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Challenging male dominance through the substantive representation of women: the case of an online women's mentoring platform

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This article analyses the design of an online mentoring platform—for women by women—in a high-technology, male-dominated UK industry: aviation and aerospace. Based on interviews with professionals and managers, we analyse the journey of the women involved and contribute to the understanding of the role of women (individually and collectively) in challenging gendered norms in a male-dominated industry through the theoretical lenses of 'critical actors' and 'critical mass'. We combine these concepts, usually seen as mutually exclusive, to explain the success of the online platform. We show how a small number of self-selected critical actors represented, listened and responded to the needs of the women in their industry, thus achieving the substantive representation of women. We also argue that while critical actors were key to its inception, the mentoring platform now needs a critical mass of women to ensure its success.

Keywords: online women's mentoring platform, critical actors, critical mass, substantive representation of women, aviation and aerospace, gender equality.

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Introduction

Mentoring is an important but scarce source of career and social support for women in male-dominated industries. Women's mentoring schemes, especially when online, can enable women to build support with other women across their industry which can, in turn, help to challenge male dominance. Online mentoring platforms can make mentoring more accessible to a geographically dispersed and under-represented group of women.

The opportunities to build mutual support, solidarity and resilience, via information communication technologies (ICTs) have been the focus of several studies published in this journal. These have included the potential of ICTs to generate solidaristic practices amongst female home-based workers, to combat exploitation (Torenli, 2010); the importance of the internet in re-building mutual support and solidarity to the shop stewards' movement (McBride and Stirling, 2014); worker self-organising via Facebook as a means to cope with the pressures of contemporary employment (Cohen and Richards, 2015); and trade union mobilisation via social media (Hodder and Houghton, 2015). These studies demonstrate how independent, mutually supportive networks are possible (and growing) through ICTs and social media.

This paper offers a further perspective on the use of ICTs as a means to challenge gender inequalities in the provision of mentoring, via an online platform (hereafter referred to as the mentoring platform). The platform was designed for professional women in the aviation and aerospace industry, one of the most male-dominated industries in the UK. Importantly, the platform enables women to receive mentoring remotely (e.g. while based in another country, on deployment or on maternity leave). The platform matches mentors and mentees through specifically designed matching questions. Matching is automatic and achieved through algorithms built into the technological design eliminating the time required for manual matching. The mentoring platform acts as an online community that is open to any professional woman employed by the industry. It is not 'owned' by a single employer but is administered by the industry professional body.

This paper analyses the design stage of this mentoring platform by examining the reasons why it was set up, the motivations of those involved and how women in a male-dominated industry challenged the lack of mentoring available to them. We examine the actions of a small number of critical actors (Childs and Krook, 2006; Celis and Childs, 2008; Celis *et al*., 2008; Childs and Krook, 2008; Childs and Krook, 2009; Celis and Childs, 2012) in setting up the mentoring platform, who can be described as self-selected representatives for women across the industry. We also focus upon the growing critical mass of women who became involved in the design stage of the mentoring platform (the 'represented') and, ultimately, its online users. The mentoring platform is the outcome of the actions of this small number of critical actors, who represented the mentoring needs of women in their industry and delivered mentoring support through the online platform.

The 'substantive representation of women', a key concept in our analysis, is defined as, 'an interactive process of interest articulation during which a multitude of interests and perspectives can be formulated by many actors and during which the representatives and the represented respond to one another in an interactive fashion' (Celis and Childs, 2012: 527). This embodies how the critical actors involved in the design of the mentoring platform joined together to represent women across their industry and, at the same time, draw a growing critical mass of women into the design process itself. It was recognised at an early stage that the scheme would only be successful with a critical mass of women to support it, as a key enabler to building 'supportive alliances' (Kanter, 1977). This equates to more than simply the descriptive representation of women (being a woman representative) and, instead, to the substantive representation of women (representing what women want and need).

The critical actor concept originates from a critique of critical mass theory. Kanter (1977) the original proponent of this theory, argued that only an increase in women's

numbers could change the male dominant culture of organisations (through forming a critical mass). There are many proponents of this argument, explored below, who argue that the descriptive representation of women will, in the longer term, lead to their substantive representation. Sceptics, predominantly feminist political theorists (Dahlerup, 1988) considered the critical mass concept within political theory but ultimately recognised its limitations. This growing scepticism has resulted in a focus, instead, on critical actors, constituted by a small minority of women who act for women in a substantive manner (Childs and Krook, 2008). This shifts the focus from 'why' women make a difference (through their numerical presence) to 'how' women make a difference, through their actions.

Three key research questions are addressed in this article: (1) What were the motivations of the critical actors to design an online mentoring platform for women in their industry? (2) Has the substantive representation of women's expressed mentoring needs been achieved through the actions of a small number of critical actors? and (3) Although critical actors may act alone, or in small numbers, ultimately, do they need to mobilise the support of those they represent to drive through positive change for women?

The article is structured as follows. The following section sets the context of the industry for which the mentoring platform was designed and why formal, online mentoring is important for women in male-dominated industries. The conceptual framework is then outlined, followed by the methods section, which explains how the research was conducted. The findings section analyses the motivations of the critical actors and why and how female professionals became involved in the design of the mentoring platform. The conclusion returns to the research questions and explains the conceptual and empirical contributions of the article.

Context: the aviation and aerospace industry

The aviation and aerospace industry is particularly significant to the UK, with a combined value of £58bn and providing just under two million jobs (Aviation, 2050; ADS, UK Aerospace Outlook, 2019). Despite this high-technology industry being widely recognised as vital to the future success of the economy (and its link with the UK Industrial Strategy), it continues to be constrained by a persistent chronic shortage of skills, which could be addressed partly through the recruitment and retention of more women. The UK government has been pro-active in attempting to increase the numbers of STEM graduates, through a number of initiatives, for example the 'Your Life' Campaign in STEM (ECITB, 2018). The industry also has its own women's Charter, with a pledge to achieve gender balance across the industry, supported by the government and key organisations in the industry.

Reliable figures on gendered employment patterns in the industry are notoriously difficult to obtain. However, two trustworthy sources (WISE, 2018; Korn Ferry, 2019) report that women comprise just ten per cent of engineers, three per cent of airline chief executive officers and six per cent of commercial pilots in the industry. Korn Ferry's (2019) recent global study of the industry reported that fifty per cent of women in the industry see a lack of opportunity for advancement and that mentors were cited as an important factor in eliminating systematic bias against women and supporting their advancement, particularly through collaboration and networking. The mentoring platform was designed to address this problem, the high-technology/high skill nature of this industry making an online platform particularly relevant and useful, especially for women who are skilled and familiar with advanced technologies.

Taken together, these factors constitute a critical context for the mentoring platform, within which multiple organisations (sometimes competitors) were drawn together by the critical actors to address a common problem: the underrepresentation of women in the industry and a lack of support to progress. The mentoring platform itself initially involved two large organisations (one public and one private sector) and the

professional body representing the industry. It was designed to operate across what is a very diverse sector, to match less experienced professional women with more experienced female mentors, with the ultimate aim of building a sufficient mass of women (especially in leadership positions) to support women professionals throughout the industry. The online nature of the mentoring initiative was crucial given its cross-industry remit.

The importance of mentoring

Women face challenges when working in historically male-dominated industries and struggle to be accepted (Martin and Barnard, 2013; Durbin and Lopes, 2017). Drawing upon the support of other women could offer a way forward, especially where there is a lack of mentors (Germain, *et al*., 2012; Durbin, 2015). We define a mentor as someone who has relevant knowledge and experience and works on a short- or long-term basis with a mentee to give advice, guidance and support to assist the mentee's career, well-being, learning and professional development.

While many organisations operate formal in-company mentoring schemes, these are usually available only to the 'talented', senior and graduate employees, leaving the majority, especially women, without mentoring support. While mentoring can be an important source of support for women, little attention has been paid to why formal mentoring schemes are set up and to what extent they challenge male dominance. In the case of the mentoring platform reported here, the women involved were active in proposing, designing and launching it. Existing literature on formal mentoring schemes also tends to be more practical than theoretical (Mercer *et al*., 2013).

While the positive gains from mentoring are clear, some negative aspects have also been identified, including mentor self-absorption (Waxman *et al*., 2009), mentor and mentee incompatibility (Hansford *et al*., 2004), manipulative behaviours by mentors, poor mentor interpersonal competency skills and mentor neglect of the mentee (Eby *et al*., 2000). These behaviours are more likely to occur where the mentee perceives the mentor as having dissimilar attitudes, values and beliefs to their own (Eby *et al*., 2000). Thus, not all mentoring is beneficial and there needs to be care in setting up formal mentoring schemes.

Online mentoring platforms have several advantages in comparison to face-to-face mentoring, including the capacity to build 'communities of practice', through which members exchange knowledge, develop individual capabilities and share identification with the group's expertise (Allan, 2002). Critically, online mentoring transcends organisational and geographical boundaries, making it widely accessible (Headlam-Wells *et al*., 2005) and therefore benefiting under-represented groups. The use of ICTs has been shown to lead to increased interaction between mentors and mentees (Gareis and Nussbaum-Beach, 2008), mentees reporting easier access to information (Risser, 2013) and feeling supported (DeWert *et al*., 2003; Alemdag and Erdem, 2017). However, online communication can be less effective and more impersonal (Rowland, 2012). If mentoring is provided solely online, the support provided by the mentor can be less useful (Smith-Jentsch *et al*., 2008; Shpigelman, *et al*., 2009), making blended mentoring schemes that combine face-to-face and a technology platform, such as the scheme reported here, ideal (Argente-Linares *et al*., 2016).

Women-only spaces, including mentoring schemes, can also be controversial because of women's desire to fit in with highly masculinised cultures (Wright, 2016). Some women may be reluctant to join anything that is 'women-only' due to their high visibility, single gender focus and backlash from male (and sometimes female) colleagues. Online women's spaces can be less of a challenge as they offer a 'virtual' and convenient means through which women can connect and support one another. They can help address marginalisation, isolation and exclusion and ensure that they are comfortable expressing their needs in a 'woman to woman' environment (Women's Resource Centre, 2007). They can also be a means by which to challenge the male

dominance of workplaces. The relative success or failure of formal mentoring schemes depends upon many factors and our understanding of this can be further developed by bringing theory and practice together.

Conceptual framework

Challenging male dominance through the substantive representation of women: critical actors or critical mass?

In the seminal work on the concept of representation in a political theory context, Pitkin, (1967: 2) describes representation as lying in-between the representative doing what they think is best and reflecting the wishes and opinions of those they represent. Pitkin therefore makes a distinction between 'standing for' and 'acting for' representation, which places the focus upon what representatives 'do' rather than who they 'are'. Substantive representation, therefore, denotes acting in the interests of the represented, in a manner that is responsive to them (or 'acting for') (Pitkin, 1967: 209).

These conceptual differences have become known as the 'descriptive' (standing for) and 'substantive' (acting for) representation of women. Proponents of critical mass theory argue that women will only have a major impact in, for example, business and politics, when they move from a small to a large minority (the 'descriptive' representation of women). The focus is upon, for example, women moving from being tokens to a 'tilted' group (at least 30 per cent) (Kanter, 1977), and the numbers of women who hold political office/elected to national and international parliaments increasing (in Pitkin's terms, 'standing for'). The substantive representation of women, on the other hand, is associated with the types of policies passed that support women; the representation of women's interests in decision-making; the effects of women's presence and the result of improved development outcomes for women (Childs and Krook, 2009; Wangnerud, 2009; Baker, 2018) (Pitkin's 'acting for' women).

Critical mass: do numbers make a difference?

Given the different approaches by critical mass and critical actor theorists to achieving the substantive representation of women, this section explores whether numbers or the actions of women are successful in this. A key argument in this paper is that these two theoretical approaches should not be viewed as mutually exclusive but rather as complementary constituents of an ongoing interactive process, to achieve the same end, that is to build an online mentoring platform that will offer support and also challenge the male dominance of an industry. The key arguments of critical mass and critical actor theorists are now explored.

A pertinent question to begin with, is, how many women does it take to bring about positive change for women? Kanter (1977) argued that token women often felt isolated due to their solitary status but that the more numbers become tilted in women's favour, the more they can enjoy increased influence over the way the company operates. While the presence of two token women can help to ease the pressure for women as managers, they could often easily be divided; therefore, it is necessary to materially increase the numbers of women for supportive alliances to develop (generally represented by 65 per cent male and 35 per cent female managers) where the 'dominants' are only just a majority and where minorities can create coalitions, form alliances and affect the culture of the organisation. Kanter argues that number balancing should be the ultimate goal in organisations because an improved balance of people leads to a greater tolerance of the differences that exist between them.

The critical mass argument has become popular, with 30 per cent generally being the set target (Torchia *et al*., 2011). This is linked to the 'business case' argument that having a critical mass of women leads to increased levels of innovation, an increased

likelihood of raising of awareness around women's issues but also higher than average performance for companies (Credit Suisse, 2012; Catalyst, 2015).

Can fewer women make a difference? The role of critical actors

Dahlerup (1988) introduced the concept of critical mass into political science debates, ultimately suggesting that 'critical acts' should replace it in relation to the substantive representation of women. She questioned whether a large minority of women could lead to changes in areas such as political culture and concluded that increased numbers of women do not gain power but can lead to a general change in attitude towards women in public roles, including reduced open resistance to and less negative attitudes towards them. She proposed the concept of 'critical acts' to replace 'critical mass'. This could be achieved, for example, through the critical act of introducing quotas for women, although this picks up the contradiction in her critique of critical mass as quotas are, indeed, aligned with numbers.

In response to Dahlerup's seminal work, a key turning point in this debate has been the focus on 'critical actors' as a means to bring about the substantive representation of women in politics, and ultimately, change. This is identified in the work of Celis and Childs (2008; 2012), Celis *et al*. (2008) and Childs and Krook (2006; 2008; 2009) who state there is no evidence of a relationship between the percentage of women elected and the passage of legislation beneficial to women as a group. While acknowledging that the critical mass concept has been useful, they claim it downplays the potential role of individuals to bring about policy changes. In proposing a focus on critical actors, they identify the role of multiple actors with strategies to achieve the substantive representation of women.

Critical actors may act alone or with others, may succeed or fail in their efforts to promote women's concerns and be male or female (although they tend to be female) (Childs and Krook, 2009). They have been defined as 'those who act individually or collectively to bring about women-friendly policy change' (Childs and Krook, 2009: 126–127) and by Celis and Childs (2008: 420–421) as 'those who put in motion individual and collective campaigns for women-friendly policy change: they initiate policy proposals on their own, even when women form a small minority, and embolden others to take steps to promote policies for women, regardless of the proportion of female representatives'. Childs and Krook (2009) and Celis *et al*. (2008) propose a framework to examine the role of critical actors at the micro level of interaction, which leaves open the possibility that critical actors can be men or women. This approach can help to unravel who acts in the substantive representation of women; where does this occur, why is it attempted, and how is the substantive representation of women expressed? Focusing upon critical actors enables us to identify the general mechanisms that link, or uncouple, the descriptive and substantive representation of women (Childs and Krook, 2009).

Other political theorists agree that numbers alone will not bring about substantive changes for women but in some ways, do recognise that numbers may have some impact in that women's increased presence could foster debate around issues that are important for women (Lovenduski, 2001; Crowley, 2004; Grey, 2006). Chaney (2012) recognises that the role of a small number of female critical actors interacting with a critical mass of female politicians can be important in bringing forward a number of issues pertinent to women. Similarly, Campbell *et al*. (2009) point out that most feminist political scientists are attracted to the potential of descriptive representation to deliver at least a measure of substantive representation but that it is not a guarantor of it, thus questioning the relationship between numbers and outcomes. In order for the substantive representation of women to occur, women need to represent women, indicating that the relationship between the representatives and the represented is an important one.

In their study of the substantive representation of women in UK Parliament, Celis and Erzeel (2015) found that female MPs make a difference for women, especially

Table1: Table of interviewees

Pseud-onym	Age	Ethnic group	Marital status/ children	Role	Public Private Sector	Length of service (years)	Full/part-time
Abigail	36–45	White (British)	Divorced; 2 children	Engineer	Private	20	Full Time
Hazel	26–35	White (Other)	Single; no children	Engineer	Private	5	Full Time
Anna	36–45	White (British)	Partner; 2 children	Health & Safety	Private	30	Full Time
Maria	36–45	White (British)	Divorced; no children	Engineer	Private	16.5	Full Time
Amy	26–35	White (Other)	Partner; no children	Engineer	Private	3	Full Time
Jennifer	18–25	White (British)	Partner; no children	Engineer	Private	Not stated	Full Time
Linda	55+	White (British)	Single; no children	Information Technology	Private	30	Full Time
Cristina	36–45	Mixed heritage	Single; no children	Engineer	Private	16	Full Time
Brenda	26–35	White (Other)	Married; 2 children	Engineer	Private	6	Full Time
Margaret	36–45	White (British)	Married; 2 children	Engineer	Private	20	Part Time
Dorothy	Not stated	Not stated	Not stated	Engineer	Private	24	Full Time
Paula	Not stated	Not stated	Not stated	Engineer	Private	3	Full Time
Nancy	41–45	White (British)	Married; 1 child	Engineer	Private	24	Part Time
Helena	26–35	White (British)	Partner; no children	Engineer	Private	9.5	Full Time
Cynthia	Not stated	Not stated	Partner; no children	Managing Engineer	Private	25	Full Time
Sandra	Not stated	Not stated	Not stated	Manager	Private	6	Full Time
Donna	Not stated	Not stated	Not stated	Engineer	Private	5	Full Time
Ruth	Not stated	Not stated	Not stated	Engineer	Private	3	Full Time
Deborah	Not stated	Not stated	Married; 2 children	Engineer	Private	30	Full Time
Belinda	26–35	White (British)	Married; no children	Pilot	Public	11	Full Time
Pamela	Not stated	Not stated	Not stated	Pilot	Public	13	Full Time
Angela	36–45	White (British)	Partner; no children	Pilot	Public	16	Full Time
Lucy	26–35	White (British)	Married; 1 child	Pilot	Public	10	Full Time
Helen	26–35	White (Other)	Married; no children	Pilot	Public	15	Full Time
Julia	50+	White (British)	Married; no children	Senior Manager	Private	30	Full Time
Andrea	41–45	White (Other)	Partner; no children	Senior Manager	Private	25	Full Time
Suzanne	26–35	White (British)	Married; 2 children	Senior Manager	Public	15	Full Time

when there is a strong alliance with feminism and the political left. They also point to the 'downside' of this in that it places a burden of extremely high expectations that women in parliament face, especially if they are token women. The descriptive representation of women would help to ease this burden and make these women more likely to succeed in their aims (Baker, 2018). But not all women 'act for other women' (Chaney, 2012; Celis and Childs, 2012) and not all women will come together when 'women's issues' are being debated. Increased numbers of women do not, therefore, mean that the substantive representation of women can be achieved. Most critical actor theorists would acknowledge that while an element of descriptive representation is required, it is a matter of looking beyond the numbers and examining positional power, the formation of strategic alliances and coalitions and building relationships with other women's organisations, through a shared commitment to an equal society.

In our case study, we argue that critical actors were key in mobilising the design and launch of the industry-wide, online mentoring platform, through acting as representatives for women in the industry and taking their needs into account when designing it (denoting the substantive representation of women). The descriptive representation of women has begun to follow on from this, as the mentoring platform attracts more and more women. The following sections set out the context for the mentoring platform, introduce the critical actors and their motivations to act and assess the extent to which the critical actors achieved the substantive representation of women in designing the mentoring platform.

Methods

This article is based upon an ESRC and industry co-funded project which aimed to design and launch an online mentoring platform for professional women in the UK aviation and aerospace industry. This was an action-oriented project and innovative initiative based upon the needs of women in the industry. An online platform was proposed by the researchers and industry partners, in part, to overcome the constraints associated with travel and availability. These issues are especially relevant for women working in a male-dominated sector such as aerospace and aviation, and those whose careers involve deployment to different locations in the UK and overseas. If the mentoring platform was to be based upon the needs of both the industry and the women in it, as wide an input as possible from the stakeholders was needed. The research revealed a need for a women-only mentoring scheme that systematically matched mentors and mentees and was supported by an online platform and bespoke training.

This article is based upon 27 interviews, three with managers/senior managers, and the remainder with women professionals, who were predominantly engineers and pilots from six large organisations from across the industry. Pseudonyms have been used. Most interviewees were based in the private sector, all but two being employed on a full-time basis. Average length of service was 14 years, the longest being 30 years, the shortest three years. For those who disclosed their age, most were within either the 26–35 or 36–45 age groups. The majority of those who disclosed their ethnicity were White British. For the two thirds who disclosed their marital status, the majority were married or living with a partner. Seven had children, seven had no children, and the remainder did not declare (please refer to Table 1, table of interviewees).

One hour interviews were conducted by two of the authors in 2015 and took place in the interviewee's workplace, with a small number by telephone due to geographical constraints. An email inviting women professionals to take part in the research was sent on behalf of the research team by the organisation's human resources departments and the women's committee of the industry's professional body. We were encouraged by the number of positive responses received, which allowed us to sample across different job levels (e.g. graduates, professionals, managers and senior managers).

The qualitative data were analysed following a thematic approach (Clarke and Braun, 2013). Each of the three authors independently coded the data, analysing

pre-agreed sections of interview transcripts. Themes were identified and then analysed independently by the authors and patterns across the data set were sought. The approach was inspired by rigorous and accelerated data reduction (RADaR), a team-based and applied research data analysis technique. Following this approach, the authors began by tabulating the raw data, then independently revising the tables in order to arrive at shorter, more concise data tables, focusing on specific themes (Watkins, 2017). This approach is less cumbersome than specialist software, yet it allows a systematic analysis to be conducted during each step of the process, standardisation and easy comparison between team members. As the research approach is action-oriented, the researchers were not detached observers but, apart from conducting the data collection and analysis, acted as facilitators for 'action', that is the development and implementation of the mentoring platform.

We identified several themes from the interviews with women professionals, including their mentoring needs, views on the introduction of a women-only, online mentoring platform and what they would consider to be key elements of the platform. These insights were used as a basis for the development of the online platform. Some identified specific development skills, and some felt more practical help would be useful, with an emphasis on advice and guidance from outside of their own organisation, which would be perceived as non-judgmental and non-threatening. In addition, some of the women interviewed were already involved in the project group. These interviews also explored motivations to act, benefits of the mentoring scheme and reflections on the impact of the scheme once it had been launched.

The initial idea for this project was a reaction to the lack of progress around gender equality, especially for women in male-dominated industries. The first author had conducted research with engineers and in that context met those women who would become the key industry partners in this project. They realised they shared a sense of urgency in progressing gender equality. Through discussion, mentoring emerged as a critical vehicle for women's progression and gender equality in the industry. The partnership came together around knowledge exchange funding. The academic team (the three authors and a specialist in training) worked closely with the industry partners through a project group, which met at least once a month.

These meetings provided opportunities to exchange and co-produce knowledge. The academics took responsibility for the research and methodology, the professional body member for the technological side of the platform and the public/private sector members provided contextual information on their organisations and industry, their experiences as women within them and access for the research. We consider the women who constitute the project group to fit Celis and Childs's (2008: 420–421) definition of critical actors: they started a specific collective campaign for a women-friendly policy change initiative—the mentoring platform—encouraging others to join them, regardless of their minority status in the industry.

Critical actors and their motivations to act for the substantive representation of women

Each critical actor involved in the decision to design the online platform was one of a minority of women in her own organisation but held a position that enabled her to build support from key decision makers and other women in her organisation, and thus to represent the women in their industry. One critical actor chaired the women's committee of the industry professional body, alongside running her own aviation business; another was a key player in her organisation's women's network, which she had been instrumental in setting up; the third headed her organisation's diversity and inclusion unit. All were well-respected members of the industry, all too aware of the lack of support, especially mentoring support, for women both in their organisations and the industry at large. They were personally committed to increasing gender equality in their organisations/industry and decided that it was time to act on behalf of other women in the industry.

Through working with other women, these critical actors created a safe space where they felt empowered to act (Women's Resource Centre, 2007). This involved successfully engaging with their organisations and encouraging them to become the founding partners for the mentoring platform, underpinned by a business case to recruit and retain more women in the industry to deal with the chronic skills shortage. This enabled the gender equality agenda to be embedded within the business case argument for the recruitment, retention and promotion of women. In addition, all three pledged to support the research process and to provide access to women professionals in their own organisations.

Julia, a representative of the industry professional body (with 25,000 members, 1,700 being female professionals) and a project group member since the inception of the project, commented on the chronic skills shortage, which she acknowledged as a shared industry problem but one that could partly be addressed through improvements in the recruitment and retention of women. She also recognised the need for a critical mass of women to support the mentoring platform:

> The industry will see a shortage of people over the next ten years, unless we can attract more women, particularly in technical engineering, flight operations and aircraft development roles… over the next three years, we expect the impact [of the mentoring platform] to increase as the model is rolled out to more companies in the UK.

The industry professional body had already recognised that while women may possess the technical skills required for their chosen careers, most lacked the knowledge, guidance, support and access to networks to progress those careers, exacerbated by a lack of suitable female mentors.

Working together through the project group, the critical actors agreed that the overarching objective for the scheme should be to provide an online mentoring platform, tailored to the specific identified needs of professional women ('designed by women for women') in a male-dominated environment, underpinned by academic research, with the target cohort and their employers. Critically, there was recognition of the need for and a commitment to create an integrated mentoring community network for women across the industry, to address the sector's skills shortage and facilitate the creation of a critical mass of women, particularly at key decision-making levels. This would only be fully realised by seizing the possibilities information technologies afford: that is, the platform being online, surmounting geographical distances between people and thus accessible to any professional woman in the industry who wished to join (Risquez, 2008).

> The aim was to highlight the cross-company industry programme to women across the industry, reaching as many women as possible and supporting the development of women, change the thinking of our industry and make a change in the gender diversity of the industry.
>
> (Julia)

At the end of the one-year project, each critical actor was asked to reflect upon the relative success of the project.

Julia felt that the project gave women a 'voice' and pushed forward the business case for gender equality:

> The research project, during the development of the mentoring platform, gave women in the industry the opportunity to express some of the frustrations, limitations and challenges experienced by them in the industry while building their careers. It was interesting for the [organisation] to see the lack of progress that the industry has made and gave an opportunity to revise the approach to supporting women and businesses in their thinking around gender diversity.

Andrea, a manager representing a large, private organisation with 15,000 employees (ten per cent being women), was focused on the building of a community of women (Women's Resource Centre, 2007) made possible through the online nature of the platform, and raising the profile of the benefits of mentoring to achieve this:

> …[the mentoring platform] provides a key complement to the already existing mentoring practices within the company, providing further opportunities for women to become both mentors and mentees. It was also key to help increase women's personal profile and provide confidence to women to become the mentors of the future generations…

Suzanne, representing a large, public sector organisation with 40,000 employees, explained her organisation's strategy to address specifically the under-representation of women (14 per cent of employees), a key area of development being the recruitment, progression and retention of women. Mentoring was specifically mentioned as an initiative to support this and she described a number of 'quick wins', which were delivered after the project:

> Raising awareness of all the challenges facing the female pipeline, including women in development decisions and empowering women to seek development opportunities.

She reported that mentoring was now actively promoted across the organisation, facilitated through a social media group dedicated to female development opportunities.

These women clearly fit Celis and Childs's (2008: 420–421) definition of critical actors as, '…those who put in motion individual and collective campaigns for women-friendly policy change: they initiate policy proposals on their own, even when women form a small minority, and embolden others to take steps to promote policies for women, regardless of the proportion of female representatives'. Critical actors then are able to identify levers within their organisations (business case) that will be useful for furthering their aims (social justice). The 'levers' analogy is useful to show how critical mass is the weight that can press down on the levers identified by the critical actors, through women signing up to the mentoring platform.

In summary, Julia articulated a strong commitment to social justice and encouraged increased engagement and support for women. Andrea saw value in raising awareness about women's under-representation and the need for change, expressing how the project had created an online community which she believed would help change the perception of what women needed to do to develop a more inclusive working environment. Suzanne saw the outcome as an opportunity to raise awareness of the challenges faced by women and empowering them to seek development opportunities through a 'woman friendly' online channel, reinforcing the organisation's view that the mentoring scheme was the 'right thing to do for women and gender equality'.

While the founding members were the key critical actors and representatives for women in the industry, it was clear that they needed to fully reflect the issues faced by female professionals in the design of the mentoring platform to develop, build and sustain relationships at a distance (O'Neill, 2011). This shows the inclusive nature of the project and how the women the critical actors sought to represent were empowered to fully express their views and suggestions for a scheme openly designed specifically for them: representatives and the represented responded to one another in an interactive fashion (Celis, 2012: 527).

Challenging gender norms in a male-dominated industry: how the voices of the 'represented' were heard and acted upon

In order for the mentoring platform to become a success, the critical actors, through the substantive representation of women, consulted women across the industry about their experiences, perceptions and mentoring needs. More volunteers came forward than could be interviewed and although these women were far from being part of a critical mass (due to their poor representation) they understood that this was a starting point to building an industry-wide, online community. Having discussed themes identified from interviews with critical actors, we now move on to discuss the views of other female professionals in the industry.

The research found a high level of awareness about the lack of mentoring and female mentors available to them in their own organisations. Interviewees were asked whether they felt there was a need for an industry-wide, online mentoring platform specifically for women. The answer was a resounding and emphatic 'yes', an important validation for the critical actors.

Several benefits of the mentoring platform were identified by interviewees. Cynthia, advocating the importance of a critical mass, felt the mentoring platform was essential for an industry with such a low representation of females and that some form of positive action was necessary in industries with less than 30 per cent female representation. Angela also felt there was a place for mentoring, especially in the areas where women were 'still working out what it means to be a professional woman in a male-dominated organisation'. Pamela saw the platform as a place for women to seek support. She described how she was 'feeling lost' and wanted to progress but was not getting the help she needed to do this. She felt it would be helpful to have someone 'out there' in the industry, to offer advice. Many interviewees felt the proposed mentoring platform would help to address the shortage of female mentors in the industry, by encouraging more experienced women to come forward as mentors, and to build supportive alliances between women.

The women-only focus of the scheme, alongside its online reach across the industry, was appealing to most interviewees. To be clear, women do not need 'saving', but many women do face greater barriers to advancement and in finding mentors. Generally, in this industry, mentors tend to be from the same organisation as the mentee, and the majority tend to be male. While one interviewee could see that having an online cross-industry scheme would enable her to share experiences as a woman, another recognised that women were in the minority and needed to be able to connect with other women. The 'woman to woman' aspect of the scheme was therefore highly valued. Cristina was happy to see that there was an interest in developing women in engineering which she felt was lacking. Having a more experienced woman to guide her through was also important and missing in her own organisation. Others made the point that women would be more likely to open up to each other and that it was easier to express feelings to another woman. For Paula, raising awareness and creating a network were the most important aspects of the scheme, enabling women to focus more on their industry than one single company in relation to their careers. Brenda felt that female mentees would have more shared experiences with a female mentor:

> Women can talk about their experiences, especially about issues to do with sexism and maternity leave and pregnancy.

This strong support for the mentoring platform demonstrated to the critical actors not only the need for the mentoring scheme but that the 'woman to woman' and online aspects were vital. Consulting with the women in this way enabled the critical actors to represent their needs and to build this into the design of the platform. The momentum towards building a critical mass of women was growing. What we see here is that the substantive representation of women is underpinned by the strong links between critical actors and those they represented. Such links rested on shared experiences that became visible through the woman to woman aspect of the project.

The online mentoring platform: what women want?

The need for the mentoring scheme was in no doubt. The limited number of senior women in the industry means there is less opportunity to find one in the first place, and given their scarcity, the 'good' ones may not have the capacity to take on further mentoring commitments. The mentoring platform design was based upon the experiences and needs of both the critical actors and the professional women interviewed. The project group, formed amongst the critical actors, reviewed the research findings which, in turn, determined the configuration of the technology to support the

mentoring platform while maintaining an intuitive user interface. The consensus amongst interviewees was that the matching of mentors and mentees should be carried out electronically rather than manually. Based upon this expressed need, the critical actors developed a unique set of matching questions for both mentors and mentees, reflecting both the generality of the mentoring process and the particular challenges of being a professional woman in a male-dominated industry.

Achieving the 'right match' between mentor and mentee, satisfying both sides, spanned a number of requirements and it was recognised that this is most efficiently achieved through automatic two-sided matching (Haas *et al*., 2018), particularly given the potential number of members as the scheme grows. Matching is achieved using an algorithmic process based on key criteria from the data provided by mentors and mentees on registration, which is a more objective and effective means to match skills and/or experience than manually matching individuals. Specific requirements include compatible matching of personalities, being matched with a mentor in a different part of the industry, tapping into the career experiences of mentors who had maintained a work/family balance and getting connected to a female role model. The critical actors identified that getting the mentor/mentee match right would be pivotal for success.

One interviewee was specifically looking for a female mentor at middle management level, with a family and possibly working part-time or job sharing, to engage with as a role model, an exemplar of where she would like to go. This strengthens the argument that the substantive representation of women hinges on shared experiences between women mentors and mentees, for example of barriers to career progression and strategies to overcome them.

Another important characteristic of the mentoring platform was flexibility around face-to-face and online mentoring sessions. There was a strong preference for both mechanisms to be available, due to some women working outside the UK/being on deployment and being on maternity leave/phased return to work. In addition, mentor training was developed specifically as a response to the need to ensure quality control of mentors. This mandatory training, initially delivered face-to-face, is now delivered via the back end of the mentoring platform (accessible to members only), through four online bespoke modules which help to foster an understanding of roles in the mentoring relationship.

The mentoring platform currently operates industry-wide and take up is already into the hundreds. Given aviation and aerospace is one of the most male-dominated industries in the UK, it will take time for the platform to achieve its aims. As more women sign up, the greater potential it has to change the nature of the industry by building a critical mass of women. The mentoring platform is unique, not just in terms of its design (based upon rigorous academic research), but also because it is not anchored to a particular business/organisation; the platform is now hosted and maintained by the professional body representing the aviation and aerospace community. This means that any individual professional woman can join, free of charge, irrespective of whether or not her employing organisation signs up. It also makes it possible for smaller employers without the capacity or resources to benefit from cross-company mentoring. Through this project, it has become clear that the actions of a small number of critical actors have been key to making the mentoring platform a reality, but this would not have happened without the support of the growing critical mass of women in the industry. Together, these women have built an online community of support, which can begin to challenge the male dominance of their industry.

Conclusions

This article offers a number of theoretical and practical insights into a bespoke, industry-wide, online mentoring platform that was designed to support women and to challenge their under-representation in a male-dominated industry. It was launched in a high-technology industry that suffers from a chronic shortage of skilled workers and an even shorter supply of skilled women. The journey for the women involved has been viewed through the theoretical lenses of 'critical actors' and 'critical mass' and the

substantive representation of women. This has both validated and extended existing thinking and developed a better understanding of the role of women (individually and collectively) in challenging the gendered norms embedded in male-dominated industries, through an online mentoring platform. Three research questions were posed at the beginning of this article, to which we now return, in order to highlight the article's contributions.

Research question (1) asked, what were the motivations of the critical actors to design an online mentoring platform for women in their industry? We have identified this as the critical actor's collective commitment to gender equality within their industry, coupled with a desire to represent and support female professionals in one of the most male-dominated industries in the UK. They sought to provide mentoring for women across the industry, which could only be achieved through providing a globally accessible online platform, transcending geographical and organisational barriers and creating opportunities to build mutual support, solidarity and resilience. The critical actors' motivations were anchored in their commitment to social justice. While these motivations preceded the project, they also evolved as the project progressed, as is usually the case in action-oriented projects. Importantly, these critical actors sought (and achieved) the substantive representation of women, the mentoring platform being designed on the back of women's expressed needs across the industry.

This leads onto the second research question; (2) has the substantive representation of women's mentoring needs been achieved by these critical actors? We argue that it has, for a number of reasons. The mentoring platform was the product of the combined efforts of a small number of critical actors, working together with women throughout their industry, acting as their representatives. There was a strong element of mutual support between the critical actors and a growing critical mass of female professionals but, importantly, the critical actors were able to take action to make a substantial change for these women, that is provide an online mentoring platform. A contribution of this article has been to open up the possibility of examining in more depth, the identity of critical actors in the substantive representation of women outside of the political arena, where this occurs, why it is attempted and how it is expressed (Celis *et al*., 2008). This perspective allows us to follow the initial actions, progress and goals of the actors involved. This is significant as it provides a valuable insight into successful ways of addressing gender inequality not just in the field of politics, where the critical actor/critical mass debate has been so far applied, but in the wider world of organisations and employment.

But there is a further criterion that has been addressed in this article; the importance of critical actors gaining support from other women not simply through numbers but by representing what women want, thus facilitating an interactive process between the representatives (themselves) and the represented (women in the industry) (Celis and Childs, 2012) and responding to one another throughout the project. This is further enabled through the online nature of the platform, where the critical actors continue to interact with the growing online community of mentors and mentees. The context in which this takes place is also important; a high-technology, high skilled business context is very different to a political/legislative context and this needs to be borne in mind when considering the outcomes from the research project. The more male-dominated the industry, the more challenging it will be for female critical actors to join together to act (Durbin, 2015; Wright, 2016).

If critical actors are to succeed in tackling gender inequality, in the case of the mentoring platform, they need the support of other women around them, which brings us to our third research question: (3) do critical actors need to mobilise the support of those they represent in order to drive through positive change for women? In other words, do the actions of critical actors ultimately need the support of the women they are representing? The answer is a resounding 'yes'. Critical mass theory has been around for some time, mostly utilised in a business context and dependent upon the 'descriptive representation of women' through women's numerical presence. The emergence of critical actor theory, through a critique of critical mass theory, argues that a small number of women can and do achieve the substantive representation of women as they are better placed to bring about change that is representative of

women's needs. Merely having numbers of women present will not necessarily bring about change; the presence of a small number of critical actors can, as the focus becomes about looking beyond the numbers and examining positional power and forming strategic alliances and coalitions (Childs and Krook, 2008).

While we have argued that critical actors have been central in bringing about this positive change for women, they could not have achieved this without a growing critical mass of women to (1) design the mentoring platform to meet their needs and (2) make it a success throughout the industry. While the descriptive representation of women (critical mass) was not needed for the inception of the mentoring platform, it was clear that the critical actors needed input into its configuration. So while we agree that critical actors are central to this mentoring platform, we also argue that through combining these usually either/or theoretical concepts, we were able to theoretically explore and explain the mentoring platform's success. This was achieved through critical actors investing heavily in building deep-rooted understanding with the women they were representing. We see this as critical actors pressing industry levers within their organisations in order to further their social justice aims and as a critical mass lending the weight to enable those change levers to operate. The representatives responded to the needs of the women they represented.

This turns the critical mass argument on its head and places a caveat on the critical actors' argument, in that critical actors can propose, lead and implement initiatives to support women but ultimately, they need the help of the women they represent. It took a small number of women to represent the interests of women in the industry; now, the mentoring platform is 'live', and it needs a critical mass of women to support it.

This scheme, co-designed by the potential mentees, specific to their needs, created what could be described as an 'ultimate' safe space, and lays the foundation for the development of a critical mass for the industry as a whole. It has not been the aim of this article to assess the ongoing value of the mentoring platform to its members. The impact of the platform is the focus of (planned) future research. What is demonstrated in this article, and here resides its main contribution, is the joining together of critical actors with a growing critical mass of women which can and does challenge the male dominance of an industry and enables the building of a critical mass of women, through an online mentoring platform. The value of the online mentoring platform, versus face-to-face, traditional schemes, lies in enabling users to transcend geographical and organisational boundaries, offering a 'safe space' for women outside of their own organisations. It also brings the provision of mentoring to an under-represented group for whom mentoring is usually inaccessible in their own organisations.

Conceptual contribution

This article contributes to the extant literature in a number of ways. Firstly, it combines key theoretical concepts from the feminist political theory and management literatures (critical actors and critical mass, respectively). While critical mass has been considered (and widely critiqued) within feminist political theory, our paper has contributed to how 'acting for' (and thus substantively representing women) is possible through a combination of these key concepts, thus moving beyond the either/or debate in this body of literature. Secondly, bringing the critical actors concept into the area of male-dominated work environments in a business context is novel and lays bare the limitations of the argument that achieving a critical mass alone will lead to the substantive representation of women. Thirdly, the key concept that binds these two important theories (the 'substantive representation of women') is unfamiliar in the women in male-dominated/business literatures and thus offers a new way forward for the critical analysis of gender inequalities and how women's needs can be better represented. Finally, the paper contributes to the debates on the use of ICTs to build mutual support, this paper specifically contributing to the debates on challenging gender inequalities through the use of ICTs and the formation of an online community.

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