



The underrepresentation of women in science: Differential commitment or the queen bee syndrome?

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We examined possible explanations for the underrepresentation of women among university faculty, in two different national contexts. In the Netherlands, a sample of doctoral students ($N = 132$) revealed no gender differences in work commitment or work satisfaction. Faculty members in the same university ($N = 179$), however, perceived female students to be less committed to their work and female faculty endorsed these gender-stereotypical perceptions most strongly. A second study, in Italy, replicated and extended these findings. Again, no gender differences were obtained in the self-descriptions of male and female doctoral students ($N = 80$), while especially the female faculty ($N = 93$) perceived female students as less committed to their work than male students. Additional measures supported an explanation in social identity terms, according to which individual upward mobility (i.e. of female faculty) implies distancing the self from the group stereotype which not only involves perceiving the self as a non-prototypical group member, but may also elicit stereotypical views of other in-group members.

'Women in science: why so few?' was the title under which, in 1965, Alice Rossi addressed the relative absence of women who pursued academic careers at the university. Today, over 35 years later, we can still pose that same question. The pervasiveness of this phenomenon is illustrated by data showing that the current proportion of female faculty in universities across the world almost never exceeds 25% (Lie, Malik, & Harris, 1994). Importantly, for some time now, about half of the university students have been women, and in some areas such as psychology they even constitute a clear majority among undergraduate students (in the Netherlands, Ellemers, 1995; and Great Britain, Radford & Holdstock, 1995) as well as among those who successfully complete

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their PhDs (in the USA, Sanderson & Dugoni, 1999). Nevertheless, the underrepresentation of women becomes worse as their academic position is higher and this has not improved significantly during the past 40 years. A recent cross-national comparison (Osborn, 1998) showed that in 13 out of 16 European countries the percentage of female full professors was 10% or less, and this was only slightly better in the USA (13%) or Australia (14%).

The present investigation, conducted in two different European countries (the Netherlands and Italy) constitutes an attempt to investigate two possible factors that may contribute to the underrepresentation of women among university faculty, namely *differential work commitment* of male and female scientists, or *biased perceptions* of these levels of work commitment. In each national context on the one hand we investigated whether male and female doctoral students show signs of differential work motivation. On the other hand, we assessed whether others in the organization hold gender stereotypical expectations of the work commitment of male and female doctoral students. This comparison between self-reports of young scientists at the beginning of their academic careers and the way they are perceived by more senior faculty allows us to identify actual gender differences versus potential misperceptions of work commitment as possible explanations for differential career patterns observed among male and female academics.

The underrepresentation of women in science

Over the years, several differences have been established in the careers of male and female academics. For instance, in the Netherlands female post-doctoral researchers are less likely than men to get a tenure track position (Crum & Bal, 1998), and given the same qualifications, female lecturers are less likely to be promoted to the senior level than are their male colleagues (Hawkins & Noordenbos, 1991). Furthermore, even women who have been extremely successful in the academic system, namely tenured full professors at the prestigious Massachusetts Institute of Technology (MIT), turn out systematically to earn less and to receive less laboratory space and research money than do senior male faculty (Lawler, 1999). Not surprisingly then, women are more likely than men to leave the university, in order to pursue a career elsewhere (Portegijs, 1993).

This is generally perceived as a problematic development, not only in view of justice considerations (denial of equal opportunities to women), but also in terms of the future viability of university teaching, as well as with respect to optimal use of the available potential for scientific research (Bosch, Hoving, & Wekker, 1999). Accordingly, in virtually all European Union countries special policy measures have been taken to address this issue, such as the formulation of target figures for the representation of women among university faculty, the provision of additional research grants, or the institution of special chairs for women (see the ETAN-report, 1999, for an overview), and similar initiatives have been taken in the USA and Canada (Timmerhuis & Bringmann, 1999). At the same time, there is no clear consensus as to what the main *reasons* for the current situation are.

Differential commitment to work

One possible explanation for discrepancies in the careers of men and women focuses on motivational differences between male and female workers. A rather robust phenomenon across different social contexts is that men and women perform different

social roles (Eagly, 1987). Males predominantly provide the family income through paid labour and women are primarily responsible for caretaking at home. In fact, cross-national evidence consistently demonstrates that also when both husband and wife perform paid labor, when both partners have equal status jobs (Biernat & Wortman, 1991), and even when the woman is the only breadwinner (Van der Lippe, 1993), women do most of the childcare and household tasks (Van der Lippe, 1993) on their so-called 'second shift' (Hochschild, 1989; Sabbadini & Camporese, 1998).

From this perspective, it has been argued that it is more difficult for women than for men to display the total availability that is seen as an indicator for their commitment to science (Etzkowitz, Kemelgor, Neuschatz, & Uzzi, 1992). For instance, a survey among male and female full professors in the Netherlands (Ellemers, 1993) revealed that, whereas virtually all male professors have a wife and family, women who have made a successful career in science are likely to be single and childless. Thus, for women more than for men, there generally appears to be a trade-off between the dual responsibilities at home and at work, and this has been taken as an indication that paid labour plays a less central role in the life of women than of men. Accordingly, *differential commitment* to their work has been cited as a plausible reason why women are less successful than men in their careers (Levin & Stephan, 1998).

However, previous research on gender differences in job commitment and/or job involvement has produced contradictory results: sometimes women appear to be more committed (Powell, Posner, & Schmidt, 1984), sometimes men are more committed (Chusmir & Parker, 1992; Powell & Posner, 1989) and sometimes no differences occur or the results of the different scales contradict each other (Chusmir, 1986; Graddick & Farr, 1983; Koberg & Chusmir, 1989). Accordingly, in their review Mathieu and Zajac (1990) conclude that there is no consistent relation between gender and the degree of commitment, that is to say, when commitment is measured at the organizational level.

Different forms of commitment

Even when men and women report similar levels of commitment to the organization, in view of their different social roles, it is possible that men and women do reliably differ from each other with respect to the *nature* of their commitment. In previous research, Ellemers, De Gilder, and Van den Heuvel (1998) demonstrated that people may feel committed to different *aspects* of their work. In addition to affective organizational commitment, Ellemers *et al.* distinguished between a form of commitment directed at individual advancement at work (career-oriented commitment) and a form of commitment that derives from a devotion to the collaboration with one's co-workers (team-oriented commitment).

To the extent that women are generally more communion-oriented than men (Ashmore, 1981; Williams & Best, 1982), this may also be expressed at work, in the sense that female workers might be relatively willing to display behaviour that helps their colleagues or benefits the organization as a whole (*organizational citizenship*, see Schnake, 1991; Smith, Organ & Near, 1983). Indeed, it appears that women tend to be more involved in their work and have a stronger tendency to stay in the organization, to the extent that they have the opportunity to contribute to social relations aspects of the organization (Chusmir & Parker, 1992; Portegijs, 1993). For men, however, the possibility to provide social contributions does not seem to be related to their involvement or their tendency to stay. Thus, the relative importance of social work aspects for women workers seems to suggest that they might be primarily committed to the collaboration with their colleagues at work. Men, by contrast, are not only

expected to be more individualistic, task-oriented and competitive than women, but also tend actually to behave in this manner, at work as well as in other contexts (Anderson & Blanchard, 1982; Bartol, 1974). As a result, male workers may tend to be primarily committed to the most individualistic aspect of work, i.e. their own career.

If indeed women are primarily team-oriented (while men are mostly career-oriented) and as a result consistently focus on team goals—possibly at the expense of their own individual task achievement—this might explain why women are less likely to advance at work. Thus, it might be that although men and women are equally committed to the organization as a whole and devote equal amounts of effort to their work, both the nature of commitment and the goal of their efforts might differ, with the end result that women are less likely to advance in their career than men are.

Gender stereotypes

Another possibility that has been raised, is that *gender stereotypes* put female academics at a disadvantage. Gender stereotyping is an extremely pervasive phenomenon, in the sense that gender stereotypes influence individual judgments even in situations where a categorization in terms of gender is clearly irrelevant (Eagly, Makhijani, & Klonski, 1992). As a result, gender stereotypes have been documented to affect women's opportunities for career advancement. For instance, although there is no overall difference in the performance of women and men who actually hold leadership positions (see the meta-analysis of Eagly, Makhijani, & Klonski, 1992), the prevailing image of a successful leader or manager is closer to the male than the female stereotype (Rojahn, 1996; Schein, 1973, 1975). Consequently, experimental research has revealed that such stereotypes may result in a preference for male candidates over female candidates for promotion, even when judges are aware of the fact that the applicants are equally qualified for the job (Van Vianen & Willemsen, 1992).

Not only do gender stereotypes affect the way people estimate the *potential* of men and women, stereotyping may also result in a biased evaluation of *actual achievements*. A successful performance of women (on a typically male task) is not primarily attributed to their ability but to chance, extraordinary effort or even cheating, whereas men with the same achievements are simply seen as competent (Deaux, 1976, 1984; Deaux & Emswiller, 1974; Taynor & Deaux, 1973). There are some indications that over the years such perceived gender differences have become less pronounced, as a result of contemporary changes in the social roles of men and women (Diekmann & Eagly, 2000). Nevertheless, recent examinations of possible explanations for differential successes of men and women in academic careers clearly show that discrimination of women still occurs when they submit research papers (e.g. Petty, Fleming, & Fabrigar, 1999), or apply for research grants (Brouns, 1999; Wenneras & Wold, 1997). Likewise, a recent experimental study among academic psychologists revealed that male as well as female judges preferred a male over a female job applicant when both had an identical record (Steinpreis, Anders, & Ritzke, 1999).

When focusing on commitment as a central work-related characteristic, we may assume that similar processes are likely to play a role. As we have indicated above, perceived commitment to science is generally seen as an important requirement for those who pursue an academic career (Etzkowitz *et al.*, 1992). At the same time, the shared knowledge that women are more likely than men to suffer from their dual responsibilities at work and at home may lead people to suspect that it is more difficult for women than for men to display the more than full-time devotion to science that is expected from scientists. As a result, even in the absence of actual gender differences,

gender stereotypic expectations may lead people to *perceive* female scientists as generally less committed to (crucial aspects of) their work than their male colleagues, which in turn may harm their career progress.

The present investigation

We have shown that women are still clearly underrepresented among university faculty. Additionally, we have argued that there may be motivational differences between men and women, and that gender stereotypical expectations may occur. Importantly, however, either process may explain the differential career success of male and female academics. Therefore, the present investigation will address the question of whether male and female scientists *actually differ* in their levels of work commitment, whether they are merely *perceived by others* to be differentially committed, or both.

In order to examine this, we have chosen to focus on male and female scientists at the beginning of their academic career, as this is a turning point at which the gender ratio starts to differ substantially (Bosch *et al.* 1999; Rabasca, 2000), while it is difficult to determine whether this is because females are actually less motivated than men to pursue an academic career, or whether this is merely the way they are seen by others, who may as a result offer less encouragement and support in achieving academic success. Thus, we assess the (self-reported) commitment of male and female PhD students and compare this to the way they are perceived by university faculty. Furthermore, we will examine whether differential commitment is evident from other work-related variables, such as general work satisfaction and (self-reported) work behaviour and achievements.

We have obtained similar data in two different national settings, the Netherlands and Italy. Contrary to what is often assumed, in the Netherlands there is considerable gender inequality at work. Labour participation of women is lower than in any other European country: only 22% of the female population over 15 years of age is employed in a full-time job (while this is 34% on average for 15 European countries; Eurostat, 2000, <http://europa.eu.int/comm/eurostat/>). Likewise, the hourly wages of women as compared to men (on an hourly basis women earn 77% of what men earn) are lower than in any other European Union country¹. An important statistic for our present investigation is that there is no country in Europe with a smaller representation of women among university faculty than the Netherlands, where only 5% of the full professors and 7% of the associate professors are female (Osborn, 1998). Thus, the Netherlands can be considered an extreme case, in the sense that it is considerably more unusual than in other European countries, North America, or Australasia for women to hold an academic position. The converse situation can be found in Italy. While the overall labour participation rate of women is average for a European country (33% of women have full-time employment), in Italy the representation of women among university faculty is among the highest in Europe, with women constituting 11% of the full professors and 27% of the associate professors (Osborn, 1998; see also Maass & Casotti, 2000)². The comparison of results obtained in these two countries therefore enables us to examine whether there is evidence of a more general process instead of having to attribute our findings to unique characteristics that are only relevant in a specific national context.

¹ See <http://www.eurofound.ie> (retrieved February 19, 2004).

² These overall differences are reflected in the specific university populations we studied: at the Free University in Amsterdam, the Netherlands women constitute 11% of the full and associate professors, at the University of Padua in Italy, this was 32%.

STUDY 1: THE NETHERLANDS

Method

Participants

The sample consisted of 132 doctoral students (at Time 1; of whom 48 students also participated at Time 2) and 179 faculty members of the Free University in Amsterdam.

Doctoral students

The participants in this study were 132 doctoral students (85 men and 47 women; the mean age was 29) who were distributed across 13 different departments (covering the life sciences, social sciences, humanities, law and medicine) of the Free University in Amsterdam. Of this first sample, 48 participants were willing to complete a second questionnaire, approximately 1 year after the first study. At Time 2 the sample consisted of 27 men and 21 women; their mean age was 30.

Faculty

The participants were 180 faculty members, employed at one of the 13 departments at the Free University in Amsterdam. They completed one of two versions of the questionnaire depending on the experimental condition they were randomly assigned to: one version focused on the opinions about *female* doctoral students, the other version asked about *male* students only. In the accompanying letter it was explained that the researchers were interested in the views of faculty members about the work commitment of (female or male) doctoral students. The faculty members who participated in the investigation consisted of 156 men and 23 women (1 respondent did not indicate his/her gender), representing the full range of academic disciplines. Of these participants, 88 (17 women) were assistant professors (49%), 27 (2 women) were associate professors (15%), and 65 (4 women) were full professors (36%). Their mean age was 47 (males: $M = 47.5$; females: $M = 41.7$).

Questionnaires

The first questionnaire assessed doctoral students' self-reported levels of commitment to the organization (the Free University), the department and their own careers. Additionally, they were asked about their general work attitudes and the time invested in work-related activities. On the second measurement, which was taken 1 year later, we repeated the commitment items, to be able to assess the test-retest reliability of our measures of career-oriented commitment and team-oriented commitment. Additionally, we included two forced-choice dilemmas, in which respondents were asked to indicate whether they would choose to devote a limited amount of time to their work or to family obligations/recreational activities. To supplement participants' reports on time invested in work-related activities, in the second questionnaire we also asked them to indicate their actual scientific output (number of publications).

The questionnaire distributed among faculty members was designed to establish whether differences would occur in the *perceived* commitment of doctoral students, depending on whether respondents focused on male or female students as a target group.

Measures

Commitment

After a brief instruction, 32 statements were presented and participants had to indicate the extent to which they agreed with each statement on a scale ranging from 1 (not at

all) to 7 (very much). The doctoral students were asked to indicate their agreement with each statement on this scale. The list of commitment statements was designed to assess three forms of commitment, i.e. (affective) organizational commitment (8 items, e.g.: 'I feel at home at the university'), career-oriented commitment (12 items, e.g.: 'I want to move ahead in my job') and team-oriented commitment (12 items, e.g.: 'I feel at home between my colleagues at work'). These three types of items were randomly ordered. The questionnaire used to measure organizational commitment is a Dutch translation (see De Gilder, Van den Heuvel, & Ellemers, 1997) of the affective commitment questionnaire developed by Meyer and Allen (1991). The other items were adapted from various existing questionnaires (e.g. Blau, 1988; Lodahl & Kejner, 1965; Steers & Braunstein, 1976) with the aim to assess career-oriented and team-oriented commitment respectively (see also Ellemers, *et al.* 1998).

This part of the questionnaire was also sent to the faculty members. They were instructed to think of a typical male/female doctoral student (depending on the experimental condition) and indicate on a 7-point scale (ranging from 1 (not at all) to 7 (very much)) to what extent a typical male/female doctoral student would agree with each of the commitment statements.

Work satisfaction

Work satisfaction was measured with a single item (see Wanous, Reichers, & Hudy, 1997), asking participants to indicate how they generally felt towards their work, on a scale from 0 (very negatively) to 100 (very positively).

Time expenditure

Participants were asked to indicate how they spend their (24) hours each day in a normal, average week. They were provided with a table in which each row represented 1 day of the week, and 5 columns represented different classes of activities to help them complete this part of the questionnaire. In this way they were asked to specify how many hours per week they spent on (1) work, (2) household tasks and other chores around the house, (3) spare-time activities, (4) personal care (eating, getting dressed, etc.), and (5) sleeping.

Demographic and context variables

In the last part of the questionnaire respondents were asked to reveal demographic information concerning their gender, age, marital status, parenthood, and to specify their academic status and discipline.

Choice dilemma and research output

At Time 2, we tried to collect some additional data that might reveal possible correlates of any differences in work commitment among the doctoral students. First, in addition to the commitment items, a dilemma situation was introduced, in order to have participants indicate how they would spend their time when forced to choose between two different activities. The dilemma situation was described as follows: 'You have to choose between something at work which is very important and urgent for you and something outside work which is also very important and urgent for you. This will take place partly during working hours and partly in your spare time.' Participants were asked to indicate on a bipolar scale whether they would be more likely to spend time on something at work (1) or on some other activity (7).

Finally, to obtain an indicator of academic performance, students were asked to report their scientific output, in terms of the number of publications they had. In order to enhance the accuracy of these self-reports, we asked them to specify for each publication they had prepared since starting on their PhD whether it was an article or a book chapter, and whether they had only submitted it or whether it had been accepted for publication.

Results

Commitment

First, a principal components analysis (with varimax rotation) was conducted, to make sure that the three different forms of commitment also emerge in this particular professional sample. This resulted in a three-factorial solution, with the items clustering in the intended way. The rotated factor solution explained 45% of the variance in the individual items. Further analyses were conducted using the unweighted mean scores for organizational commitment ($\alpha = 0.78$), career-oriented commitment ($\alpha = 0.87$), and team-oriented commitment ($\alpha = 0.81$). The scales for career-oriented and team-oriented commitment were also included in the questionnaire at Time 2, in order to assess test-retest reliability. Both scales proved to assess stable orientations, resulting in a correlation between the measures taken at Time 1 and Time 2 of .81 ($p < .001$) for career-oriented commitment, and of .73 ($p < .001$) team-oriented commitment.

We could not establish reliable differences between reported levels of commitment for male and female doctoral students on any of the three subscales (organizational commitment: male students: $M = 2.99$, $SD = 1.19$; female students: $M = 3.08$, $SD = 1.28$, $F(1,126) < 1$, *ns*; career-oriented commitment: male students: $M = 3.86$, $SD = 1.33$; female students: $M = 4.01$, $SD = 1.37$, $F(1,126) = 1.40$, *ns*; team-oriented commitment: male students: $M = 4.69$, $SD = 1.11$; female students: $M = 4.73$, $SD = 1.11$, $F(1,126) < 1$, *ns*) at Time 1. Also at Time 2, male and female doctoral students indicated they were equally committed to their own career ($\alpha = 0.85$; males: $M = 3.94$; females: $M = 4.17$; $F < 1$, *ns*) and to the team in which they worked ($\alpha = 0.73$; males: $M = 4.65$; females: $M = 4.68$; $F < 1$, *ns*).

Work satisfaction

No gender difference was observed in the mean levels of work satisfaction reported by male ($M = 71.08$, $SD = 15.28$) and female ($M = 67.42$, $SD = 19.90$) doctoral students ($F(1,126) = 1.50$, *ns*).

Behavioural indicators

Time expenditure

We examined how student gender affected the number of hours per week spent on the different activities specified in the questionnaire. This reveals an overall difference between male and female students, in terms of the number of hours spent on work, $F(1,104) = 4.32$, $p < .05$, and on household tasks, $F(1,104) = 8.29$, $p < .005$. Male respondents generally indicate that they spend more hours per week on work ($M = 51.08$) than do female respondents ($M = 47.00$), whereas female students report a greater number of hours spent on household activities ($M = 15.63$) than their male colleagues ($M = 10.94$).

Choice dilemma

When asked to indicate how they would decide to spend their time when forced to choose between two different activities, male respondents appear relatively even-handed in their preferences ($M = 4.14$) while women are more inclined to opt for some other activity instead of work ($M = 5.35$, $p < .002$). Correlational analyses revealed that respondents' choice for a work-related activity was positively related to their level of career-oriented commitment, for male ($r = .39$) as well as female ($r = .63$) respondents.

Publications

Although the mean number of publications seems to be lower for female ($M = 2.8$) than for male respondents ($M = 4.3$), no reliable gender difference was established between the total amount of (in press) publications reported by the male and female PhD students ($t = 1.08$, *ns*). This may be due to the small number of doctoral students that completed the questionnaire at Time 2.

Faculty: Perceived commitment

First, a principal components analysis (with varimax rotation) was conducted, to establish whether perceptions of commitment revealed the same three factors that we distinguished in self-reported levels of commitment. The results of this analysis confirm that the three intended factors could be distinguished, with the rotated factor solution accounting for 58% of the variance in the individual items. Further analyses were conducted using the unweighted mean scores for organizational commitment ($\alpha = 0.68$), career-oriented commitment ($\alpha = 0.87$), and team-oriented commitment ($\alpha = 0.83$).

We conducted 2 (faculty gender) \times 2 (target gender) ANOVAs to examine any gender differences in the perceived commitment of male and female doctoral students. This revealed a main effect of target gender on career-oriented commitment ($F(1,164) = 15.13$, $p < .001$), however this was qualified by an interaction effect between faculty gender and target gender ($F(1,165) = 4.96$, $p < .05$). The relevant means and *post hoc* contrasts indicate that female faculty members believe that there is a reliable difference between commitment levels of male and female doctoral students, while no such difference in perceived commitment depending on target gender emerges in the ratings of male faculty. That is, women, but not men, tend to assume that female doctoral students are less committed to a scientific career than their male colleagues (see Table 1). A similar interaction and means pattern was obtained for perceived levels of organizational commitment ($F(1,165) = 4.17$, $p < .05$), although the *post hoc* contrasts did not reach significance for this variable.

Discussion

Building on our previous work (Ellemers *et al.*, 1998) a first objective of this investigation was to establish whether gender differences in work motivation would emerge more clearly when distinguishing between specific forms of commitment, rather than relying on a general measure of affective organizational commitment, as is usually the case in research on this topic. In line with results obtained among other professional samples (Ellemers *et al.*, 1998) we were able to assess career-oriented commitment and team-oriented commitment as relatively stable constructs, separate from general

Table 1. Mean perceived levels of career-oriented and organizational commitment as a result of faculty gender and target gender in the Dutch sample

	Target	
	Male students	Female students
Career-oriented commitment		
Faculty gender		
Male	4.83 _{ab} (<i>SD</i> = .81)	4.46 _{ab} (<i>SD</i> = .85)
Female	5.52 _a (<i>SD</i> = .92)	4.29 _b (<i>SD</i> = .65)
Organizational commitment		
Faculty gender		
Male	4.05 (<i>SD</i> = .83)	4.14 (<i>SD</i> = .72)
Female	4.34 (<i>SD</i> = .74)	3.68 (<i>SD</i> = .71)

Note. Means that do not share common subscripts differ reliably from each other ($p < .05$).

organizational commitment. Furthermore, in view of the higher mean commitment levels reported, it would seem that—for this sample of academic professionals—these specific forms of commitment may be more relevant measures of work motivation than the widely used measure of affective organizational commitment.

However, contrary to what might be expected, at both points in time, male and female doctoral students reported similar levels of team-oriented as well as career-oriented commitment. We could observe *no difference* in the average extent to which male and female doctoral students feel committed to various aspects of their work.

While a similar distinction between the three forms of commitment emerged in faculty ratings of the doctoral students, the nature of their perceptions differed from the doctoral students' self-reports. In line with prevailing stereotypes, overall, women are seen as less committed to their careers than men (even though target gender was manipulated between participants). In order to explain this finding, we might look at the results of other measures. In line with our general argument and the results of previous investigations, the self-reported time expenditure of the students as well as participants' responses to the choice dilemma attest to the fact that—also among this sample of young academic professionals—women seem to suffer more from the dual tasks at home and at work than men do. Indeed, in the trade-off between work and home-related responsibilities, the female respondents indicate that they spend more hours on household tasks and less hours on work than do their male counterparts.

Perhaps this difference in time expenditure constitutes the observational basis that causes the faculty to believe that female students are less committed to the university and to their academic career. However, to the extent that this perceived difference in commitment to work might be a reason for faculty to be more encouraging and offer more career opportunities to male than female PhDs, it is important to establish whether the difference in time allocated to work and home responsibilities actually results in a difference in academic performance. Now the only indicator of this that we included in the present study is the number of (in press) publications reported by the students. Here we see no significant difference between male and female students. However, the mean level of publications seems higher for male than female respondents, and the fact that this did not emerge as a reliable difference might indicate a lack

of statistical power, due to the relatively small number of students that participated at Time 2 and completed this measure. Therefore, additional data are necessary to establish whether or not there is an actual gender difference in the academic performance of PhD students.

It is striking that *female* faculty instead of male faculty most clearly differentiates according to gender in their perceptions of doctoral students.³ While there is a perceived gender difference in career-oriented commitment in the eyes of the female faculty, the male faculty perceives male and female students as equally committed to their careers. A similar pattern emerges with respect to the perceived commitment of male and female doctoral students to the university, suggesting that only female faculty assumes that female doctoral students are less committed to their work than their male counterparts. Why?

It is a common belief that males are more inclined than females to endorse gender stereotypes (e.g. Brenner, Tomkiewicz, & Schein, 1989). Indeed this has been taken as a point of departure to explain the underrepresentation of women at higher levels in organizations from the fact that men traditionally have been more likely than women to make decisions about hiring and promotion of personnel (e.g. Levin & Stephan, 1998). Nevertheless, the literature also shows that sometimes women are more likely than men to rate other women negatively (Mathison, 1986). Previous attempts to explain why it is that women seem sometimes more biased and sometimes less biased than men have argued that this may have to do with differences in personal attitudes (Cooper, 1997), or differences in the social roles they occupy (Eagly, 1987; see also Pratto, Stallworth, Sidanius, & Siers, 1997). Indeed, it has been demonstrated that women are less likely to support policy measures that would be beneficial for women as a group, to the extent that they hold a competitive attitude towards other women (Cowan, Neighbors, DeLa Moreaux, & Behnke, 1998).

The term *queen bee syndrome* was coined to describe the general phenomenon that in particular women who have been individually successful in male-dominated environments are likely to oppose the women's movement (Staines, Tavis, & Jayaratne, 1974). It has been argued that women who have risen to the managerial level in a male-dominated work organization may oppose such more systemic changes as they should be motivated to maintain the organizational culture in which they have fared so well (Gibson & Cordova, 1999). Such behaviour may be understood in a more theoretical sense, from a social identity point of view, i.e. to the extent that women in male-dominated work environments are different from women in general, they can be seen as pursuing some form of individual mobility (Tajfel, 1978; Tajfel & Turner, 1979).

A variety of cognitive, affective and behavioural responses has been associated with the use of individual mobility strategies (Branscombe & Ellemers, 1998), all having to do with a emphasis on intra-group differences rather than similarities, which enables individual group members to contrast the self with the rest of the group. Indeed, in a previous study among full professors at different universities in the Netherlands,

³In seeming contrast with our findings, Brown and Smith (1989) observed that female faculty tended to view the performance of their female colleagues more favourably than that of their male colleagues. However, the work of Brown and Smith differs from our study in several important ways. In their study, the female faculty favourably judged their female colleagues while the target of their ratings (a) like themselves had already established a successful academic career (whereas we asked faculty to rate PhD students), (b) actually performed better than the male faculty on objective indicators (while we had no reliable evidence of performance differences), and (c) comprised a group the judges were likely to identify with (while we have reason to assume that our female faculty disidentified with the female target group).

Ellemers (1993) obtained more masculine (and less feminine) self-descriptions from female professors than from their male colleagues, indicating a perception of self as a non-prototypical (gender) group member. Similar processes may then account for our current finding that female faculty members are relatively inclined to view other members of their gender group in gender-stereotypical terms.

Although this pattern of results can be explained from a social identity perspective, and seems to fit in with previous related findings, it is based on observations among a relatively small number of female faculty. Furthermore, our argument is based on the assumption that the greater tendency of female faculty to hold gender-stereotypical perceptions of PhD students has to do with their own careers and the context in which these were made. Therefore, we have conducted a second study, in order to examine whether these findings can be replicated with a different sample, and to obtain some additional data that may shed light on the validity of our theoretical account of these findings.

STUDY 2: ITALY

A second study was conducted to examine more closely the most striking finding obtained in Study 1, namely that female faculty is more likely than male faculty to endorse gender stereotypical perceptions of doctoral students. First, we assess whether this is unique to the Dutch national context or whether it represents a more general phenomenon, that can also be observed in another national context. Secondly, we aim to investigate more specifically whether our *post hoc* explanation of the pattern observed in Study 1 is valid.

The social identity analysis of our findings revolves around the assumption that people's own career efforts and the way they relate to their group are a crucial determinant of the way they view others around them. Empirical support for this position may be derived from a study by Tougas, Brown, Beaton, and St Pierre (1999), who focused on women who were frustrated in their attempts to advance at work, and showed that those who fail to gain access to male-dominated jobs are inclined to endorse egalitarian views and favour affirmative action programmes at work. We look at the other side of the coin and argue that women who have been individually successful in a traditionally male field of work would likely see themselves as different from 'regular' women. As a result, they are inclined to maintain stereotypical views of men and women, while they perceive themselves as non-prototypical group members. Converse evidence that people's own experiences in gaining their current position determine the way they view other group members can be obtained from the work of Fajak and Haslam (1998). In their studies, the experimenter assigned male and female research participants to a certain level in a simulated organization. Under these conditions, i.e. when they did *not* have to demonstrate that they qualified for a powerful position despite their gender, female research participants tended to favour other women in promotion decisions to redress the underrepresentation of women at higher organizational levels.

Thus previous work shows that there are circumstances under which women will perceive themselves as representative of their female colleagues and try to help them to advance at work. Notably, this is the case when one's own attempts at upward mobility have been unsuccessful (as in the study by Tougas *et al.*, 1999), or when achievement of a powerful position was not contingent on one's gender identity (as was the case in the study by Fajak & Haslam, 1998). By contrast, our hypothesis refers

to women who have been individually successful in a male dominated setting. In this sense, it is relevant to a class of situations that differs fundamentally from the contexts examined in previous research. Hence, we may still expect to find evidence of the queen bee syndrome, in the sense that the very strategies individual women employ to achieve career success despite their gender are likely to cause them to discriminate against other women.

As we have indicated previously, in Italy women currently are relatively well represented on the labour market in general and among university faculty in particular. Thus, in Italy, the older generation of female academics, who made their career when this was still exceptional for women, is most likely to emphasize the ways in which they are different from other women (a similar argument has been proposed by Etzkowitz, Kemelgor, Neuschatz, Uzzi, & Alonzo, 1994). However, there is reason to assume that younger women have encountered less career difficulties and hence have a different view of themselves as well as their female colleagues. Based on our assumption that one's own individual mobility experiences are a crucial determinant of the way one views others, we therefore surmise that younger faculty members are less likely to differentiate themselves from other women, while the older generation, who arguably have experienced more difficulties in achieving individual career success, should be most likely to replicate the pattern of discrimination against other women that we obtained in the Netherlands.

To the extent that biases against female PhD students stem from the process of setting the self apart from women as a group, we should find that those women on the faculty who endorse gender stereotypical views are most inclined to perceive themselves as non-prototypical group members. As a result, they should describe themselves in relatively masculine terms. To examine the validity of this argument, in the second study Bem's (1974) Sex Role Inventory was added to the faculty questionnaire. This enables us to examine whether gender stereotyping among male and female faculty is indeed related to the content of their own gender identity.

Method

Participants

The sample consisted of 80 doctoral students and 93 faculty members from different departments at the University of Padua.

Doctoral students

The participants were 39 male and 41 female doctoral students at Padua University their mean age was 28. They worked in 26 different departments across the university and were therefore roughly representative of the doctoral student population of the University of Padua.

Faculty members

The participants in this study were 52 male and 41 female faculty members (mean age 45) who were working in 14 different departments of the university. Due to the inferior number of women among university faculty, female faculty members were contacted first and, where possible, an equal number of male faculty of the corresponding rank in the same department were recruited subsequently. In order to allow comparisons across rank and age groups, a roughly equal number of assistant

(*ricercatori*: 30%), associate (*associati*: 34%) and full professors (*professori di prima fascia*: 36%) were included in the study.

Questionnaires

The questionnaires were virtually identical to those used in Study 1 conducted in the Netherlands except for the inclusion of the Bem Sex Role Inventory (BSRI) for the faculty sample, to assess whether they perceived the self predominantly in masculine or feminine terms.

Doctoral students

The questionnaire of the doctoral students first comprised the scale measuring career-oriented commitment, organizational commitment, and team-oriented commitment. Subsequently, the students were asked to complete the measure of work satisfaction, the measure of time expenditure specifying different activities, and were also asked to indicate their number of publications (which was only assessed at Time 2 in Study 1).

Faculty members

The questionnaire was similar to the one used in Study 1. Each faculty member was randomly asked either to rate typical female doctoral students or typical male doctoral students. Thus, the questionnaire consisted of a scale assessing perceived levels of career-oriented, organizational and team-oriented commitment among doctoral students (either male or female, depending on the experimental condition). Additionally, in this study the questionnaire included the BSRI to assess the extent to which faculty members perceived themselves in masculine or feminine terms (content of gender identity). The BSRI was administered in its short form consisting of 40 items half of which representing typically masculine (e.g. *assertive*), half typically feminine traits (e.g. *sensitive*). Participants had to describe themselves using a 7-point scale (from 1 = not at all applicable to 7 = extremely applicable). First, two scores were derived from this measure: a masculinity score and a femininity score. Then, in order to estimate the relative prevalence of masculine vs. feminine traits, the difference between the average ratings on masculine and feminine traits was calculated.

Results

Doctoral students

Self-reported commitment

The commitment scales had satisfactory internal consistency. Cronbach's alpha was 0.85 for career-oriented commitment, 0.75 for organizational commitment, and 0.80 for team-oriented commitment. Statistical comparisons between the levels of commitment reported by male and female students only revealed a marginally significant difference for team-oriented commitment, with women being more committed to the colleagues in their department ($M = 4.66$, $SD = 1.01$) than men ($M = 4.21$, $SD = 1.05$, $F(1,78) = 3.76$, $p < .06$). No gender difference was observed for self-reported commitment to one's career (females: $M = 4.14$, $SD = 1.05$; males: $M = 3.92$, $SD = 1.07$, $F(1,78) < 1$, *ns*), or to the university organization (females: $M = 3.79$, $SD = 1.01$; males: $M = 3.87$, $SD = 1.05$, $F(1,78) < 1$, *ns*).

Work satisfaction

Again, males ($M = 72.34$, $SD = 19.28$) and females ($M = 73.61$, $SD = 18.81$) reported to be equally satisfied with their work ($F(1,77) < 1$, *ns*).

Table 2. Mean perceived levels of career-oriented commitment as a result of faculty gender and target gender in the Italian sample

	Target	
	Male students	Female students
Career-oriented commitment		
Faculty gender		
Male	4.99 _{ab} (<i>SD</i> = .67)	4.67 _{ab} (<i>SD</i> = .95)
Female	5.41 _a (<i>SD</i> = 1.26)	4.62 _b (<i>SD</i> = 1.02)

Note. Means that do not share common subscripts differ reliably from each other ($p < .05$).

Time expenditure and scientific output

In this study, male and female doctoral students reported similar time expenditure on different activities. Although the mean number of (self-reported) hours spent at work seems slightly larger for males ($M = 49.31$) than for females ($M = 46.59$), this difference is not significant. Additionally, and consistent with the findings in the Netherlands, male and female doctoral students showed a very similar publication record. The average number of publications in international journals was practically identical (males: $M = 1.51$, females: $M = 1.56$), as was the number of book chapters (males: $M = .20$, females: $M = .19$), and the number of conference papers (males: $M = 1.84$, females: $M = 1.77$). The only difference emerged for national journals (males: $M = 1.41$, females: $M = .46$, $p < .05$) that, however, tend to have rather low impact and recognition. Taken together and in line with the results regarding self-reported commitment, these indicators provide very little evidence for a reliable gender differences in work-related effort.

Faculty members

Perceived career-oriented commitment of doctoral students

In order to see whether male and female faculty members perceived male and female doctoral students as differentially committed to their careers, a 2 (faculty gender) \times 2 (target gender) between-participants ANOVA was run. The results revealed a main effect for target gender, $F(1,85) = 6.60$, $p < .01$, indicating that male students were perceived as more committed to their careers ($M = 5.19$) than female students ($M = 4.65$). Although there was no significant interaction with faculty gender ($F(1,89) = 1.27$, *ns*), separate comparisons for males and females revealed the predicted pattern that was also observed in Study 1. Female faculty members perceived male doctoral students ($M = 5.41$) as reliably more dedicated to their careers than female students ($M = 4.62$), $t(41) = 2.15$, $p < .05$, while male faculty members did not rate male and female students as significantly different in this respect ($M = 5.00$ for males and $M = 4.67$ for females, *ns*, see Table 2).

Intergenerational differences in gender stereotyping

We have argued that to the extent that gender stereotyping is caused by one's own career experiences, there might be a difference between older and younger generations of female faculty. The faculty sample was therefore split into two age groups at

Table 3. Mean perceived levels of career-oriented commitment of male and female doctoral students as a function of faculty gender and intergenerational differences in the Italian sample

	Target		<i>p</i> value
	Male students	Female students	
Faculty gender			
Male			
Older generation	5.28	4.90	<i>ns</i>
Younger generation	4.69	4.12	<i>ns</i>
Female			
Older generation	6.02	5.20	.05
Younger generation	4.98	4.26	<i>ns</i>

the median (above or below 47 years of age) to investigate whether gender stereotyping is indeed less pronounced among the younger generation. Generation was therefore added as an independent variable, resulting in a 2 (faculty gender) \times 2 (generation) \times 2 (target gender) between-participants ANOVA. In addition to the main effect of target gender described above, this analysis revealed a main effect for generation, $F(1,84) = 17.23$, $p < .001$, indicating that older faculty members ($M = 5.35$) generally perceived doctoral students (regardless of target gender) as more committed than did their younger colleagues ($M = 4.52$), as well as a marginally significant main effect of faculty gender ($F(1, 84) = 3.48$, $p < .07$), with female faculty seeing students as more committed to their career ($M = 5.12$) than male faculty ($M = 4.75$). More relevant to our argument is the interplay between these effects of target gender, faculty generation and faculty gender, even though the three-way interaction was not significant. As can be seen in Table 3, the only subgroup that perceived male doctoral students as significantly more committed to their careers than female students were the *older female* faculty. Male faculty of both age groups and younger female faculty did not differentiate in their ratings of male and female students.

Gender identity

Based on social identity theory and previous findings with regard to female professors in the Netherlands (Ellemers, 1993), we argued that—particularly in the early days—female faculty, in order to be successful in a male-dominated work environment, had to have a particularly masculine self-perception. This involves emphasizing differences rather than similarities with other women, which might explain the bias of female faculty against female graduate students. In order to assess whether further empirical evidence could be obtained for this line of reasoning, we examined the content of the gender identity among our faculty sample (operationalized as self-attributed male characteristics minus self-attributed female characteristics). First, in contrast to observations among other samples of men and women (e.g. college students, Holt & Ellis, 1998), we obtained no reliable overall difference in gender identity content between male and female faculty ($F(1,88) = 1.64$, *ns*). Even though the interaction between faculty gender and generation was not significant (probably due to limited statistical power), in view of our predictions and previous observations, we investigated the extent to which this lack of difference in gender identity could be traced to the older

Table 4. Gender identity of male and female faculty members in the Italian sample—higher scores indicate a more masculine self-description

	Faculty gender		<i>p</i> value
	Male	Female	
Older generation	.41	.29	<i>ns</i>
Younger generation	.50	.08	<i>p</i> < .05

and younger generations of men and women in our faculty sample. The pattern that emerges (see Table 4) shows that only the older generation of female faculty primarily describe themselves in masculine terms, i.e. their self-descriptions are not reliably different from those of their male colleagues. However, among the younger generation we find a more prototypical pattern, with women clearly holding a less masculine self-description than men. While this observation deviates from previous research showing that older women are generally more clearly sex-typed than younger women (Moore & Rosenthal, 1980; Twenge, 1997), it is consistent with our argument that the career difficulties encountered by the older generation of female faculty should result in a perception of the self as a non-prototypical group member. Indeed, only in this subgroup of our female faculty sample that reports a relatively masculine gender identity do we find evidence of stereotyping against other women.

Discussion

As was the case in the first study, the self-reports of the doctoral students mainly reveal similarities rather than differences between males and females. In this sample, male and female doctoral students do not reliably differ in self-reported career-oriented commitment, organizational commitment, time spent at work, or scientific output. The only difference that emerged indicates that female doctoral students are *more committed* than their male counterparts in that women report somewhat higher levels of team-oriented commitment.

In their ratings of the doctoral students, male faculty reflect these self-reports most accurately: they do not perceive male and female students as differentially committed to their work at the university. However, as was the case in the Dutch sample, *female* faculty do differentiate between doctoral students according to their gender, by rating female students as less career-oriented than male students. The inclusion of some additional measures in this study allows us to shed some more light on the reasons why this might be the case.

A closer look at the data revealed that the bias against female doctoral students is limited to the older generation, i.e. to female faculty with an age above the median (47 years). These women (born between 1921 and 1949) decided to pursue their own careers at a time when this was still exceptional for women. Consistent with our argument that making a successful career under these circumstances involves setting the self apart from one's gender group, there is indeed evidence that these faculty members regard themselves as non-prototypical women. Whereas younger colleagues describe themselves as reliably less masculine than their male comparison group (see also Twenge, 1997), the self-descriptions of older female faculty are just as masculine

as those of their male colleagues. In other words, these women have adopted a masculine self-stereotype that emphasizes how they differ from more prototypical members of their gender group (see also Moore & Rosenthal, 1980).

Thus, these data are consistent with our theoretical argument that when it is exceptional for women to pursue an academic career, those who are successful in doing so perceive themselves as non-prototypical members of their gender group. Indeed the parallel effects we have observed with respect to age of female faculty, masculinity of self-description and perceived commitment in female students suggest that this heightened awareness of differences (rather than similarities) between the self and the gender in-group not only involves adopting a masculine self-image, but can also imply that other women are contrasted with this self-view, and as a result are perceived in gender stereotypical terms. While, due to the relatively small number of older female faculty in our sample we cannot establish statistically reliable evidence of mediation, the pattern we observe is intriguing, is consistent with theoretical notions presented here and clearly deserves further research.

GENERAL DISCUSSION

This investigation set out to examine possible reasons why women continue to be underrepresented in science. Two alternative hypotheses were advanced in the introduction: (1) due to their dual responsibilities at home and at work women might be *less committed* to their work, hence they invest less effort and are less successful than their male colleagues, or (2) due to gender stereotyping women may be *perceived* as less committed and hence seem less suitable for a scientific career to those who have to select and encourage young academics. Furthermore, when focusing on commitment as an indicator of one's devotion to work, we distinguished different forms of commitment and argued that actual or perceived gender differences in *career-oriented* commitment might be most detrimental to the academic careers of women. We examined these hypotheses with data collected in two different national contexts, which differ from each other in terms of the representation of women in the general labour force, as well as in the university.

In neither of the two studies did we find evidence that female doctoral students are less committed to their work than their male colleagues. Male and female students generally reported being equally committed to different work aspects. The only exception to this pattern was found in the Italian sample, where female students reported somewhat greater team-oriented commitment than male students. While this is consistent with the overall notion that women are generally more community oriented than men, this in itself does not explain a gender difference in career success, as there is no evidence that as a result female students are less committed to their careers or to the university than male students.

In the Dutch sample (Study 1), female doctoral students indicate that they spend less time on work and more time on household tasks than do male doctoral students. However, when we look at the resulting scientific performance, there is no clear evidence of a gender difference in the output indicators that are available. This is consistent with findings from other studies, examining the productivity of male and female researchers. First, it has been demonstrated that there is no one-to-one relation between the amount of time available for work and scientific output. On the contrary: there is evidence that female scientists who are married and have children produce just as much or are even more productive than single females (ETAN-report, 1999).

Furthermore, when scientific output is not only measured in terms of number of publications but is corrected for journal impact, gender differences in productivity tend to disappear (ETAN-report, 1999; Maass & Casotti, 2000; Van Vianen, Ottens, & Van Schie, 1997).

While the self-reports in both samples reveal few, if any, differences in indicators of work motivation and scientific performance among male and female doctoral students, faculty members in the Dutch as well as the Italian sample perceived female students as less committed to their careers than male students. Thus, taken together, the results of these studies offer more evidence for a stereotyping explanation for the fact that so few women have been successful in an academic career, than for an account based on differential work commitment of male and female researchers. Moreover, unlike what is often assumed, it seems that men are not the main culprit for the occurrence of gender stereotypical views among university faculty. By contrast, it turns out that *female* faculty members are most inclined to hold stereotypical views of the work commitment of male and female doctoral students.

As we have argued when discussing the results from the Dutch sample (where the underrepresentation of women among university faculty is extreme compared to other countries), survival of women in a male-dominated work environment entails a form of individual mobility, in the sense that they have to prove to themselves and others that they are unlike other women in order to be successful in an academic career. When discussing the findings of Study 1 we referred to a previous study (Ellemers, 1993) revealing that, overall, female full professors in the Netherlands have a particularly masculine self-image, which would be consistent with our theoretical argument.

In the Italian sample we replicate this pattern and have additional data that further corroborates our argument, as we found that the older generation of female faculty, for whom pursuing an academic career was most exceptional, both describe themselves as non-prototypical group members *and* hold stereotypical views of other women at the university. While the small number of observations among this particular group of research participants does not allow us to demonstrate mediation, parallel effects emerge on different variables, in the sense that older female faculty are the ones who (1) show biased judgments of female doctoral students, and (2) report a masculine self-image. By contrast, for the younger generation of women in Italy the pursuit of an academic career is less extraordinary, as is evident from the relevant statistics. Hence, they have less reason to accentuate the differences between themselves and other women. As a result, they continue to describe themselves in relatively feminine terms and hold unbiased judgments of other women in the university.

Thus, stereotyping of women rather than differential work commitment emerges as a plausible reason that women have more difficulty than men to be successful in an academic career and—because of their own precarious position—women are more likely than men to engage in gender stereotyping in this context. Importantly, when women hold biased evaluations of other women, this is usually not recognized as a form of gender discrimination (Baron, Burgess, & Kao, 1991; see also Petty *et al.*, 1999), but taken at face value instead. This is even more likely to be the case when the merit of individual men and women is being assessed (as is often the case in academic settings), so that the detection of any group-based prejudice is impaired (see also Schmitt, Ellemers, & Branscombe, 2003). Thus, when (biased) judgments of senior women about the potential of their junior colleagues are not questioned, other women may suffer from this. Indeed recent research (Barreto & Ellemers, *in press*) reveals that

women suffer most when they encounter gender sexism by other women, as their difficulty in recognizing this as a form of gender discrimination impairs the use of adequate coping responses.

This may lead to the provocative conclusion that recent measures intended to prevent biases against women may help perpetuate them. Specifically, involving senior female scientists in supervision and review procedures may harm rather than help the cause it is intended to serve, as chances are that this eventually results in the provision of less rather than more encouragement and opportunities to young female scientists. Thus, paradoxically, in this way the very people who have successfully escaped their plight as members of a disadvantaged group may be the ones who legitimate and perpetuate the *status quo* in terms of overall social relations (see also Ellemers, 2001).

On a more positive note, however, the younger generation of faculty in the Italian sample seems to suffer less from such biased judgments. This suggests that there might be a critical point at which it becomes easier for women to make a career while maintaining their femininity. Thus, when it no longer seems necessary to distance oneself from other gender group members in order to prove one can be successful at work, this may prevent gender stereotypes from affecting the career opportunities of women at the university.

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