

Chapter 2

The Psychological Work Climate of Researchers: Gender, Nationality, and Their Interaction with Career Level and Care for Children in a Large German Research Organization

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Abstract

Purpose: This study examines the relationship between gender, nationality, care responsibilities for children, and the psychological work climate of researchers.

Basic Design: Based on a dataset of approximately 2,900 cases, the main effects of gender and nationality, their interaction effect and the interaction effects of gender with care responsibilities for minor children, and with hierarchical position are considered in relation to work climate. Dummy regressions and *t*-tests were performed to estimate and compare the means and regression parameters of the perceived group climate and the view of leaders as evaluated by researchers. The dataset used was taken from a full survey of employees of the Max Planck Society, which is one of Germany's largest research organizations with over 80 facilities and institutes in various disciplines and a focus on basic research.

Results: Gender differences concerning the evaluation of the work climate are particularly pronounced among doctoral candidates and researchers who have a non-EU nationality. Gender gaps increasingly level out with

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each successive career step. Additionally, a main effect of gender and a weak interaction of gender and care responsibility for minor children was supported by the data. A main effect of nationality on work climate ratings was found but could not be meaningfully interpreted.

Interpretation and Relevance: The interaction effect between gender and the position of a researcher can be interpreted as being a product of the filtering mechanism of the research system. With this interpretation, the results of the study can plausibly be explained in the light of previous research that concludes that female researchers face higher career hurdles than male researchers.

Keywords: Team climate Inventory; CPE questionnaire; leadership; intersectionality; survey; gender gap

Since 2005, The European Charter for Researchers...

... aims to contribute to a productive and conducive relationship between researchers and their employers or funders. The paper, published by the European Commission, has since been endorsed by some 1,300 research organizations throughout the European Union (EU) and associated countries. With their signature, the research organizations commit themselves to the guiding principles of the charter and thus also to combat all forms of discrimination, to provide equal working conditions for men and women, and to enable nationally and internationally mobile scientific careers (EURAXESS 2021).

The European Charter for Researchers is not the only effort being made to improve working conditions in the research system. The work and objectives of the European University Association as the representative of the university management, Eurodoc for early career researchers, the EURAXESS platform for the promotion of the mobility of researchers, or Science Europe as the representative of the research performing and funding organizations in Europe are complementary and share the same objectives. These efforts of versatile international and national actors have in common the pursuit of the creation of a fair and sustainable as well as inclusive research culture. Despite these laudable efforts, there is a great deal of scientific evidence that shows that the system of scientific research in its current form marginalizes women, foreign researchers, and those with caregiving responsibilities (Zacharia et al., 2020, pp. 34–35; Schraudner et al., 2019, p. 64 ff; NASEM, 2018; Gewinner in this collection).

However, just because these marginalization effects are known and documented does not mean that they are relevant in their effect size and pertinent for individual research institutions. “We don’t have anything like that,” is still a common argument from skeptics in practice, which puts the burden of proof back on those who advocate for a more inclusive work climate in research. Thus, there is a constant need for an evaluation of the situation and for gathering quantitative evidence of systemic marginalization processes in science, to the same extent as there is in other areas of society.

Current research lacks analytical assessments concerning the extent to which the sociodemographic attributes of a researcher influence his or her working climate. Few prestigious projects provide statements on the characteristics of the working climate and the extent of marginalization in science within the European Research Area. One of the exceptions to this tendency is a full-scale survey on working climate that the German Max Planck Society (MPG) conducted in its institutions, in which more than 9,000 of its scientific and non-scientific employees participated. The data from this survey form the basis of this article.¹

The MPG is one of Germany's largest research organizations, with over 80 facilities and institutes focusing on basic research in various disciplines. The dataset obtained from the internal survey conducted by the MPG is the world's largest sample of research on work climate under (comparatively) the most homogeneous organizational and national context conditions to date. Of all the surveys conducted in this context, the MPG study is also the only one that surveys work climate using items validated in psychological studies that can be combined into robust indices.

This study focuses on the examination of the relationship between the gender² of a researcher and the work climate he or she perceives. Using a dataset with around 2,900 cases of MPG researchers, the intersections of gender with other sociodemographic characteristics such as nationality, care responsibility for underage children, and hierarchical position, are considered. In addition, there is also a consideration of the main effect of nationality. The article provides an analytical inventory of marginalization in top research in addition to organization-wide benchmarks and can serve as an orientation for concrete organizational countermeasures for the MPG and beyond.

The article starts with the definition of the object of study, namely, work climate. This is followed by an overview of the current state of research on the relationship between gender and perceived work climate in the research workplace. The hypotheses underlying this study were derived from the current state

¹Other relevant projects are, first, the surveys of the so-called MORE projects 1 to 4. Within the framework of MORE, the mobility patterns and career paths of EU researchers within and outside the European Research Area are investigated. Some 8,500 researchers participated in the survey conducted in 2019 (PPMI, IDEA Consult, and WIFO, 2021, p. 47). Second, a global survey of 32,000 STEM researchers conducted as part of the Gender Gap in Science project funded by the International Science Council and other partner organizations provided comprehensive insights into the different perceptions of the working climate and conditions of male and female researchers (Guillopé & Roy, 2020). Third, in 2020, the UK Wellcome Trust presented the results of a large-scale survey on research work culture, in which over 4,200 researchers – mostly working in the UK – participated.

²This study uses the term “gender,” which relates to a person's identity, whereas “sex” refers to a person's physical characteristics at birth. In the questionnaire underlying the dataset, respondents were asked to “Please indicate your gender.” The purpose of the survey was thus to capture self-ascribed gender identities. Accordingly, this study also uses the term “gender” throughout.

of research. In the next section, the context conditions of the MPG are mapped out before the methodology section presents the dataset that was used, and describes the outcome, predictor, and interaction variables. The data were subjected to linear regression with dummy variables and *t*-tests, and the methodological requirements of these evaluations are also explained in this section. The results of the data analysis are subsequently presented before the findings are interpreted. The article ends with a conclusion that summarizes the main results and discusses the theoretical and practical relevance of the findings and the limitations of the study.

Literature Review

Work Climate as a Research Object and Its Relevance

Work climate can be understood as being the

[...] shared perceptions of and the meaning attached to the policies, practices, and procedures employees experience and the behaviors they observe getting rewarded and that are supported and expected [...]. (Schneider et al., 2013, p. 362)

Following this definition, a distinction must be made between the psychological and organizational work climate (Ostroff et al., 2013). Whereas the psychological climate is concerned with individual workplace perceptions, the organizational climate explicitly refers to the views on the work climate shared by employees. In this context, a distinction should also be made concerning organizational culture. While the work climate is formed by the employees' views on their organizational practices, policies, and procedures, the organizational culture deals with the often implicit and shared basic assumptions that lead to the emergence of certain practices, policies, procedures, and other artifacts (Kuenzi and Schminke, 2009; Ostroff et al., 2013).

The present study deals with the psychological work climate of a researcher, and hence with their individual perception of the research group they are assigned to. The psychological work climate can be divided into five main areas in addition to organizational and subsystem attributes (James and Sells, 1981): job characteristics, role characteristics, leadership characteristics, workgroup, and social environment characteristics (Parker et al., 2003). This study focuses on leadership and workgroup characteristics.

The work climate stands in a complex relationship to the concept of workplace discrimination, which is the leitmotif of this edited collection. While work climate concerns general opinions and attitudes toward the workplace, discrimination – understood as the differential treatment of individuals based on functionally irrelevant status cues (Merton, 1972) – is a concrete experienced behavior. In this sense, those who experience discrimination, bullying, or persistent incivility will logically change their attitude to the workplace, that is, perceive it as having a different, more negative work climate. Accordingly, empirical surveys on

discrimination in the workplace justified their relevance by the consequences that discrimination has on the work climate and individual attitudes to work (Triana et al., 2015; Appelbaum et al., 2012). At the same time, the work climate can either be a breeding ground for discrimination and other experiences of non-scientific misconduct at work, or the basis for effective protection against it (Willness et al., 2007; Giorgi et al., 2016). This is particularly true for sub-dimensions of the work climate such as the diversity, ethical, or the psychosocial safety climates (Boehm et al., 2014; Dalton et al., 2014; Bond et al., 2010). The work climate can thus be regarded as an antecedent, a consequence, and a moderator of discrimination experiences.

It can be assumed that non-scientific misconduct, be it discrimination, bullying, or other uncivilized behavior is primarily reflected on the climatic level. Those affected might view the participatory security in the group or the relationship to their supervisor critically even before they perceive themselves as being affected by discrimination or bullying. Hodgins et al. (2020) describe this phenomenon concerning bullying in organizations as the third face of power, which refers to the preconscious influences people experience that may lead them to act against their own interests. Accordingly, people who experience non-scientific misconduct must deal with whether they want to view themselves as being discriminated against or bullied, whether this understanding would be intersubjectively tenable by their colleagues or a complaints body, and whether they want to take measures to address the situation. In contrast, work climate – especially in its role as a necessary precursor of potential discrimination experiences – enables a more comprehensive assessment of whether and to what extent certain groups of people experience justified or unjustified unequal treatment in the workplace.

Theoretical Assumptions

The theoretical assumptions of the study are mainly based on social role theory and especially its extension, namely the role congruency theory. Here, following Bates (1956), a social role is understood as a more or less integrated and related pattern of social norms that is distinguishable from other norm patterns. Norms, in turn, are behavioral expectations (including stereotypes) that are consistently addressed to the members of a group and are enacted and reproduced, at least by some members of the group. Stereotypes arise when people observe the behavior of other people with certain characteristics (such as gender, class, ethnicity, or religion) and conclude that the behavior of the respective characteristic group results from group membership and not individual preferences (Eagly and Wood, 2012). In a society, people are confronted with different stereotypical role expectations within the social structure according to their respective position, which they can either accept or reject. The acceptance or rejection of a social role represents a process of negotiation between the self and its environment (parents, partner, employer, community, etc.) as a result of which a person reproduces, modifies, or completely rejects an expected role (Eagly and Wood, 2012). If an individual takes on a role, he or she increasingly adapts to this role during socialization by developing specific character traits and skills, and the line between role

expectation and the supposed “natural predisposition” to a certain behavior becomes increasingly blurred (Eagly and Wood, 2012).

By observing purely superficial characteristics, in-groups and out-groups are created by collectives of individuals through the process of stereotyping described above. Such group memberships can be promoted or discriminated against by the observer, depending on their position as a member of the respective in- or out-group (Tajfel and Turner, 2004). The present study assumes that scientific jobs are still characterized by stereotypes that superficially attribute an overall higher competence to men compared to women – by both men and women alike. Williams et al. (2014) call this phenomenon the “Prove-It-Again” bias (see also Moss-Racusin et al., 2012; Sobieraj and Krämer, 2019; Oh et al., 2019). Furthermore, women are significantly more affected by sexism, sexual harassment, and sexual discrimination in the workplace, as was already demonstrated based on the population targeted in this study (Schraudner et al., 2019, p. 64 ff).

Current research provides ample evidence that the pressure for women to assume a domestic role and the likelihood of negative stereotyping as being less competent or committed in the workplace increases when the woman is perceived as a mother (Williams et al., 2014; Williams, 2005; Eagly and Wood, 2012).

Therefore, it can be assumed that the stereotypical discrimination of women, and especially mothers, in occupations that are not regarded as typical female domains leads to a different perception of the work climate on the part of women than of men.

The differentiation of (German) society according to gender roles not only leads to women being stereotypically ascribed greater responsibility for caring for children and other dependents but also to women assuming this responsibility more frequently than men. In Germany, mothers, whether they are single parents or in a relationship, invest an average of about 80 percent more time in care work than men (Institute for Social Work and Social Education, 2020, p. 16). Accordingly, it can be assumed that, on average, female researchers with care responsibilities perceive a higher double burden of work and “private life” than is the case for male researchers with care responsibilities.

It was thus predicted that the perception of the psychological work climate will generally be less positive for female researchers than for males, and even less so for female researchers with underage children at home.

H1. Female researchers perceive their work climate less positively than their male colleagues.

H2. Female researchers that have children under the age of 18 in their household perceive their work climate less positively than male researchers in general, male researchers with children, and female researchers without children or with older children.

According to role congruency theory, it was also assumed that professional pressure and, as a consequence, the probability of professional failure increases more strongly among women compared to men at each level of the hierarchy.

According to [Eagly and Karau \(2002\)](#), this is because management positions are closely linked to a masculine role stereotype, whereby women are regarded as being less qualified to fill a leadership position and are more critically evaluated if they behave appropriately in a leadership role and thereby deviate from their stereotypical gender role.

H3. The gender gap in the perception of work climate increases with higher career levels.

Like gender, the characteristic of nationality (here synonymous with citizenship) represents different role stereotypes and realities of life with which experiences of discrimination can be associated. Firstly, the assumptions of social role theory apply to foreign employees as well. Such processes of demarcation of a national in-group and devaluation of a foreign out-group can also be observed if the members of the supposed out-group come from the same language and cultural area. This is exemplified by [Köllen \(2016\)](#) for employees with German nationality in Austria (see also [Dietz et al., 2015](#)).

Secondly, job mobility is often accompanied by higher levels of social disintegration. If a person moves to another country for a temporary research position, or even permanently, they are confronted with a different everyday language and possibly also traditions, values, and behaviors that might diverge significantly from those of their home country. It also becomes more difficult to maintain social contact with family and friends when living abroad.

Thirdly, in the sense of cultural studies, different cultural areas can be assumed, which are defined by shared values and norms, also regarding the work context, and are compatible with each other to varying degrees ([Hofstede, 2001](#)). Accordingly, the greater the cultural distance between an employee and the culture of their workplace, the more adaption efforts become inevitable, for example, concerning the language used or organizational processes that need to be followed.

Fourthly, a person's citizenship also implies different legal consequences and bureaucratic burdens for foreigners, especially if they do not have a permanent residence permit. These bureaucratic hurdles can also have a significant negative impact on career opportunities such as short-term research stays or teaching positions ([Gewinner](#) in this collection).

It is expected that the described experiences of out-grouping, social disintegration, cultural fitting, and bureaucratic hurdles negatively impact the psychological work climate of the researchers surveyed. In the present study, nationality was operationalized using a trinary coded characteristic of nationality (German, EU nationality, and non-EU nationality). It was assumed that the negative impact due to nationality would be more pronounced for persons with non-EU nationality than for persons with EU nationality. However, it is important to note that these categories include rather different groups of countries: Switzerland, for example, is a non-EU country, but part of its population shares a long common cultural and linguistic tradition with Germany. It can thus be assumed that such heterogeneities dilute the predicted nationality effect. In principle, however, Germany is part of the European cultural area ([GLOBE, 2021](#)), the group of EU

countries only comprises countries of the European cultural area, and the group of non-EU countries extends beyond the European cultural area.

H4. Foreign researchers perceive their work climate less positively than German researchers. Researchers with a non-EU nationality rate their work climate the least positive of all.

The intersectionality approach assumes that due to the manifold aspects of an individual's identity, the experiences of discrimination linked to certain sociodemographic characteristics can overlap in the individual (Crenshaw, 1991). These intersections of identity and discrimination result in individual experiences of discrimination based on different group memberships. Accordingly, the concrete discrimination experiences of black women, for example, differ from those of black men and white women. In the context of the United States, Ghavami and Peplau (2013) show that ethnic stereotypes are more consistent with stereotypes of men in the respective ethnic group than with those of women. Typical gender stereotypes show the greatest consistency with stereotypes against white men and women. Similarly, other studies show that not only stereotyping but also gender-based experiences of discrimination and professional attributions of competence vary significantly between ethnic groups (Tao, 2018; Trauth et al., 2016).

Scott and Siltanen (2017) formulate three features of an intersectional approach to quantitative research based on the feminist literature. First, analyses must be conducted in a context-sensitive manner. Context-sensitivity can be facilitated, for example, by including appropriate variables in a regression equation or by running regressions on different contextual conditions or, when computational inclusion is not possible, by qualitatively explaining a specific context. The context of this study in this regard is presented in the following section. Second, a heuristic approach should be used to identify relevant categories of inequality. In practice, this means that an investigation should partly be exploratory and not too hastily narrow its view of relevant dimensions of inequality according to fixed a priori assumptions. Third, the analysis should capture the complexity of intersectionality and social reality. In this study, objectives two and three were realized by conducting a comprehensive examination of the intersectionality of gender and nationality that includes both an additive and an interactional approach.

Building on the theoretical explanations above, an additive approach is thus reasonable. It was predicted that female researchers will perceive the work climate less favorably and that both male and female researchers with foreign citizenship will perceive a less positive work climate. Based on this, it was predicted that foreign female researchers will report the lowest work climate ratings compared to German female researchers and both German and foreign male researchers. An intersectional approach thus considers the addition of experiences of discrimination, but furthermore also considers interaction effects (Bowleg, 2008). It is conceivable that the characteristics of nationality and gender not only have a linear effect on the psychological work climate but also interact to reinforce or level out experiences of discrimination for certain subgroups. In this collection,

Gewinner shows that previous studies in an academic context provide controversial results concerning migration background and gender, and that evidence for both additive intersectionality and interactive intersectionality can be found. The self-image of highly qualified, foreign female academics conveyed in qualitative studies oscillates between the perception as a successful adapter (Sang et al., 2013) and the “marginalized elite” (Riaño, 2016).

Two working hypotheses were formulated based on this, whereby additive intersectionality was tested based on the comparatively closed *H5a*, whereas *H5b* was formulated very openly and thus, to a very large extent, takes possible interactions into account.

H5a. The gender gap in the evaluation of the working climate is largest between male German researchers and female researchers from non-EU countries. All other subgroups fall between these two poles.

H5b. The size of the gender gap in perceptions of the work climate varies across nationality groups.

Empirical studies are available on the connection between gender and the team or group climate, as one of the sub-dimensions of the work climate used here. The results are strongly context-dependent and mixed. In a survey of teams in general medical practices, Goh et al. (2009) found that women rate the team climate slightly less positively than men. Using a sample of postdoctoral researchers, Hüttges and Fay (2015) argued that, unlike male researchers, professionally ambitious female researchers are more likely to encounter an environment that does not recognize or that negates their professional ambitions. In their study, the preference among women for a profession with prestige, a high salary, and similar external incentives showed a negative correlation with the assessment of the cooperation with the manager and with the assessment of team support.

The relationship between nationality and participative safety in the team (see Outcome Variables Section) was investigated among physicians in Finland by Aalto et al. (2014). However, they could not find statistically significant differences in the mean values.

Empirical studies are also available on the connection between gender and mentoring. Ragins and McFarlin (1990), using a dataset of 880 employees from three US research and development organizations, concluded that there were no significant gender differences in the assessment of the mentoring relationship by the protégées. Only marginal gender differences were found in this study, particularly that women stated somewhat more often that their mentor offers them a protection function, while men highlighted a social function of their mentor slightly more frequently. In a follow-up study using a sample of public accountants, it was found that the assessment of a mentoring relationship by the protégées did not vary between the biological sexes, but that the gender roles espoused by a person did have an influence (Scandura and Ragins, 1993). Another study among doctoral candidates and postdocs in nursing also found no gender differences in the assessment of mentoring relationships (Foster and Hill, 2019).

A research desideratum can be identified regarding the evaluation of leaders. There are sufficient studies that examine the influence of the gender or nationality of a leader on the assessment by their employees. However, the influence of these characteristics on the employee's assessment has not been addressed in the research to date. It is also unclear how the responsibility for childcare affects the perception of work climate. Intersectionality or interactions between socio-demographic characteristics and their effects on the psychological work climate have also not been investigated in this context.

Context

The present study is based on a full survey of all institutes and facilities of the MPG conducted in 2019. The MPG is one of the largest non-university research organizations in Germany. In its 86 institutes and facilities, more than 23,600 scientific and non-scientific employees conduct basic research in the natural sciences, life sciences, and humanities – both in Germany and internationally (Max Planck Society, 2020a). The MPG has several special aspects that must be taken into account when applying the results of this study to other research institutions.

Significantly, the MPG is a pure research organization and its researchers have no teaching obligations. While it can be assumed that many Max Planck researchers take on teaching positions at universities or universities of applied sciences in addition to their research activities, this is neither obligatory nor the rule. Therefore, generally speaking, Max Planck researchers can fully concentrate on their research.

The scientific staff of the MPG is characterized by a high degree of internationality. According to personnel statistics, the proportion of foreigners among W3 researchers (professorship) is 37 percent and 57 percent among doctoral candidates. In comparison, the proportion of foreigners among full-time professors at German universities is 7.1 percent while among doctoral students it is 23.6 percent.³ These data indicate that internationality is “more normal” in the institutes of the MPG.

The MPG conducts top-level research in its institutes and facilities. To this end, the best researchers worldwide are attracted by optimal research conditions (Max Planck Society, 2020a). This claim is reflected, firstly, by very good financial resources, which can be illustrated using a rough comparison. In 2019, the MPG was funded with 1.86 billion euros (Max Planck Society, 2020b). With approximately 23,600 employees, this results in a per-capita budget of 78,814 euros. By comparison, in 2017, German universities had around 704,000 employees (Destatis, 2019b, p. 15), while in the same year, the universities invested a total of 36.3 billion Euros, mainly from public funds, in both research and teaching (BMBF, 2020, p. 18), which results in a per-capita investment of 51,562.50 euros.

³Own calculations of the proportion of foreigners among PhD candidates (Destatis 2019a) and full-time professors (Destatis 2019b, p. 19; BMI 2018, p. 82).

A central structural principle of the MPG is the so-called Harnack Principle. This is a set of guiding principles for the organization of science, which place the promotion of individual outstanding research personalities at the center of the organization (Max Planck Society, 2010). Once the heads of a department or research group have been successfully appointed, they are not obliged to pursue a specific research program or curriculum but are solely obliged to follow their research interest (Max Planck Society, 2010). The appointment as the head of the department of an institute of the MPG is accompanied by a funding commitment until scientific emeritus status. Depending on the results of the evaluations carried out, the financial flows to the respective directors can be adjusted within certain limits. The MPG refers to the high trust principle (Max Planck Society, 2010) and appointed executives are given a great degree of scientific freedom thanks to solid financing and job security. In return, however, they also take on a high level of responsibility for their institute as a whole, the scientific success of their institute, and for the personnel in their department and at their institute.

Research Approach

Data

The following analysis is based on a dataset of MPG employees' perceptions of their work atmosphere. The organization-wide online survey was conducted from February 13 to March 13, 2019 and more than half of the employees of the MPG took part in the online survey. After data cleansing, evaluable questionnaires were available from 38 percent of the employees ($n = 9,078$), of which 4,308 questionnaires were from scientific employees. The dataset is the property of the MPG.

The extent to which the response to the full survey covered the population of employees in various subgroups is outlined in Table 2. Compared to the personnel statistics, women, directors and research group leaders, postdocs, doctoral candidates, and non-scientific staff are overrepresented while employees with foreign citizenship and guest researchers are underrepresented.

It is debatable whether the dataset represents a full survey or a random sample. If the data were to be considered a full survey, inferential statistical information such as confidence intervals and statistical significances would be superfluous and the analysis would focus on effect sizes. In contrast, if the dataset was regarded as a random sample, conventional inference statistics are important in addition to the effect strengths. This is a paradigmatic dispute in which both sides have good arguments (Broscheid and Gschwend, 2005) and thus both points of view were considered here.

Due to the unique aspects of the MPG described above, the data collected was treated as a full survey, that is, no representativeness of the data collected for other German or international non-university or university research institutions is assumed. Nevertheless, the test statistics are reported comprehensively, and a mixed approach is taken. While effect sizes are the focus of the result interpretation, p -values and confidence intervals are also reported as measures for assessing the robustness of the mean differences obtained. As no representativeness of the data of the MPG for other research organizations is assumed here, the qualitative transferability of the results is discussed in the conclusion of this study.

Table 2. Comparison of Various Employee Groups at the MPG, as a Proportion of the Survey Population (According to HR Statistical Data), and as a Proportion of Respondents.

Employee Group	HR Statistics (12/31/2018) in %	Survey (3/14/2019) in %
Women	43.2	48.6
Employees with non-German citizenship	35.5	25.5
Employment contract holders	88.2	91.5
Scholarship/funding contract holders	3.4	5.7
Guest researchers	8.3	1.6
Directors and research group leaders	2.8	6.4
Postdoctoral researchers	11.6	17.0
Doctoral candidates (excl. IMPRS)	16.0	20.3
Non-scientific staff	36.0	40.0

IMPRS, International Max Planck Research Schools.

Variables

The survey questionnaire, which was largely based on literature in English, was translated into German by a professional translation agency. The English and German-language versions of the questionnaire were subjected to pretests and reviewed in detail by a specially established task force of the MPG. The task force consisted of institute directors from the three sections of the MPG, representatives of its stakeholder groups, and employees from the General Administration. The procedure ensured that the questionnaire was formulated in a coherent and meaningful way for all MPG employees. The German and English questionnaires were subsequently proofread by the agency that was commissioned to perform the translation.

Outcome Variables. Work climate was operationalized through the main constructs “group climate” and “perception of leader.” For the two main constructs, mean values based on the means of the underlying subconstructs were calculated. The range of values for the main and subconstructs is from 1 to 5 according to a five-point Likert scale that was used for the measurement. The subconstructs are based on the items listed in Appendix 1. When calculating the mean values of the subconstructs, cases were only considered if at least three items of the subconstruct were answered. When calculating the main constructs, all existing cases were considered, that is, if at least one subconstruct could be calculated for the case. One result of this approach was that

the number of cases (n) of the main constructs was higher than that of the individual subconstructs (Table A1).⁴

The question items for group climate are based on the Team Climate Inventory of Anderson and West (1998) and the main construct group climate consists of four subconstructs. The shared vision of the group asks respondents about their views on how clear, amenable to consensus, attainable and valuable the goals of their research group are. The subconstruct task orientation measures the general commitment of the group to excellence in task performance and building reciprocally on the ideas of its members. Participative safety surveys the active participation of group members in common processes in an atmosphere of mutual trust and support. Lastly, innovation orientation measures the expectation and approval of and practical support for work on new ideas and approaches.

The main construct perception of leader was operationalized through the CPE (change, production/structure, employee/relation) questionnaire of Fjell et al. (2007). The questionnaire divides the perception of leadership behavior into three subconstructs. Employee orientation assesses the views of respondents regarding the extent to which their (scientific) leaders value the work of subordinates and value them as people. Change orientation measures the evaluation of respondents concerning to what extent their leaders act in a creative and visionary manner and are willing to take risks. Rule orientation examines the extent to which leaders try to solve problems within a clearly defined framework of rules and processes and how much importance they attach to this framework according to their subordinates.

Since further qualification for higher positions is of central importance in an academic career, the quality of mentoring was identified as a subconstruct of the main construct perception of leader. Mentoring relationships have a psychosocial dimension (e.g., mentor as a role model or friend), and a career-related dimension (e.g., mentor as a sponsor, coach, or protector) (Ragins and McFarlin, 1990). This survey focused exclusively on the latter dimension.

The individual items of the variables and their scaling are listed in Appendix 1, while Appendix 2 presents the descriptive statistics and Cronbach's alpha values for the subconstructs of work climate based on the total sample.⁵ The values of Cronbach's alpha lie between 0.78 and 0.92, whereby the internal consistency of the items used to measure the outcome variables can be considered good.

⁴The index calculation procedure results in the fact that, in some cases, the two main constructs are calculated on the basis of only one of three subconstructs each. In comparison with an index value calculation in which at least three subconstructs must be available for each main construct, it was examined whether the consideration of these cases distorts the distribution of the predictor variables. This could not be supported. Changes in the mean, standard deviation, skewness, and quartile distributions were limited to the third decimal place.

⁵The numbers of cases for the outcome variables differ between Tables 3 and 4. Table 4 was created using the entire sample, while Table 2 reports the number of cases for the outcome variables that were also included in the regressions performed. The numbers of cases in Table 2 are lower because of missing cases with one or more predictor variables.

Table 3 shows the descriptive values of the two outcome variables as they were included in the regression equations.

Predictor Variables. Based on the theoretical assumptions, the sociodemographic categories analyzed were gender and nationality. The descriptive values of the predictor variables are shown in Table 4.

Gender was differentiated into male and female. A further category “No answer/Other gender” was not further considered in the evaluation due to its lack of precision, since it is unclear whether the respondents who used this option assign themselves to an alternative gender or simply wanted to conceal their gender. Due to data protection laws and to guarantee the anonymity of the respondents, it was not possible to conduct an isolated query of a different gender as this would have made it possible to identify specific individuals in the dataset.⁶

Nationality was queried using the categories “German,” “other EU countries,” and “non-EU countries.” As was the case concerning gender, a more precise differentiation of nationalities was not possible due to data protection. It should be noted that four of the more than 80 institutes of the MPG are in other European countries and one is in the USA. The three European institutes belong to the Social Sciences and Humanities Section of MPG. A cross-table analysis of section and nationality showed no association of a relevant effect size between the two variables (Cramer’s $V = 0.041$, $p = 0.011$, $\text{Chi}^2(4) = 13,086$, $n = 3,904$).

Interaction Variables. The interaction variables “children below 18 years of age living in the same household” as an individual characteristic and academic position as an organizational characteristic were also investigated (also see Table 4).

For the variable “children below 18 living in the same household,” respondents were asked whether children under 18 years of age live in their household. The variable classified respondents into a group of those with children under 18 years of age in their household (1) and a group of those without children, those without children in their household, and those with children older than 18 years of age in their household (0).

Table 3. Descriptive Statistics of the Outcome Variables for the Performed Analyses.

Variable Name	<i>N</i>	Max Item Number	Min.	Max.	Mean	SD
Main construct: Group climate	2,965	15	1.00	5.00	3.780	0.744
Main construct: Perception of leader	2,871	20	1.00	5.00	3.664	0.740

⁶Of the 3,817 researchers surveyed, 385 (10.1 percent) placed themselves in the “No answer/Other gender” category.

Table 4. Descriptive Statistics of the Predictor Variables for the Analyses Performed.

Variable Name	Category	Group Climate		Perception of Leader	
		N	Marginal Percentage (%)	N	Marginal Percentage (%)
Gender	Female	1,147	38.7	1,153	40.2
	Male	1,818	61.3	1,718	59.8
Nationality	Other EU country	615	20.7	603	21.0
	Non-EU country	600	20.2	596	20.8
	German	1,750	59.0	1,672	58.2
Children below 18 living in the same household	Yes	794	26.8	681	23.7
	No	2,171	73.2	2,190	76.3
Position of scientific staff	Directors and research group leaders	330	11.1	–	–
	Postdocs	891	30.1	960	33.4
	Other research associates employed	706	23.8	771	26.9
Doctoral candidates	1,038	35.0	1,140	39.7	
Total		2,965		2,871	

The position of a respondent indicates his or her hierarchical position. Researchers were asked to categorize themselves as “directors and research group leaders,” “doctoral candidates,” “postdocs,” or “other research associates employed.”⁷ The positions were summarized in this variable, regardless of whether the respondents have an employment contract, a scholarship, or whether their doctoral studies are conducted within the framework of one of the International Max Planck Research Schools (IMPRS).

The category “directors and research group leaders” was filtered out of the positions before analyzing the perception of leader. For reasons of data protection, no distinction was made between directors and research group leaders in the survey. In the case of directors, it is unclear which person they considered their superior in each case, although the relationship between institute directors and their respective superiors is difficult to compare with the member-leadership relationship in which the other scientific employees stand. A meaningful interpretation of the perception of leader was thus not considered possible for the institute directors and research group leaders and was therefore omitted in the regression equation for the estimation of the perception of leader.

Methods

To explore whether the perception of the work climate is related to the different socio-demographic characteristics of the respondents, linear regressions with dummy variables were performed whereby the main effects of the predictor variables and the interaction effects between gender and all other variables were examined. In the first step, the parameters of the regression equations were calculated for the two outcome variables. Based on these estimated parameters, the predicted mean values were then (automatically) calculated for the groups of people to be compared according to the research hypotheses.⁸ In the results section, the comparisons of means are described with their confidence intervals and *p*-values. The interpretation of the results was based on the overall tendency and the effect size of the comparisons of the estimated marginal means carried out to test the individual hypotheses.

Based on the literature, comparatively small effects were to be expected that can nevertheless have an impact in practice (Martell et al., 1996) and a meta-study by Eagly et al. (2003) on gender differences in managerial behavior should be highlighted in this context. The values determined for Cohen’s *d* ranged from 0.02 to a maximum of 0.27.

⁷The category “other research associates employed” is a residual category for all scientific employees with an employment contract (as distinct from a fellowship or *Fördervertrag*) who have not identified themselves with the other scientific categories and also not as student/graduate assistants, trainees, or interns. In practice, the “other research associates employed” form a separate group of persons of permanent scientists, which in practice most closely intersects with postdocs and research group leaders.

⁸The methodological added value of calculating and comparing estimated marginal means instead of reporting results directly from the overview of parameter estimates is that reference categories can be flexibly calibrated, just as it makes the most sense for testing the individual hypotheses.

Since the post hoc analyses performed did not consider all possible contrasts of the estimated marginal means, but only the ones relevant for testing the formulated hypotheses, no automatic alpha-level correction was applied. The analysis was performed with SPSS and the syntax code of the analysis is part of the SPSS output included in the online appendix⁹.

Isolated statistical outliers in univariate correlations were identified but when checked they were not found to contain logically incoherent answers. The tests for normal distribution were omitted for two reasons.

First, *t*-tests and linear regressions are deemed to be robust to violations of normal distribution (Lumley et al., 2002). Second, all examined group constellations of the samples comprise at least 20 cases, which is why, due to the central limit theorem, assumptions about the distribution of the sample as a prerequisite for *t*-tests become secondary (Kwak and Kim, 2017; Pituch and Stevens, 2016, p. 224).

Levene tests were performed to check for heterogeneity of variances and these were predominantly significant ($\alpha = 0.05$). Robust estimators were thus used. As the population of cases in the cell categories was very unbalanced, the calculation of the regression models was performed with the Type III sum of squares, which is particularly suitable for the calculation of unbalanced models (IBM, 2020).

Results

The mean values of the first outcome variable – the main construct group climate – were estimated using the following regression equation¹⁰:

⁹The online appendix can be accessed at: https://github.com/clemensstriebling/diversity_and_discrimination_in_RPOs.

¹⁰No checks were made for age and contract type. This was due to data protection considerations. If these variables were also considered, it would have been possible to identify individual persons within the MPG and to estimate the response mean for them. In accordance with good scientific practice, care was therefore taken to ensure that all possible combinations of characteristics were stored with at least five cases. Nevertheless, to test the hypothetical assumptions of the reviewers, the regression models were calculated with age (age groups 15–29, 30–44, 45–59, and 60 and older (reference group 45–59)) and contract type (temporary or permanent) without publishing the regression parameters here.

The following results were obtained: The age group 15–29 evaluates the group climate and the perception of leader considerably more positively than the other age groups. Between the other age groups, the differences in the evaluation of group climate and perception of leader are low and rather insignificant. Contract type has no relevant influence in either model. The two control variables have little effect on the data patterns in Figs. 1 and 2. No substantial change in the effects shown in the figures could be detected. “Substantial changes” are defined as those where the introduction of the control variable changes the effect direction as well as the inclusion of the null value in the 95% confidence interval. It should be noted that PhDs and postdocs at the MPG are generally employed on a temporary basis (in the dataset, less than 5 percent of respondents from this group reported having a permanent contract) and, of course, there is also a strong overlap of age and hierarchical position in the dataset, so that

$$\begin{aligned}
Y_{\text{Group climate}} = & \beta_0 + \beta_{\text{Female}} + \beta_{\text{EU}} + \beta_{\text{Non-EU}} + \beta_{\text{Children}} + \beta_{\text{DirectorRGL}} + \beta_{\text{Postdoc}} \\
& + \beta_{\text{OtherRes}} + \beta_{\text{Female} \times \text{Children}} + \beta_{\text{Female} \times \text{EU}} + \beta_{\text{Female} \times \text{Non-EU}} + \beta_{\text{Female} \times \text{DirectorRGL}} \\
& + \beta_{\text{Female} \times \text{Postdoc}} + \beta_{\text{Female} \times \text{OtherRes}} + e
\end{aligned}$$

The regression equation for the second outcome variable, perception of leader, was slightly modified for the reasons outlined above. No dummy variables were created for the category “directors and research group leaders” and the category “female directors and research group leaders.”

$$\begin{aligned}
Y_{\text{Perception of leader}} = & \beta_0 + \beta_{\text{Female}} + \beta_{\text{EU}} + \beta_{\text{Non-EU}} + \beta_{\text{Children}} + \beta_{\text{Postdoc}} + \beta_{\text{OtherRes}} \\
& + \beta_{\text{Female} \times \text{Children}} + \beta_{\text{Female} \times \text{EU}} + \beta_{\text{Female} \times \text{Non-EU}} + \beta_{\text{Female} \times \text{Postdoc}} + \beta_{\text{Female} \times \text{OtherRes}} + e
\end{aligned}$$

The parameter β_0 indicates the estimated mean value of the reference group for the respective main construct. This is thus based on all German male doctoral students who have no children under 18 in their household. The estimated regression parameters for the two outcome variables are presented in the sections “Group climate” and “Perception of leader” below. Using the means estimated from these equations, *t*-tests were performed to test the five formulated hypotheses. Furthermore, to test the formulated hypotheses, especially “differences of differences” were examined. These tests that, for example, compare whether the gender gaps in group climate differ statistically significantly between the hierarchical levels, were either taken directly from the regression equations in Appendices 1 and 2 or calculated manually.¹¹

A total of 39 *t*-tests were performed for the two outcome variables. Because the *p*-values reported were not automatically corrected, a Bonferroni-corrected alpha level of 0.001 was applied ($\alpha_{\text{Bonferroni}} = 0.05/39$).

Group Climate

H1: Effect of Gender. Appendix 3 shows the parameters of the regression equation used to estimate the mean of the group climate. Based on this equation, an estimated marginal mean of the group climate for female researchers of 3.797 was calculated. For male researchers, the estimated mean is 3.892, resulting in a conditional difference of -0.095 (95% CI: $-0.163/-0.028$, SE = 0.034, $p = 0.006$). All calculated mean differences are summarized in Fig. 1. The figure thus represents the effect size of the conditional difference between the hypothetically relevant groups.

these variables appeared to be dispensable, not only for data protection, but also for theoretical considerations.

¹¹The following formula was used to manually calculate the hypothesis tests (Paternoster et al., 1998):

$$z = (\beta_1 - \beta_2) / \sqrt{((SE \beta_1)^2 + (SE \beta_2)^2)}.$$

The *p* value and Standard errors were calculated using the following formulas (Altman and Bland, 2011):

$$\begin{aligned}
p = & \exp(-0.717 * z - 0.416 * z^2) \\
SE = & \text{Estimate} / z.
\end{aligned}$$

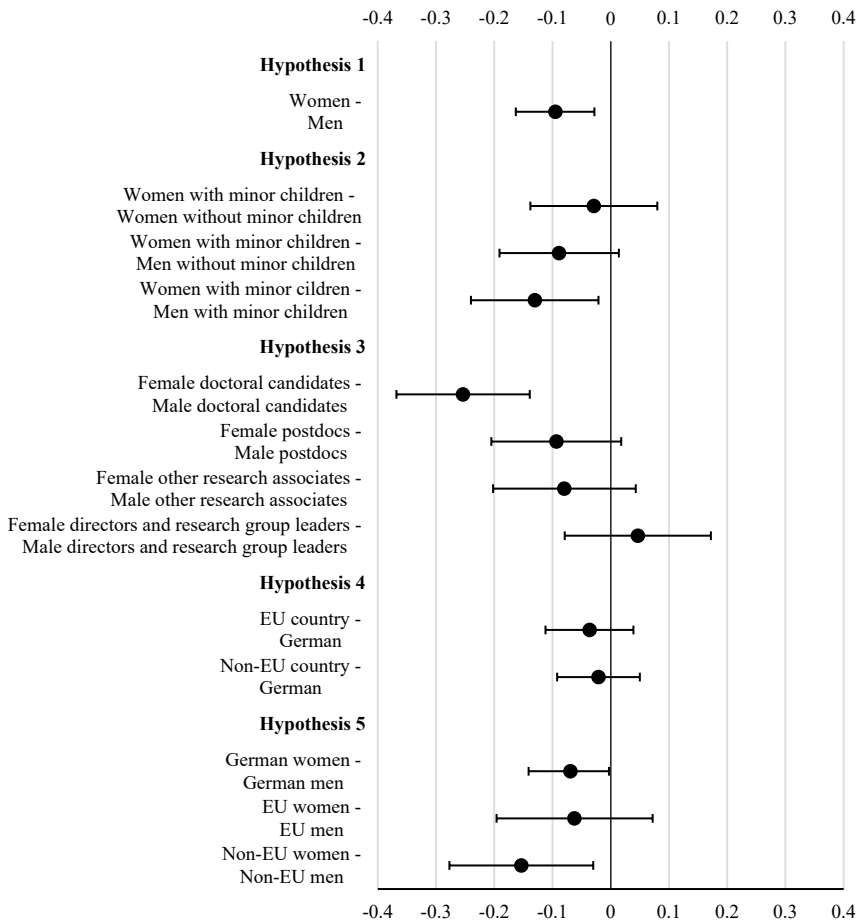


Fig. 1. Conditional Differences Between the Estimated Marginal Means for the Hypothetical Relationships of Group Climate. 95% Confidence Interval.

H2: Interaction Effect of Gender and Care for Underage Children. The responses of female researchers with children under the age of 18 in their household had an estimated mean of 3.782. This is 0.029 (95% CI: $-0.138/0.080$, SE = 0.055, $p = 0.601$) lower than the mean of female researchers without children under 18 and 0.089 (95% CI: $-0.191/0.014$, SE = 0.052, $p = 0.089$) lower than the mean of male researchers without children under 18. Between female researchers and male researchers with minor children in the household, the difference amounts to -0.130 (95% CI: $-0.240/-0.021$, SE = 0.056, $p = 0.020$).

H3: Interaction Effect of Gender and Hierarchical Position. The estimated mean of the group climate of female doctoral candidates is 3.550. This is 0.254 (95% CI: $-0.368/-0.139$, SE = 0.058, $p = 0.000$) lower than the mean of male doctoral candidates. For postdocs, women have a mean of 3.610 and men 3.703, which corresponds to a difference of -0.093 (95% CI: $-0.205/0.018$, SE = 0.057,

$p = 0.101$). For other research associates, the mean score for females is 3.774 and males differ from this by -0.080 (95% CI: $-0.202/0.043$, SE = 0.062, $p = 0.201$). Female directors and research group leaders reported an estimated mean for group climate of 4.253, while males reported a difference of 0.047 (95% CI: $-0.079/0.172$; SE = 0.064, $p = 0.465$).

Comparing the gender gaps in the evaluation of the group climate, it was found that the higher the hierarchical position of a female researcher, the more positively she will rate the work climate relative to male researchers on the same hierarchical level. The gender gap for postdocs is 0.160 smaller than for doctoral candidates (95% CI: 0.015/0.306, SE = 0.074, $p = 0.031$) while for other research associates, the gender gap is 0.014 points lower than for postdocs (95% CI: $-0.195/0.223$, SE = 0.107, $p = 0.904$). The gender gap between directors and research group leaders is 0.126 lower than among other research associates (95% CI: $-0.098/0.350$, SE = 0.114, $p = 0.273$) and smaller than for postdocs by 0.140 (95% CI: $-0.081/0.361$, SE = 0.113, $p = 0.216$).

H4: Effect of Nationality. The estimated mean score of German researchers is 3.863, whereas the mean score of EU researchers is 0.036 lower (95% CI: $-0.112/0.039$, SE = 0.038, $p = 0.347$). The score of non-EU researchers differs by -0.021 (95% CI: $-0.092/0.050$, SE = 0.036, $p = 0.561$). Thus, a 0.015 higher estimated marginal mean of the group climate was estimated for non-EU researchers than for EU researchers (95% CI: $-0.074/0.104$, SE = 0.045, $p = 0.737$).

H5a and H5b: Interaction Effect of Gender and Nationality. Female German researchers have an estimated mean of 3.829 for the group climate. This is 0.069 (95% CI: $-0.141/-0.003$, SE = 0.037, $p = 0.060$) lower than the mean score of male German researchers. The group climate mean score of female EU female researchers is 3.796, which differs from the mean of male EU researchers by -0.062 (95% CI: $-0.196/0.072$, SE = 0.068, $p = 0.361$). Female non-EU researchers rated the group climate on average with 3.766 which is 0.154 (95% CI: $-0.277/-0.030$, SE = 0.063, $p = 0.015$) lower than the estimated marginal mean of male non-EU researchers.

The difference in gender gaps between German and EU researchers is 0.007 (95% CI: $-0.144/0.158$, SE = 0.077, $p = 0.929$) and between German and non-EU researchers -0.084 (95% CI: $-0.226/0.057$, SE = 0.072, $p = 0.242$). EU researchers and non-EU researchers differ by -0.091 (95% CI: $-0.298/0.116$, SE = 0.105, $p = 0.395$).

Perception of Leader

The regression equation for the evaluation of the perception of leader is comparable to that of the group climate (Appendix 4). While there is a smaller difference between male and female doctoral candidates, at the same time, more pronounced conditional mean differences can be observed for several other variables, including the main effect of gender (Fig. 2).

H1: Effect of Gender. Female researchers have an estimated marginal mean of 3.590 for the perception of leader, which differs from that of males by -0.136 (95% CI: $-0.211/-0.061$, SE = 0.038, $p = 0.000$).

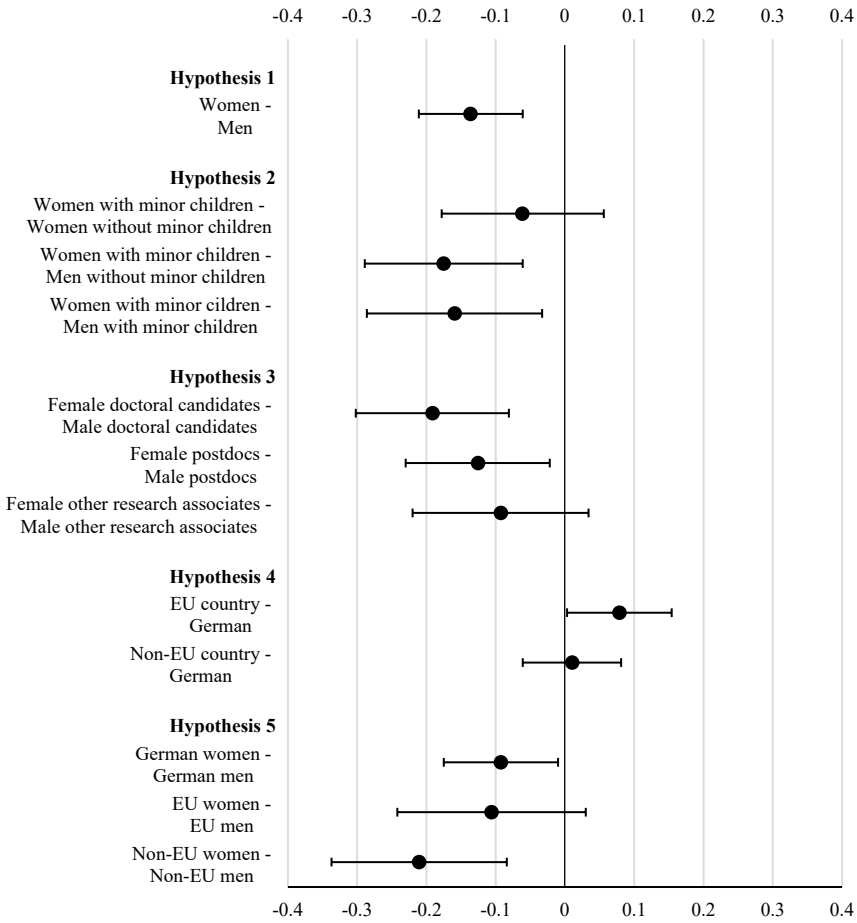


Fig. 2. Conditional Differences Between the Estimated Marginal Means for the Hypothetical Relationships of Perception of Leader. 95% Confidence Interval.

H2: Interaction Effect of Gender and Care for Underage Children. Female researchers with children below the age of 18 in their household have a mean score of 3.559 for perception of leader. Compared to female researchers without minor children in their household, this mean score is 0.062 (95% CI: $-0.179/0.056$, SE = 0.060, $p = 0.303$) lower and it is 0.175 (95% CI: $-0.290/-0.061$, SE = 0.058, $p = 0.003$) lower compared to that of male researchers without children. The difference to the mean of men with minor children in their household is -0.159 (95% CI: $-0.286/-0.033$, SE = 0.065, $p = 0.014$).

H3: Interaction Effect of Gender and Hierarchical Position. The gender and position interaction again compared gender differences at the individual position level. Female doctoral candidates have a mean score on perception of leader of 3.553. This differs from male doctoral candidates by -0.191 (95% CI: $-0.302/-0.081$,

SE = 0.056, $p = 0.000$). Female postdocs have a mean of 3.580, which is 0.126 (95% CI: $-0.229/-0.022$, SE = 0.053, $p = 0.017$) lower than that of male postdocs. Females employed in the “other research associates” category answered the items on the perception of leader with an estimated mean of 3.637 which is 0.093 (95% CI: $-0.219/0.034$, SE = 0.065, $p = 0.152$) below the mean score of their male peers.

It can be stated that the higher the hierarchical position, the lower is the gender gap in the assessment of the perception of the leader. The gender gap for postdocs is 0.066 smaller than for doctoral candidates (95% CI: $-0.071/0.202$, SE = 0.070, $p = 0.345$) while for other research associates, the gender gap is 0.033 points lower than for postdocs (95% CI: $-0.032/0.098$, SE = 0.033, $p = 0.322$).

H4: Effect of Nationality. German researchers rated the perception of leader at 3.628. In contrast, researchers from other EU countries rated the perception of leader 0.079 (95% CI: 0.003/0.154, SE = 0.039, $p = 0.041$) higher and non-EU researchers 0.010 (95% CI: $-0.061/0.081$, SE = 0.036, $p = 0.774$) higher. The difference in the conditional estimated marginal means between EU and non-EU researchers is thus 0.068 (95% CI: $-0.019/0.155$, SE = 0.044, $p = 0.124$).

H5a and H5b: Interaction Effect of Gender and Nationality. For female German researchers, the assessment of perception of leader yielded an estimated marginal mean of 3.582. This mean differs from that of German males by -0.093 (95% CI: $-0.175/-0.010$, SE = 0.042, $p = 0.029$). Female EU researchers have a mean of 3.654, which is 0.106 (95% CI: $-0.242/0.030$, SE = 0.069, $p = 0.126$) lower than that of male EU researchers. Female researchers from non-EU states have a mean of 3.533, which is 0.211 (95% CI: $-0.337/-0.084$, SE = 0.065, $p = 0.001$) lower than the mean of males.

The gender gaps between German and EU researchers differ by -0.013 (95% CI: $-0.165/0.138$, SE = 0.077, $p = 0.861$) and between German and non-EU researchers by -0.118 (95% CI: $-0.260/0.024$, SE = 0.073, $p = 0.104$). The gender gaps of EU and non-EU researchers differ by -0.105 (95% CI: $-0.847/0.637$, SE = -0.379 , $p = 0.794$).

Fig. 2 shows that the largest differences in the estimated marginal means exist between female and male doctoral candidates and between female and male researchers from non-EU states. These mean differences are also robust regarding the false-positive error. In general, all tests performed for the perception of leader show a similar tendency as those concerning the group climate. An exception is a statistical weak deviation for the main effect of nationality, as although foreign researchers perceive a less favorable group climate than German researchers, their evaluation of the perception of leader is higher.

Interpretation

As outlined above, the data was derived from a full survey conducted by the MPG, and hence the results are only valid for the MPG due to its specific contextual conditions. The evaluation of the hypotheses is therefore based on the effect sizes. In addition, however, statements are made about the statistical significance of the effects. Of the 39 significance tests carried out, 14 were below

the uncorrected significance threshold of 0.05, and of these, four were below the Bonferroni-corrected significance threshold of 0.001.

Table 5 presents the interpretation of the results depending on the effect sizes obtained concerning the five hypotheses established. *H1*, *H2*, and *H5b* correctly predicted the results while *H3* and *H4* are to be modified in the outcome of the study.

Contrary to what was predicted by *H3*, it was shown that female researchers at the level of doctoral candidates perceive group climate and perception of leader less positively than men (*p*-value below the corrected significance level). A similar effect direction was observed for postdocs and other research associates employed, albeit with less pronounced effects. At the level of directors and research group leaders, female researchers rated the group climate more positively than male researchers (no robust *p*-values). Figs. 1 and 2 imply the following weak pattern: female doctoral candidates rate the group climate and perception of leader lower than males. This difference becomes more evenly distributed with each hierarchy level, that is, at the level of postdocs and other employed research associates. Once a researcher reaches the level of a director or research group leader, the assessment of group climate changes its direction: female researchers evaluate this main construct better than men. Thus, the results do not support the role congruity theory but rather contradict its predictions.

One possible explanation for the interaction of gender and position on group climate and perception of leader are filter mechanisms in scientific careers, due to which female researchers tend to drop out more frequently in the Ph.D. or postdoc phases than males. Due to societal role expectations, especially regarding parenthood, and institutional gender biases, female researchers face greater hurdles than men to remain in the research system, which is presumably also reflected in a lower-rated work climate (Williams et al., 2014; Moss-Racusin et al., 2012; Sobieraj and Krämer, 2019; Oh et al., 2018; Eagly and Wood, 2012). As a result, at the level of directors and research group leaders, female researchers of the MPG sample appear to have a higher “professional fit” than males. This filter thesis will be discussed in more detail in the conclusion section as a central result of this study.

Unlike predicted in *H4*, only minor differences were found in the conditional mean values between the nationality groups. For perception of leader, the conditional mean value of the EU researchers is higher than that of the German researchers, while the conditional mean value of the non-EU researchers does not deviate relevantly from that of the German researchers.

Consequently to the lack of support for *H4*, *H5a* was also not in line with the results as German male researchers and non-EU female researchers do not represent two maximum poles in the evaluation of the working climate. However, *H5b* was supported as a complex interaction of gender and nationality is discernible from the results. While the gender gap in the evaluation of group climate and perception of leader is comparable for German and EU researchers, the gender gap is about twice as pronounced for non-EU researchers. Contrary to predictions, the results suggest that in terms of psychological work climate, it is not male German researchers who form the maximum contrast pole to female non-EU researchers, but male non-EU researchers.

Table 5. Interpretation of the Hypotheses According to Effect Sizes.

Hypotheses	Factors on Work Climate	Hypothesis	Interpretation Group Climate	Interpretation Perception of Leader
1	Gender	Female researchers perceive their work climate less positively than their male colleagues	Supported ^a	Supported
2	Gender × Children below 18	Female researchers that have children under the age of 18 in their household perceive their work climate less positively than male researchers in general, male researchers with children, and female researchers without children or with older children	Supported	Supported
3	Gender × Position	The gender gap in the perception of work climate increases with higher career levels	Not supported	Not supported
4	Nationality	Foreign researchers perceive their work climate less positively than German researchers. Researchers with a non-EU nationality rate their work climate the least positive of all	Not supported	Not supported
5a	Gender × Nationality	The gender gap in the evaluation of the working climate is largest between male German researchers and female researchers from non-EU countries. All other subgroups fall between these two poles	Not supported	Not supported
5b	Gender × Nationality	The size of the gender gap in perceptions of the work climate varies across nationality groups	Supported	Supported

^a All tests conducted related to a hypothesis are below the Bonferroni-corrected significance threshold of $\alpha = 0.001$.

Conclusion

The starting point of this study was the question whether female and foreign researchers perceive the work climate differently than their male and German colleagues and whether there are interactions between gender and nationality and between gender and responsibility for underage children and hierarchy position that contribute to this perspective. To investigate this question, a full survey of researchers from the MPG, one of the largest German non-university research institutions, was used. It should be noted that these findings refer to average values and thus to general tendencies among the researchers of the MPG. It cannot be ruled out that at the level of individual institutes or research groups there may be an accumulation of problematic or commendable behavior due to the misconduct or excellence of individuals or situational group dynamics.

Theoretical Implications

The main findings of the study can be summarized by stating that, in general, female researchers perceive the work climate less favorably than male researchers. Responsibility for minor children also has a negative effect on the assessment of the work climate for female researchers (in contrast to men), albeit only weakly. A consistent and robust effect of nationality on the assessment of the work climate in the sense of the formulated hypothesis could not be identified. Nevertheless, the nationality of the respondents interacts with gender in the evaluation of the work climate. While female researchers generally rate the work climate lower than their male colleagues, this gender effect is most pronounced among researchers without EU citizenship. Since no further distinctions were made between individual nationalities in the survey, no further interpretations of this interesting interaction effect of gender and nationality are made here. A differentiated survey of different perceptions of the work climate according to different cultural groups or nationalities, or a qualitative study of the work-related experiences of male and female academics from non-EU countries in Germany should thus be the subject of future studies.

The most interesting finding from the author's point of view concerns the interaction effect between gender and the position of a researcher. At the level of doctoral candidates, female researchers of the MPG rated group climate and perception of leader relevantly lower. On the higher hierarchical levels of post-docs and other research associates employed, this effect levels out and changes its direction for the leadership positions, whereby female directors and research group leaders rate the group climate slightly more positively than men.

Next to other equally plausible explanations, it is conceivable that the gender differences in the assessment of the work climate between the individual hierarchical levels are a result of filter mechanisms in research careers. If one follows this speculation, the observed interaction effects can be regarded as support for the social role hypothesis – in a different way than expected. Accordingly, female researchers would experience a lower workplace integration and thus rate the work climate less positively than men. If one followed this argumentation, no

relevant statistical correlation between the gender of a researcher and the psychological work climate could be shown above the level of early career researchers simply because persons with more negative perceptions of the work climate have left at or after the junior researcher level. However, to test this hypothesis would require a gender analysis of MPG researchers that drop out as part of another study.

The case of the MPG showed that female early career researchers rate the climatic conditions at the workplace less positively than their male peers. Another competing explanation for this finding could be that the skepticism of female junior researchers merely diminishes during the course of their research careers. However, in accordance with the research literature and in the face of a de facto female drop out, the above-mentioned filter mechanisms are considered more likely.¹² According to this interpretation, during a research career, especially persons with a below-average professional fit would leave – which would affect women more often than men. Accordingly, among research leaders, persons with an above-average professional fit would be overrepresented among women compared to men.

This interpretation is consistent with previous research, according to which women face disproportionately higher career hurdles in research than men (Zacharia et al., 2020, pp. 34–35). The most significant career hurdles are seen in the lack of compatibility between temporary employment and uncertain career opportunities in science with pregnancy and the tasks arising from a classically stereotypical role of motherhood (Zacharia et al., 2020). However, as a third possible explanation, the results of this study could be also in line with social role theory's thesis of a gender bias in the perception of leadership ambitions and competence attributions of female researchers (Williams et al., 2014; Eagly and Karau, 2002) as a result of which female early career researchers perceive a less favorable work climate than their male peers. The results do not explicitly provide evidence for role congruency theory as it could not be shown that the evaluations of women concerning the psychological work climate are lower with each subsequent hierarchical level but rather that the opposite is true: the psychological work climate is increasingly more positively evaluated as women advance in their career.

The results of the present study could also be plausibly interpreted in light of the so-called “queen bee” syndrome. According to this theory, upward mobility, that is, the assumption of leadership tasks in a male-dominated environment,

¹²As in most German research organizations, the proportion of women in the Max Planck Society decreases with each successive hierarchical level. Of 3,502 researchers in the data set who provided corresponding information on gender and position, 43 percent of the doctoral candidates are female. Among postdocs, women make up 40 percent, among other research associates employed 36 percent, and among directors and research group leaders, 30 percent. Looking only at the 1,161 researchers with children surveyed, the gender gap is wider: women make up 44 percent of doctoral candidates, 34 percent of postdocs, 32 percent of other research associates, and 23 percent of directors and research group leaders.

goes hand in hand with self-distancing from the stereotypes of the marginalized group. As a result, female scientific leaders generally see themselves as non-prototypical women, attribute a higher professional fit to themselves, and tend to stereotype other women more strongly (Ellemers et al., 2004; Derks et al., 2016). Accordingly, female researchers in leadership positions are under greater pressure to distinguish themselves in their self-conception from female junior researchers than is the case with male leaders and male junior researchers. If one followed this argumentation, it would be conceivable that this overcompensation leads to a narrowing of the gender gap in the evaluation of the work climate among researchers with leadership responsibilities compared to early career researchers – which cannot be ruled out based on the data analyses.

As a summary of the theoretical discussion, the following can be stated: The results of this study show that, for the MPG, female early career researchers rate the work climate less positively than male researchers. In the course of the filter argument, it could be speculated that (among other things) this lower, self-perceived “professional fit” would lead to a higher drop out of female researchers. It could further be speculated that the women who do remain in research and continue to rise up the career ladder, would in turn feel greater pressure to self-distance from female junior researchers. This in consequence could limit the effectiveness of mentoring relationships between female mentors and mentees. The purely speculative further development of the observations made in this study offers a starting point for elaboration in future studies. A correlation between the less positive assessment of work climate by female early career researchers and a higher drop out probability would first have to be examined.

Practical Implications

The study carried out provides partly intuitive and somewhat surprising evidence of differences in the assessment of the working climate among the employees of one of the largest research organizations in Germany, determined by the sociodemographic characteristics of the respondents. From a management perspective, the results of this study can be used, in particular, to derive implications for the target groups of organizational support measures:

- It is proven that women in Germany bear the main share of care work in the home (Institute for Social Work and Social Education, 2020). The study implies that the responsibility for minor children also affects the perception of researchers concerning the psychological work climate. According to the study, male researchers with young children are, on average, presumably in a different life situation than female researchers with children. While female researchers need explicit support structures here, the majority of fathers did not seem to face bigger challenges in reconciling care responsibilities with their careers.
- The study indicates that female researchers without EU citizenship experience a considerably different working environment than their male counterparts. Research institutions should collect data to better understand the situation of this group and provide targeted support.

- In public discourse, the distorted perception and evaluation of the behavior of female research managers in terms of role congruity theory is justifiably receiving increasing attention (Reimer and Welp, 2021; Egner and Uhlenwinkel, 2021; Abbott, 2021). The present study indicates that in academic careers, it is female early career researchers in particular who rate the work climate less positively. The less positive average perception of the work climate in research and academic organizations could be a major reason why women leave academic careers in disproportionate numbers and are consequently underrepresented in leadership positions. In this respect, the results of the study substantiate the relevance of career development measures that are specifically targeted at female early career researchers as well as measures to prevent sexist behavior in the workplace.

At the organizational level, it must be ensured that research managers are provided with, and are aware of, a comprehensive toolbox with which they can realize equality and equal opportunities (e.g., a reconciliation-sensitive performance evaluation system, mentoring schemes, scholarships). Research managers, in turn, should seek regular and structured exchanges with their employees to actively support them in their career development and, if necessary, with the institution's own support measures. Schraudner et al. (2019, p. 43) point to the considerable correlation between regular development-oriented discussions between superiors and employees and the assessment of group climate and perception of a leader. In the MPG sample, three out of four researchers had such conversations (Schraudner et al., 2019). The data also show that female researchers have personal meetings with their superiors less often than male researchers and that German nationals have them less often than foreigners (Schraudner et al., 2019).

Academia is largely a "self-regulating profession" in which peers can have a large influence on work-related successes and failures. This culture of peer governance reaches its limits when subjective biases or tolerance of colleagues' misconduct undermine the objectivity of career development, support, and performance evaluation (Keashly, 2019). In this respect, structured and documented development conversations, in addition to anti-bias training, can be regarded as instruments of rationalization and professionalization as well as a means of creating equal opportunities.

Finally, it should be recognized that an inclusive research culture is also being discussed at the structural level. The British Wellcome Trust and Science Europe, as well as the European Commission, should be mentioned as drivers here. With the help of the Horizon Europe research framework program, comprehensive funding calls have been and are being launched that also aim at a cultural change toward more inclusive research organizations (e.g., European Union 2021).

Transferability and Limitations

A particular strength of the present study is the size of its sample, which provides very good coverage of the target population and high statistical power due to its large sample size in relation to comparable studies (e.g., the MORE project, the

Gender Gap in Science project, or the Wellcome Trust). At the same time, there is the limitation that all results exclusively refer to the case of the MPG and its research institutions. In view of the specific contextual conditions of the MPG, the question arises as to what extent the results of this study are transferable to other research institutions, including universities. Regarding the interactions of gender and position and gender and nationality on the work climate, there is no reason why the effects found should only apply to the MPG and it is debatable whether both effects are not even more pronounced in the university context. It was shown that, on average, female doctoral candidates rate the group climate less positively than male candidates. It should thus be investigated whether the more frequent social interactions with students and the concomitant higher vulnerability of experiences of “contrapower harassment” (Lampman, 2009), especially due to teaching responsibilities at the university, strengthen or weaken the interaction effect of gender and position on work climate. This question also applies to the more pronounced gender difference among non-EU researchers. In addition, the proportion of foreign researchers at German universities is much lower than at the MPG. Therefore, it is conceivable that foreign researchers at universities perceive themselves much more strongly as being in a minority role and correspondingly experience a poorer work climate.

As mentioned, a further limitation of the study is that only the psychological work climate was surveyed and not a collective work climate. A multilevel study would have made it possible to take cluster effects caused by research groups or institutes that deviate positively or negatively from the average work climate into account.

Finally, the requirements of data protection also limited the theoretically possible complexity of the regression equations. Although the experiments with control variables showed that the regression models are largely robust, it would have been very interesting to have taken the disciplinary context into account in more detail as research disciplines are considered in Striebing on academic bullying in this collection by omitting the variable on care responsibility.

Impulses for Future Research

Based on the results of this study, there are two particularly promising future research perspectives in addition to the usual need for reproduction and validation. Firstly, cost-benefit analyses are needed to assess the social impact of the effect sizes determined here. The effect sizes determined for the interaction of gender and position state that the interaction of the two variables explains between 1.2 percent and 6 percent of the variance of the relevant subdimensions of the work climate. In a computer simulation for an organization with eight hierarchical levels, with 500 positions at the lowest level and 10 positions at the highest level, Martell et al. (1996) showed that even a slight gender bias in the promotion evaluation can lead to a remarkable shift in the gender balance among the top positions in an organization. With a gender bias with an effect size of 1 percent, the proportion of women at the lowest level decreases from 53 percent to 35 percent at the highest level. Comparable cost-benefit analyses of the

connection between psychological work climate and exit from a research career would be desirable.

Second, in the context of the present edited collection, it is worth discussing whether the filter mechanisms discussed could be particularly effective in a research system that works like a “flow heater system,” in which junior researchers have only temporary and part-time contracts for a long time, career prospects are unclear, and performance and competitive thinking are encouraged. Gendered filter mechanisms can plausibly be embedded in the theoretical literature on the masculinization of work culture in science in the context of the diffusion of New Public Management institutions (Thomas and Davies, 2002; Brorsen Smidt et al., 2020). However, this connection has not yet been presented in the context of quantitative studies. Such quantitative studies can only be comparative internationally because it is very likely that the research system before its reformation 20 or 30 years ago, with its ivory tower structures and old boys’ networks, was even more gender-biased than the modern research system is assumed to be.

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Appendices

1. Outcome Variables and Item Construction

Please answer the following questions.

[scaling: Not at all, Slightly, Moderately, Very, Completely]

Vision of a group, its clearness and relevance

- How clear are you about what your group's objectives are?
- How far are you in agreement with these objectives?
- To what extent do you think your group's objectives are clearly understood by other members of the group?
- To what extent do you think your group's objectives can actually be achieved?
- How worthwhile do you think these objectives are to your institute or facility?

Task orientation of a group

- Do members of the group build on each other's ideas in order to achieve the best possible outcome?
- Are group members encouraged to question the basis of what the group is doing?
- Does the group try to identify and address its own flaws and shortcomings, so as to become more effective in what it does?

Do you agree with the following statements about your group?

[scaling: Strongly disagree, Disagree, Neither agree nor disagree, Agree, Strongly agree]

Participation safety of a group

- People keep each other informed about work-related issues in the group.
- People feel understood and accepted by each other.
- Everyone's opinion is listened to even if it is unpopular.
- There are real attempts to share information throughout the group.

Support of innovation of a group

- People in this group are always searching for fresh, new ways of looking at problems.
- In this group we take the time needed to develop new ideas.
- People in the group work together to develop and implement new ideas.

Do you agree with the following statements?

My immediate superior at my institute or facility at the Max Planck Society...

[scaling: Strongly disagree, Disagree, Neither agree nor disagree, Agree, Strongly agree]

Employee-orientation of a leader

- ... respects their subordinates.
- ... is considerate.
- ... allows their subordinates to make decisions.
- ... relies on their subordinates.
- ... is friendly.

Change-orientation of a leader

- ... offers ideas about new and different ways of doing things.
- ... sees possibilities rather than problems.
- ... initiates new projects.
- ... experiments with new ways of doing things.
- ... thinks about and plans for the future.

Structure-orientation of a leader

- ... plans carefully.
- ... is very rigid or exacting about plans being followed.
- ... gives clear instructions.
- ... is controlling in their supervision of subordinates' work.
- ... makes a point of following rules and procedures.

Please answer the following questions.

My immediate superior at my institute or facility...

[scaling: Not at all, Slightly, Moderately, Very, Completely]

Support of a leader as a mentor

- ... uses their influence to advance my career.
- ... supports me in planning my career.
- ... shields me when I am improperly criticized.
- ... gives me tasks through which I can further develop my skills.
- ... brings me into contact with people who can positively influence my career.

2. Descriptive Statistics and Cronbach's Alpha of Outcome Variables

Table A1. Descriptive Statistics and Cronbach's Alpha of Outcome Variables (the Analyzed Main Constructs and Their Subconstructs Are Shown). The Values Refer to the Distribution of the Variables in the Whole Dataset. The Descriptive Statistics of the Analyses Performed Are Given Below.

Variable Name	<i>N</i>	Max. Item Number	Min.	Max.	Mean	SD	Cronbach's Alpha
Main construct: Group climate	3,891	15	1.00	5.00	3.784	0.753	0.899
Vision of a group, its clearness and relevance	3,837	4	1.00	5.00	3.944	0.662	0.833
Task orientation of a group	3,681	3	1.00	5.00	3.574	0.982	0.826
Participation safety of a group	3,865	4	1.00	5.00	3.875	0.858	0.864
Support of innovation of a group	3,726	3	1.00	5.00	3.736	0.905	0.830
Main construct: Perception of leader	4,210	20	1.00	5.00	3.693	0.742	0.827
Employee-orientation of a leader	4,196	5	1.00	5.00	4.163	0.819	0.895
Change-orientation of a leader	4,146	5	1.00	5.00	4.004	0.846	0.877
Structure-orientation of a leader	4,133	5	1.00	5.00	3.228	0.820	0.780
Support of a leader as a mentor	3,862	5	1.00	5.00	3.319	1.125	0.919

3. Parameter Estimates of Group Climate

Table A2. Parameter Estimates with Robust Estimators for Group Climate.

<i>Parameter</i>	<i>B</i>	<i>SE</i>	<i>95% Wald Confidence Interval</i>		<i>Hypothesis Test</i>		
			<i>Lower</i>	<i>Upper</i>	<i>Wald Chi-Square</i>	<i>df</i>	<i>Sig.</i>
Intercept	3.789	0.0301	3.730	3.848	15,855.391	1	0.000
Gender (Female)	-0.193	0.0508	-0.292	-0.093	14.376	1	0.000
Gender (Male)	Reference	-	-	-	-	-	-
Nationality (EU)	-0.040	0.0478	-0.133	0.054	0.685	1	0.408
Nationality (Non-EU)	0.021	0.0432	-0.064	0.106	0.240	1	0.624
Nationality (German)	Reference	-	-	-	-	-	-
Children below 18 (yes)	0.041	0.0389	-0.035	0.118	1.132	1	0.287
Children below 18 (no)	Reference	-	-	-	-	-	-
Position (Directors and research group leaders)	0.403	0.0493	0.306	0.499	66.692	1	0.000
Position (Postdocs)	-0.100	0.0459	-0.190	-0.010	4.785	1	0.029
Position (Other research associates)	0.050	0.0456	-0.039	0.139	1.205	1	0.272
Position (doctoral candidate)	Reference	-	-	-	-	-	-
Gender (Female) × Nationality (EU)	0.007	0.0770	-0.144	0.158	0.008	1	0.929

(Continued)

Table A2. (Continued)

<i>Parameter</i>	<i>B</i>	<i>SE</i>	<i>95% Wald Confidence Interval</i>		<i>Hypothesis Test</i>		
			<i>Lower</i>	<i>Upper</i>	<i>Wald Chi-Square</i>	<i>df</i>	<i>Sig.</i>
Gender (Female) × Nationality (Non-EU)	-0.084	0.0721	-0.226	0.057	1.368	1	0.242
Gender (Female) × Children below 18 (yes)	-0.070	0.0677	-0.203	0.062	1.079	1	0.299
Gender (Female) × Position (Directors and research group leaders)	0.300	0.0847	0.134	0.466	12.579	1	0.000
Gender (Female) × Position (Postdocs)	0.160	0.0743	0.015	0.306	4.669	1	0.031
Gender (Female) × Position (Other research associates)	0.174	0.0764	0.024	0.324	5.187	1	0.023
(Scale)	0.519	0.0135	0.493	0.546	—	—	—

4. Parameter Estimates of Perception of Leader

Table A3. Parameter Estimates with Robust Estimators for Perception of Leader.

Parameter	B	SE	95% Wald Confidence Interval		Hypothesis Test		
			Lower	Upper	Wald Chi-Square	df	Sig.
Intercept	3.700	0.0301	3.641	3.759	15,095.914	1	0.000
Gender (Female)	-0.124	0.0486	-0.220	-0.029	6.553	1	0.010
Gender (Male)	Reference	-	-	-	-	-	-
Nationality (EU)	0.085	0.0483	-0.009	0.180	3.120	1	0.077
Nationality (Non-EU)	0.069	0.0444	-0.018	0.156	2.444	1	0.118
Nationality (German)	Reference	-	-	-	-	-	-
Children below 18 (yes)	-0.016	0.0426	-0.099	0.068	0.140	1	0.708
Children below 18 (no)	Reference	-	-	-	-	-	-
Position (Postdocs)	-0.039	0.0435	-0.124	0.047	0.794	1	0.373
Position (Other research associates)	-0.015	0.0450	-0.103	0.073	0.106	1	0.745
Position (doctoral candidate)	Reference	-	-	-	-	-	-
Gender (Female) × Nationality (EU)	-0.013	0.0772	-0.165	0.138	0.031	1	0.861
Gender (Female) × Nationality (Non-EU)	-0.118	0.0725	-0.260	0.024	2.649	1	0.104

(Continued)

Table A3. (Continued)

<i>Parameter</i>	<i>B</i>	<i>SE</i>	<i>95% Wald Confidence Interval</i>		<i>Hypothesis Test</i>		
			<i>Lower</i>	<i>Upper</i>	<i>Wald Chi-Square</i>	<i>df</i>	<i>Sig.</i>
Gender (Female) × Children below 18 (yes)	-0.046	0.0734	-0.190	0.098	0.387	1	0.534
Gender (Female) × Position (Postdocs)	0.066	0.0695	-0.071	0.202	0.892	1	0.345
Gender (Female) × Position (Other research associates)	0.099	0.0767	-0.052	0.249	1.651	1	0.199
(Scale)	0.543	0.0143	0.515	0.572	-	-	-