 out of 32 male scientists' names were hyperlinked to their homepages, while neither of the two women's names were. This is in line with Silverberg's comments on the CBS website of the US mathematics-solves-crime *Numb3rs* TV series. Only three

characters did not have a character profile on the website during season two, including the two main female characters in the series (Silverberg, 2006). This is particularly problematic since going from one hyperlink to another is a key way that people navigate the internet and, in the case of online SET, this limits the opportunities to access more information about the work of women in SET and limits the possibility of what we call 'matrilinear websurfing' , whereby women, as well as men, can be tracked through the world wide web**.** Such subordination was also reflected in the common practice of referring to the relationships women in SET had with others, in particular with men scientists. As we have argued elsewhere in the case of mathematicians, this risks being read as suggesting that women owe their success and position to the support of another (male) scientist, whether a father, a partner and/or a collaborator (Moreau et al., 2010). This pattern overlapped with the locating of women scientists in the private sphere, to which we return later.

Discourses Of 'Feminine' Science Or The Clichéd Constructions Of Women Scientists In Online Spaces

Our analysis also revealed a strong association between women scientists and cultural constructions of SET as 'feminine' in online spaces. One aspect of this related to the concentration of women in sections of websites which were specifically dedicated to them, in contrast with their absence from mainstream websites or web pages. This also reflected the construction of femininity as 'special' and 'marked', while masculinity, like science, appeared as universal and 'gender-free'. The Wikipedia website provided an illustration of this point. Thirty-one out of the 32 scientists named on the Scientists entry of Wikipedia were men (the one woman named was Mary Somerville). Similarly, out of the 22 scientists who appeared in rotation on the Wikipedia Science portal, only two were women (Rosalind Franklin and Maria Mitchell). Yet, Wikipedia also included a specific entry on 'Women in science'. The use of this particular wording, rather than 'Women Scientists' is problematic as it reproduces the gendered binary between 'doing science' and 'being a scientist' (Archer et al, 2010), with women associated with the former category. In contrast, the absence of an entry on Men in Science or men scientists, reproduced their unmarked positions as men and, again, the default association between masculinity and science. Furthermore, there was a significant male presence in the Wikipedia entry on Women in Science, as their relationships with other men (partner, father, collaborator, and often scientists themselves) were routinely mentioned. More evidence of the marking of women scientists as women was provided on Twitter: while Ada Lovelace attracted an enthusiastic following on Twitter (second only to Richard Dawkins, among the six people we sampled), nearly all tweets featuring her remarked about being a woman programmer and/or seeking to use her person to promote women in technology.

The emergence of online spaces for 'women in science' and attempts to acknowledge the work of women scientists as well as men scientists are partly the positive outcome of years of campaigning for women's rights in general and for women in SET in particular (Phipps, 2008). They are also made possible by the different editorial practices within online media and by the expansiveness of web space whereas, for 'traditional media', editorial and space constraints tend to be

more restrictive. However, the marking of women scientists as gendered and of their work as women's work remains (Damarin, 2000), while the relationship between masculinity and doing science work is often left unquestioned. Thus, women's exclusion from the general articles about science and scientists, on websites such as Wikipedia and others, risks perpetuating the masculine default image of scientists and reproducing a view of women scientists as 'specific'.

As well as being concentrated in 'specific' sections of the internet, women were also more likely to be associated with particular domains of science and storylines which are culturally constructed as 'feminine'. One of the YouTube Science and Technology shows we analysed ('Born to be Wild: Tamzin Outhwaite Goes Wild with Dolphins') featured many women scientists, including some in management positions. However, all of them worked with animals and/or children with disabilities, both areas with some connection to caring, an activity predominantly seen as feminine (Skeggs, 1997). On another website (Sky TV), the only woman mentioned on the sampled pages was a psychologist (Clare Wood), who has conducted research on phone texting and literacy. Thus, she was associated with writing and communication, two areas in which women are sometimes seen as performing better than men. More generally, as noted above, we found that women were associated with scientific activities closely tied to traditional female attributes, such as caring, demonstrating empathy towards living beings (human or animal) and as having a 'natural' proximity with the natural world, as opposed to the physical world, which is associated with masculinity. A Guardian article on Jane Goodall, which was analysed for the purpose of this study, provided a further example of this association between women scientists and dominant discourses of femininity. Three of the seven mentions of women scientists identified on the Guardian webpages were found in a single article (a piece about Jane Goodall, which also included some references to Dian Fossey and Birute Galdikas). In that particular case, communication skills and developing relationships, usually considered as feminine traits, may contribute to making primatology and anthropology acceptable areas of work for women, compared with, for example, physics or computer programming. This also echoes previous work on online newspapers, albeit not in relation to SET, which showed the continued stereotyping of women, their linking to designated sections and their concentration in areas considered of 'less importance' (Matteos de Cabo et al., 2011). This clichéd pattern was not shared by all the sampled websites. In the articles on the New Scientist site, women did appear in disciplines beyond the stereotypical image of biological sciences, despite representing only three out of the 35 scientists mentioned.

Feminist scholars have argued that gender is a system of binary oppositions, with activities/attributes described as either masculine, or feminine, and the former usually given more value than the latter. The coverage of Susan Greenfield[4] in the media around the time we conducted this study highlights the use of oppositions between 'good' and 'bad' science/scientists and, sometimes, the disproportionate association between women and the latter category. This opposition has been popularised by Ben Goldacre's Bad Science Blog, in which a category of 'bad' science (broadly: not following the evidence) underpins the text, presumably in dichotomy with 'good' science (or following the evidence), with people being located

in one of these two camps. In the blog entries we sampled from this site, women were disproportionately associated with 'bad' science; three out of four of the women compared to 12 out of 27 of the men. Similarly the Watts Up With That? website, a blog which mainly endorses the view of climate change skeptics, yet presents itself as scientific. This blog also operated around an opposition. This opposition is between people who support the view that climate change is happening and people who seek to expose the 'climategate conspiracy' with the former constructed as failing in their understanding or as dishonest and the latter constructed in heroic terms. Women were more likely to be associated with the former position (i.e. associated with what constitutes 'bad' science from this particular blog's perspective), with three out of four women falling into that category compared to 14 out of 24 men.

Another striking feature was the lack of ethnic diversity among these online figures. Typically, on the New Scientist website, all of the six recent graduates who were 'Big Wide World bloggers' were White. Owing to the low number of women in SET online, it was difficult to draw any firm conclusions about whether or not they are more diverse ethnically than men. However, precisely because of their small numbers, women scientists from minority ethnic groups represented exceptional cases. One such exception was the portrayal of a Black woman on the 'I want to be an ologist' Natural History Museum site. It is however worth noting that on the day we analysed this site, the pages of the five young White scientists in this section described them as 'palaeontologist', 'entomologist', 'mineralogist', or 'botanist'. In the case of the only Black woman among them, her page featured her area of specialism not her job (thus 'zoology" rather than 'zoologist'). Although this has since been amended, there are still some references to 'zoology' (rather than to being a 'zoologist') on her page. This supports our earlier comments on the 'Women in Science' (rather than 'Women Scientists') entry of Wikipedia and on the opposition between 'doing science' and 'being a scientist' (Archer et al., 2010). People with disabilities in SET were invisible, with the obvious exception of Stephen Hawking. More evidence would be needed to generalise such observations, but we suggest that they provide further indications of the default association of science/SET with White middle-class men, also noted in research on 'traditional' media and in research using the 'Draw a scientist test' (Kitzinger et al, 2008a; Whitelegg et al., 2007).

The Association Of SET Women With Intimacy And The Body In Online Media

Compared with men in SET, online accounts of women in SET were more likely to include references to what we can broadly describe as their intimate and private lives, and to their body. This included mention of family circumstances more frequently than is the case for their male counterparts, in line with the wider societal opposition associating men with production/paid work and women with reproduction/the family (Crompton, 1999). The Science Museum website offered some evidence of this in a section on Marie Curie which included lengthy details about her private life and work with Pierre Curie (her husband). The level of detail provided has no equivalent in the descriptions of the private lives of the male scientists presented on the same website. Further, the picture illustrating this

section showed her standing behind Pierre Curie, her hand on his shoulder, both looking at a piece of uranium he is holding, a pose suggesting her reliance on and/or her support of him.

There was also greater emphasis on women's appearance and personality than is the case for men. Two articles published on the Guardian website, one about Jane Goodall and one about Susan Greenfield, included detailed accounts of their hair, clothing and accessories, as well as detailed information on their private lives and personality. In the article on Susan Greenfield, written shortly after her high profile departure from the Royal Institution, she was described as driven by ambition and her own goals rather than by interests related to science. The piece, suggestively titled 'Good bye to a not-so-good scientist', included limited material on Greenfield's work and concluded with the words: 'I wish she had behaved more like a real scientist'. That the author of this particular piece was a woman also indicates the importance of avoiding simplistic assumptions about men and women authors' treatment of women. The Guardian piece about Jane Goodall also included detailed information about her appearance, such as: 'Jane Goodall, grey in complexion but resplendent in a red shawl, is sitting on the sofa in a dimly lit room in west London'. Her portrayal was akin to that of a saintly figure, in sharp contrast with the sexualised and somewhat demonised construction of Susan Greenfield, on the same website. The article referred to Goodall's comparison to Mother Teresa by another journalist, something described by the author as a 'good description: she combines stateliness with a kind of holiness, her religion a predominantly green one'. This particular focus on women's appearance and personality echoed work by Jenny Kitzinger and colleagues (Haran et al., 2007; Kitzinger et al., 2008a) who found, in their similar study of 'traditional media', that journalists were more likely to comment on appearance when writing about women scientists than men scientists. Similarly, they found that descriptions of women as 'sexy' and 'glamorous' may jeopardise their scientific status.

Another prominent feature of online discourses of gender in SET was the sexualisation of women. This related to two of the patterns already discussed: their positioning in the private and domestic realm and their association with physical bodies as opposed to abstract intellects. It can also be understood as part of the 'general sexualization of culture, or the mainstreaming of sexuality' and more specifically to 'pornification', the blurring of the boundaries between pornography and the mainstream of popular culture (Paasonen et al., 2007: 8). The most extensive examples of this were found on the Web 2.0 sites, driven by user content and with limited editorial input: YouTube and Twitter. Although the sexualisation of women is endemic in popular culture (Redfern and Aune, 2010), our findings suggested that the informal side of the web and the production of user content, facilitate this. This was evidenced in the responses to Tamzin Outhwaite's[5] BBC programme on dolphins (posted on YouTube). The programme did contain a large number of shots of Outhwaite wearing a bikini (suggesting her role is partly ornamental) and contained two sexualised comments from her, such as when she jokingly suggested that a dolphin is wolf-whistling her. However, this did not explain the eight comments from the 55 left at the time of sampling that objectified her by discussing her sexual attributes and comparing the video with pornography.

Although similar work by Jenny Kitzinger and colleagues (2008b) also found evidence of sexualisation of women scientists, it was not equivalent to what we have found in some of the user-generated material. Strikingly, coming back to this particular example, there were no asexual positive comments on the page about Outhwaite (although there are a few negative comments without sexualisation) and no other people in the programme were mentioned. Findings from the other show analysed on YouTube and from the Twitter website echoed this. Two of the three women and none of the three men we looked at attracted sexualised tweets. For example Ada Lovelace was said to have the 'sexiest programmer name ever', while someone tweeted that he 'is taking Dr Alice Roberts to bed'. Although sexualisation was most blatant on the informal sites, we also found it in less obvious forms on the institutionalised websites. Notably, the foregrounding of women as (sexual) partners of men, exemplified in the representation of Marie Curie discussed above, was a sexualisation of her by positioning her as a wife in a heterosexual marriage. While sexualisation is not specific to women in SET, it is particularly problematic here because of the low number and tokenistic status of SET women online.

CONCLUSIONS

Previous research on online media has highlighted that these can contribute to the reproduction of gender arrangements, while others have commented on the transformative power of the internet in favour of more egalitarian gender regimes. Pursuing this line of enquiry, our paper highlights how the gender regimes of the particular online spaces we explored failed to generate a gender equitable view of scientists. A key finding in relation to the discursive constructions of women scientists which circulate on these websites relates to the muting of women's voices, through their relative invisibility and their positioning as science communicators. Another finding consists of their peripheral and subordinate positioning, for example when they are not central to a storyline, or are positioned as 'assistants' or junior scientists. The study also provides evidence of the association of women scientists with areas of science culturally defined as 'feminine', as well as with the body and the private sphere. In some instances, we found that these discursive constructions of women scientists also reproduced the widespread hierarchy between the 'masculine' and the 'feminine' through women being more likely than men to be associated with the idea of 'bad science'.

While, broadly, these discourses reproduce the existing dichotomy and hierarchy between men and women, the 'masculine' and the 'feminine', present in the wider gender order within Western societies (see, for example, Héritier, 2002), these online discourses do not have the same prominence on all websites. First, the sampled websites have distinctive gender regimes with significant differences between them in relation to the presence of women scientists, which goes from their total absence to women representing a significant minority of scientists. Second, some websites maintain a conservative gender regime based on the marginalisation or 'othering' of women, for example through their peripheral positioning or their sexualisation. In particular, blogs and user-generated materials often included evidence of aggressive and sexualised comments, something not so apparent in research about traditional media (Kitzinger, 2008a). These exchanges are often characterised by the general assumption that users are men (this is

encapsulated, for example, in the default use of terms such as ‘man’ and ‘dude’ to refer to fellow users on YouTube and RichardDawkins.net). They also commonly construct male homosexuality as a devalued form of masculinity (Connell, 1995), for example through the use of ‘gay’ as an insult, as identified in our study. Another important finding from this study is that there does not appear to be a clear relationship between the numerical presence of women scientists on these websites and the way women scientists are represented. For example, while the Science so What? website only features a small number of women scientists, women and men scientists are portrayed in very similar ways. This website also makes reference to the Women Into Science and Engineering (WISE) campaign and calls for less stereotyping for girls in relation to career choice. This suggests that, to be the most effective, policy intervention should focus on increasing the visibility of women scientists *and* on encouraging the producing of egalitarian representations of men and women scientists, as one aspect does not necessarily derive from the other.

Finally, it is worth remembering here that ‘where there is power, there is resistance, and yet, or rather consequently, this resistance is never in a position of exteriority in relation to power’ (Foucault, 1990: 95). In this respect, for example, even *in* the spaces where the dominant discourses unfold, there is room for the emergence of counter-discourses. For example, the voicing of SET by women which we have already commented on, may reiterate some gendered associations, yet, gives them the opportunity to ‘reshape’ old discourses and ‘articulate’ new ones (Hall, 1986), as the transmission of knowledge is never completely distinct from its production. Similarly, while Wikipedia may be described as a prevalently ‘masculine’ order, all those with access to the appropriate technology are able to edit content and eventually to create entries voicing counter-discourses. Moreover, the small-scale study on which this paper draws has focused on some of the most popular websites. Although popularity, in the sense of having a mass audience, is an important criterion, our prioritisation of this meant that we were unable to include many of the more original representations of women in SET. It would be of particular interest to explore, for example, feminist websites aiming to promote women in SET. While we have highlighted here the reproductive power of some of the discourses which circulate in online SET texts, such research would complement ours and contribute to a better understanding of the conditions facilitating a shift towards a more egalitarian SET sector.

ACKNOWLEDGEMENTS

We would like to thank the UKRC for funding this research and Anna Zalevski, Gill Kirkup, Liz Whitelegg and Ruth Wilson who acted as critical friends throughout the study. We are also very grateful to the participants in this research, to the gatekeepers who facilitated their participation and to Arani Ilakuberan, the study’s administrator. Last but not least, thank you to Uvanney Maylor who commented on a draft of this paper, and to the two reviewers.

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APPENDIX

Table 1. List of website and sampling processes.

The Guardian/The Observer website The Daily Mail/Sunday Mail	These websites were sampled on two different days (14th and 29th January 2010). We did a systematic search for mentions of scientists in all articles featuring on the homepages (or with a link on there), and then in the Science section of the Guardian and the Science and Technology section of the Mail, with a focus on the most recent articles. Where sampled articles allow for readers to leave comments, we analysed these.
BBC family of websites	We looked at all material on the homepage including any links to science content. We focused on the most recent articles, and included some pages from h2g2, an encyclopaedic project to which everyone can contribute. We also looked at the programmes part of the website.
Channel 4 family of websites	We looked at the articles on the homepage, then focused on those in the Science Technology & Environment section.
Sky TV UK family of websites	We looked at the most recent articles on the homepage of the website and in the Science and Technology section. We also looked specifically at the articles on the homepage of Discovery Channel (which is part of the Sky TV package) and at the most active forums and blogs which were about science or technology.
YouTube	We sampled two strands of content on this website. The first was the Mentos and Diet Coke 'experiment', a widely viewed YouTube phenomenon. The second was the Science and Technology shows section, a new section on YouTube. We focused on the two most viewed texts in this latter section and also analysed the user comments.
Wikipedia	We analysed the Scientist entry, the Women in Science entry, the Science Portal and an entry on Rosalind Franklin, which was linked to from the Science Portal.
Twitter	We searched for specific names (in male/female pairs): Richard Dawkins and Susan Greenfield (perhaps the most prominent and controversial male and female UK scientists), Alice Roberts and Robert Winston (both contemporary and on television), Charles Babbage and Ada Lovelace (comparative field, time, level of fame). We monitored Twitter traffic for each person across two six day periods, summarising the frequency and content of these.

New Scientist website	We sampled the six most prominent articles from the New Scientist home page and all the blog entries on the opening page of the Big Wide World collection of recent science graduate bloggers. We also looked at responses to the articles/blog posts.
Ben Goldacre's 'Bad Science' blog	We focused on the blog rather than the forums, marketing materials and so on, since this is both literally at the centre (of the homepage) and metaphorically at the centre of the site's activities. We worked through the posts backwards from 11th January 2010, analysing five posts and user responses to these.
Science - so what? So everything	We sampled all the recent articles in the foregrounded sections, including looking at any user comments on these.
The Science Museum website	We sampled a range of material, starting with the homepage and the foregrounded sections (following links where scientists were named). We also sampled some of the most recent entries to the blogs from the Museum's curators. Most of our analysis focused on the Online Stuff section, as it is developed specifically for the website and contained many mentions of scientists.
The Natural History Museum website	We explored systematically the foregrounded sections and focused on the Education and Kids Only sections. These included pages containing scientists from different areas, talking about their career choice.
RichardDawkins.net	The coding for this site was done on 11th January 2010. In terms of sampling, we focused on the most recent threads with the highest number of posts. As numbers of scientists mentioned were low, we also focused on particular discussions of scientists, especially women scientists and looked at two threads discussing these. However, these had a limited number of posts and viewing.
Neuroskeptic blog	We worked through the posts backwards from 13th January 2010, analysing five posts and user responses to these. This site often cites papers, in which case only the scientist named in the main blog was listed (e.g. Silverman in Silverman et al) even though the full reference including all co-authors is given at the bottom of the post.
Watts Up With That?	We analysed the most recent entry on the website (on 24th January 2010) and responses to this.

ENDNOTES

[1] For readability purpose, we will use the acronym ‘SET’ across this paper. We will also use the word ‘scientists’ as a shortcut to refer to those doing SET.
[2] The sampled websites were: three British TV channels (BBC, Channel 4, Sky), two British newspapers (The Daily Mail and The Guardian), YouTube, Wikipedia, Twitter, New Scientist, the Bad Science blog, Science so what? So Everything, The Natural History Museum, The Science Museum, RichardDawkins.net, Neuroskeptic and Watts Up With That?. The websites are named so that the data is contextualised and the reader can refer to the source material. Also, given the search facilities on the internet, it is impossible to anonymise the sites in a meaningful way. For further details on the sample, see Table 1 in Appendix.
[3] Brian Cox is a British scientist and is well-known in the UK for being a presenter of science programmes on the BBC.
[4] Susan Greenfield is a British scientist. She was director of the Royal Institution of Great Britain.
[5] Tamzin Outhwaite is a British actress and TV presenter.