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Jenny Vainio

HEGEMONY, CONTRADICTION, AND GENDER IN THE CONTEXT OF FINNISH UNIVERSITY PHYSICS

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Custos
Professor Yrjö Engeström, University of Helsinki

Supervisors
University Lecturer, Docent Annalisa Sannino, University of Helsinki
Professor Cathrine Hasse, University of Aarhus, Denmark

Pre-examiners
Professor Endla Lõhkivi, University of Tartu, Estonia
Professor Susan Meriläinen, University of Lapland

Opponent
Professor Tara Fenwick, University of Stirling, Scotland

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Abstract

This study takes its point of departure in the gender-gap phenomenon observed in most academic communities worldwide. The statistics show that academic women are less likely to advance in their university careers than their male colleagues. The female underrepresentation is especially severe in the scientific field of physics, which is the focus of this study.

Previous research on the gender-gap issue in the universities suggests that gender difference is produced through the prevailing structures of academic work. The evaluation and selection processes of academic staff are likely to render men as more competent than women. Moreover, the organization of academic work often puts women and men in reproductive age in unequal positions. Women, who still take most of the responsibility for family duties are less able to meet the implicit requirements of a disembodied academic worker. In Finland, family policies and gender-equality plans are targeted at providing equal career opportunities for women and men. Yet the persisting gender gap in Finnish academia indicates that gender inequality might not be only a matter of legislation.

Historical analysis shows that in the past centuries, Finnish physics departments were largely dominated by men, and women entered physics rather late in our country. From the 1960s onwards, the rapid development of the university scene has increased the number of physics departments and also the number of women in the field. However, there are still few female physicists who have reached the highest academic positions in physics. Also, the changes in university politics and research funding have affected women's careers more than men's as women are more likely to be recruited in temporary positions than men.

In order to further understand the social and historical processes behind the gender-gap phenomenon in physics, three concepts were chosen as theoretical resources of this study. Hegemony (Gramsci) captures the dialectical processes of resistance and integration behind social consent. Contradiction (Ilyenkov, Engeström) refers to the dynamics of socio-historical changes in Finnish academia. Gender is understood as a set of social and organizational processes (Acker) through which gender difference is produced in the context of university physics.

This study is based on qualitative data, namely semi-structured interviews with 36 Finnish physicists, both current and former university staff. In the data analysis, three intermediate concepts—alignments, turning points, and discursive manifestations of contradiction—were utilized as a bridge between the theoretical resources and the empirical data. As a data-analysis method, tools of discourse analysis and narrative analysis were used.

The analysis guided by the three intermediate concepts revealed several gendered patterns in the data. Analysis on alignments showed that women and men took up different alignments in relation to the professional images of a physicist as well as in relation to features of academic work such as teamwork and competition. Analysis on turning points in the physicists' careers indicated that the economic insecurity of university employment and the requirement for international mobility contributed to women's decisions to leave their academic careers more often than men's decisions. Analysis on discursive manifestations of contradictions pointed to gendered patterns in terms of sexual harassment, reconciliation of work and family, and administrative work.

When considering the data analysis results from the point of view of gendered career paths in physics, it can be suggested that men are more adapted to the prevailing images and norms of research work. They identified themselves with the idea of a lone scientist more often than women who preferred teamwork. Moreover, men expressed more willingness to enter the academic competition than women and it was generally easier for them to prioritize work over family than for women. At the same time, women have to adapt to the male-dominated workplace-interaction in order to survive sexual harassment. Women performed more willingness to take up administrative and supportive tasks than men who preferred research work. These different preferences and modes of interaction in the academic work might contribute to the fact that women and men are likely to pursue on different academic careers.

The data analysis also indicates a set of gendered processes and historical contradictions in the academic community of physics. For instance, sexual harassment can be interpreted as an interactional gendered process that has its roots in a contradiction between traditional male-dominated interactional rules and the current community of physicists where also women are present. The issue of reconciliation of work and family suggests a symbolic gendered process where the ideal image of a scientific worker implies a male researcher without family duties. Here, a contradiction between the traditional rules of organizing research work and the contemporary community of both male and female physicists can be traced.

The above-presented data-analysis results inform the concept of hegemony. The dialectical notion of hegemony calls for identifying processes through which hegemony becomes reproduced and/or contested. In the data, instances of integration and resistance were gendered and clustered around two poles. In

general, women expressed resistance against what can be called a traditional mode of academic work. At the same time, men integrated with it. On the contrary, men strongly resisted some of the current developmental trends in the academic working environment whereas women seemed to integrate with them more easily. Based on these observations of integration and resistance, it can be suggested that, in the context of Finnish universities, two types of hegemonic forces are at play. Male interviewees found their site of integration in the hegemonic idea of traditional academic work, whereas female interviewees expressed resistance against some of its features. Male resistance was targeted at the emerging hegemonic idea of a managerial university whereas female interviewees could integrate with it to an extent.

This study provides insights into the social and historical dynamics behind the gender gap in Finnish University Physics. It also illustrates some of the social and historical transformations that the physics community and the Finnish university scene have experienced in the past decades and the meaning of contradiction in any change in a human community. Even though the history of a male dominated academic field is still reflected in workplace realities, manifestations of female resistance have already led to changes in the academic environment. Similarly, resistance against current university changes performed mainly by men may function as a platform for transformations towards a more gender-equal academic community.

Key words: gender gap, university physicists, hegemony, contradiction, Finnish universities, activity theory

Helsingin yliopiston käyttäytymistieteiden laitos
Kasvatustieteellisiä tutkimuksia 244

Jenny Vainio

HEGEMONIA, RISTIRIITA JA SUKUPUOLI SUOMALAISEN YLIOPISTOFYSIIKAN KONTEKSTISSA

Tiivistelmä

Tutkimukseni lähtökohta on yliopistojen sukupuolikuilu, joka kuvaa naisten ja miesten akateemista työuraa. Kansainväliset tilastot osoittavat, että useimmissa maissa ja useimmilla aloilla miehet etenevät yliopistourallaan nopeammin ja pitemmälle kuin naiset. Tutkimuksessani keskityn tarkastelemaan sukupuolikuilua fysiikan alalla, jolla naisia on suhteellisesti erittäin vähän.

Aiemmat tutkimukset ovat osoittaneet, että akateeminen työ sisältää sukupuolieroja tuottavia käytäntöjä ja rakenteita. Akateemisissa arviointi- ja valintaprosesseissa miespuoliset tutkijat arvioidaan usein pätevämmiksi kuin naiset. Myös akateemisen työn organisointi asettaa usein miehet ja naiset epätasa-arvoiseen asemaan. Perheissä naiset kantavat yhä pääasiallisen vastuun lasten hoidosta ja pystyvät siksi vastaamaan huonommin tutkimustyön implisiittisiin vaatimuksiin: joustavuuteen työaikojen ja liikkuvuuden suhteen. Suomessa miesten ja naisten yhtäläisiä mahdollisuuksia työuran luomiseen on pyritty varmistamaan lainsäädännöllä ja tasa-arvosuunnitelmilla. Yliopistomaailman sukupuolikuilu on kuitenkin osoitus siitä, että sukupuolten eriarvoisuus ei ole korjattavissa pelkästään lainsäädännöllä.

Historiallinen analyysi osoittaa, että fysiikka on tieteenalana ollut maassamme varsin miehinen. Naisten osuus fysiikan opiskelijoista alkoi kasvaa vasta 1960-luvulla, ja edelleenkin vain harvat naiset ovat saavuttaneet fysiikan alan korkeimpia akateemisia virkoja. Myös tiedepolitiikan ja tutkimusrahoituksen muutokset vaikuttavat naisten akateemisiin työuriin, sillä naisia palkataan useammin määräaikaisiin työsuhteisiin kuin miehiä.

Tutkimukseni tavoite on ymmärtää fysiikan alan sukupuolikuilun taustalla vaikuttavia sosiaalisia ja historiallisia prosesseja kolmen teoreettisen käsitteen (hegemonia, ristiriita ja sukupuolittuneet organisaatioprosessit) kautta. Hegemonian käsite (Gramsci) kuvaa sosiaaliseen yksimielisyyteen sisältyviä vastarinnan ja sopeutumisen dialektisia prosesseja. Ristiriita (Il'enkov, Engeström) viittaa yliopistomaailman muutosten sosiohistorialliseen dynamiikkaan. Sukupuolittuneilla organisaatioprosesseilla tarkoitan mekanismeja (Acker), jotka tuottavat sukupuolieroa yliopistossa.

Tutkimusaineistoni koostuu 36 suomalaisen fyysikon haastattelusta. Haastateltavista puolet on miehiä ja puolet naisia. Puolet haastateltavista työskentelee yliopistolla, ja puolet on siirtynyt tutkijanuralta muihin töihin yksityiselle tai julkiselle sektorille. Haastattelumenetelmänä käytän puolistrukturoitua haastatte-

lua ja aineistoa analysoin diskurssianalyysin ja narratiivisen analyysin keinoin. Analyysivaiheessa käytän kolmea välitason käsitettä: liittouma, käännekohta ja ristiriidan diskursiivinen ilmaisu, jotka mahdollistavat yhteyden luomisen empiirisen aineiston ja teoreettisten käsitteiden välille.

Välitason käsitteiden avulla tehty analyysi osoittaa, että aineisto on monella tavalla sukupuolittunut. Nais- ja miesfyysikot liittoutuivat eri tavoin oman alansa ammatillisiin mielikuviin ja akateemisen työn osa-alueisiin kuten tiimityöhön ja kilpailuun. Käännekohtien analyysi osoittaa, että naisten päätös lopettaa yliopistoura liittyy useammin yliopistouran taloudelliseen epävarmuuteen ja vaatimukseen kansainvälisestä liikkuvuudesta kuin miesten päätös. Miehet ja naiset myös ilmaisevat eri tavoin diskursiivisia ristiriitoja seksuaalisen häirinnän, työn ja perheen yhteensovittamisen sekä hallinnollisen työn osalta.

Aineiston analyysin perusteella voidaan sanoa, että miesfyysikot mukautuvat naisfyysikoita paremmin tutkimustyön vallitseviin mielikuviin ja normeihin. Miehet samaistuvat perinteiseen individualistiseen työtapaan enemmän kuin naiset, jotka korostavat tiimityön merkitystä tutkimuksessa. Miehet myös ilmaisevat halukkuutta osallistua akateemiseen kilpailuun useammin kuin naiset, ja heidän on yleisesti ottaen helpompi asettaa työ perheen edelle kuin naisten. Naisten haastatteluista sen sijaan käy ilmi pyrkimys sopeutua miesvaltaisen työyhteisön vuorovaikutuskäytäntöihin ja selviytyä työyhteisöissä ilmenevästä seksuaalisesta häirinnästä. Naiset myös ilmaisevat halukkuutta hoitaa laitoksen hallinnollisia ja tutkimusta tukevia työtehtäviä, kun taas miehet pitävät lähes poikkeuksetta tutkimustyötä hallinnollisia tehtäviä kiinnostavampana vaihtoehtona. Nämä akateemisen työn sukupuolittuneet valinnat ja vuorovaikutuksen muodot saattavat vaikuttaa myös naisten ja miesten erilaiseen suuntautumiseen yliopistouralla.

Aineiston analyysi tuo esiin akateemisissa yhteisöissä vallitsevia sukupuolittuneita prosesseja ja historiallisia ristiriitoja. Seksuaalinen häirintä on esimerkki vuorovaikutuksellisesta sukupuolittuneesta prosessista. Sen taustalla on ristiriita perinteisten, miesten määrittämien vuorovaikutussääntöjen ja nykyisen, miehistä ja naisista koostuvan tutkijayhteisön välillä. Työn ja perheen sovittamisen ongelma voidaan ymmärtää symbolisena sukupuolittuneena prosessina, johon liittyy ajatus ideaalitutkijasta ilman fyysisiä tai sosiaalisia rajoitteita. Myös sen taustalta voidaan jäljittää ristiriita, joka syntyy perinteisesti miesvaltaisen alan normien ja nykyisen, miehistä ja naisista koostuvan yhteisön välille.

Aineiston analyysi valottaa myös dialektista hegemonian käsitettä, joka edellyttää hegemonian uusintamisen ja haastamisen prosessien ymmärtämistä. Haastatteluaineistossa sopeutuminen ja vastarinta ovat sukupuolittuneita ja ryhmittyvät kahden navan ympärille. Naiset ilmaisevat vastarintaa tiettyjä perinteisen akateemisen työn ilmiöitä (kilpailu, ajatus ideaalitutkijasta, seksuaalinen häirintä) vastaan, kun taas miehet liittyvät perinteiseen akateemisen työn tekemisen tapaan (kilpailu, individualistinen työkulttuuri). Sen sijaan miehet vastustavat

voimakkaasti yliopistotyön nykyisiä muutoksia (erityisesti hallinnollinen työ), kun taas naiset ilmaisevat sopeutuvansa niihin helpommin. Sopeutumisen ja vastarinnan ilmaisujen analyysin kautta tutkimuksessani piirtyy kuva suomalaisen yliopistoympäristön kahdesta hegemoniasta. Perinteinen akateemisen työnteon hegemonia ilmenee haastatteluissa individualistisena työn tekemisen tapana, kilpailuna, ideaalikuvana työlleen omistautuneesta tutkijasta sekä myös maskuliinisina vuorovaikutuksen sääntöinä. Uusi managerialistinen hegemonia ilmenee haastatteluaineistossa ennen kaikkea suunnittelun, raportoinnin ja hallinnon lisääntyneinä työtehtävinä, jotka kaventavat perinteistä akateemista vapautta. Molempiin hegemonioihin liittyy sekä sukupuolittunutta vastarintaa että sopeutumista.

Tutkimukseni tarjoaa näkökulman suomalaisen yliopistofysiikan sukupuolikuilun sosiaaliseen ja historialliseen dynamiikkaan. Se kuvaa myös joitain suomalaisen yliopistokentän muutoksia viime vuosikymmeninä ja ristiriidan merkitystä kaiken sosiaalisen muutoksen taustalla. Vaikka fysiikan alan miesvaltaisuus heijastuu edelleen akateemisen työn tavoissa ja käytännöissä, naisten niitä kohtaan osoittama vastarinta voi johtaa ja on jo johtanut muutoksiin akateemisissa työyhteisöissä. Myös nykyisiä yliopistokentän muutoksia kohtaan osoitettu vastarinta voi parhaimmillaan toimia lähtökohtana yliopistojen muutokselle entistä tasa-arvoisempaan suuntaan.

Avainsanat: sukupuolikuilu, yliopistofyysikot, hegemonia, ristiriita, suomalaiset yliopistot, toiminnan teoria

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To my father, who gave me the curiosity
to explore and understand
the world.

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1 INTRODUCTION

1.1 The gender gap in Finnish academia

Finland is considered a model country for gender equality. In an international comparison, Finland ranks high in terms of women's participation in different institutions of public life. According to indexes that describe women's status in society, education, health, and politics, in 2008, Finland had the second smallest gender gap in the world (Hausmann et al., 2008). This can also be stated when looking at Finnish higher education where the proportion of women at all levels of the academic hierarchy is one of the highest in Europe (European Commission, 2009). Women outnumber men in many academic fields at the undergraduate level, and during the past 20 years, women have completed the majority of Master's degrees (Ministry of Education, 2011).

However, a phenomenon typical of the Finnish labor market is its strong gender segregation both horizontally and vertically. Women and men cluster in different occupational fields with the result that a 20 percent gender gap in income has persisted over the last two decades (Statistics Finland, 2010). This gap exists even in the academic world, where a certain gender imbalance can be observed. Women in Finland gained access to university education at the beginning of the 20th century and from the 1960s on, more than half of the basic degree students have been women. However, this gender balance is not fully reflected in the gender distribution of academic positions. In 2009, the proportion of female Ph.D. graduates in all fields was 52 percent while the proportion of female professors was just 24 percent (Ministry of Education, 2011). Moreover, despite the political measures taken to promote gender equality in work life (for instance, public day care system, family leave) the university scene remains strongly gender segregated. In 2009, the highest proportion of female Ph.D. graduates was found in veterinary medicine and health sciences (100 percent and 82 percent) while the lowest was in engineering (25 percent). The highest proportion of female professors was in veterinary medicine and the health sciences (52 percent and 61 percent), and the lowest was in engineering and natural sciences (8 percent and 12 percent) (Ministry of Education, 2011). Thus, women seem to cluster in certain academic fields and remain underrepresented in others.

Despite the proportionally high percentage of women working in universities, the distribution of women and men within academic communities can be depicted as a 'scissor diagram.' The higher one rises in the academic hierarchy, the wider the gap between the numbers of male and female scientists becomes (Ministry of Education, 2008).

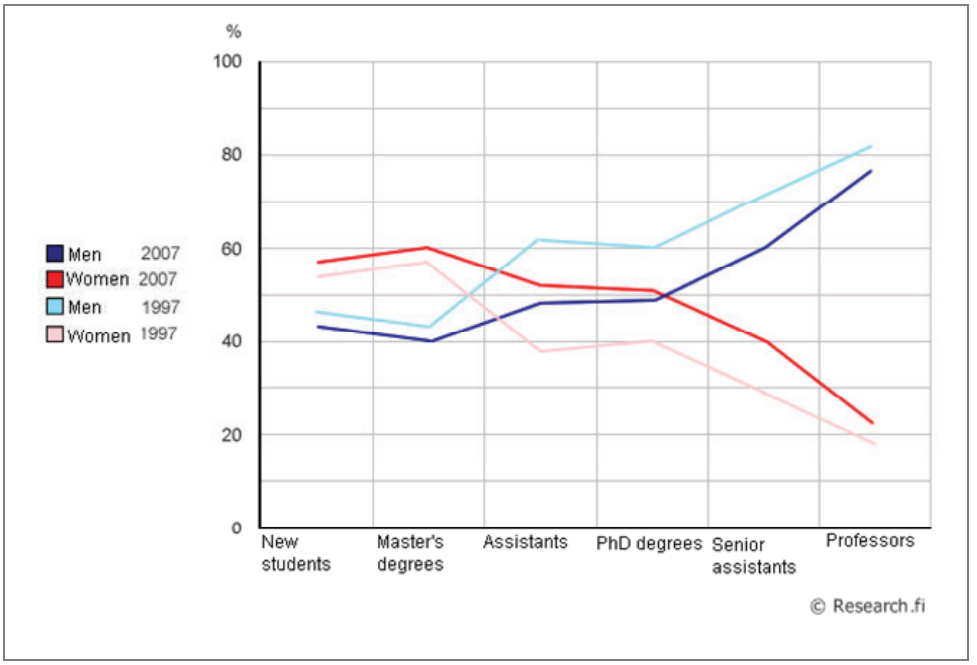


Figure 1. Gender distribution, all academic fields in Finland in 1997 and 2007[1]

The diagram, which depicts the gender distribution of certain jobs, is similar to almost all European countries, and illustrates the fact that women tend to move upwards in the academic ranks more slowly than their male colleagues do. As the number of women decreases along the academic hierarchy, it can also be assumed that some female academics even leave academia prematurely. This is also indicated in a recent study by the Finnish labor union of university researchers that shows that women are less satisfied than men are with their academic careers, and 65% of them have even considered leaving the university (Puhakka & Rautopuro, 2010, p. 65). The diagram also implies that women and men embark on different academic careers, and the latter are more likely to end at the top of the hierarchy. These statistics point to the fact that the gender gap in the academic hierarchy in Finland has remained rather stable despite the growing number of females, both absolute and relative, completing academic degrees in recent decades.

1.2 Studies on the gender gap in academia

The existence of a gender gap in academia has been observed in quantitative research at both the national and international level (European Commission, 2000; European Commission, 2009; Ministry of Education, 1996). In studies on

[1] Translated from Finnish by the author.

gender equality in work life, the gender gap phenomenon has been identified by the terms "glass ceiling, leaky pipeline and black hole"—metaphors that attempt to illustrate the factors within and outside of work that push/pull women out of their careers in academia. The problem with these metaphors is, however, that they tend to omit the variety of reasons that lead women to leave academia (Hasse & Trentemøller, 2008, pp. 192–193). From the 1980s on, qualitative research on women in the academic world has paid attention to a number of obstacles in women's scientific careers, among them the so-called chilly climate and other obstacles to women integrating into the scientific community (Aisenberg & Harrington, 1988). In the Finnish context, several studies on gender issues in different academic communities have been released (e.g., Julkunen, 2004; Naskali, 2004; Kantola, 2008; Vainio, 2006; Tala, 2006; Ahtela, 2004). They indicate that Finnish academia, despite the presence of large numbers of females, is gendered in overt and subtle ways. For instance, women pursuing an academic career often lack positive role models and self-confidence (Wager, 1994; see also Benney, 2006, p. 23) and the distribution of work is often gendered in scientific communities (Academy of Finland, 1998). Women also often experience problems in combining maternity and career as well as direct and hidden gender discrimination and harassment (Husu, 2001; Kantola, 2008).

On the international level, research on the gender gap in academia revolves around two major topics: evaluation processes and reconciliation of work and family. Bird (2011) suggests that the gender gap in academia is maintained on the system level through gendered bureaucratic structures. These structures are typical of universities that as institutions are characterized by a high degree of decentralized decision-making. Faculties consist of highly educated autonomous faculty members who are entitled to set their own performance standards according to discipline-specific standards (Bird, 2011). This enables disjuncture between the official requirements and unofficial practices in terms of organizing the academic work in evaluation and selection processes.

In academic evaluation processes, gender schemas often become manifested as a series of small disparities that lead to underrating of women and overrating of men in terms of academic proficiency, for instance when writing letters of recommendation (Valian, 2005; Madera et al., 2009). A British study suggests that academic women and men might have different perceptions of the criteria used when evaluating their performance: women emphasized the role of teaching in evaluation more than men who rated research as more important to their career (Todd et al., 2008). Men's perceptions seemed to be more realistic whereas women seem to lack information about the merit criteria in academia. Furthermore, in Sweden, male-dominated academic disciplines rated academic performance as the most important criteria when new doctoral students were selected. In female-dominated disciplines, other qualities of the applicant (personality, usefulness of the study subject) were also considered in the

selection process (Haake, 2011). In general, meritocracy as a base of academic promotion is a seemingly egalitarian and objective model of evaluating different professionals, but it omits other than academic aspects in people's lives such as unequal division of domestic labor and renders gender as "unimportant" (van den Brink et al., 2010). As a result, meritocracy has the tendency to reinforce the advantage men have in the academic workplace while women (and men representing non-dominant masculinities) become marginalized and labeled as less productive academics. Especially in the "hard" fields of science (for instance, physics), competition functions as a powerful way to sustain masculinity in the academic communities (Knights & Richards, 2003, pp. 218–219).

Furthermore, gendered bureaucracy also includes the aspect of reconciling academic career and family (Bird, 2011). A statistical study on American scientists indicates that female researchers are more likely to experience conflicts between their work and family responsibilities than male researchers (Fox et al., 2011). Mason & Goulden (2004) show that American women pursuing ambitious academic careers are different from their male colleagues in terms of family formation as many of them postpone having children or even have no children at all. Respectively, women with children are also more likely to end in less demanding "second tier" academic careers because they prefer a balance between work and family life (Baker, 2009). In general, the problem of reconciling work and family is lifted up as a major problem for young female scientists that strive for an academic career. Especially in the natural sciences, requirements of mobility in the early career stages as well as the perceived requirement to devote excessive hours to work causes difficulties for women who often are in the phase of starting a family. Women in the natural sciences tend to enter motherhood later and have fewer children than women in other academic occupations (Blackwell & Glover, 2008, p. 539). Interestingly, the national family service policies do not seem to affect the career patterns of academic women, as a similar tendency was observed in both the US and Nordic countries with more advanced child care policies (Mayer & Tikka, 2008).

1.3 Studies on gender and physics

In this study, I focus on an academic field where women have been underrepresented throughout history, namely, physics. International studies (Barinaga, 1994; Hasse, 2008) indicate that the gender gap in physics is a universal phenomenon which has been tackled by campaigns and programs to promote female scientists' careers, that establish special research posts for women and increase girls' general interest in the natural sciences (van Eerd et al., 2009; Cerón Loyaza, 2009; Fredriksen & Borg, 2009; Mendez Martinez et al., 2009). Interestingly enough, the proportion of women in physics does not

seem to depend on the general gender equality status of the country, as the highest proportion of female physicists is not found in countries with equal opportunity policies for women (Viefers et al., 2006). For instance, in Finland and Sweden, female physicists are still relatively few in the highest academic positions, whereas in Italy, for example, women are better represented at all levels of the academic hierarchy in physics. The diagram below depicts the distribution of women and men in different academic positions in the Department of Physics at the University of Helsinki in 2005 (University of Helsinki, 2005). As women are underrepresented at all levels of the academic hierarchy, the diagram does not resemble scissors (cf. Figure 1), but rather has the shape of tweezers.

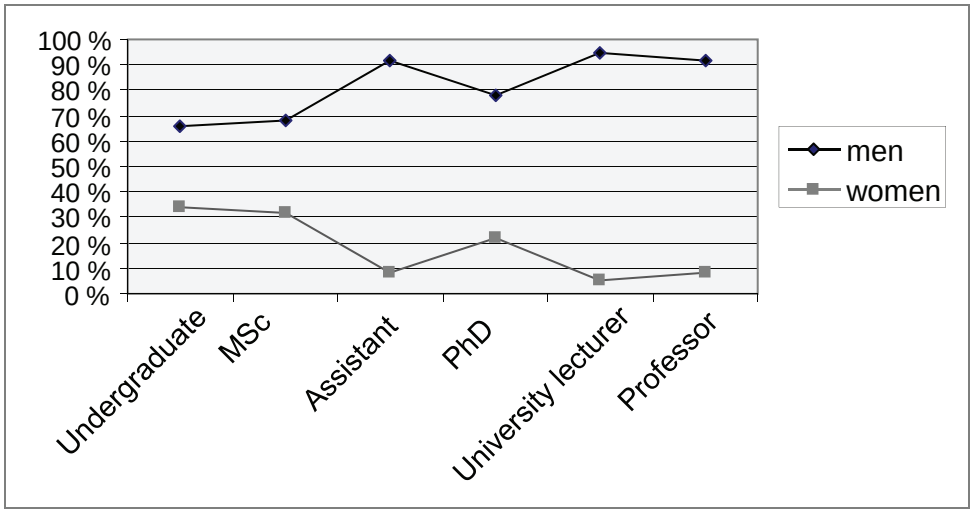


Figure 2. Gender distribution in the Department of Physics, University of Helsinki, 2005

The diagram indicates that while about one third of basic degree students and Master's in physics were women in 2005, every fifth PhD degree is achieved by a woman and the proportion of female teaching personnel (assistants, university lecturers, professors) in the department was only about 10%.[2] This percentage points to the observation that women might drop out from their academic careers, but also that they might have other types of employment within academia. For instance, women embarking on academic career work as junior researchers more often than men do and they also might be employed in different specialist jobs at the university (Puhakka & Rautopuro, 2010, pp. 17–18).

[2] More current statistical information about the exact numbers of female teaching staff in the Department of Physics was not available as the Personal Data Act prohibits publishing statistical data that includes fewer than six persons. However, the Department of Physics Annual Report (University of Helsinki, 2010a) indicates that in 2010, four out of 30 professors were female.

In the realm of natural sciences, the female underrepresentation in research jobs has been perceived as a severe problem for two reasons. Firstly, female scientists are seen as a potential workforce in fields where scientific and technical professionals are ageing. Attracting and retaining the best and talented persons, both female and male, in scientific careers is therefore seen as an ultimately important issue (Benney, 2006, p. 23). Secondly, the idea of science as a social activity demands that the group of people practicing science should be as heterogenic as possible in order to bring about a sufficient scale of research questions and interpretations. Diversity among the scientific workforce is seen as a way to promote diversity in science and even to promote change in science (Blackwell & Glover, 2008, p. 581; Rolin, 2008, p. 1124).

The gender gap phenomenon in physics becomes even more intriguing in light of the fact that many physicists consider the field entirely objective and gender neutral, a "culture of no culture" (Traweek, 1988). Cultural and feminist studies on scientific communities, however, take as their point of departure the assumption that science itself is a culture. Culture includes the practice of science; it refers to the frames of meaning within which people enact their lives and engage in symbolic and ritual events (Knorr Cetina 2007, p. 364). Thus, it can be stated that the practice of physics is embedded in a professional culture maintained by human beings who are likely *not* to be gender neutral (Rolin, 2001 and 2008). In what follows, I give an overview of studies that touch upon the interwoven nature of physics culture and gender.

The scientific culture of physics and its practice can also be seen as modified by historical, psychological and ideological processes that define our perceptions of what is masculine and what is feminine. Evelyn Fox Keller (1988), a sociologist of science and a physicist herself, has studied the ideology of physics from the perspective of psychoanalysis. She takes as her point of departure the individuation process identified by the psychologists Sigmund Freud and Jean Piaget, that is, the developmental process of a child becoming cognitively and emotionally independent of his/her mother. It is through this process that a person gains the ability to make objective observations of the world. Furthermore, it is the conviction of psychoanalysis that distancing from a mother is easier for a boy than a girl, as a boy's object of identification will be his fathers not his mother. In her study, Fox Keller points out that the scientific ideal of objective knowledge reflects this ideal of an independent personality, one that is able to fully differentiate between subject (him/herself) and objects of knowledge. As this ability can be seen as a masculine quality, it is justified to claim that scientific ideals are gendered from their outset (Fox Keller, 1988). The interference of gender and images of science is noted also by Amy Bug (2003), who shows that the cultural expectations about what it takes to be a physicist are an obstacle to recruiting women. The prevailing myth of a "lone investigator" as well as the elitist idea of "pure physics" (for example,

theoretical physics) as superior to the more interdisciplinary fields of physics (for example, biophysics) is likely to exclude most women from the activity of physics research.

One more example of gendered scientific ideals can be found in Margaret Wertheim's study, *Pythagoras's Trousers* (Wertheim, 1997). Wertheim claims that physics is and has been a religiously inspired activity with a quest for truth. Religion and especially the role of the priest have been strongly associated with men in Western culture. Thus, the priestly image of a physicist functions as a barrier to the entry of women. This observation has been confirmed in a study on Estonian physicists' professional images and ideals (Velbaum & Lõhkivi, 2008). In the Estonian context, there are two prevailing images of a physicist: the image of a priest of truth and the image of a blacksmith. However, women physicists find it easier to identity with the image of a priest of truth than with the image of a blacksmith, which is strongly associated with mechanics and engineering (Velbaum & Lõhkivi, 2008).

The interplay between gender and physics can also be observed in the processes through which individuals become members of the scientific culture (Hasse, 2001). Cathrine Hasse's study on physics students in a Danish university (Hasse, 2002a) shows that playfulness and joking related to physical theories and science fiction is encouraged within university education, while, for instance, an explicitly feminine appearance may be socially unacceptable. Moreover, male physics students who engage themselves in play during lectures gain more positive attention from teachers than female students who follow instructions. Hasse concludes that the fact that certain types of masculinity are encouraged in physics communities may exclude women and men who do not fit into this ideal. The connections between gender and science may also vary across local and national cultures. Thus, physics can be seen not only as a culture, but also in a culture. In a comparative analysis of physicists in five European countries, Cathrine Hasse and Stine Trentemøller (2008) provide a framework for understanding how ideas on gender, family, community and competition become connected differently in different cultural contexts. These cultural connections produce three ideal types of physicist (Hercules, Worker bee and Caretaker) that become manifested in local workplace cultures. The fact that certain ideal types are favored over others may also function as a mechanism of inclusion and exclusion as male and female physicists' career paths become shaped differently in different local contexts (see Hasse & Trentemøller, 2009).

The issues of gender equality and female underrepresentation in Finnish physics communities have been studied (at least) by Suvi Tala (2006), Kristina Rolin and me (Rolin & Vainio, 2011; Vainio, 2008). These qualitative studies raise the issues of participation and division of labor in physics communities. In her report on gender equality at the Department of Physics, University of

Helsinki, Tala illustrates the problems female physicists face when embarking on an academic career. According to Tala, women in physics departments often suffer from a sense of loneliness and experience problems identifying with a male-dominated work environment. Another set of difficulties is connected to family issues: going on maternity leave and returning to research work is not always unproblematic for women physicists. As remedies, Tala suggests more networking among women as well as mentoring for female physicists. She points out that support in career planning is needed from both senior female colleagues and supervisors.

In a previous study (Vainio, 2008), I discussed the features of physics academic culture that are or may be gendered and thus contribute to the gender gap phenomenon. The central themes that arose from my research data included reconciling work and family, administrative work, and competition. Most importantly, as shown in several previous studies, caring responsibilities affect women and men differently in academic work settings. Children demand more time from their mothers than from their fathers, limiting the hours that women have available for work and international mobility. Moreover, my study indicates that work tasks that are not ”pure” research (administration, managerial work) seem to attract women more than men, which may contribute to gendered career choices within a university. Lastly, female and male physicists differently recognize competition inherent to academic work. Men express more willingness to engage in competition; they benefit from competitive situations, but also run a risk of losing the game. Women, on the contrary, are less likely to recognize competition in research work and even if they do, often prefer not to participate (Vainio, 2008).

A study by Kristina Rolin and myself (Rolin & Vainio, 2011) suggests that the everyday life of scientific communities is steered not only by outer norms like work legislation or gender equality plans, but also by various unspoken and subtle norms, rationalizations and assumptions about the work. These assumptions and norms are generally accepted and mainly unquestioned despite the fact that they may favor some group over others. For instance, a prevailing idea among physicists is that working excessive hours is necessary for a successful career in science. Another conviction is that a scientist needs to be mobile in terms of work. These unwritten assumptions concerning physicists' work are considered self-evident, generally accepted and most importantly, gender neutral by interviewees. However, these ideals often place women and men in an unequal position, as women with children are less mobile and less willing to compromise their private lives because of work. Thus, ideals inherent in academic work may function as gendering processes, and as such may appear problematic in terms of equal career opportunities (Rolin & Vainio, 2011).

1.4 Why study gender gap among university physicists?

The studies referred to above diverge in method and focus, but indicate unanimously that the scientific culture of physics is gendered on multiple levels. The studies identify several cultural and gendered understandings connected to physics: what counts as plausible scientific knowledge (Fox Keller, 1988), how physicists see their own mission in the field of science (Wertheim, 1997), and what it takes to be a good physicist (Hasse, 2002a). Moreover, interview data analysis that Kristina Rolin and I conducted (Rolin & Vainio, 2011) suggests that the gender gap in physics can be seen in connection with gendered ideals, norms and rationalizations inherent in the practice of physics. The aspect of power is embedded in the results of studies as they illustrate how certain cultural understandings, assumptions and norms are privileged over others in physics communities. At the same time, certain experiences and spheres of life are classed as less valuable or even non-existent in a scientific organization. However, the power in question remains rather invisible: it is not manifested as a coercive force, but rather as something on which individuals agree on and to which they give their consent. Thus, the power does not reside outside the individuals, but within them. This makes it subtle and not easily identified. Therefore, power is not often explicitly problematized in studies on physics and gender.

Power is usually understood as "the capacity or ability to direct or influence the behavior of others or the course of events" (Power, 2011). The very traditional studies on organizations have dealt with the issues of power in the same manner: power is conceived as uncontested and residing in organizations that are seen as "domains of legitimate authority" (Clegg, 1979; Mumby & Stohl, 1991). However, postmodern and critical researchers of organizations have pointed out that power is not only located in bureaucracy, but also on a deeper level where it shapes organization members' sense of identity and understanding of the social reality. Tara Fenwick (2008a) has pointed out the importance of understanding power relations as a part of individual-collective learning at workplaces. Power issues are at play when community rules, hierarchies and recognitions become produced in human interaction at work. (Fenwick, 2008a, p. 238). According to Fenwick, more systemic studies on power in workplaces would be needed in order to identify the ways in which power functions to "position people and practices, promote interests, recognize some knowledge and ignore others" (Fenwick, 2008a, p. 239).

The above presented approach draws on a postmodern conception of power, perhaps most centrally presented by Michel Foucault (1980). In Foucault's analysis of power, identifying powerful persons or institutions is less important than examining the practices in which power resides. According to Foucault, power is embedded in all social relationships and practices through which people have an effect on each other. Thus, human subjects do not exist independently of

power but are produced within different webs of power. Moreover, Foucault considers power and knowledge to be intertwined. Power and knowledge can produce each other: power is at stake when objects and modes of (scientific) knowledge are chosen. Conversely, knowledge can be used as a tool for power. In Foucauldian thought, power in modern societies is manifested in the production of knowledge that has the human being as its object. Psychology, medicine, pedagogy, biology and other areas of science have the capacity to create norms into which individuals become integrated. Individuals subjected to this type of normative power do not need to be controlled or punished, but begin to control their lives in terms of the models of humanity created by science (Mumby & Stohl, 1991, p. 316; Alhanen, 2007).

In social studies of science, the issues of power have been approached from many angles. Power relationships between scientific institutions and the state have been investigated as have the problems connected with the authoritative position of science in political decision-making. Moreover, the interaction between science and non-governmental actors like business has proved to be a research object worth studying (Cozzens & Woodhouse, 1995). The connection between power and male dominance has been raised through discussions on an androcentric bias. Feminist scholars Evelyn Fox Keller (1988) and Helen Longino (1994), to mention two, have pointed out that the human process of producing and justifying scientific knowledge is not likely to be value-free, but rather dependent on non-epistemic components like gender. Feminist studies on the history of science have shown that experimental research in several areas of science (i.e., medicine, genetics) has focused on problems of primary interest to men. The promotion of male-centered research has in many cases led to the use of faulty experiment designs and scientific language dominated by patriarchal parameters. This androcentric bias has been seen as resulting from the fact that men have held virtually all theoretical and decision-making positions in science (Rosser, 2008, p. 54).

Mapping out gendered power in scientific communities is important because gender may be connected with epistemological questions such as: What research problems and objects are chosen? Which research methods are used? And how are research results communicated? Feminist organizational studies go even further by assuming that power is embedded in all human relationships and social endeavors such as work (Calas & Smirchic, 1996). Thus, power relations in scientific communities may affect various aspects of everyday academic life. One example of these aspects are mechanisms of inclusion and exclusion: how is a good scientist defined, under which conditions is scientific work supposed to be done, what rules apply in social interaction between scientists, who gets to embark on a scientific career and who drops out (see also Hasse, 2002a). As increased interaction between politics and science is being called forth by universities and politicians (League of European Research Universities, 2009),

more knowledge about these subtle processes in science is needed. Scientists are people in our society who, by doing their work, participate in shaping our worldviews. Through their input in political decision-making, scientists have a growing impact on our everyday lives, and thus it is worthwhile for members of society to also understand the subtle processes of the scientific community.

In this study, I address gender relations in the context of university physics departments. The question of power and gender is made topical by the statistical facts presenting gender gaps in academic communities and specifically in physics. As gender distribution especially in the highest academic positions is perceptibly uneven, it is justified to maintain that power in academia is gendered. I assume that power in scientific communities is likely to be found in the practices and normative knowledge suggested by Foucault (1980) and that power is manifested in collective and/or subtle understandings of the nature of academic work. Thus, I am interested in the modes in which physicists make sense of their everyday work and the rationalizations and the generally accepted rules that organize it. Moreover, I analyze the ways in which individual physicists relate themselves to these rationalizations and rules. Taking the gender gap as the point of departure of my study, I also consider the interplay between power and gender in physicists' accounts. By investigating the manifestations of power and individual responses to it, I attempt to understand the processes through which gender difference is produced in the context of university physics departments. In this study I use Gramsci's concept of hegemony to develop a dialectical lens of power.

In order to deepen my analysis of hegemony, I am also utilizing concepts from the research traditions of cultural historical activity theory and gender studies. While combining concepts from three different theoretical backgrounds, this study is not easily positioned in solely one line of research or discipline. Rather, it addresses the issue of gender gap in the academia from multiple angles and thus can be positioned in several fields, such as gender studies, organizational studies and activity theoretical studies.

The structure of this thesis is as follows. In the second chapter, I present the historical, political and ideological background of physics as an academic field in Finland. After that, the third and fourth chapters are devoted to the theoretical and methodological resources of the study as well as the research data utilized. In the subsequent three empirical chapters, the data analysis results are provided. In chapter eight, I discuss these results in relation to the theoretical framework. In the concluding chapter, I summarize the study and consider its practical implications as well as possibilities for future research.

2 HISTORICAL, IDEOLOGICAL AND POLITICAL BACKGROUND OF PHYSICS IN FINLAND

In this chapter, I contextualize my research object by drawing some main lines of the history of physics as an academic field in Finland as well as the history of women in Finnish academia. Firstly, I sketch the history of physics as an academic field in Finland. Secondly, I consider women's participation in the academic world and specifically in physics parallel with the major societal reforms that have promoted female emancipation. Thirdly, I provide an outline of changes in the university policies, funding system and personnel in recent decades, and fourthly, I present a short overview of gender equality actions taken in the Finnish universities during the 1990s and 2000s.

2.1 A history of physics departments in Finland

Isaac Newton, one of the world's most famous physicists, first published his Laws of Motion in Great Britain in 1687; they remained fundamental to the scientific community of physics until the early twenty-first century. At the same time, in Finland, physics first appeared as an academic field of study in 1640 when the University of Turku was founded as a part of rapidly developing higher education system of Sweden-Finland. At that time, physics was one of the subjects of the preparatory Faculty of Philosophy; the Faculty of Theology was the most esteemed institution at the university. Physics comprised the natural sciences including botany, zoology and anatomy. The first physics professors at the University of Turku contributed to science by making observations and conducting experiments, especially in astronomy. However, in order to proceed in their academic careers, many of the early Finnish physicists moved over to the Faculty of Theology and made a new career in the ecclesiastical realm and became bishops (Holmberg, 2004, p. 77). The rise of Cartesian thinking during the 18th century emphasized rationality and utility as the basis of the natural sciences and enhanced their status in the university and in society in general. At the same time, as Tapio Markkanen (2000) shows in his work on history of physics in Finland, the development of the mathematical natural sciences and empirical research promoted an unforeseen rise of physics, astronomy and mathematics. This transformation was reflected in increased appreciation of these fields of study in Finnish academia (Markkanen, 2000, p. 83).

During the era of autonomy under the Russian regime (1809–1917), physics research in Finland was mainly empirical and motivated by the socio-economic needs of agriculture, industry, mining and medicine. While physics research was

developing internationally in areas like electricity (especially in Britain) and thermodynamics (especially in Britain and Germany), the research interests in Finnish academic physics were focused on weather observation, land surveying and geomagnetism (Markkanen, 2000, p. 86). The scarce financial resources and lack of scientific personnel along with the geography and natural conditions of Finland steered physics research towards applied fields of study, geophysics and meteorology; theoretical physics and laboratory research developed later. Moreover, before the 1900s, individual scientists conducted physics research and the development of certain fields of research often depended on a single person's achievements. These solitary conditions contributed to the fact that many promising physicists eventually abandoned their research career and moved over to other leading positions in society (Markkanen, 2000, pp. 95–96). An exception was the field of astronomy that had possessed since 1834 an observatory with a broad set of research equipment in Helsinki. Astronomy was also a field in which Finnish scientists contributed to international research co-operation; the most important collaboration project was *Carte du Ciel*—a project that lasted several decades with the aim of listing celestial objects by photographing them (Isaksson, 1987, p. 91).

Shortly after the beginning the era of the Russian government in Finland, Helsinki was established as the new capital of Finland and in 1821, the University of Turku was moved to Helsinki where teaching and research in physics continued, yet with insufficient facilities. In 1911, a new Physical Institute with several laboratories and other research and teaching facilities was built on Siltavuorenpenger Street, in Helsinki in 1911 (Holmberg, 2004, pp. 99–100). In the early years after Finnish independence (1917), two new universities, University of Turku and Åbo Akademi, were founded in Turku. Physics was also included in their curricula from the beginning (Markkanen, 2000, p. 100). In the University of Helsinki, physics was divided in two subjects: applied physics (including meteorology and geophysics) and physics (including experimental and theoretical physics).

At the beginning of the 20th century, physics research made major leaps internationally (especially in the United States and Germany). Quantum mechanics alongside nuclear physics was developing rapidly and the general relativity theory was created (Markkanen, 2000, p. 94). At the same time, theoretical physics research was started at the University of Helsinki, but was largely dependent on activities of individual scientists and during the World War II (1939–1945) most of the international research co-operation ceased. Consequently, theoretical physics research experienced its second rise and started to develop greatly after World War II as the first professorships in theoretical physics were established at the University of Helsinki and the University of Turku in the 1950s and 1960s (Markkanen, 2000, pp. 118–119). Research in theoretical physics was also conducted at the Helsinki University of

Technology and at the Institute of Theoretical Physics that was founded in 1964 as a national center for promoting studies in theoretical physics.

The post war decades (1950s and 1960s) were a time of rapid expansion of higher education in Finland. On the political level, promoting university education and research was seen as a strategy for developing the economy and welfare of the nation. This strategy was also reflected in the growing numbers of physics professors and students; between 1956–1973, four new professorships were founded at the University of Helsinki. This development also led to the emergence of such specified subjects in physics as nuclear physics, theoretical physics and high-energy physics (Markkanen, 2000, p. 109). The first accelerator laboratory was established in 1956 at the University of Helsinki (Markkanen, 2000, p. 108). At the same time, physics research at the University of Turku developed based on the physics of condensed matter, low temperature physics and applied physics as well as particle physics and space physics (Markkanen, 2000, pp. 113–114). New universities and research institutions were founded and state funding in research was increased significantly, as science was seen to have a positive influence on industrial and economic growth. The universities that offered physics education were the University of Oulu (founded in 1959), the University of Jyväskylä (from 1965 on), the University of Joensuu (from 1969 on) and the University of Kuopio (from 1972 on). Physics research and teaching was conducted also in the new Universities of Technology in Tampere and in Lappeenranta. The growing need for energy and technical resources in Finnish industry gave impetus to the development of technical physics and nuclear technology (Markkanen, 2000, pp. 126–127).

During the 1970s, physics research in Finland expanded in scope becoming more diversified and international; at the same time, the number of researchers and research groups grew rapidly. This is why it is difficult to present the later history of physical sciences in a short and compact form (Markkanen, 2000, p. 120). This developmental trend continued in the 1980s alongside steady economic growth in Finland, which was reflected in the growing resources in research. Simultaneously, as in previous decades, a general belief in research and development as assets for industrial competitiveness held sway (Markkanen, 2000, pp. 121–122). These developments led to increasing international co-operation especially in fields of "big science," that is, those fields of physics that demand massive investments in research equipment. In the 1980s and 1990s, Finland joined several European and international research organizations: in 1987 the European Space Agency, in 1993 the European Synchrotron Radiation Facility and in 1991, CERN (Centre for Research in Nuclear Energy) (Markkanen, 2000, p. 122).

In the 1990s, Finland faced a deep economic depression, which affected the resources in the university sector and research. In physics research, the need to cut down costs led to a merger of separate research institutions; the new Helsinki

Institute of Physics was founded in 1996 and included the former Institute of High Energy Physics, the Institute of Theoretical Physics and the Institute of Particle Physics (HUT). The Helsinki Institute of Physics was also given the task to coordinate the Finnish co-operation with CERN (European Organization for Nuclear Research) (Markkanen, 2000, p. 123). After the recession, from the mid-1990s on, public funding on research and development has been increasing steadily with the political aim of enhancing Finland's international competitiveness by high quality education and research (Markkanen, 2000, p. 144). In the university sector, from 1995 on, centers of excellence have been chosen in order to promote high quality international research, and several physics institutions have been among them. Postgraduate schools started in the Finnish university sector in 1995 with the aim of increasing and systematizing doctoral education (Markkanen, 2000, p. 144). As a result, research training in physics has grown in scope and the numbers of PhD students and doctoral degrees have grown. For instance, in the Department of Physics at the University of Helsinki, the number of PhD theses approved was 11 in 1995 and 19 in 2010 (University of Helsinki, 2011; Markkanen, 2000, p. 144).

The developmental trends of physics research in Finland from the 1990s on can be described as twofold. On one hand, such national and global challenges as climate change that require multifaceted solutions are approached by interdisciplinary physical sciences like environmental physics, space research and the biosciences. On the other hand, there can be seen a movement towards a shared scientific basis when it comes to research objects and methods of different fields of physics. For instance, theoretical physicists, geophysicists and astronomers (Markkanen, 2000, p. 144) now study planetology and cosmology.

2.2 Women in the universities and in physics in Finland

The first Finnish women entered the universities in the 1870s—about the same time as their counterparts in the other Nordic countries. The academic fields in which the first women entered were natural sciences and history, as in many other European countries (Engman, 2000, p. 12). The entrance of women into Finnish universities occurred during a time of female emancipation that had its roots in the industrialization of the country as well as the rise of nationalism and civil society in the late 19th century (Hagner & Försti, 2006, p. 14). Being an autonomous part of the Russian empire, Finland was subjected to oppressive politics that the nationalist movement set out to oppose. Equal franchise was among the goals of these political struggles. Finnish women also actively took part in the popular enlightenment project and ideological associations like the temperance movement. They began to claim enhanced civil and political rights organizing within political parties. Female activism was motivated by questions and problems of everyday life: the social rights of women and children, work

life and family, and education and welfare. At the beginning of the 20th century, feminist organizations were formed to promote these issues; the right to higher education for women was one of the most important claims of these organizations (Hagner & Försti, 2006, p. 42).

In Finland, women's right to education was seen as an important part of the national project and therefore male professors and academics were more positive towards women in Finnish academia than in Sweden (Engman, 2000, p. 7). However, until 1901, women had to apply for an exception because of their gender before they could begin their studies in the universities. Furthermore, a special allowance was needed for women in order for them to accomplish academic degrees and to apply for a professor's post. University posts were opened to women in 1916 and after that, no special allowances were needed (Engman, 2000, p. 7). The first Finnish woman to achieve a doctor's degree in Finland was Karolina Eskelin, who defended her thesis in medicine in 1895. The first Finnish woman appointed to a professor's post was historian Alma Söderhjelm in Turku in 1927 (Engman, 2000, pp. 9–11).

When looking at the numbers of female university students in the early decades of the 21st century, we can see that Finland was one the leading countries in Europe. As early as the 1930s, women comprised 43% of the university students and by the 1960s, half of the university students were women (Husu, 2000, p. 28). At the same time, women accomplished more than 40% of the Master's degrees at the University of Helsinki, whereas the share of female PhDs was around 10% (Husu, 2000, p. 31).

The above-described development took place in the decades before and after World War II (1920s to 1950s) when the promotion of female rights was motivated mainly by the goal of enhancing the wellbeing of families. Household work was seen as an essential part of the national economy and substantial resources were invested in the education of homemakers. At the same time, the ideal of combining work and family was adopted as early as the 1920s. The issues of salaries and working hours of women, maternity aid and better public services were of importance in the political debates that aimed at both securing the status of working mothers and keeping up the fertility rates (Hagner & Försti, 2000, p. 100). During the 1960s and 1970s, Finland underwent a phase of rapid urbanization with growing numbers of women entering the labor market. This development gave rise to feminist claims for a redefinition of gender roles and division of labor in families. Women were considered as equally entitled to education and paid work as men, and care responsibilities were seen as the responsibility of both parents (Hagner & Försti, 2000, p. 193).

During the past three decades (from 1980 to the 2000s), women's participation in the academic world, work life and society in general has further increased. On the political level, the municipal day care system and the Equality Act, among other measures, have been taken in order to improve women's

possibilities for equal careers. Women have reached leading positions in nearly all spheres of public life and gained access to such institutions as the church and the military forces. At the same time, certain problems in gender inequality seem to persist. The average earnings of Finnish female employees in 2007 were about 80% of those of their male counterparts (Statistics Finland, 2010, p. 60). This disparity is mainly due to the typical feature of the Finnish work life—that is—its strong gender segregation. Women tend to concentrate in lower paid fields like services and nursing, whereas men typically choose fields with a higher level of wages such as IT and technical fields (Statistics Finland, 2010, p. 47).

A certain gender imbalance can also be observed in the academic realm. From year 1989 on, women have completed more than 50% of the Master's degrees in Finland. In 2007, Finnish women were on average more educated than Finnish men as 15.5% of all Finnish women and 14.8% of all Finnish men had finished a higher university degree (Statistics Finland, 2010, p. 26). The share of doctoral degrees completed by women has grown steadily from 1989 (33% of PhDs) to 2009, when more than half of the doctoral degrees (52%) were acquired by women. Despite this tendency, women have remained under-represented in the highest levels of the academic hierarchy. In 2009, women comprised about 53% of the university assistants and lecturers, whereas only about 24% of professors were female. Women professors are very rarely found in the natural sciences, where their share was about 12% in 2009 (Ministry of Education, 2011).

To sum up, the main milestones in Finnish women's history in the terms of female emancipation and in the academic world are presented as follows:

Table 1. Milestones in female emancipation in Finland (Statistics Finland, 2010)

1860:	Unmarried women received their full rights; that is, they gained the right to be in control of themselves and their property.
1906:	Women received voting rights in connection with Parliamentary reform that turned the previous bicameral parliament into a unicameral parliament. In addition to the right to vote, Finnish women gained the right to be electoral candidates. Consequently, 19 women were elected to the Finnish parliament in 1907. In 1917, Finland gained independence.
1926:	The Act on Women's Eligibility in State Posts was passed, though with some limitations that were struck down only gradually. In the same year, the first female minister for the Finnish government was installed.
1930:	The Marriage Act was amended releasing wives from the guardianship of their husbands and giving wives right to their own property.
1937:	The Act on Maternity Allowance was passed.
1944:	Laws concerning municipal maternity and child health care were passed.
1960:	The contraceptive pill was approved for use in Finland.
1962:	The principle of equal pay for work of equal value was established in both the public and the private sector.
1970:	The Abortion Act was passed in Finland.
1972:	The Council for Gender Equality (TANE) was established to monitor gender equality in Finland.
1973:	The law concerning municipal day care was enacted. Consequently, an organized development of day care systems in Finland began to promote the reconciliation of work and family.
1980:	The first Plan of Action for Promotion of Gender Equality was adopted in the Finnish Government.
1986:	Finland ratified the UN Convention on the Elimination of All Forms of Discrimination against Women (CEDAW).
1987:	The Act on Equality between Women and Men was passed in (amended in 1995 and 2005).
1990:	Municipal daycare became a social right of children up to age three.
1990:	The first woman in the world became a Minister of Defense.
1992:	Female candidate was chosen for the post of the Director General of the Bank of Finland.
1994:	A woman became the Speaker of the Parliament.
2000:	A woman was elected President of Finland (Statistics Finland 2005, 4).

Table 2. Milestones in women's history in Finnish academia (Engman, 2000)

1870:	The first women received the right to study in the university.
1872:	Women gained the right to an academic degree.
1901:	Women received the right to university education on equal terms with men.
1916:	Professor posts were opened to women.
1927:	The first female professor, Alma Söderhjelm, was nominated.
1992:	A female candidate was chosen for the post of University Rector.

The tables above illustrate that women reached many milestones in the academic world even before certain emancipatory gains in society. For instance, women received the right to university education on equal terms with men in 1901, while general suffrage was reached in Finland in 1906. Similarly, professor's posts were open to women ten years before The Act on Women's Eligibility in State Posts was passed in 1927. Thus, universities may be seen as paving the way for women in the early decades of Finnish independence. In the following section, I focus on women in the academic field of physics, which has traditionally been one of the most male-dominated in the universities.

Women in physics

Despite their historically limited access to scientific education, European women have been represented in the field of physics for centuries, especially in the field of astronomy. Female physicists have also been prominent in proceeding in the academic hierarchy. Laura Maria Caterina Bassi (1711–1778), a member of the Italian Academy of the Institute of Sciences and a chair of the Institute of Experimental Physics, became one of the first women to officially teach in the university (Nurminen, 2008, p. 358.) A Polish-French scientist, Marie Curie (1867–1934), became world famous for her pioneering work in radioactivity and in 1903 was the first woman to win the Nobel Prize. Marie Curie was also the first person honored with two Nobel prizes, in physics (1903) and in chemistry (1911) (Goldsmith, 2005).

In Finland, however, women's entrance into the academic field of physics occurred much later. Even though the natural sciences were among the first academic fields to which Finnish women entered, not many of them studied physics, but chemistry or mathematics instead. In fact, at the beginning of the 20th century, only 30% of the female university students chose natural sciences; the rest studied either medicine or humanities, which were considered better suitable for women than the exact natural sciences (Isaksson, 1987, p. 120). Female physicists are not mentioned in the early history of Finnish physics even though it is clear that women were contributing to physics research in such

positions as research assistants. For instance, during the project Carte du Ciel mentioned earlier, several Finnish women were employed at the Observatory of Helsinki as research assistants and calculators. The first Finnish woman to receive a PhD degree in physics was Eugenie Lisitzin in 1938. She made her career in the Finnish Institute of Marine Research studying sea level changes (University of Helsinki, 2000). Maybe the most prominent Finnish female physicist, astronomer Liisi Oterma defended her doctoral thesis on minor planets in 1955 and was appointed as a professor of astronomy at the University of Turku in 1965 (Isaksson, 1987, p. 124). Liisi Oterma was known as a reticent and unpretentious person who was not only a competent astronomer, but also a proficient linguist. Her status as the first Finnish woman to receive a PhD in astronomy also brought her visibility in other fields of society. In 1956, the Finnish alliance of business and professional women chose her as their "Woman of the Year" (University of Helsinki, 2000). However, it was not until the higher education boom in the 1970s that women began to enter the physics departments in larger numbers. Later, in 2004, Ritva Serimaa was the first woman nominated as a professor of physics at the University of Helsinki (University of Helsinki, 2004).

The lack of field-specific and gender-sensitive statistics in the university field makes it difficult to outline the exact development of female participation in academic physics on the national level. The statistics from the Ministry of Education (KOTA database) are rather aggregated and present the share of women in natural sciences, but they are not field specific. Therefore, I mainly refer to the statistics provided by the University of Helsinki, which has the largest department of physics in Finland; I treat this data as representative of the academic field in Finland. The statistics from the University of Helsinki list the share of women reported in the yearly overviews on university students, personnel and degrees from 1996 on.

What is especially interesting is that the share of female MSc and PhD graduates has been illustrated in the annual report of the Department of Physics at the University of Helsinki from 2001–2008, but after that, due to the Personal Data Act, no gender-specific information on the department's students or degrees has been provided in the annual reports. However, based on the Annual Report of the Department of Physics 2008 (University of Helsinki, 2008a), it can be said that during the timeline 1998–2008, women have comprised about one third of the basic degree students in physics and about 20 percent of the PhD degrees in the department (University of Helsinki, 2008a, p. 19). According to the Department of Physics annual report, in 2010, 4 out of 30 physics professors in the University of Helsinki were female (University of Helsinki, 2010a).

2.3 Changes in university funding from the 1980s to 2010 in Finland

To understand the present context of physicists' work in Finnish universities, it is important to provide an overview of recent transformations in the university politics and economy. The history of the current Finnish university network begins in the 1960s and 1970s when most of the universities were established. The most important changes in the university sector have taken place since then, so in this study, I focus on the timeline from the 1980s to the 2010s.

Universities in Finland are public sector institutions organized under the Ministry of Education. They all have the same legal status and are entitled to confer doctoral degrees. Moreover, all the universities provide degree tuition free of charge. As in many European countries, the funding model of universities is based on two elements: government funding and so called external funding that typically is competitive funding targeted to research projects. In the current Finnish university funding model (from 2010 on), government funding is divided into different components such as universities' educational tasks research, and doctoral training. The amount of governmental funding mainly depends on the volume of these activities in each university, but the quality and outreach of education, research and doctoral training are also a factor when governmental funds are allocated to the universities (Ministry of Education, 2009, p. 29). External funding may be provided by private sector organizations and enterprises, but in the case of Finland, the bulk of external funding comes from public sector sources: ministries and funding organizations such as the Academy of Finland and Tekes (Nieminen, 2005, p. 95). Thus, the notion of external funding de facto refers to public sector funding that is not budgeted to the universities but competed for by various departments at different universities. Typically, external funding is fixed-term funding and targeted to specific themes or fields of research.

Because of the close connection between the universities and the government in Finland, the changes in university funding have to be examined in the wider perspective of science policies and society. As Kaukonen and Välimaa (2010, p. 13) note, the universities in Finland are currently undergoing a reform that is connected to other transformations in the society and thus difficult to analyze. In the following, I consider some main transitions in the Finnish society and science politics that have affected the university funding volume and structure during the 1990s and 2000s. Thereafter, I briefly present the most important changes in university legislation and the consequences of the above-mentioned transformations on the level of university personnel.

Changes in science politics

The 1960s and 1970s were the building phase of the Finnish decentralized mass higher education system. During that time, several new regional universities were founded to meet the needs of industrial society and the welfare state.[3] The systematic development of the higher education system was related to the educational needs of the large post-war generation. Science policies were introduced by the OECD that emphasized the function of science in the development of the society (Lemola, 2001, p. 20). In the 1980s, the focus of science politics was turned to the development of new technologies, such as advancing research in the natural sciences; technology was considered a key element in the national development strategy. This turn in Finnish science policies emphasized the salience of technology and natural sciences and paved the way for a move from "soft" sciences to "hard" sciences. At the same time, research co-operation with Western European research organizations like CERN opened up new research areas for natural scientists (Kaukonen & Välimaa, 2010, p. 13). These trends were reflected in the research and development sector funding where the total investments grew exceptionally rapidly in the late 1980s. The financial input to the universities more than doubled from 1980–1993 (Ståhle, 1996, p. 419).

The long period of growth in university funding was broken in the early 1990s (1991–1993) when Finland faced a deep economic recession and the government funds for universities were decreased. In 1993 and 1994, the budget funding of universities was diminished by nearly 10% from the level of 1992. In the latter part of the 1990s, the volume of budget funding was increased again and it has been growing since then. A simultaneous trend in the university funding structure has been that the share of external funding in the university budgets has grown steadily throughout the 1990s and 2000s (Ministry of Education, 2009, p. 58).

After the depression, the new economic boom led by the development of information and communication technology brought about rapid changes in the science and research policies in Finland. The main emphasis of the Finnish science policies was put on innovations, their transmission and commercialization (Lemola, 2001, p. 23). The state released special funds by selling some of the state-owned companies and these funds were allocated to research and development through such funding agencies as the Academy of Finland and TEKES (Finnish Funding Agency for Technology and Innovations) and besides, external competitive funding was also provided in new instances from such sources as the European Union. Consequently, the research funding structure in the Finnish universities widened and diversified. More research funding was

[3] University of Oulu, University of Tampere, University of Jyväskylä, University of Kuopio and University of Rovaniemi.

targeted to applied research as the needs of industry and other fields of the society spilled over into university research through external funding. At the same time, interdisciplinary research increased in the university field. Even basic research funding increased and the total volume of research activities in the universities doubled during the 1990s. This developmental trend went on in the early 2000s reaching its peak in 2004. It is noteworthy that this increase of research volume took place solely because of the increase in external (competed) funding that enabled the universities to employ more research personnel, such as doctoral students. Nowadays, external funding comprises about 50% of research funding in Finnish universities (Nieminen, 2005). Thus, the rapid growth of external funding can be considered one of the most important changes in Finnish universities' funding during the past twenty years.

Changes in the university legislation

The changes in science policies and funding structures have taken place alongside changes in university administration and legislation. From the late 1980s to the late 1990s, the universities underwent a gradual change from state bureaucracies to results-oriented organizations with market-based coordination. The main motivation behind this reform was to increase the autonomy of the universities and make academic research more relevant to the needs of the society (Kaukonen & Välimaa, 2010, p. 15). This goal was realized by increasing universities' financial autonomy and developing the planning, funding and management methods (Hölttä, 1998, pp. 57–58).

At the level of university legislation, in 1997 the university law brought about the most important changes by enhancing the universities' autonomy to appoint and nominate its professors and members of its executive board. Moreover, it was enacted so that the universities were responsible for assessing their own activities and improving their interaction with the rest of the society. The universities' economic scope was also expanded so that they could found a company (Kaukonen & Välimaa, 2010, p. 17). The newly made university law (2010) is seen as profoundly changing the university's role as a state institution. The most important transformations involved are the changing administrative and economic statuses of the universities. The universities are no longer seen as state agencies, but as independent juridical persons with the rights to property and corporate activities. The universities may also raise funds independently. The basic budget funding of the universities still comes from the Ministry of Education and is index-linked. In 2009, the share of the basic budget funding of the total budget of universities was 64, 5%. The budget negotiations between the state and universities are held every fourth year (Kaukonen & Välimaa, 2010, pp. 18–19).

Changes in the university students and personnel

Changes in the university funding structures are reflected in the nature of university work. Due to the growing proportion of external research funding, project work and fixed-term, contracts have become the prevailing form of university employment. Even though the number of person-years in research work in the universities has not grown since 2004, the number of people working in research positions has increased. This indicates the growing number of fixed-term-contracts (Kaukonen & Välimaa, 2010, p. 15). According to a recent survey on Finnish university employees, about 60% of all personnel at the universities were working on a fixed-term contract. Fixed-term contracts are especially common among women employees; 65% of all female respondents worked on a fixed-term contract whereas 55% of male respondents had a fixed-term contract (Aarrevaara & Pekkola, 2010, p. 38). Fixed-term contracts in research work have been considered beneficial in terms of guaranteeing the high quality of science as they nurture the needed turnover of research personnel and thus provide opportunities for career advancement especially for junior scientists. However, the effects of fixed-term employment are also seen in an increasing amount of project management work in the universities: writing funding applications and reporting research results to the funding institution have become a regular part of researcher's work while the actual time for research work may have diminished (Aarrevaara & Pekkola, 2010).

Differentiated functions and the division of labor in the universities can also explain the growing number of university personnel. While the number of university teachers has remained the same during the past 20 years, the number of other personnel (researchers, doctoral students and supportive personnel) in universities has increased by 70% from 1990 to 2008 (Ministry of Education, 2009, p. 56). Along with the growing number of research personnel, the number of university students has grown during the 1990s and 2000s. The intake of new students was increased by 22% from 1990 to 2008 and at the same time, the amount of university students increased by 44% from 1990 to 2008. However, as the universities' budget funding was cut during the economic depression in the 1990s the number of university teachers (professors, lecturers and assistants) stagnated during the same period (Ministry of Education, 2009, p. 56). Even though the budget funding increased after the depression, the number of university teachers did not increase. This has resulted in a larger tuition group size and probably also affected the quality of teaching. Furthermore, university teachers have to dedicate more of their time to teaching and most do it at the expense of research work (Miettinen & Tuunainen, 2010, p. 15).

2.4 Gender equality in Finnish universities

As shown above in section 2.2, Finland has a long tradition of promoting women's rights and gender equality in general. In the Finnish universities, gender equality plans have been adopted as the major policy tool in attempts to prevent gender-based discrimination and to increase the relative numbers of women in academia. The inequality between men and women in academia has been a topic of both academic and political discussion for the past 40 years in Finland. In the 1960s, attention was paid to the disparity between women's high level of education and their low level of participation in the scientific work force. Since the 1980s, the debate on the inequality between men and women in academia has been policy-oriented (Husu, 2007, p. 170). The key actors in the gender equality policy in academia have been the Ministry of Education, the Academy of Finland, and the Ministry of Social Affairs and Health. In the 1980s, the Finnish gender equality policy for academia succeeded in making three important reforms: women's studies departments were established at the universities; women's relative numbers in national research councils were increased, and temporary research positions were extended as a compensation for parental leave (Husu, 2007, pp. 173–174). In the 1980s, the debate focused on women's difficulties in reconciling an academic career and a family life. In the 1990s, the problem was partly solved by developing national childcare policies. These policies have significantly improved academic women's capabilities to balance work and motherhood (Husu, 2007, p. 173).

The Act on Equality between Women and Men came into force in 1987 with the purpose of advancing gender equality and preventing discrimination especially in work life. According to the Act, universities as employers and as educational institutions are responsible for promoting equality. In 1995, the Act on Equality was amended so that gender equality planning was made obligatory (Husu, 2007, p. 176). In 1995, the first Equality Plan was put into action at the University of Helsinki, emphasizing efforts to increase the number of female post-graduate students and to enhance women's academic career opportunities (University of Helsinki, 1994). The Equality Plan also insisted on promoting gender equality in terms of payment policies and division of labor at university departments. In the following, I consider the gender equality plans in the University of Helsinki and in the Academy of Finland, which is one of the main research funding organizations in Finland.

The 1995 Equality Plan at the University of Helsinki stated as its major goal an increase in the number of female doctoral students and the enhancement of women's academic career opportunities (University of Helsinki, 1994). Gender differences in salaries and the division of labor were identified as the major issues to be addressed by the gender equality policy. In the 21st century, the term "mainstreaming" was introduced to equality plans (University of Helsinki, 2007; Academy of Finland, 2005, p. 39). "Mainstreaming" gender equality

refers to the principle that all decision-making processes should be assessed from a gender perspective, that is, they should be evaluated in terms of their potential impact on the equality between men and women. Equality plans have also promoted the idea that the status of women's studies and gender studies should be strengthened in the university. The implementation of Gender Equality plans is also systemically assessed at the University of Helsinki. According to these assessments, several key goals such as the appointment of more women to senior research posts have not been reached to date. The partly inadequate statistical information at the university has proven to be problematic in terms of monitoring the equality plans.

The current Equality Plan at the University of Helsinki drawn up for 2010–2012 (University of Helsinki, 2010b) focuses on the following activities:

1. Incorporation of an equality perspective into all strategic plans at the university and faculty level;
2. Producing long-term statistics on gender equality;
3. Gender-sensitive monitoring of changes in post structure, establishment of new posts, and appointments to posts and division of duties within faculties;
4. Support of research on women's studies and gender-sensitive teaching;
5. Promotion of the equal treatment of students in teaching and in assessment;
6. Development of an impartial and open recruitment at all levels at the University;
7. Assurance of adequate and equitable supervision for both female and male post graduate students, and
8. Promotion of the reconciliation of work and family.

At the departmental level, the Department of Physical Sciences in the University of Helsinki has implemented a project on gender equality in 2006 (Tala, 2006). The purpose of the project was to identify and develop practices in university teaching and supervision that motivate female students to embark on a researcher's career in physics. A more detailed description of the project report can be found in the chapter Introduction. The Department has also released a pamphlet (University of Helsinki, 2008b) addressing the gender equality issues in the field of physics. It aims at improving the status of women in the physics departments by challenging the prevailing ideas about gender equality and providing new ways of promoting equal opportunities in everyday work life in the physics departments.

The Academy of Finland is a state-funded organization and a major provider of funding for scientific research. In the past, women have been in the minority among the Academy researchers and gatekeepers, that is, as experts used in scientific reviews. The gender imbalance was addressed in the first Academy Equality Plan drafted for 2000–2002, where actions for increasing the proportion

of women were suggested. Consequently, special advertisements were released to invite female researchers to apply for Academy grants and research posts. So-called initial-grants for 2–4 months were funded especially for female researchers beginning post doc research, as well.

The Academy Equality Plan for 2005–2007 (extended to 2010) focuses on promoting equal and transparent decision-making when filling research posts and granting funds as well as supporting the combination of an academic career and a family. Among others, the Equality Plan (Academy of Finland, 2005) does the following:

1. Creates guidelines for prohibiting discrimination and harassment in the work place;
2. Promotes gender balance when filling research posts by giving priority to applicants representing the minority gender in cases when applicants only slightly differ from each other in qualifications;
3. Appoints equal numbers of men and women to serve as experts in scientific evaluations;
4. Considers the applicant's "academic age" and not his/her physical age, when granting funding;
5. Promotes researcher equality in regard to the availability of maternity, paternity and parental leaves. Using parental leave may in no way shorten the length of a researcher's funding period;
6. Promotes gender equality in all science communications within and outside the Academy, and
7. Takes gender equality perspectives into consideration when developing research funding forms.

In order to monitor the gender equality goals set, the Academy of Finland releases gender-based statistics on the distribution of research funding and research posts. The share of female academics receiving different types of funding from the Academy of Finland in 2008–2009 was as follows: post-doctoral research projects, 39%; general research funding, 28%; senior researcher's posts, 38%, and academy professor's posts, 13%. However, from year 2010 on, the share of female academy professors has been as large as 22% (Kurki, 2009, p. 1). The statistics also illustrate the fact that the share of research funding granted to women exceeds the relative share of women applying for funding (Kurki, 2009, p. 2).

The developmental trends sketched out in this chapter show that although physics as an academic field has a relatively long history in Finland, its boom only began in Finland after World War II. The volume and variety of physics research has expanded in a rather short time and simultaneously, major university political and economic transformations have also been under way.

Furthermore, despite the well-established gender equality policies in Finland, women have entered the field of physics rather late and are still under-represented in the university organizations.

Considering these developments is important as this study takes its theoretical point of departure in the cultural historical understanding of human activity, for instance, physics (explained more thoroughly in the following chapter). This understanding implies that history is not only seen as a set of past events recollected for contextualizing, but also as constitutive of the present social and cultural reality. For instance, the fact that physics research in Finland was initially an activity of devoted, individual (male) scientists may help us to understand how today's physicists construct their professional identities. Furthermore, the fact that women only started to enter physics in larger amounts in the 1960's and 1970's in Finland provides us with a historical perspective to the issue of gender equality that the community of physics has only faced rather recently. And when looking at the changes in research funding and university policies in the last three decades, it becomes possible to view the larger continuum of the current challenges that the university physicists face in their working life.

3 THEORETICAL RESOURCES OF THE STUDY

In this chapter, I present the theoretical resources of my study. They are: the concept of *hegemony* (Gramsci), the concept of *contradiction* (Marx/Engeström) and the model of *gendered organizational processes* (Acker). The concept of hegemony and contradiction have a common background in Marxist thinking and are interrelated in the sense that the idea of transformation through contradiction is embedded in the concept of hegemony as will be explained later. Gender understood as produced through organizational processes implies that gender is not seen as a person's stable identity, but rather as an activity and social dynamic. Thus, the perspective of dynamic social reality that is open to change is also present in the ways in which gender is approached in this study.

As the main theoretical focus of my work is on Gramsci's concept of hegemony, the major part of the chapter is devoted to it and its applications in empirical research. The concept of gender and the concept of contradiction are introduced in a more condensed way.

3.1 Gramsci's concept of hegemony

The Italian political philosopher Antonio Gramsci (1891–1937) analyzed power in the relations between peasant culture and the social elite in Italy during the early 1900s. The fact that in his country masses of people were governed by a small elite attracted Gramsci's interest. At the same time, he was also interested in the question of how to recruit people into political activism. Inspired by the Communist Manifest, Gramsci (1971) adopted the concept of hegemony from the Russian language and developed it in order to explore power relationships in a post-feudal society and the concrete ways in which these were lived (Clegg, 1979, p. 82). While imprisoned by the Mussolini government, Gramsci wrote most of his works under the threat of censorship, which is partly why his writings are rather fragmentary. This is also the reason why many later scholars refer to the secondary sources when writing about Gramsci's work. Later research (e.g., Femia, 1975; Crehan, 2002; Clegg, 1979; Mumby, 1997; Jackson Lears, 1985) has also been active in reconstructing Gramsci's perception of societal power.

As it is neither the focus nor in the scope of this study to provide an extensive analysis of Gramsci's theoretical thinking, I rely mainly on secondary studies that have successfully shed light on Gramsci's vast production when defining the meaning of hegemony. Furthermore, as the focus in my study is on hegemonic relations across genders in academia, I consider examples of empirical research

that address these issues. Finally, I explain specific aspects of the concept of hegemony that are particularly relevant in my study.

Because of the fragmentary nature of Gramsci's literary production, it is rather difficult to point to a specific definition of hegemony in Gramsci's original texts. The often-quoted definition of hegemony by Gramsci is the following: "the spontaneous consent given by the great masses of the population to the general direction imposed on social life by the dominant fundamental group" (Gramsci, 1971, p. 12). This quote characterizes the concept of hegemony as a form of societal power that is widely accepted by those who are subjected to it. Hegemony is thus perceived as something that is unequivocally accepted. This definition of hegemony is rather one-dimensional in that it does not capture the aspect of contradiction and resistance that necessarily are present in any social setting. This definition also does not cover the dynamics of power that Gramsci seemed to have in mind. For Gramsci, hegemony is a process of struggle rather than a status quo. The prevailing hierarchical positions between people, values and practices are not stable, but constantly moving; they are contested and reformulated in the course of social life. Thus, rather than describing a one-way power relation between the dominant and the subordinates, hegemony is always open to challenges and reformulations.

Gramsci's understanding of hegemony is deeply anchored in his Marxist background and the idea of dialectical materialism. This bottom line of Gramsci's thinking is embedded in his concept of "philosophy of praxis," which, for him, represented the essence of Marxist theory.[4] As Haug (1999, p. 107) puts it, philosophy of praxis means the interpretation of the present reality and its background. Philosophy of praxis designates the way in which the reality should be understood as mediated by human activities and conditions under which they are carried out, which in turn are mediated by previous actions. By philosophy of praxis, Gramsci also means the individual's ability to critique and act against hegemonic systems of meaning and power. When layman's philosophy is transformed into a philosophy of praxis, revolution is possible. Thus, philosophy is not viewed as a mere ideology, but a form of collective activity that has the aim of engaging social forces and ideologies. Through gaining a more enlightened understanding of reality, people may be acting in the process of transforming the world (Mumby, 1997, pp. 349–350). A philosophy of praxis can be said to be the general approach that mediated Gramsci's other theoretical input, such as the understanding of hegemony. Gramsci's analysis of hegemony has its perspective in human interactions and their cultural conditions. These interactions are considered in the context of their history, that is, previous interactions that are seen as mediating the present. Thus, by opening up the

[4] Some researchers (i.e., Herzberg, 1994, p. 42) consider the term "philosophy of praxis" a cipher for "dialectical materialism" that Gramsci used in his prison writings due to fear of censorship. This view is contested by Haug (1999, p.106).

interactional origins of hegemonic relationships, Gramsci's analysis of hegemony can provide a critical insight to ideologies that tend to legitimize suppression by mystifying this condition (Haug, 1999, p. 117).

In his work on hegemony, Gramsci attempts to lay out the premises of social cohesion—the dynamics that prevent the capitalist society from falling apart despite its inequalities. At the same time, when theorizing about hegemony, Gramsci is pursuing his political ambitions, that is, to detect possibilities for a socialist revolution. Thus, the concept of hegemony is not just about societal dominance: it captures both the aspects of societal consent and the revolutionary capacity of the masses to create a counter hegemony, that is, the emergence of a new culture, mode of thought and being. (Femia, 1975, p. 35). Yet in Gramsci's philosophy, unlike some later research traditions (especially critical organizational studies), hegemony is used as a descriptive term to explain how a particular group gains intellectual and moral leadership over other groups (Mumby, 1997, p. 348).

Even though Gramsci's concept of hegemony is essentially bound to the context of capitalist society, it does not limit its analytical capacity to economic relations of dominance. Indeed, a key difference between Gramsci and the Marxist tradition lies in that he avoided historical and economic determinism and did not consider class (ownership/non-ownership) the only dividing line between different groups of people. Instead, Gramsci promoted an analysis of social formations that is also bound by ties (such as religious and ideological) other than just economic (Jackson Lears, 1985, p. 571). According to Gramsci, a certain group may gain a ruling position by creating an ideology that possesses both economic and cultural solidarity. Yet, for Gramsci, hegemony never means a mere ideology or mental state. The concept of hegemony always implies the dimensions of ideas, activity and identity formation both on collective and individual levels. Hegemony is thus inseparable from its cultural historical surroundings and has to be analyzed within its context. (Crehan, 2002, p. 104).

Gramsci's concept of hegemony not only describes the status quo of power relations in bourgeois society, but is also concerned with articulating the process of revolution through which capitalist ideology can be replaced with a socialist one. A central element in this characterization of Gramsci's concept of hegemony is its dialectical nature. This implies an understanding of hegemony as a process of constant struggle between consent and resistance in competing ideologies and worldviews. It also implies recognizing the productive and at the same time destructive tension between consent and resistance. Although based on general consent, hegemony can be defined as a continuum between total integration and widespread resistance that may mobilize groups of people and even nations. Thus, Gramsci's idea of hegemony is premised by the idea of a process of struggle rather than an existing state of consensual domination (Mumby, 1997, pp. 365–366). Rather than being a monolithic set of societal

values, practices and rules, hegemony is manifested through "partial, dynamic, fragmented and discontinuous moments of struggle" (Mumby, 1997, p. 369). The continuum between the aspects of consent and struggle in the concept of hegemony can be illustrated as follows:



Figure 3. Dialectical continuum of hegemony

Here, collective responses to hegemony are depicted in the axis of total integration (consent in a bourgeois society) and widespread resistance (potential communist revolution). It is worth noticing that this figure allows for oscillation between these two poles that are both present in the idea of hegemony. In the following, I consider both the aspects of consent and resistance in Gramsci's concept of hegemony. First, I look at the ways in which consent is achieved and then move to examining the signs of resistance and hegemonic struggle, which, in Gramsci's thinking, manifest in *contradictory consciousness* (Gramsci, 1971, p. 333).

Gramsci's analysis of the history of his country (Italy) serves as a basis for his views on societal power and hegemony as a special mode of domination. According to Gramsci, societal power may manifest itself in two modes: hegemony and coercive power. Intellectuals are persons in a key role in exercising the functions of power. For Gramsci, every man has the potential to be an intellectual, but not all are intellectuals by social function. He differentiates between so-called "traditional" and "organic" intellectuals when talking about functional intellectuals. Traditional intellectuals are people, whose authority and prestige in society derives from the class hierarchy (clerks, scientists). Organic intellectuals, on the other hand, may represent any profession and social group, and their status as intellectuals is gained by their ability to articulate the ideas and worldviews of the social group they represent. In his *Prison Notebooks*, Gramsci considers these two modes of power when describing intellectuals and their functions in a society:

> The intellectuals are the dominant group's "deputies" exercising the subaltern functions of social hegemony and political government. These comprise:
>
> 1. The "spontaneous" consent given by the great masses of the population to the general direction imposed on social life by the dominant fundamental group; this consent is "historically" caused by the prestige (and consequent confidence)

> which the dominant group enjoys because of its position and function in the world of production.
>
> 2. The apparatus of state coercive power which "legally" enforces discipline on those groups who do not "consent" either actively or passively. This apparatus is, however, constituted for the whole of society in anticipation of moments of crisis of command and direction when spontaneous consent has failed.
>
> *(Gramsci, 1971, p. 12)*

Gramsci's understanding of societal power essentially forms a continuum between coercive power and consent. These two poles of power are typically manifested through different institutions: coercive force is mainly used by the state and consent becomes manifested in different instances in civil society. However, Gramsci understands the two forms of power not as opposites, but as different sides of the same phenomena, the two agents of power (state and civil society) may also appear to be intertwined (Crehan, 2002, pp. 102–103). Hegemony is attained through the myriad of ways in which institutions of civil society operate in order to shape the cognitive and affective processes through which people perceive and evaluate the social reality (Femia, 1975, p. 31). Sometimes hegemony can become so internalized that the subordinate groups participate in hegemonic processes that marginalize them, but hegemony does not work in just one-way, for the ruling group may also adapt features from the subordinated group in its own behavior and thus change the prevailing power dynamics (Demetriou, 2001). In any case, hegemony instantiates in commonly held values and beliefs and is maintained by organized religion, mass media, the school system, and patriotic rituals (Femia, 1975, p. 48).

Gramsci's understanding of consent seems to include two aspects, active consent and passive consent that may develop into resistance and even a struggle over hegemony. In the quotation above, Gramsci seems to define consent as an active commitment that is "historically caused by the prestige (and consequent confidence) which the dominant group enjoys because of its position and function in the world of production." Hegemony thus involves some kind of emotional and moral acceptance of the prevailing social order and those people maintaining it. However, Gramsci describes hegemonic consent as a passive, yet contradictory state of consciousness in proletarian minds. According to Gramsci, this contradictory consciousness may arise when members of a subordinated group (working class) come to realize the gap between their own worldview and the values of a ruling group (owning class) embedded in their actions. The struggle between political ideas and hegemonies affects the self-understanding of the members of the subordinate group. Thus, the state of consent is never complete, but involves the outlook of subordinate groups that remain divided and ambiguous (Jackson Lears, 1985, p. 570). Gramsci describes the origins and consequences of contradictory consciousness as follows:

> The active man-in-the-mass has a practical activity, but has no theoretical consciousness of his practical activity, which nonetheless involves understanding of the world in so far as it transforms it. His theoretical consciousness can indeed be historically in opposition to his activity. One might almost say that he has two theoretical consciousnesses (or one contradictory consciousness): one which is implicit in his activity and which in reality unites him with all his fellow-workers in the practical transformation of the real world; and one, superficially explicit or verbal, which he has inherited from the past and uncritically absorbed. But this verbal conception is not without consequences. It holds together a specific social group, it influences moral conduct and the direction of will, with varying efficacy but often powerfully enough to produce a situation in which the contradictory state of consciousness does not permit any action, any decision or any choice, and produces a condition of moral and political passivity. Critical understanding of self takes place therefore through a struggle of political "hegemonies" and of opposing directions, first in the ethical field and then in that of politics proper, in order to arrive at the working out at a higher level of one's own conception of reality.
>
> *(Gramsci, 1971, pp. 326–327, p. 333)*

The manifestation of contradictory consciousness, as defined by Gramsci, can be defined as a mix of approbation and apathy, resistance and resignation (Jackson Lears, 1985, p. 570). It varies from individual to individual, for not everyone becomes socialized in hegemony in the same way. The struggle over hegemony can sometimes give birth to critical understanding of self and the society; sometimes contradictory consciousness may take the form of active resistance and even lead to the rise of a counter hegemony. Gramsci describes the process of rising contradictory consciousness as a matter of individual activities that may first appear as cacophonic, but that are needed in order for a social group to organize meaningfully.

> For some organisms a question of life is not passive and indirect consensus but the active and direct consensus, therefore the participation of single individuals, also if this leads to an appearance of breaking-up and tumult. A collective consciousness, therefore a living organism, is not formed before the multiplicity has unified through the friction of the individuals: neither can one say that silence is not multiplicity. An orchestra which rehearses, each instrument on its own, gives the impression of the most horrible cacophony; yet these rehearsals are the condition for the orchestra to live as a single instrument.[5]
>
> *(Gramsci, 1975, p. 1771)*

[5] Reference: Gramsci, A. (1975). Quaderni del carcere, Vol.3. (p. 1771) Torino: Einaudi. English translation Annalisa Sannino.

Here, a metaphor of the orchestra is used to illustrate how contradictory consciousness first takes place in individual consciousness and may appear as turbulence; however, when several individuals clash with the commonly accepted norms and rules, a new culture can emerge.

The idea of hegemonic struggle follows from the assumption that the subordinated group is not self-evidently determined in its position, but can develop a new, revolutionary consciousness and activity. In Gramsci's thinking, important agents of hegemony and counter hegemony are intellectuals, that is, people who have the capacity to direct and aspirate the ideas of the social group to which they belong. Intellectuals bear the role of thinking and organizing elements of a certain social group, and thus have crucial importance for potential social change. They are responsible for articulating for the subordinated class a coherent worldview and thus translating their thinking into a new, revolutionary ideology (Gramsci, 1971, p. 5).

An interesting feature in Gramsci's ideas about hegemony, consciousness and struggle is the role of language. Even though Gramsci does not provide a developed theory of language, it is evident in his thoughts that language plays a crucial role in the formation of contradictory consciousness and resistance. For Gramsci, language is a central means by which people build their worldview, and define their place in relation to others. On one hand, Gramsci names "lack of vocabulary" (Gramsci, 1971) as a reason for political passivity within the subordinated group. On the other hand, he insists that the intellectuals have the capacity to help the masses in creating a coherent interpretation of the world. Only by developing an adequate understanding of the capitalist environment, will the working class be able to ascend from common sense to the good sense that makes political resistance possible. This transformation is dependent on the degree to which the subordinated group is able to discursively penetrate the conditions of their lives (Mumby, 1997, p. 350). Thus, language can be considered as a powerful tool for resistance and change; it can help people in building their identity, recognizing and explicating inequalities in their environments and creating alternative worldviews.

To sum up, concerning human consciousness and its potential to change, Gramsci seems to leave open both the options for transformation and stagnation (Gramsci, 1971, p. 323). As Mumby (1997, p. 366) notes, Gramsci's concept of hegemony thus strives at overcoming the divide between domination and resistance by recognizing both the possibilities for social change and the persistency of dominant hegemony resistant to change. Mumby (1997, p. 368) suggests that when hegemonic struggles are studied, special attention should be paid to the ways in which discourses and actions can be simultaneously resistant and consensual. This aspect of hegemony neither assumes the existence of societal actors who unreflectively reproduce the status quo nor the transformative capacity of individuals in marginal positions. On the contrary, it

provides a useful framework for empirical research on how dominant beliefs are propagated, maintained and challenged in society (Femia, 1975, p. 48).

3.2 Activity theory and the concept of contradiction

Embedded in Gramsci's idea of contradictory consciousness, is an assumption of transformations that occur through contradictions. For Gramsci, the rise of revolutionary ideology is ultimately an issue of individual consciousness that deviates from the hegemonic culture. Hence, Gramsci's thinking can be seen as parallel to the idea of *contradiction* inherent in cultural historical activity theory (CHAT). Developed first by the Russian psychologists Lev Vygotsky and Alexei Leontev CHAT studies individual consciousness as part of a collectively formed and artifact-mediated activity system and like Gramsci's work, takes as its point of departure the Marxist idea of dialectical development.[6]

The basics of Marxist definition of contradiction lie in the analysis of the functions of capitalism. According to Evald Ilyenkov (1982), in a capitalist society, the basic contradiction in any production activity takes the form of *commodity*. Commodities are objects that possess exchange value and that are valued by the average amount of social labor needed for their production. This leads to the reduction of all kinds of labor into "labor in general" (Ilyenkov, 1982, p. 97). In a modern society where the division of labor is highly specified, individuals become alienated from each other and at the same time mutually dependent because of the necessary production of exchange value. Exchanging activities and products has become a vital condition for each individual, yet it leads to indifference and excluding all personal features of work (Marx, 1973, pp. 160–161). According to Marx's ideas, in a capitalist society, there prevails a fundamental contradiction between the use value and exchange value of goods. This contradiction is born when money is introduced as a tool for exchange; the exchange of commodities becomes complicated, as goods first have to be transformed into money and only after that into their counterparts. Thus, the use value and exchange value of goods are never the one and same thing but there is a growing inconsistency between the value of goods and the value of the labor that is needed to purchase them (Ilyenkov, 1982). A parallel observation can be made, for instance, when looking at school education and learning, where an individual child's learning outcomes are valuated only in relation to other's learning outcomes (Lave & McDermott, 2002). This so-called primary contradiction becomes reproduced in different historical contexts and generates

[6] The law of "forbidden contradiction" typical to formal logic is not applicable to the use of the concept of contradiction in Marxist dialectics. As Wilde (1989, p. 104) writes, "in analyses of systems in motion, the principle of non-contradiction loses its prominence". Formal logic treats systems which are frozen in time, while Marxist dialectics analyzes systems in historical movement."

secondary contradictions specific to the particular activity or institution (Engeström & Sannino, 2011, p. 370).

When looking at the concept of contradiction from the point of view of cultural historical activity theory, a brief overview of the basics of this theoretical framework is needed. One of the basic tenets of CHAT is that all human activity is object-oriented. This means that people within a community are oriented towards a shared purpose, that is, an object that contributes to something larger than any individual could accomplish alone. Another basic assumption of CHAT is that the relationship between the subject and the object is mediated by artifacts. In other words, the relationship between the individual and the world is mediated by the surrounding, human-made culture. Cultural artifacts are tools and signs by means of which the object-oriented activity is accomplished and which an individual can use to control his or her own actions (Engeström & Sannino, 2011, pp. 371–372).

Yrjö Engeström (1987, see also, for instance, Engeström, 1999a) has developed the original idea of object-oriented activity into a model of activity system that consists of six basic elements: subject, object, tools, rules, division of labor, and community. The subject refers to the individual(s) whose point of view is adopted in the analysis, whereas the object can be defined as the ”problem area” that focuses and motivates the activity. The community in the activity system consists of the people or groups that share a common object that is being transformed with the help of mediating artifacts—physical or symbolic tools. The rules consist of explicit and implicit norms that regulate the actions of individuals. The division of labor refers to the vertical and horizontal division of tasks, power and rewards within the activity system (Engeström, 1999a, pp. 30–31). The activity system is in a state of constant flux and development, affected by its internal contradictions.

The meaning of contradictions for an activity system cannot be over emphasized. Contradictions are seen as the driving force of an activity system and the source of its development (Ilyenkov, 1977, p. 330). Any new form of an activity first emerges as a rupture or an exception from the rule. It first appears as an individual deviation from a codified norm which later can be transformed into a universal norm. Thus, a dialectical relationship between the individual and the universal is an integral part of all human activities (Ilyenkov, 1982, pp. 83–83). Contradictions are historically evolving and systemic tensions and therefore they have to be dealt with in connection with their historical development. Analyzing the inner contradictions of an organization implies understanding the mechanisms through which the contradiction takes place in the organization. Only through a careful examination of the inner contradictions of the organization, does it become possible to identify and resolve the external tensions reflected in the everyday life of the organization (Engeström & Sannino, 2011, pp. 370–371).

Engeström (1987, pp. 87–88) differentiates four levels of contradictions that may appear in any activity system. The primary contradiction refers to the dual nature of use value and exchange value in the components of an activity (Engeström, 1987, pp. 89–90). The dual nature of medical instruments and drugs serve as an example. On the one hand, medical instruments are useful tools for curing illnesses; on the other hand, they are commodities that are manufactured, marketed and sold with a profit. This is a contradiction that every doctor has to face in his/her daily work. In the context of physics research, a primary contradiction could arise when a researcher is writing a scientific publication. On one hand, publications are meant to convey scientific knowledge that is of as high quality as possible. Writing such publications is time consuming. On the other hand, publications are also an asset in the scientific competition where a researcher's merits are mainly counted by the number of publications. The pressure to publish as many publications as possible may lead to a situation in which the quality of the publications suffers. This dual nature of scientific work may lead to a contradiction where a lower publication rate often equals higher quality publications and a higher publication rate means scientific merits, but probably lower quality in publications.

A secondary contradiction appears between the different elements of an activity, for instance when a stiff division of labor prevents the implementation of new, advanced tools or instruments in work (Engeström, 1987, p. 90). An example from the medical world could be the contradiction between current disease classifications and new, increasingly complex forms of illnesses. An example from the research world could be a situation in which a new more complicated object, such as an unknown natural phenomenon, is examined with the help of inadequate equipment suitable for already known and simpler objects.

A tertiary contradiction can be identified when an activity system and a culturally more advanced activity system collide, for example, when new care procedures are introduced in a ward system by administrative staff (Engeström, 1987, p. 90). Even though new procedures may be officially accepted and implemented, the staff may still resist them. A parallel example can be found in the university context where, for instance, a new payroll system was introduced by the administrative staff and fiercely protested by some of the research staff. While the idea of the new payroll system was to make the pay system in the university more individual and rewarding, the research staff perceived it as increasing their amount of work and causing unnecessary bureaucratic procedures.

A quaternary contradiction is a collision between an activity system and a "neighboring activity system". In the research world, a typical quaternary contradiction appears between the activity systems of work and family, when

one of them moves to a new and more demanding stage, while the other one has difficulties to cope with this change.

In my study, I utilize the concept of contradiction as one of the analytical tools in order to understand the hegemonic relations within Finnish academia. The concept of contradiction thus provides a framework for making sense of the ruptures and clashes that are described by individual interviewees in my data and locating them in their wider ideological, social and economic context.

3.3 Gender as a set of organizational processes

As this study explores the question of hegemony from the point of view of gender, some considerations on the concept of gender are needed. In feminist research, the issues of being a woman and a man have traditionally been conceptualized by distinguishing the purely biological category (sex) from the socially constructed identities (gender). In this study, I am adhering to the so called "doing gender"—approach initially presented by scholars Candice West and Don Zimmermann (1987), whose work has been widely applied in research on gender and work organizations (West & Fenstermaker, 1995; Acker, 1992; Gherardi & Poggio, 2001; Connell, 2005; Yancey Martin, 2003). West and Zimmermann define gender as "the activity of managing situated conduct, in the light of normative conceptions of attitudes and activities appropriate for one's sex category. Rather than as a property of individuals, gender is conceived as an emergent societal feature: both as an outcome of and rationale for various social arrangements and as a means of legitimating one of the most fundamental divisions in society" (West & Zimmermann, 1987, pp. 125–126). In other words, gender is not seen as a simple property or stable identity of a person, but rather an activity and social dynamic.

Thus, gender is something people do in their everyday lives and make accountable to others. As Gherardi and Poggio (2001, p. 247) put it, gender may be considered as a set of social practices that help define the relations between men and women. Gendered[7] practices are situated (located in time and space) and help people to position themselves in relation to others and to construct themselves as persons within the possible cultural expectations and norms about what it is to be a man or a woman. Patricia Yancey Martin (2003, p. 354) distinguishes gendered practices from the actual event of practicing gender; that is, the literal activities through which gender order is constituted at work. Practicing gender means the actual doing, maneuvering and performing of one's identity as a man or a woman. Hence, the concept of gender includes both the practical and relational aspect; it is something that is acquired and negotiated through social processes.

[7] In this study, I use the words "gendering" and "gendered" as equivalent modifiers of practices that are perceived, interpreted and/or intended to be about gender.

Gender is also a constitutive element of social relationships that are based on the perceived differences between male and female (West & Zimmermann, 1987; Acker, 1992). Being a man or a woman in a certain culture at a certain time involves a positioning process in which female and male function as alternative categories: affirming the one entails denying the other (Gherardi, 1994, p. 595). Thus, building gender identity happens in a comparison process whereby individuals construct their identities through difference (Gherardi & Poggio, 2001, p. 248). However, it is important to note that in this view, gender is seen as a culturally constructed category in the sense that feminine and masculine qualities in one culture are not necessarily transferrable to other cultures.

In the realm of organizational studies, the idea of gender as a set of social processes has been applied in order to understand the ways in which gender differences are constructed, reconstructed and challenged in organizational structures, symbols and interaction. In her model of *gendered organizational processes*, Joan Acker (1992) distinguishes four sets of processes that produce gender difference at work. In *structural* processes, the production of gender differences takes place in the gendered patterns of division of labor, wages, hierarchies and power. Even though the structural processes may sometimes be altered by the managers or unions, they often persist in the perceptions of what kinds of jobs are suitable for women and men. These perceptions, for their part, shape decision making in the society (Acker, 1992, pp. 252–253). In organizational processes where *symbols and images* are created, gender differences are produced by means of stories or pictures that justify the gendering of jobs, wages, hierarchies, and power (Acker, 1992, pp. 252–253). Gender differences may be produced explicitly in the ways in which organizations and its employees are defined. For instance, natural scientists are often represented as men in both public media and university web pages. Gender differences may also be produced implicitly when evaluation standards of a job appear to be gender neutral, but in reality, only a male person may meet the requirements (Acker, 1992, pp. 257–258). In the set of *interactional* processes, gender differences are produced in myriads ways in which alliances and exclusions are created in an organization. Sexual harassment is one form of these interactional processes, but they often are much more embedded in the organizational activities and constitute them (Acker, 1992, p. 253). Finally, the internal *mental* processes of individuals participate in the production of gender difference in an organization. This occurs through individuals' understanding of their place as women and men in an organization (Acker, 1992, p. 253). For women, this may mean adapting one's identity to the demands of gender-appropriate behavior, such as being "one of the guys," and hiding aspects of personal life that are perceived to be unacceptable.

When attempting to understand the manifestations of gender difference in my study, I rely on Acker's (1992) models of gendered organizational processes. I am interested in the multiple ways and dimensions in which gender difference becomes produced, reproduced and/or challenged by female and male physicists. I focus not only on the explicit references to gender, but also on practices, values, images and interactions through which individual physicists construct their identity when accounting for their work.

As Slaughter (2011) notes, Gramsci's theoretical heritage has been influential in the rise of gendered consciousness in Western countries from the 1970s on. Indeed, the concept of hegemony has been applied in various empirical studies in order to explain the power relations between men and women. One of the leading scholars in masculinity studies, R. W. Connell, has developed the concept of hegemonic masculinity, which combines theoretical aspects from gender studies and Gramsci's idea of hegemony. In his concept of hegemonic masculinity, Connell attempts to combine the assumption of male supremacy and the hegemonic mode of domination. Deriving from the work of Gramsci (1971), Connell defines hegemony as "a cultural dynamic by which a group claims and sustains a leading position in social life" (Connell, 2005, p. 77). Hegemonic masculinity, according to Connell, can be defined as a configuration of gender practices that is accepted in a certain historical space and time and that guarantees the dominant position of men and the subordination of women (Connell, 2005, p. 77). However, Connell sees gender as both complex and processual; masculinity and femininity are multifaceted and diverse rather than monolithic entities. Hegemonic masculinity embodies qualities like hetero-sexuality, physicality and activity and becomes contrasted with homosexuality and passivity. It is based on culturally constructed gender relations and beliefs about appropriate gender roles. As such, hegemonic masculinity appears natural and justifies present social positions and embodies a currently accepted strategy for defending male dominance (Lusher & Robins, 2009, p. 388). Male dominance ideology is reflected in both individual beliefs and power structures.

While Connell's (2005) concept of hegemonic masculinity is compact and powerful, an essentialist assumption of the oppressive male gender transpires in Connell's work. In the following, I introduce other studies that focus on hegemony from a gender perspective.

Empirical studies on gender, hegemony and academia

It is worth noting that Gramsci's legacy affects a variety of studies conducted in the realm of human sciences that examine issues such as power relations, resistance and contradictory consciousness. However, not nearly all of these studies take Gramsci's original work as their theoretical point of departure (e.g., Haas & Hwang, 2007; Mescher et al., 2010; Crane, 1999; Benschop & Doorewaard, 1998; Welsh, 2001; Erkama, 2010); neither did they always

elaborate the concept of hegemony but rather used it as a universal notion referring to commonly accepted rules and power relations. Hence, the concept of hegemony is in danger of losing its original dialectical nature and to becoming diluted as a general term describing power relations.

As a result of an article search in the University of Helsinki database (Nelli), I drew the conclusion that the concept of hegemony has been inflated in some social scientific studies. I went through 60 articles that were relevant to the themes "hegemony and gender" and "hegemony and academia," but only eight of them referred to Gramsci's original work on hegemony. Many of the 60 articles provided a highly interesting analysis of power relations, gender and academia, but as in this study the focus is on the specific use of Gramsci's concept of hegemony, I decided to look more closely at those studies that attempted to follow Gramsci's original work when theorizing about hegemony. In these studies, Gramsci's concept of hegemony was utilized for analyzing gender roles produced in television-series (Wilson, 2010) and advertisements (Gentry & Harrison, 2010) as well among ethnic minority groups (Pyke & Johnson, 2003). In the following, I present three of these articles as examples of how Gramsci's concept of hegemony is applied in empirical research on gender relations. I have chosen these articles because they are most relevant to my research theme.

Ching Kwan Lee (1993) has studied hegemony and the interplay of women's family roles and workplace relations in the context of an electronic company in Hong Kong. In her analysis of participant observational data from the shop floor work, she analyses a regime of workplace hegemony that she calls familialism. With familial hegemony, Ching Kwan Lee means the ways in which femininity and women's' gender roles in a family are used as means of workplace dominance and resistance. Thus, her understanding of hegemony is "dialectical, open and contested" (Kwan Lee, 1993, p. 531).

Kwan Lee points out that many workplace phenomena contain both elements of control and resistance. For instance, on the level of workplace interaction, female supervisors would use humorous comments on femininity as a means of assessing the quality of their work: "How can you be so careless; you're a woman, aren't you?" (Kwan Lee, 1993, p. 537). While female workers seemed to accept this association with their gender, at the same time, they made jokes about their male colleagues ridiculing their masculinities and thus performing resistance with the help of their innate femininity (Kwan Lee, 1993, p. 537). Familial discourse constituted the identity of the female shop floor workers as they anchored their self-understanding more to their family than to the factory. In the workplace discourses, family issues were a key for male supervisors to address the female employees. Family needs were generally seen as the reason for most of the women to work in the factory and family responsibilities were also used as arguments when negotiating work shifts (Kwan Lee, 1993, p. 539).

However, the company management was able to manipulate the employees with the help of a female supervisor, to whom workers wanted to show solidarity and thus they accepted overtime work.

Kwan Lee concludes that these gendered norms and behaviors function as both a means of management control and leverage for working mothers to negotiate their working conditions with their supervisors. However, it seems that the familial hegemony maintains and reinforces the existing hegemonic organization of class and power in the workplace even when the female workers tried to resist it (Kwan Lee, 1993, p. 545).

In the scene of higher education studies, T. O. Patton (2004) has discussed the interdependence of sexism and racism in academia. Being a female African-American scholar, Patton is a member of a dual minority in the Euro-American university world. She bases her analysis of white supremacist hegemony on Gramsci's idea on the hegemonic struggle that a class needs to win in order to dominate. Thus, hegemony can be understood as a constant attempt to structure and restructure strengths and weaknesses and to recuperate the forms of resistance (Patton, 2004, p. 189).

In her analysis of three narratives from African-American female scholars, Patton considers the manifestations of white male hegemony in the current Euro-American academic world and the interlocking systems of domination that it produces. The manifestations of hegemony that Patton identifies are: 1) outsider-within, 2) intersectionality of gender and race, and 3) modern racism. By outsider-within Patton means social situations in which a person is simultaneously a member of a group (i.e., women) and marked in a category of others (i.e., African American). Gender and race intersect when a female African-American scholar is told to put up with devaluations based on her race and gender because she has no one to support her in the department. Here, the requirement to assimilate to the status-quo can be seen as an attempt to maintain the white male dominance in the university (Patton, 2004, p. 194). By modern racism, Patton means covert and inferential racism that manifests itself in a belief in power and privilege of the white supremacy. It may manifest in situations in which members of a majority assume the right to claim that the group is non-racist, as when a white male colleague says to his female African-American colleague: "There is no discrimination in the department!" (Patton, 2004, p. 196).

In her conclusion, Patton considers the possibilities to interrogate the white supremacist hegemony in academia. She suggests that critical examination is needed in terms of the ways in which whiteness and masculinity are articulated in academia. Only by unveiling the social and cultural constructions of the male white supremacy, can an alternative academic reality be articulated (Patton, 2004, p. 197).

Barbara Bagilhole (2002) has studied the implementation of equal opportunity policies in British universities. Having interviewed university staff on different levels of the academic hierarchy, Bagilhole provides an interesting analysis of the modes of responses to the perceived demands of equal opportunity policies. Bagilhole draws from the theoretical heritage of Gramsci (1971) and Connell (1987) by introducing a notion of *accommodating masculine hegemony*. By accommodating masculine hegemony Bagilhole refers to efforts and sacrifices made by the dominant group (male, senior academic staff) in favor of the subordinated groups (Bagilhole, 2002, p. 23).

Bagilhole categorizes the outcome of her data analysis into four groups of answers according to the types of responses to the equal opportunity policies. They include: 1) confusion; 2) collusion; 3) cynicism, and 4) contrariness. *Confusion* covers answers that reflect a general or conceptual lack of clarity on the substance of equal opportunity policies and an individual's own opportunities to promote equality at his/her work place. *Collusion* included answers that overtly accepted equal opportunity policies as long as they did not challenge existing power structures, for instance, informal forms of career support and the autonomous position of professors in terms of recruitment processes (Bagilhole, 2002, p. 25). *Cynicism* was a category describing answers that presented a dual view of discrimination of women. On one hand, these answers demonstrated sympathy towards women who were discriminated against. On the other hand, they also stated that "real life" in academic communities is inherently masculine-dominated and that women should adapt to that (Bagilhole, 2002, p. 27). This attitude is captured by the idea of being "one of the chaps" a strategy that some academic women seemed to have adopted. *Contrariness* was a label for those answers that overtly resisted any official equal opportunity policies. As an example of contrariness, Bagilhole analyses answers to a question about flexible working hours. Both men and women expressing cynical view on equal opportunity policies maintained that flexible hours system seriously contradicts the favored academic working culture. They adhered to the "long hours culture" as the only demonstration of commitment. Motherhood responsibilities were also considered as an obstacle in women's careers (Bagilhole, 2002, pp. 29–30).

In conclusion, Bagilhole states that the different responses to equal opportunity policies reflect the dominant modes of thought in the British universities. The leading academic staff is responsible for implementation and/or resistance of equal opportunity policies and at the same time is in the elitist position in defining the agenda and the model for a "proper academic." Taking into account that these persons in power mainly belong to the group of white, middle-aged men working in a traditionally male dominated area of higher education Bagilhole concludes that they represent masculine hegemony (Bagilhole, 2002, p. 31). Thus, in Bagilhole's analysis, hegemony results from

the fact that most powerful academics are men. Masculine dominance becomes produced in a set of conventions and ideals in the academic world that include and exclude individuals. Yet, not men reproduce masculine hegemony; some women also participate in marginalizing themselves.

The studies above highlight important aspects of the concept of hegemony and its gendered aspects. Firstly, they show that hegemony is not primarily coercive power, but usually becomes manifested in mundane practices in organizations. Secondly, hegemony is something that people give their consent to; it can take the form of self-evident and naturalized perceptions about the world, human relationships, and workplace realities, while at the same time, hegemony involves the idea of marginalizing some groups and privileging others. Thus, hegemony becomes produced and reproduced not just by the ruling group, but also by marginalized groups (Bagilhole, 2002). Furthermore, hegemony based on gender may in some cases interlock with other hegemonic relations, such as race (Patton, 2004).

The studies also present hegemony as dialectical and contested and provide examples of contradictory consciousness, for instance when African-American female academics reflect their experiences on white male hegemony in the university (Patton, 2004). The empirical analysis of these studies also reveals certain mechanisms of resistance, for instance in the case of female factory workers who resisted the management requirements to work over time by pleading obligations to their family responsibilities (Kwan Lee, 1993). However, the actual struggle over hegemony is not very visible in these studies while in Gramsci's thinking, dominance based on consensus is something that is historically constructed and thus bound to transformations. As Mumby (1997, p. 352) points out, hegemony is more about competition of different worldviews than permanent dominance of certain group. When groups and ideologies fight for their legitimacy and space in a certain historical time and space, contradictions are likely to arise. Therefore, a Gramscian analysis of hegemony requires sensitivity to the nuances of historical transformations and potential changes in current circumstances.

3.4 Hegemony, contradiction and gendered organizational processes as theoretical tools of this study

Above I have introduced the three theoretical concepts that I employ in this study—hegemony, contradiction and gendered organizational processes. They are intertwined in the sense that the dialectical concept of hegemony implies the concept of contradiction. Furthermore, embedded in the analysis of gender relations there are questions about hegemony and contradiction. As the main topic of this study is hegemony, I adhere to three aspects of Gramsci's ideas about hegemony. The first aspect is struggle, contradiction and resistance. As

hegemony is by nature something generally agreed on, it is as highly demanding if not impossible, task for a researcher to operationalize hegemony, that is, to figure out what are the indicators of hegemony in speech and action. Therefore, by looking at instances where ideas, conventions, practices and values clash, it is possible to identify dominant and opposing worldviews. Thus, recognizing hegemonic ideas (those generally accepted) becomes easier by looking at places where they are challenged. At the same time, it is justified to ask questions about the processes through which dominant worldviews are maintained and propagated.

The second aspect at the core of my understanding of hegemony is the dialectical material dimension of hegemony that becomes articulated in Gramsci's concept of the philosophy of praxis.[8] It is evident from Gramsci that hegemony is not just an issue between ideologies, but that the hegemonic struggle becomes manifested in the lives of societal classes, men and women, old and young, and different ethnic groups. Thus, hegemony is not just a mental state or ideology, but becomes materialized in human lives. The manifestation of hegemony is bound to the historical, economic and societal environment and involves ideology, activity and identity formation. This means that hegemony can be studied appropriately by understanding the material and historical backgrounds of ideas, activities, and identities that prove to be hegemonic. Furthermore, it can be asked, "What are the preconditions for resistance and what counter-hegemonies are available?"

The third aspect of hegemony I focus on in this study is its connection to gender. My intention is to look at various ways in which gender and hegemony become intertwined in my data while not considering gender as an immediate source of dominance or subversion. Therefore, I chose not to combine hegemony and gender in one theoretical concept such as hegemonic masculinity, but to find theoretical tools to make sense of different aspects of hegemony and gender. Thus, I aim at identifying the organizational processes through which gender difference becomes produced, reproduced and challenged in relation to hegemony and resistance.

Based on these considerations, I modified Mumby's (1997) figure of the two poles of hegemony and added a vertical axis with the concept of gender (female/male). As a result, the theoretical framework of my study can be represented by the following figure:

[8] See section 3.1.

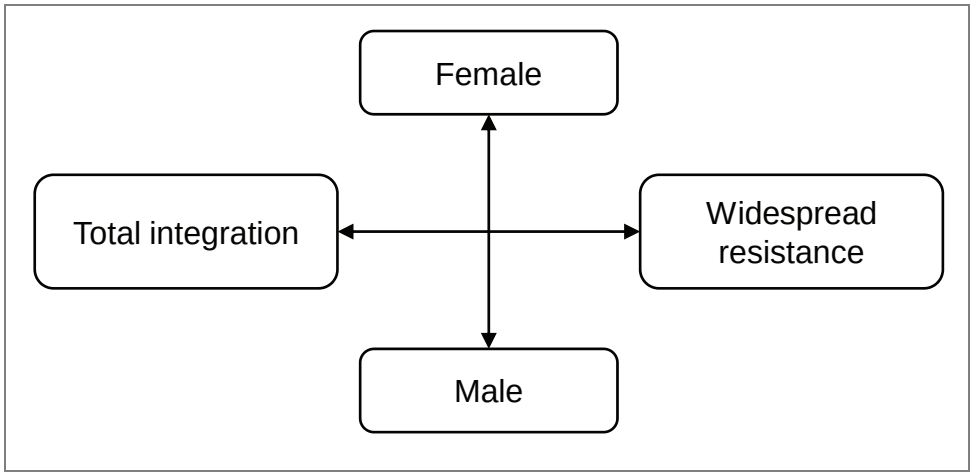


Figure 4. Axes of hegemony and gender

This figure attempts to integrate the theoretical tools I introduced earlier. The dialectical aspect of hegemony is presented in the horizontal axis. At the same time, the idea of contradiction as a driving force for any transformation is embedded in the continuum between total integration and widespread resistance. The vertical axis between female and male represents the idea of gender as a socially constructed, dual concept. In the empirical analysis of this study, I use these theoretical tools to understand in which ways and to what extent hegemony becomes contested and resisted (horizontal axis) and how hegemony is gendered in organizational processes (vertical axis).

4 RESEARCH QUESTIONS, DATA AND METHOD

4.1 Research questions

In this study, I am approaching the issue of hegemony through mapping out the instances of resistance and integration in the context of university physics. As noted by Mumby (1997), social and organizational contexts are never dominated by one all-encompassing ideology or total plurality of voices. Rather, they are characterized by greater or lesser degrees of resistance/integrations. This observation implies, that hegemony describes a dialectical continuum between total integration and widespread resistance (Mumby, 1997, p. 365). When hegemony is understood as a process of struggle rather than a state of consensual domination, it becomes possible to study hegemony via looking at the instances of resistance and integration in empirical data. What hegemonic relations become reproduced and contested in these instances? How are they lived in work practices, interpersonal relationships and self-understandings of the physicists? And how does gender intersect with them?

The research questions of this study pertain to interview accounts, not to direct observations or similar evidence. The three research questions I aim at answering in this study are the following.

1. How does hegemony reproduce itself or become contested in the careers pursued by male and female university physicists?
2. What causes hegemony to be reproduced in some cases and contested in some others?
3. How does hegemony affect the careers of male and female university physicists?

The three research questions have different statuses in terms of the theoretical concepts utilized in this study. As shown in the beginning of this chapter, integration and resistance are seen as the two poles of the dialectical continuum of hegemony. In other words, integration with hegemony involves reproduction of hegemony whereas resistance involves contesting hegemony. The three research questions build on the processes of reproduction and contestation as points of departure, and aim at opening up the dialectical nature of hegemony in empirical data. Question number one aims at describing hegemony as an empirical phenomenon, as it aims at mapping out the ways in which hegemony is reproduced and/or contested. Question number two tackles the issue of contradictions by shedding light on the processes through which individuals

either resist or integrate into hegemony. While the gender aspect is present in questions number one and two, question number three covers specifically the issue of gender difference as it focuses on the actual consequences and effects of hegemony in the lives of male and female physicists.

In my data analysis, I aim at tackling the question of resistance and integration with the help of three intermediate concepts: alignments, turning points and discursive manifestations of contradiction. As Mumby's (1997) presentation of hegemony as a dialectic continuum indicates, hegemony becomes not only reproduced, but also contested in the social reality. Thus, responses to hegemony may vary from total integration to widespread resistance. On the other hand, hegemony is by definition something that is widely agreed on and consequently, hegemony is not easily identifiable *per se,* but needs to be addressed through the instances of integration and resistance it arises in the social reality. When trying to understand hegemony, one has to examine the struggles and ruptures within it.

However, hegemony is a theoretical concept that as such does not lend itself to empirical research. Therefore, intermediate concepts were needed in order to bridge the phenomena described by a theoretical concept (hegemony) and empirical data (interview material). The empirical data suggested the choice of the three intermediate concepts of alignments, turning points, discursive manifestations of contradictions. They provide three different analytical perspectives to the phenomena of integration and resistance.

With the help of these three intermediate concepts, I aim at analyzing the linguistic processes through which resistance and integration are articulated in the interviews. *Alignments* are linguistic strategies that people employ when positioning themselves in relation to the speech context and other people. *Turning points* refer to narratives that describe a major change or transformation in individual life, more specifically, in his/her career path. *Discursive manifestations of contradiction* refer to dilemmas, conflicts and double binds expressed in talk and typically connected to specific linguistic cues. I am interested in the ways in which resistance and integration are lived in when physicists position themselves in relation to their work and colleagues (alignments), the transformations in their career paths (turning points) and the conflicting aspects of their everyday work (discursive manifestations of contradictions). These intermediate concepts are introduced more in depth in the respective empirical chapters.

4.2 The context of the data collection: The UPGEM project

I began this study within a multinational research project called Understanding Puzzles in the Gendered European Map (UPGEM) that ran from 2005 to 2008. Funded by the European Commission's 6th Framework Programme, "Structuring

the European research area, science and society: Women and Science", UPGEM was a collaboration between five European countries, namely Denmark, Estonia, Finland, Italy and Poland.[9] I worked as the Finnish research assistant in the project and was responsible for gathering, analyzing, and reporting empirical data. This study is based on the data that I have collected in the UPGEM project.

The project took its point of departure from the statistical observation that although women are underrepresented in the highest academic posts in the natural sciences throughout Europe, the percentage of female academic professionals in the natural sciences is higher in Southern European countries than in the Nordic countries (European Commission, 2003, p. 65). This pattern emerges in smaller scale statistical studies on physicists (see Hasse & Trentemøller, 2008, p. 13). The purpose of the UPGEM project was to study the reasons underpinning the aforementioned gender gap in physics as well as nationally diverse gendered career paths of physicists. This was accomplished by exploring universities as workplaces and examining the culturally and historically formed career paths of individual physicists (Hasse & Trentemøller, 2008, p. 11). The project also paid special attention to the mechanisms of inclusion and exclusion in scientific communities, that is, the reasons that lead some scientists to embark on an academic career and others to move on to other types of jobs. Therefore, both physicists who worked in academia and physicists who left their academic careers were included in the study. By including the physicists who left academia in the empirical data, UPGEM aimed at gaining a retrospective external perspective on the local processes that steer the career paths of physicists.

Even though the imbalance between men and women in physics was the impetus of the UPGEM study, the gender aspect did not mean that research was performed only on women. Quite the contrary, the research focus was equally on men's and women's careers and working conditions. This was a choice that pinpointed the need for study both women's and men's issues within the field of gender research (Hasse, 2008, p. 16).

Theoretical and methodological basis of the UPGEM project

UPGEM was not only a multinational project; it was also multidisciplinary as the research partners represented different humanistic fields: anthropology, philosophy, linguistics, education, gender studies and psychology. The theoretical framework of the project, however, was principally rooted in cultural historical activity theory (CHAT). CHAT sees human beings as creating

[9] The UPGEM partners were Cathrine Hasse (co-ordinator), University of Aarhus/ DPU, Denmark; Kristina Rolin, Helsinki School of Economics, Finland; Anna Maria Ajello, University La Sapienza, Italy; Endla Lõhkivi, University of Tartu, Estonia; Yrjö Engeström and Merja Helle, Centre for Activity Theory and Developmental Work Research, Finland, and Elzbieta H. Oleksy (until November 2007), University of Lodz, Poland.

dynamic activity systems in relation to their material, social and historical environments (see, for example, Engeström, 1987). Human activities are historical formations always object oriented, mediated by artifacts and involving more or less explicit rules. Human activities are studied as processes of development that occur in the interface of individual and social learning processes. To be able to understand one's research object, for instance the work of a physicist, insight into the historical, material and social environments of the object is needed (Engeström, 1999a, pp. 35–36).

In line with cultural historical activity theory, three basic concepts were selected to guide the data collection, namely gender, culture, and stayer-leaver. These concepts also formed three dimensions of a preliminary analytic framework for empirical data (see Figure 5).

In the initial phase and for sake of simplicity, gender was defined through biology (sex) as male and female. In the later analysis, its social and cultural dimensions (gender) were unfolded (Hasse et al., 2008b, pp. 28–29). The term culture referred to both national culture and the specific culture of physics; however, in the first phase, the main emphasis was on comparing national differences in physicists' careers.[10] The dual concept stayer-leaver referred to two groups of physicists that were investigated in the study. Physicists who worked in academia (that is, state-funded universities/research institutions) at the time of data gathering were called "stayers". "Leaver" in the UPGEM study meant a physicist who had begun or finished a doctorate degree, but who had left research work in academia no more than 10 years ago.

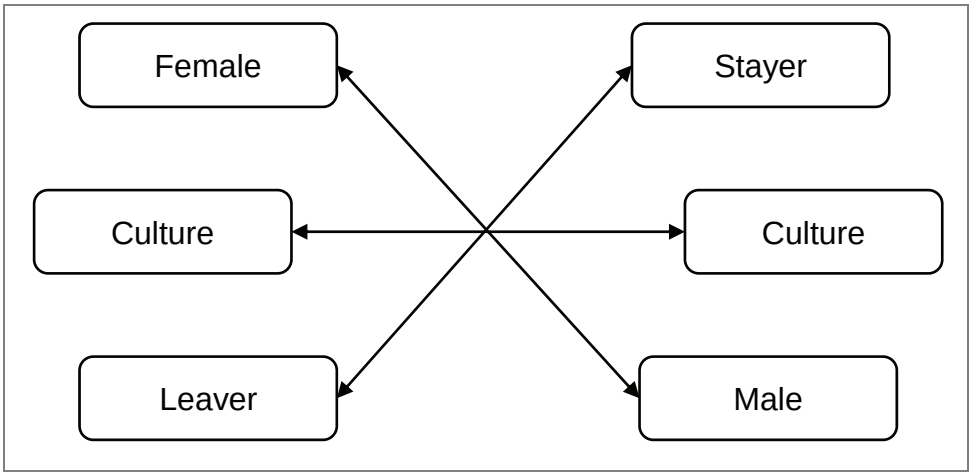


Figure 5. Three dimensions of data analysis in UPGEM (Hasse & Trentemøller, 2008, p. 30).

[10] See Hasse & Trentemøller, 2008 for more extensive analysis of the concept of culture.

Activity theoretical research typically involves an ethnographic research method with periods of participant observation and fieldwork which has proved to be a fruitful way to study different types of organizations and work communities (see, for example, Kerosuo, 2006). Previous studies on physicists and their work have also been based on extensive ethnographic field work (i.e., Knorr Cetina, 1999; Hasse, 2002b; Traweek, 1988). However, in an international and multidisciplinary project like UPGEM, ethnographic fieldwork as a data gathering method was not easy to arrange. Moreover, the quality and coherence of data gathered by many researchers on multiple sites was more probably ensured when data gathering was organized by the same principles in every project country. This is why UPGEM mainly relies on a semi-structured interview as its method of gaining empirical data. Even though the data gathering process included some participant observation in physics institutions, linguistic material gathered by interviewing physicists was the primary data used in the final analysis (Hasse & Trentemøller, 2009, p. 50).

The phases of the UPGEM project

The practical activities of the UPGEM project were organized around a core group of the previously mentioned six senior partners and 18 research assistants from the five project countries.[11] The senior partners were responsible for creating the theoretical and methodological basis of the study, while the research assistants did the actual data gathering, analyzing and reporting. The project was divided into three phases, which are presented below (see Hasse & Trentemøller, 2008, pp. 24–25).

In Phase 1 (from January to February 2006), the project members met to discuss the methodological and theoretical premises of the project, to develop a shared research object and to agree on the data gathering process. The planning meetings were held among project partners and in January 2006, research assistants from the project countries met in Copenhagen at an Innovation seminar.[12] During the six-week seminar, through lectures, workshops and discussions, the research group developed a shared understanding of some basic theoretical concepts relevant to the project. These included concepts such as

[11] Each partner country recruited one to five research assistants who worked either part time or full time in the project. The research assistants were: Katrin Velbaum and Mari-Liis Tina (Estonia); Christina Belardi, Giulia Calafiore, Piera Gabola and Cristina Cimino (Italy); Stine Trentemöller, Anne Bjerregaard Sinding, Maja Hojer, Lena Dannow, Ane Bentzen and Stine Adrian (Denmark); Jenny Vainio (Finland); Patrycja Chudizcka, Anna Diekmann, Malgorzata Miazek and Bartek Zwardon (Poland). See Hasse et al. 2008a, 373–374 for the concise list of research assistants' input to the project.

[12] After the Innovation Seminar in Copenhagen (9.1.–17.2.2006), the UPGEM research group met six times: a Conference and work seminar in Lodz, Poland (4.9.–5.9.2006); a mid-term seminar in Tartu, Estonia (27.11.–8.12.2007); a workshop in Copenhagen (21.2.–22.2.2007); a mid-term-seminar in Helsinki, Finland (8.7.–20.7.2007), and two data analysis seminars in Rome, Italy (15.11.–25.11.2007 and 20.4.–30.4.2008).

culture, physics, gender, science and technology studies and qualitative research methods. Moreover, the seminar participants discussed the practical implementation of the research and developed an interview guide that was used in all countries for gathering the interview data. Before the seminar, each research assistant had conducted a test interview with a physicist in his or her home university and translated it into English. These test interviews served as a starting point for the development of the actual interview guide. Following the premises of cultural historical activity theory, the interview themes were chosen so that they encompassed the historical, material, social and economic aspects of the work of a physicist. Such themes as family, children, professional identity and future aspects were also included in the interview guide.[13] The interview guide was first created in English, but later translated to the native language in each partner country. The purpose of creating a unified interview guide was to ensure the transparency and coherence of the data gathering process.

In Phase 2, interview data was gathered in the five project countries. The data gathering period lasted from March 2006 to summer 2007 and during that time, altogether 239 interviews with female and male physicists, both present and former university employees, were conducted. The number of interviews was defined according to the population in each country so that in the larger countries (Italy and Poland), at least 50 interviews were conducted, whereas in the smaller countries (Denmark, Estonia and Finland) at least 36 interviews were conducted. To ensure diversity in the empirical material, the interviewees were chosen so that they represented various fields of physics.[14] The interviewees were of different ages and represented different academic statuses from PhD student to professor. As one of the research focuses in the project was in the academic selection mechanisms, about 40% of the interviewees were chosen from physicists who had left academia. In addition, interviews were conducted in at least two universities in each country (Hasse & Trentemøller, 2008, p. 31).

The interviews were conducted in native tongues, but as the whole UPGEM team was supposed to gain access to the data, the recorded interviews were transcribed and translated into English. An internet-based platform (SharePoint) was first used for storing and sharing the data, but due to complications in the interface, the project members decided against using the platform and stored the data locally.

Besides conducting interviews, the research assistants were assigned to conduct some participant observation in one physics institution. This was done in order to deepen the research assistants' understanding of their research object. Each partner country also produced "information boxes" about the changes in its

[13] The entire text of the interview guide is provided in Appendix 1.

[14] For example geophysics, theoretical physics, nanophysics, solid state physics, particle physics, nuclear physics, X-ray physics, aerosol physics, astrophysics, astronomy, meteorology and material physics. (Hasse et al., 2008a, p. 382)

political, economic and academic life as well as women's emancipation and equality policies in the respective countries. Neither field notes from participant observation periods nor the information boxes were used as research data as such, but they provided background information about the social, historical and material environments of the interviews (see UPGEM, 2008).

During Phase 2, communication between the research assistants and the coordinator occurred via e-mail and Skype conferences. The research assistants reported on and exchanged information on their work by writing monthly state of the art letters that were delivered to the project members. In addition to virtual contacts, several meetings[15] were held where research assistants and the coordinator met in order to discuss the data analysis and define the working hypothesis that formed the basis of data analysis.[16] The interview data was sorted and analyzed nationally according to these hypotheses with the help of the qualitative analysis software Atlas.ti. As it was not possible to deal with all working hypotheses when writing the research reports, the seven most important themes connected to clusters of hypotheses were chosen. Each country had to report on these themes, but it was left up to each local team how to weigh and analyze these themes. The themes covered were: a) change in the universities from 1960 to today; b) career path; c) workplace environment; d) family; e) mobility; f) the future, and g) identity (Hasse, 2008, p. 16). As an outcome of this period of data gathering and analyzing, five national research reports were produced. They were published in a book entitled *Draw the Line—Universities as Workplaces for Male and Female Researchers in Europe* (Hasse et al., 2008). A publication conference was held at Danske Pedagogiske Universitet in Copenhagen, Denmark in May 2008.

In Phase 3 (January 2008 to June 2008), the research work was mainly conducted by the Danish team that produced a comparative analysis of the entire interview data collected by researchers in the UPGEM-countries. The method used in this study is called "cultural contrast" and it tackles the cultural diversity in producing word meanings and connections in the international research data. The results of this analysis are published in a report, *Break the Pattern* (Hasse & Trentemøller, 2008) and in an article by Cathrine Hasse and Stine Trentemøller (2009).

As the UPGEM project ended in spring 2008, all the data gathered during the project remained the property of the project's consortium. However, individual researchers were granted the right to use the data material they collected and

[15] After the Innovation seminar in Copenhagen (9.1.–17.2.2006), the UPGEM research group met six times: at a conference and work seminar in Lodz, Poland (4.9.–5.9.2006); at a midterm seminar in Tartu, Estonia (27.11.–8.12.2007); at a workshop in Copenhagen (21.2.–22.2.2007), at a midterm-seminar in Helsinki, Finland (8.7.–20.7.2007), and at data analysis seminars in Rome, Italy (15.11.–25.11.2007 and 20.4.–30.4.2008).

[16] The 34 original working hypotheses are provided in the project report (see Hasse et al., 2008a, p. 384).

gathered for scientific purposes. Since I was the only Finnish research assistant in UPGEM, I had the responsibility for the whole process of conducting the empirical research in Finland. Consequently, I was familiar with the vast and thematically rich bulk of interview data. However, in my research report based on the Finnish interviews (Vainio, 2008), I was only able to touch upon certain aspects of the interview material, while many themes, such as the issues of power in physics communities, could not be investigated. Therefore, a further and more thorough analysis of the interview data is justified, and that is what I undertake in this study. In the following, I introduce the research data used in this study in more detail.

4.3 Data collection

Method of data collection: Semi-structured interviews

The interview method used in this study resembled a semi-structured form of interviewing as described by Kvale (1999, p. 129), Aull Davies (2002, pp. 94–95), and Fontana and Frey (2005, p. 705). The semi-structured interview always contains an outline of themes and issues to be investigated; in this case the pre-established interview guide. However, the research questions do not rely only on pre-established response categories that might limit the inquiry, but they are designed to produce diverse and lively accounts of the interviewees' lives. The interviewer may change the wording of the questions or their order if needed; besides the interviewees are encouraged to expand on their answers or digress and even go beyond the themes introduced by the interviewer (Aull Davies, 2002, p. 95). The rather loose structuring of the sequence and form of questions also made it possible to explore new themes that arose during the interviews (Kvale, 1999, p. 97).

The semi structured interview situation often resembles a normal conversation although it is characterized by a systematic form of questioning (Kvale, 1999, p. 130). Thus, the interviewer remains in the position of inquiring about the interviewee's life, yet does so relatively informally and follows up with questions and general curiosity (Hasse & Trentemøller, 2008, p. 32). In this study, due to the prefabricated set of interview questions, an uneven distribution of talking turns in terms of questions and answers was present in the interviews—the interviewees were talking more than the interviewer was. In terms of data quality, the mentioned imbalance was not a problem but an asset; by letting the interviewees talk as much as he/she wished, the richness and variety of the interview data were ensured (Kvale, 1999, p. 145).

Another feature of a semi structured interview is that underscores the need for sensitivity to the context. In order to pose meaningful questions and to understand the interviewee's experiences, the researcher has to gather some

knowledge of the local settings (Holstein & Gubrium, 1995, p. 45.) As pointed out by Aull Davies (2002, p. 95), the semi-structured interview requires "at minimum attention to the interview context and the relationship between participants beyond simply what is said." Therefore, semi structured interviews often contain multiple contacts with the research subjects. The interview data may be enriched by conducting participant observation or focus group interviews. For this reason, semi structured interviews are sometimes also called ethnographic interviews. As Fontana and Frey (2005, pp. 705–706) put it, the ethnographic interview refers to the idea that like an ethnographer engaged in fieldwork, the interviewer is getting to know a new culture (for example, that of physics)—its habits, its language and ways of life—with the help of the interviewees. Thus, the focus of ethnographic interviewing is in understanding and contextualizing the interviewee's experiences by getting to know his/her environment.

The interview method used in this study has features of an ethnographic interview in the sense that contextualizing the interview data was part of the research process. Most importantly, I conducted one week of participant observation in tandem with the interviews as one of my interviewees gave me permission to follow her work at the physics department. This period of participant observation gave me an insight on the life of the department, its practices, routines and social relationships. Even though I did not analyze the fieldwork notes systematically, this background information helped me to deepen my interpretative perspectives on the research data. As Holstein and Gubrium (1995, p. 45) suggest, doing fieldwork also enables the researcher to reformulate research questions and pay attention to certain themes that were not explicitly asked but emerged during the interviews. In my experience, one topic that arose was the dual task of administrative work and research work, which came out as a highly topical issue. After having identified this issue in the interviews, I went on to ask more specific question about the administrative tasks that the interviewees conducted.

Besides this period of participant observation, I attempted to contextualize the individual interviews I conducted. Before each interview, I gathered background information about the interviewee's research activities via the Internet. This was done in order to orientate to the research topics of my interviewees at least on rudimentary level. While conducting the interviews, I took field notes describing the interviewee, the interview surroundings, the atmosphere of the interview, possible interruptions and other issues that might affect the interview process (see Aull Davies, 2002, p. 110). These field notes were attached to the interview transcriptions in order to make it easier to recall the interview situations when analyzing the data.

The traditional idea of a detached interviewer—an objective and distant scientist who asks questions, records answers, analyzes and reports them—has

been contested by pointing out that however objective a researcher aims to be, an interview is always an interactional event in which both the interviewer and the interviewee participate in the construction of knowledge (Fontana, 2002, p. 163). According to Holstein and Gubrium (1995), the interviewer always has an active role in the sense that he/she is responsible for evoking interviewee's answers (whether abundant or monosyllabic). They provide an alternative to the traditional, disinterested role of the interviewer, namely, that of an active interviewer. The active interviewer consciously stimulates the narrative production of the interviewee. This can be done by posing provocative questions, opposing arguments or precedents as well providing the interviewee with such narrative resources as stimulating stories. The interviewer may also offer the interviewee ways of making connections and conceptualizing issues relevant to the study. By applying these activating elements in the interview, the interviewer is able to harness the interviewee's narrative potential to the research task (Holstein & Gubrium, 1995, p. 39). The active role of the interviewer is also highlighted by Fontana and Frey (2005, p. 711). They point out that the intimacy which is created by reciprocity between the interviewer and the interviewee can be seen as producing a larger variety of responses and providing the researcher a greater insight into the lives of the respondents. Thus, it can be derived that high quality interview data is most likely to be produced in a situation in which the interviewer creates an active yet discrete and mindful rapport with the interviewee (Madison, 2005, p. 31).

Bearing in mind these aspects, I aimed at developing my own style as an empathetic and active interviewer. In the interview situations, I did not follow the interview guide mechanically, but permitted the discussion to flow freely or even digress. I felt free to react to the interviewees' answers, to express my emotions and ask questions that were not listed in the interview guide. By doing this, I intuitively acted as a sympathetic listener; I was motivated by understanding and not judging what my interviewees said and expressed to me (see Madison, 2005, p. 32). At the same time, I activated my interviewees' narrative production by providing them with "triggers" when appropriate. For instance, I would rephrase the interviewees' answers or pose follow-up questions in order to focus their arguments. Sometimes I could also refer to my own experiences or other interviewees' answers when trying to encourage the interviewee to elaborate on a certain topic. Here is an example in which I quote previous interviewees in order to promote a more extensive reflection on the issue of maternity leave.

> JV: Well, I was just going to ask if you think that it would be theoretically possible to spend a few years at home with the children, and then to continue working?
>
> Interviewee 1: Well, yes, it would be.

> JV: Ok, yes. I have also spoken with some women who are researchers and they think that long maternity leaves aren't possible. And by long, I mean normal length. Someone had stayed at home for three months with the baby and then returned to do research. But I thought that sounded really, merciless, but I don't know if it can be like that every field.
>
> Interviewee 1: No, here we have had, in the post-graduate phase, a number of people on a year's maternity leave, and I think that someone was on maternity leave twice. But even then it was a year at a time.
>
> JV: Yes, of course.
>
> Interviewee 1: So if you spent five years away at a stretch, you would just need to persevere. It depends a little on where in the cycle you have children. If the post-graduate studies have already been started, it is possible to jump back in, but if nothing has even been begun, it may feel difficult to get started.

Issues of power are inherent in all human encounters and therefore it is also important to consider them also when assessing one's role as a researcher. D. Soyini Madison (Madison, 2005, p. 33) points to this by illustrating the inevitable power asymmetry that is created between the researcher and the research subject. However equal the people might otherwise be, the interviewer has the power to interpret and report the lives of the interviewees, who are the subjects of the study. According to D. Soyini Madison, the researcher always has to be aware of this status difference in order to carry out responsible research. At the same time, there is a need to consider power relations that stem from the backgrounds of the interviewee and the interviewer. The interviewer has to be aware of the potential hierarchies or differences in social status that might skew the interview situation in one way or the other. As Aull Davies (2002, p. 100) exemplifies, the problem with interviewing such experts as university professors is that the interview may easily become steered by the interviewee's interests and not the researcher's interests.

In this study, the interview situations were influenced by the fact that my role as a researcher studying researchers was twofold. On one hand, I came from the same context as my interviewees, that is, academia. Like my interviewees, I had an academic degree and my work was similar to theirs. Thus, when discussing the academic career path or the university as a workplace, it was relatively easy for me to empathize with the interviewees and resonate with their experiences. On the other hand, in terms of the substance of physics, I was a complete layperson; my interviewees were genuinely in the position of knower while I was a non-knower inquiring about their work. This asymmetry, however, did not appear as problematic as Aull Davies (2002, p. 100) put it, but all my interviewees independent of their academic status were motivated to answer my (sometimes unsophisticated) questions.

Even though I shared the basic knowledge of university life with my interviewees, I recognized that it did not guarantee mutual understanding in all respects. Therefore, I adapted to what D. Soyini Madison (Madison, 2005, p. 32) calls "positive naïveness" especially when discussing the substance issues of physics. This meant that I told my interviewees about my lack of knowledge in physics and acknowledged them as experts. Most interviewees took this for granted and made a great effort to explain their research topics and methods to me in non-technical language. However, sometimes I was surprised to realize that my interviewees assumed that I was more familiar with their research than I was. This happened especially in the last phase of data gathering, when I had gained some general knowledge of physics as a science and could apply some of its basic vocabulary when posing questions about substance issues. My perception of these cases was that I may have accidentally omitted "positive naïveness" and slipped into a role of "pseudo-knower." Here is an example of a situation in which the interviewee's account of his/her research interests goes far beyond my understanding. Even though harmless, this episode shows an unwilling twist of roles that may occur during an interview. At the same time, it pinpoints the importance of assuming the position of non-knower explicitly enough.

> JV: Ok. What does super symmetry mean?
>
> Interviewee 2: Super symmetry is the symmetry that joins fermions and bosons to each other. I don't know if you're familiar with fermions and bosons, but an example of a fermion is an electron, and of a boson is a photon. Super symmetry makes it so that each fermion has a super partner, so an electron would have a super symmetrical electron; we call them s-electrons. For this theory to work there needs to be some kind of a, broader Higgs field, which then produces five Higgs boson. Three of them, let's say the degrees of freedom for a Higgs field is a W plus minus zero mass, and the rest five degrees of freedom are visible particles. Then there are three neutrons, a light Higgs, two heavy ones, which I am researching and then the charged plus/minus Higgs boson. The super symmetry...
>
> JV: So it describes their analogue...
>
> Interviewee 2: It is a bit like the W boson, if you are aware of the W?
>
> JV: No, I am not.
>
> Interviewee 2: You are not. Well, that too is plus/minus. It has two particles. Like an electron and a positron, so that too has an electron minus and a positron plus, so this is just like that.

The last aspect to power relations in the interview process is connected to the need to overcome the traditionally hierarchical positions of a researcher and a

research object. This need is typically expressed by feminist researchers (see Fontana, 2002, p. 166), but it is also inherent in the ethnographic interview approach. As D. Soyini Madison (Madison, 2005, p. 25) points out, in an ethnographic interview the interviewer and the interviewee are put in a dialogical relationship. They construct the meaning and experience together. In my own study, I wanted to recognize the interviewees as active members of the data-gathering process even after the actual interview situation. After the transcription was done, all the interviewees were offered the opportunity to read their respective translated interviews, to comment on them as well as to correct possible misunderstandings or errors in scientific terminology. This option was not exercised by everyone who participated in the interview. However, by granting the interviewees access to the data they had co-produced, their status as research partners—rather than mere sources of information—was epitomized.

Having considered the different aspects of the data collection method, I also address the question of the status of interviews as research data. As Holstein and Gubrium (1995, pp. 8–9) argue, there are two main models of approaching interview data. In a traditional model, interviews are considered as direct accounts of past experiences. The researcher's task is to design and conduct the interview so that the research data would answer the preset questions as well as possible. Thus, deviations from the preset interview design are considered research biases and the interview is seen as a data pipeline (see also Mäkitalo, 2005, p. 193). Another model of treating interview data is to view it as a narrative construction of experiences. Here, the interview data is understood to reflect the interviewee's culturally and historically available ways of knowing and the interactional interview situation (Holstein & Gubrium, 1995, p. 17). The interview material is not treated as a one-to-one reflection of truth, but rather as a set of possible representations of the social reality, yet historically and socially grounded. In my study, I am adhering to the latter understanding of research data.

Research ethics

In this study, there were basically two key research ethical questions connected to the process of data gathering: the need to reach an informed consent with the interviewees and to ensure their right to privacy (Fontana & Frey, 2005, p. 715; Skeggs, 2001, pp. 433–434; Kvale, 1999, pp. 153–154). The question of informed consent was addressed before conducting the interviews as I informed the possible interviewees about the research project and its procedures. Each interviewee was also presented with a letter of information stating that all interview material would be anonymized and used for scientific purpose only.[17] As the interviews did not contain any confidential health information (cf.

[17] The letter of information is provided in Appendix 2.

Kerosuo, 2006), an oral agreement to the interview was considered as a sufficient form of informed consent (cf. Kvale, 1999, p. 154) Thus, the interviewees were not asked to sign a research permission or other written document, but they gave their consent by accepting the interview request.

The interviewee's right to privacy was a matter that had to be taken into account at several stages of the study. This was necessary as some interview material contained intimate information on interviewees' lives and furthermore, the interviewees could be relatively easily identified due to the small number of interviewees. Therefore, everyone who gained access to the data was requested to keep confidential all the information contained in the interviews. Apart from the UPGEM project members, the four translators who worked on the interview material also signed a letter of confidentiality before starting the translations.

In the process of reporting the data analysis, I detached all person and institute names in the interview extracts and only identified the interviewees using the interview document codes of the Atlas.ti program.[18] I also made the decision not to present personal information on the interviewees in such a way that could lead to their identification. Thus, the statistical information on the interviewees is presented in separate tables so that the age of the interviewees, their parental statuses and their academic positions cannot be connected.

The interviewees and their work contexts

I started the process of identifying interviewees by choosing the physics departments and institutions where I wanted to gather the data. The physics institutions where interviews were conducted were chosen so that they represented different types of state-funded organizations. Therefore, one large and one smaller university as well as two state-funded research institutions were chosen. The decision not to include private sector research institutions was motivated by the need to concentrate on the academic context and institutions that are closely related to it. The following physics institutes were contacted: the Department of Physics at the University of Helsinki; the Finnish Meteorological Institute; the Helsinki Institute of Physics, and the Department of Physics at the University of Turku.

The Department of Physics at the University of Helsinki has 30 professors and altogether 330 employees (year 2009) and is the largest physics department in Finland. The research and teaching in the department is organized under four divisions: materials physics, elementary particle physics, atmospheric sciences, and geophysics and astronomy. The researchers in the department also collaborate on many international projects, such as CERN (European

[18] Atlas.ti is a computer software designed for qualitative data analysis. In the software codes for text documents P stands for "primary document" (a technical term in Atlas.ti) and a running number refers to the particular interview. For example P200, P201 etc.

Organization for Nuclear Physics) and ESFR (European Synchrotron Radiation Facility) (University of Helsinki, 2009).

The Department of Physics at Turku University is a medium-sized physics department with ten professors and approximately 100 employees. The department is divided into six laboratories and an observatory. The laboratories concentrate on basic research and physical applications for industrial purposes. The laboratories are: laboratory of industrial physics, laboratory of optics and spectroscopy, materials physics laboratory, laboratory of theoretical physics, space research laboratory, and a low temperature laboratory (Wihuri physical laboratory) (University of Turku, 2010).

The Finnish Meteorological Institute (FMI) is a state-funded research institute under the mandate of the Ministry of Traffic and Communication. Its mission is to provide the society with meteorological and observational services as well as conduct research on the atmosphere. The research activities of FMI are organized in seven research units and cover themes such as: climate change, air quality, marine research, arctic research, meteorology and space research. Unlike the physics departments in universities, FMI has no teaching responsibility (Finnish Meteorological Institute, 2010).

The Helsinki Institute of Physics (HIP) is a physics research institute operated jointly by the Universities of Helsinki and Jyväskylä, Aalto University and the Technical Universities of Lappeenranta and Tampere. The institute is mainly located at the University of Helsinki. The mandate of the institute is to carry out and facilitate basic and applied research in physics as well as in physics research and technology development at international accelerator laboratories. One of the main functions of HIP is to coordinate the Finnish research collaboration with CERN. The research activities at the Helsinki Institute of Physics are organized in five research programs: theory, high energy physics, CMS (Compact Myon Solenoid), technology, and nuclear matter. The research interests of these programs cover a wide range of subjects in theoretical physics and experimental subatomic physics (Helsinki Institute of Physics, 2005).

After having chosen the four departments/institutions, I contacted the department leaders in order to inform them about the research project. Even though this study mainly focused on individual physicists, I considered it important to also gain trust as a researcher on the institutional level. Therefore, I sent the department leaders an e-mail clarifying the purpose of the UPGEM project and informing them that I was going to contact some of the researchers at his/her institute. Having received positive feedback from a department head, I then went on to explore the institute websites and contact individual physicists (normally 2–4 per department/institute) by e-mail, introduce the research project to them and ask if they wanted to participate in the interview. In general, finding interviewees was rather unproblematic; most of the physicists contacted were

willing to donate their time for an interview. However, six of those whom I contacted refused to give an interview and three could not be reached at all, either by e-mail or telephone.

Having identified the interviewees who worked in academia, I went on to identify potential interviewees who had left university positions. In order to find these candidates, I consulted department/institute secretaries and also institution web pages. Additionally, I asked physicists whom I interviewed if they knew of anyone who had left the department for some other work. Many interviewees could mention a colleague that had left and in some cases I even received his/her contact information. This "word-of mouth" method proved to be an effective way to identify interviewees who did not necessarily keep in contact with their former department. However, female physicists who left academia were more difficult to trace than their male counterparts were. This is probably partly because some of the female physicists had married and changed their family names, but it also seemed that women have a stronger tendency to "disappear" when they leave academia; most physicists could recall several male ex-colleagues of theirs, whereas they were less clear on the whereabouts of former female colleagues.

The corpus of my research data consists of 36 interviews with Finnish male and female physicists, both current and former research staff at university institutes. According to the research task of the UPGEM project introduced earlier, the interviewees were chosen so that an equal number of men (18) and women (18) were interviewed. Furthermore, half of the interviewees (18 interviewees) were working in academia at the time of the interview, whereas the other half (18 interviewees) had left academia fewer than 10 years ago.

The interviewees were chosen so that they represented a broad variety of different fields of physics, different age groups (from 29 to 59 years old), and all academic levels from PhD student to professor (see Tables 3 and 4). The fields of physics represented in the interviews included both traditional and more recent fields of physics, and theoretical as well as applied fields of physics. The fields of physics covered were: astrophysics, astronomy, space physics, geophysics, meteorology, atmospheric physics, materials physics, nuclear physics, particle physics, theoretical physics, and X-ray physics. The family statuses of the interviewees also varied: I interviewed physicists who were single, physicists with families, as well as those who had a partner but no children (see Table 5).

The interviewees who had left academia represented about the same variety of fields of physics, academic degrees and age groups as those interviewees who worked in academia during the time of the interview. Most of them had left academia after completing the PhD degree and all but one had left fewer than ten years earlier. The interviewees who had left their scientific careers most often moved to research- or management-oriented jobs in the corporate world or

public institutions. Some interviewees also left university for a teaching position in polytechnics schools or institutes. As explained earlier (in the section on the research ethics), more detailed information about the interviewees' employment, academic positions, age groups or parental statuses is not provided here in order to protect the interviewees' anonymity.

Table 3. Interviewees according to gender and age groups

	Age 29–39	Age 40–49	Age 50–59	Total
F	61% (11)	28% (5)	11% (2)	100% (18)
M	67% (12)	11% (2)	22% (4)	100% (18)

Table 4. Interviewees by gender, academic degree and university employment status

	PhD student	PhD	Docent	Professor	Employed at university	Left university	Total
F	22% (4)	56% (10)	11% (2)	11% (2)	50% (9)	50% (9)	100% (18)
M	28% (5)	39% (7)	22% (4)	11% (2)	50% (9)	50% (9)	100% (18)

Table 5. Interviewees by gender and parental status

	Children	No children	Total
F	61% (11)	39% (7)	100% (18)
M	67% (12)	33% (6)	100% (18)

As Table 3 shows, the majority of the interviewees (61% of women and 67% of men were aged between 29 and 39, but younger and older interviewees were also included. Table 4 indicates that most of the interviewees were either PhD students (22% of women and 28% of men) or people who had received their PHD (56% of women and 39% of men) by their academic status. By the time of the interview, half of the interviewees were employed at the university and half of them had left the university. Table 5 provides information about the interviewees' parental status: most of them (61% of women and 67% of men) had children.

Follow up: The interviewees' employment status in 2010

Even though it is not within the scope of this study to present longitudinal data on the interviewees, the question about the future career paths of my interviewees was raised in the process of data analysis. I became intrigued by the idea of learning what had happened to these physicists some years after the interview: had they stayed in their careers or moved somewhere else? Therefore, I carried out a Google search for the interviewees to determine their employment in August 2010. The result was as follows.

Out of 18 interviewees who worked in academia at the time of the interview, all but one had stayed in the academic field. Three PhD students had finished their doctoral dissertations; two interviewees with a PhD had gone abroad to work as post-doctoral researchers, and two interviewees had changed university departments. Out of 18 interviewees who worked outside the university at the time of the interview, three people had changed employers and two had finished their doctoral dissertations. Current employer information was not available in the Google search results for four leaver interviewees.

In conclusion, it can be stated that the physicists I interviewed seemed to lead a rather stable working life since only about 10% of them changed employment during the four-year period. On one hand, those who worked in academia did not flee to other types of jobs; on the other hand, those who left academia did not seem to be interested in returning to academic work. However, some border crossings between academia and working life outside academia seemed to have occurred. Two PhD students who had left the university had finished their doctoral theses while working outside academia. This certainly reflects their qualities and capabilities as researchers, but it also says something about the flexibility of the Finnish workplace. The gap between academia and business life does not seem to be too vast, but rather can be bridged so that individual solutions for combining academic studies and other types of work are possible.

The phases and circumstances of the data collection

Because of the schedules of UPGEM project, the data gathering process was divided into two phases. The first phase lasted from March 2006 to October 2006, and during that time, 20 physicists were interviewed. After the preliminary data analysis and the project mid-term seminar in Tartu (December 2006), it was decided that 16 more interviews would be conducted in order to enhance the variability of the data.

As the majority of my interviewees worked and lived in the capital area of Helsinki, the interview schedules and sites could be arranged on short notice. However, in order to meet two of my interviewees I had to travel to other parts of Finland where they worked. Most of the interviews were conducted in the work places of the physicists: in university offices and laboratories, luxurious

meeting rooms of large technology companies, and schools' coffee rooms. Sometimes I conducted the interview at the interviewee's home because it was the most comfortable option for him/her. The interviews were recorded with a digital sound recorder and lasted from 45 to 135 minutes. In general, the recording technique functioned very well; only once did the recorder run out of battery and I had to take notes on the last 20 minutes of the interview (interview *P221*).

4.4 Processing and analysis of the data

Translations and transcriptions of the interviews

The interviews were mainly conducted in Finnish; however, in two cases where the interviewee was not a native Finnish speaker, English was used as the language of the interview. As the interview corpus was originally material for an international research project, all the data were translated and transcribed into English. The translation and transcription was accomplished by four transcribers who either studied or had completed their MA in English philology and translation. They translated and transcribed the Finnish interview material by listening to the recorded interviews and transcribing them directly into English. The method of simultaneously translating and transcribing the interviews proved to be time and cost efficient and thus suited the needs of the UPGEM project. Yet, as the transcribed interview material only existed in English, I was dependent on the translators' work when analyzing the data. Being aware of the inevitable loss of the subtleties of speech in the process of translation (Aull Davies, 2002, p. 112), I attempted to overcome this problem by listening to the interview records several times while checking the transcriptions and analyzing the data. Listening to the records gave me the opportunity to correct possible mistakes and errors in the transcribed data and also enabled me to identify details and characteristics of spoken language that were not captured by the transcription.

As my research interest is not on the lexical or syntax level of the speech, but rather the meanings produced by the interviewees, the transcription style did not extend to the finest details. The questions and answers were transcribed verbatim, including pauses, laughter, repetitions and hesitations, but the lengths of pauses were not indicated in the transcription. In total, the transcribed and translated interview data comprised 1,248 single-spaced pages typed in font size 12. A table showing the interviewees and the respective lengths of their interviews in number of pages is presented in the following section.

Table 6. Interviews by gender, length of the interview and number of speaking turns

Code	Gender	Pages	Speaking turns
P200	f	29	382
P201	f	26	406
P202	f	29	326
P203	m	22	323
P204	m	26	462
P205	f	23	431
P206	f	24	414
P207	m	27	432
P208	m	27	284
P209	f	30	380
P210	f	26	328
P211	m	38	442
P212	m	29	414
P213	f	29	298
P214	m	28	463
P215	f	27	331
P216	f	26	367
P217	m	30	434
P218	f	19	311
P219	f	40	845
P220	m	30	717
P221	m	50	1026
P222	f	75	1520
P223	m	21	315
P224	f	41	831
P225	m	28	409
P226	f	44	882
P227	m	60	1022
P228	f	36	668
P229	m	53	965
P230	m	48	936
P231	f	29	426
P232	m	59	1254
P233	m	53	1081
P234	m	20	271
P235	f	46	899

Methods of data analysis

This study is an attempt to examine gendered manifestations of hegemony in the context of Finnish academia. Here, manifestations of hegemony are examined primarily through language and tools of *discourse analysis* and *narrative analysis*. My approach to the data analysis can be defined more precisely as inspired by critical discourse analysis (CDA). CDA offers a mode of approaching linguistic data from the specific point of view of power relations. It attempts to bridge the gap between micro level analysis of language and macro level analysis of power and dominance in human communities by analyzing the ways in which these are mediated in social interaction (Fairclough, 1992; van Dijk, 1993).

Critical discourse analysis has been criticized by Yrjö Engeström for taking discourse as a privileged mode of social conduct and losing the point of practical activity (Engeström, 1999b, p. 170). Engeström also shows that CDA's unit of analysis–processes of discursive control—is too broad and he proposes that an object oriented activity system is taken as a unit of analysis when, for instance, organizational speech is studied (Engeström, 1999b, p. 173). While this analytical approach is fundamental when observational/ethnographic data is concerned, horizontal interview data calls for analysis that focuses on the linguistic and discursive phenomena of the research material. Moreover, discourse analysis does not have to erode the perspective of historically and culturally formed activity: if language is considered a cultural form of producing and reproducing knowledge (Hall, 1997, p. 6), discourses (or the ways to use language) are then seen as culturally and historically formed, relevant ways of knowing. This idea is based on the assumption that these stocks of knowledge are deeply rooted in the particular activities and environments of the speakers (Holland & Cole, 1995, p. 482) and that the data available in the interviews can be seen as consequential in the activities of the people who are interviewed (Mäkitalo, 2005, p. 193). Thus, discourses can be examined as windows to the activity systems in which they are located culturally and historically without forgetting the perspective of power relations surrounding them. To motivate this choice of methodology, I adhere to Norman Fairclough's (1992) presentation of hegemony and discourse as a social practice.

Discourse as a form of social practice

The understanding that hegemony can be manifested in language is related to the idea of discourse as a social practice. Here, discourse is defined as "use of language;" it can be either written or spoken utterances, but needs to be in a linguistic form (Fairclough, 1992, p. 63). Discourses are seen as essentially dialectical in relation to the social reality. This means that discourses are both constrained by the social and constitutive of the society. Discourses are powerful

means for constructing social identities and subject positions; they help to build and maintain social relationships as well as systems of knowledge and belief (Fairclough, 1992, p. 64). At the same time, however, discourses are constrained by social structures. Our ways to use language do not come out of nowhere, but are deeply embedded in the material, historical, sociological and ideological surroundings in which the language is used. Social practices can be studied through discourses, but they are not reducible to discourses.

As Fairclough states, discourses have a textual level and a level of social practice. However, they also have the specific level of discursive practice, which means the social and cognitive processes through which texts are produced, distributed and consumed (Fairclough, 1992, p. 71). Discursive practices are socially constrained ways in which the members of a discursive situation construct and interpret texts, and draw upon resources. Thus, discursive practices are of special importance in mediating between the text and social practice (Fairclough, 1992, p. 80). In his model, Fairclough (1992, p. 73) depicts the three levels of a discourse as containing each other:

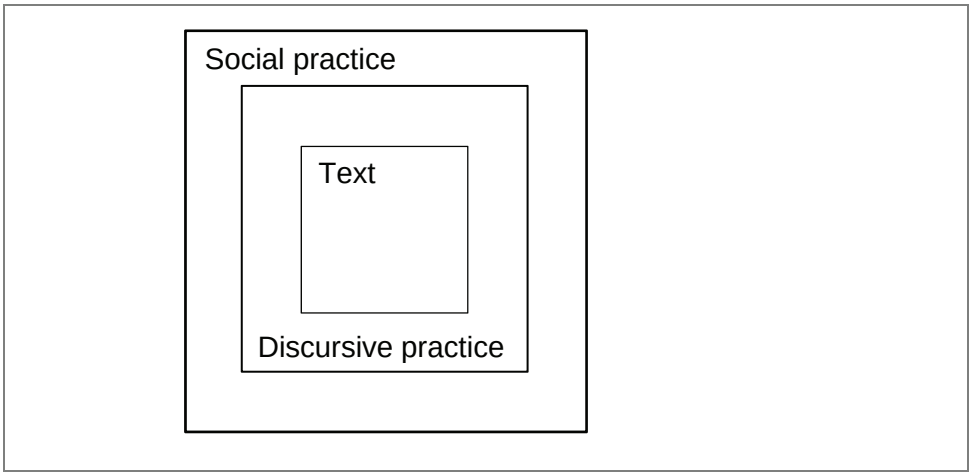


Figure 6. Three levels of discourse

From the point of actual data analysis, the three-level model suggests that to be able to grasp the relation between discourse and the social reality it is part of, one needs to move between the three levels. This requires analysis of both micro and macro levels of the discursive practice. Microanalysis typically involves examination of the text from the point of view of vocabulary (individual words, word choices, etc.), grammar (how words are combined in sentences), cohesion (how clauses and sentences are linked) or structure of the text (larger scale organization of the text) (Fairclough, 1992, p. 75; Suoninen, 1999, pp. 110–111). These linguistic features of a text are the starting point of most discourse analysis and can provide the researcher with information on how the texts are

shaped. The dialectical understanding of discourse implies, however, that the analysis cannot omit the social realities surrounding the text. This means that when discourses are analyzed, the focus needs to be on both the form and the meaning of the language used and the discursive practices mediating them. The main task of discourse analysis is thus mapping out the ways in which the text and discursive practice are constrained by the social practice surrounding them. For Fairclough, this could mean examining how discourses draw upon existing conventions or how they challenge them (Fairclough, 1992, p. 84; see also Törrönen, 1995).

Bridging the notion of hegemony and discursive data

As stated above, people are able to affect their surroundings and each other through language use, that is, discourses. Discourses are a part of social practice and social domination as they have the capacity to naturalize some power relations and ideologies and also reproduce or challenge the existing orders of discourse. (Fairclough, 1992, p. 66, p. 95). This idea of discourse as a tool for power originates from Foucault, who saw discourses as "creating topics," that is, defining what we can know and how we can speak about knowledge. Thus, societal power is embedded in discourses, as they not only define topics that can be discussed, but also exclude some topics (Hall, 1997, p. 49).

The link between discourse and hegemony follows from this concept of discourse as a social practice. As I show in the theoretical subchapter of this study, hegemony can be defined as economic, political, cultural and/or ideological leadership in the society. Exercising hegemony is about creating alliances and concessions in order to govern the subordinate groups by winning their consent (Fairclough, 1992, pp. 92–93). Thus, hegemony is something that easily becomes naturalized as "common sense" in people's perceptions of the world and is implicitly manifested in social life and the lives of individuals (Gramsci, 1971, p. 324). Hegemony is reflected in the representations of social reality that are constantly created and contested in language use. Thus, hegemonic struggles have to be studied as parts of social practice that either articulate or rearticulate the existing power relations and conventions.

The task of detecting hegemony in a discourse is a challenging one, as it demands combining a general level theoretical notion (hegemony) with analytical concepts that allow exploring empirical data. One example of this endeavor is a current study by Montesano Montessori (2011) who has created a theoretical-methodological-analytical model by integrating the Gramscian concept of hegemony, critical discourse analysis and discourse theory. By employing this framework, Montesano Montessori analyzes hegemonic procedures in Mexican political discourse. In her ambitious work, Montesano Montessori thus aspires to present a criterion as to how to identify when hegemony has been attained in discourse (Montesano Montessori, 2011, p. 180).

In my study, however, I decided not to build an integrated framework for analyzing hegemony in discourse. Rather, critical discourse analysis and Fairclough's ideas of the link between discourse and hegemony functioned as a source of inspiration for the design of the data analysis method. I decided to go about the problem of combining the concept of hegemony and empirical analysis by employing the three intermediate concepts that are all connected to discourse analytical tradition. By unpacking discursive data with the help of different analytical tools, I was able to identify instances of resistance and integration on the micro level of discourse. After having done this, it was possible to move to the macro level of discourse by looking at the ways in which the context of the discourse and its prevailing norms and conventions were reproduced and/or contested. Thus, the dialectical continuum between resistance and integration reflected in the analysis functioned as a bridge between the theoretical concept of hegemony and the empirical data. At the same time, gender analysis was maintained, as I observed the ways in which women and men reproduced and/or contested the prevailing practices and norms in their work place.

Intermediate concepts

Another aspect relevant to the data analysis is the question of how to create a viable connection between the theoretical concepts and the empirical data. Theoretical concepts such as hegemony do not usually allow the researcher to tackle the relevant content of the data as such, but rather *sensitize* the researcher to see what is important in the data (Blumer, 1986; see i.e., Rainio, 2010, p. 61). Thus, there is a need for intermediate analytical concepts that help to bridge the gap between theoretical concepts and the observations from the data (Engeström, 1999b, p. 177). Furthermore, as scholars in sociolinguistics claim, some phenomena are best understood when looked at from the "corner of the eye" (Bateson, 1994 cited by Tannen, 1994, p. 201). This means that issues such as hegemony can be better observed through some other aspects in the empirical data. Intermediate concepts are thus well suited for analytical lenses for looking at abstract issues indirectly.

In the process of identifying intermediate concepts in connection with the theoretical concept of hegemony, I found Mymby's (1997) dialectical presentation of hegemony especially useful. Mumby (1997, p. 365) suggests hegemony can be observed via the ways in which individuals and social groups *respond* to it. These responses may then be analyzed by the degree of integration and/or resistance they indicate in terms of the prevailing power systems and conventions. For this analytical purpose, I chose three intermediate concepts that proved to be adequate for the process of identifying the responses to hegemony in the interview data. The three intermediate concepts utilized in this study are: alignments (Goffmann, 1979), turning points (Abbott, 1997) and discursive manifestations of contradictions (Engeström & Sannino, 2011). In the following,

I introduce them. In the respective empirical chapters, each intermediate concept is examined in more depth.

*Alignment*s are understood as positions the actor "seems prepared to take up in what is about to happen in the social situation" (Goffman, 1979, p. 1). Thus, alignments are linguistic strategies indicating the speaker's status and social distance (Tannen, 1994, p. 212). In my study, I consider the term alignment that refers to the possible postures, stances or self-projections that the speaker may assume in relation to the speech context and to the other people involved. They are expressed in speech in the way the speaker manages the production or reception of an utterance. In my data analysis, I focus specifically on the use of the personal pronouns *I* and *we* (see Mühlhäusler & Harré, 1990; Chiang, 2009, pp. 257–258) and the positioning and aspects of the physicists' professional self-images that are produced in tandem with them.

Turning points refer to narrative constructions of sudden and surprising changes that transform the life course of an individual. Abbott (1997, pp. 94–95) suggests that turning points typically separate two trajectories in an individual's life. Whether instantaneous or prolonged, turning points are moments of critical change, yet they can best be observed in hindsight. Thus, when analyzing turning points in interview data, it is important to focus on the narrative structure of the story. Only by identifying a starting point, turning point and an ensuing trajectory, can the turning points be observed in the data (Yair, 2009, p. 353). In my data analysis, I analyze the turning point narratives of those physicists, who eventually decided to leave the academic workplace.

Discursive manifestations of contradictions is a framework for analyzing the talk that people use when making sense of dilemmas, conflicts and double binds they face in their work (Engeström & Sannino, 2011). The idea of this framework is to establish a systematized platform for analyzing the discursive phenomena that are often called ruptures, tensions, and conflicts and to relate them to the underlying historical contradictions of the community (Engeström & Sannino, 2011, p. 375). The analysis of discursive manifestations of contradictions happens primarily through observing linguistic elements such as the use of negatives, personal pronouns and particles that may refer to conflicting and opposing ideas, and hesitations. In my data analysis, I examine the discursive manifestations of contradictions that are related to the physicists' everyday work in the university and attempt to understand them in their historical contexts.

These three intermediate concepts can be seen as providing perspectives into different modes of integration and/or resistance. As responses to hegemony, they also bridge the theoretical concept of hegemony and the empirical data. The intermediate concepts could be tentatively located in Mumby's (1997) continuum in the following way:

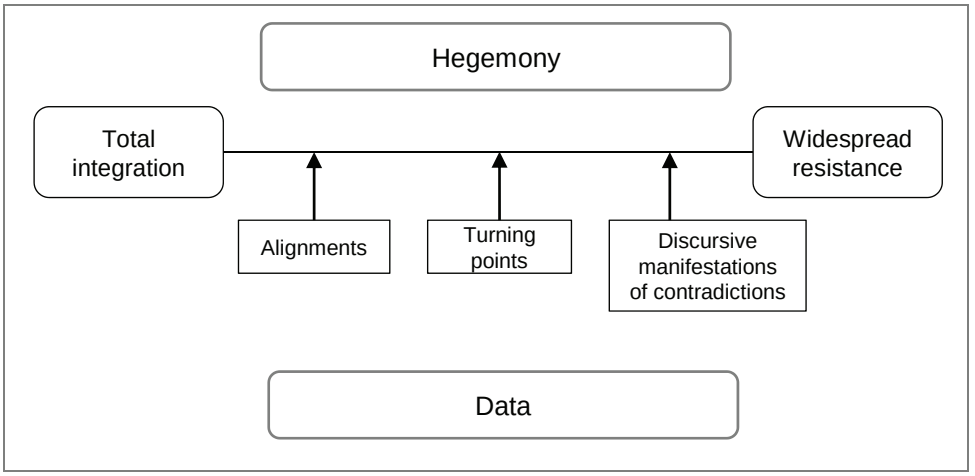


Figure 7. The interplay between the notion of hegemony, intermediate concepts and empirical data.

In this illustration, different types of responses to hegemony are at play. They function as gateways from the empirical data to the theoretical concept of hegemony and vice versa. When considering the phenomena that can be studied through the three intermediate concepts, I concluded that alignments seem to represent the most integrated responses to hegemony. Turning points are placed in the middle between total integration and widespread resistance, while discursive manifestations are seen as providing the most resistance against the prevailing hegemony. This preliminary understanding of the relation between hegemony and intermediate concepts is tested and further developed throughout this study. The aspect of gender is included in this representation in order to determine how women and men manifest resistance and integration in their discourse.

Discourse analysis and narrative analysis

As mentioned, this study is inspired by critical discourse analysis. However, as a means of data analysis I apply methods from the discourse research tradition, namely discourse analysis and narrative analysis. Both families of methods have their origins in the linguistic turn of qualitative research that has focused on the language as a central means for creating and transmitting meanings in the culture (Hall, 1997, p. 4–5) and are also utilized in critical discourse analytical studies. They are suited for close-up examination of such text material as interviews, but bring a slightly different perspective. Discourse analysis is a tool for understanding how cultural resources are used and/or challenged in the process of meaning making in human communication (Hall, 1997, p. 6). Narrative analysis focuses on the processes through which peoples' experiences are represented and performed (Bamberg, 1997, p. 335). Both discourse and

narrative research take their epistemological point of departure in the assumption that discourses and narratives are constructed and framed in social environments. This means that an individual's surroundings (community, organization, culture, historical time) provide certain opportunities and limitations for a meaningful construction of reality and self that becomes articulated in language (Chase, 2005, p. 666). Thus, the linguistic analysis of empirical data may provide a window on social reality.

As Fairclough's model (1992, p. 73) suggests, discursive (as well as narrative) analysis involves shifting between micro and macro levels of the language. In order to say something about the surrounding social reality and cultural practices, one has to grasp the micro linguistic elements of the text, in this case, the interview. This type of discourse analysis typically focuses on choice of words and vocabulary, turn takings in conversation and modes of speech (Suoninen, 1999). On the macro level, discourse analysis seeks to provide meaningful interpretations about the relationship of the micro level of the language and the macro level of language, that is, the social, institutional and cultural surroundings of speech.

In narrative analysis, the structure of the story is often of primary interest. This means that the analysis starts from how the story is told and proceeds towards why it was told. Typically, the structure (or plot) of a story is investigated as bearing sociolinguistic functions (such as orientation, evaluation, and resolution). Moreover, narratives can be classified by the progression of the plot (drama, comedy, romance) or the roles the narrator assumes (victim, protagonist, hero) (Lieblich et al., 1998, pp. 13–14). However, narrative analysis may also be added to sociological analysis that calls for understanding how individuals make sense of personal experience in relation to culturally and historically specific discourses—how they draw on, resist and transform these discourses when narrating their own lives. A principle goal of this approach is to illustrate how narratives are created in relation to their discursive environments (Chase, 2005, p. 659).

In my data analysis, I utilize elements from both discourse analysis and (sociological) narrative analysis. The choice of analysis method depends on the intermediate concepts used. When analyzing alignments and the use of the pronouns "I" and "we," the micro level analysis of discourse focuses on the use of specific words and the ways in which professional self-images are constructed through them. Analysis of turning points calls for tools from narrative analysis in order to construct the reasons for and consequences of the turning points in individual physicists' lives; it is important to identify different structural elements of the turning point narratives as well as their overall plots. Analyzing discursive manifestations of contradictions proved to be a mixture of micro discursive analysis and narrative analysis. Identifying the linguistic cues and

manifestations of contradictions in physicists talk about their work required analysis of both the choice of words and narrative structures of the interviews.

In all cases, the micro level analysis of speech was in a later phase extended to analysis of the social and historical environment of the discourse/narrative. By contextualizing the results of the analysis, it was also possible to explore how resistance and integration were manifested and what existing conventions and norms were challenged and/or contested. Further methodological elaborations were moved in each empirical chapter as they concerned the specific nature of the intermediate concept on which each chapter was focused.

Phases of the data analysis

In this study, the actual process of data analysis can be illustrated as a flow chart. Initially, the content analysis of the data was conducted in terms of the emic categories created in the UPGEM project (see section on the research data). This content analysis served as a starting point for formulating the initial research questions. Based on the initial research questions, three intermediate analytic concepts were formulated and the appropriate analysis methods and data were selected. Finally, systematic data analysis was conducted and the three empirical chapters were written. As the flow chart below shows, this was a two-way process in the sense that the research questions were reformulated all the way through the data analysis.

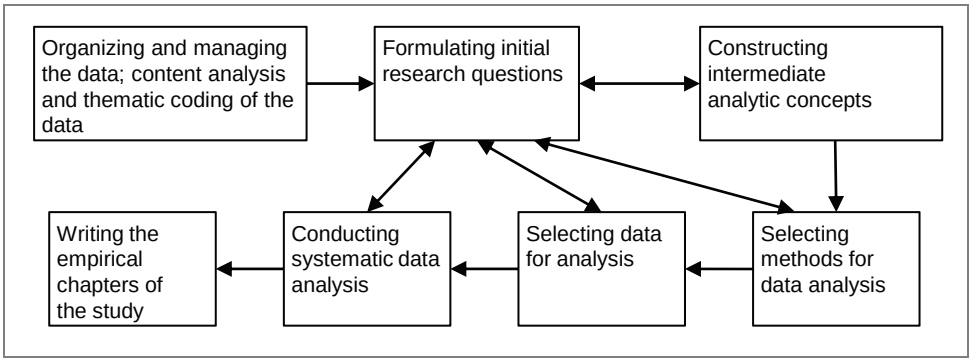


Figure 8. Phases of data analysis

After the interviews had been transcribed and translated, I downloaded them to the Atlas.ti computer program. Atlas.ti is software developed for organizing and analyzing large amounts of qualitative data. [19] In this study, Atlas.ti was utilized in thematic coding of the interview data. By carefully reading the interview material, I labeled the content of the interviews with the 34 thematic codes introduced earlier. The more detailed criteria for each individual code are

[19] For more information on Atlas.ti, see the webpage www.atlasti.com.

provided in Appendix 3. As a result of the coding, 2,800 interview quotations were derived from the data. The distribution of the interview quotations in terms of thematic codes is illustrated in a table in Appendix 4. This distribution of codes was used as a starting point for the design of actual data analysis; however, as the coding was originally designed for the UPGEM research project, in this study it served mainly as a means of mapping out the contents of the data.

The initial research questions were formulated on the basis of the three theoretical concepts: hegemony, contradictions and gendered organizational processes. Creating and testing the research questions was a process that required interplay with theoretical resources, empirical data and intermediate concepts. On the one hand, theoretical concepts sensitized me as a researcher to focus on certain dimensions of the empirical data. On the other hand, only by analyzing the interview data by means of the intermediate concepts did certain aspects of the theoretical concepts become meaningful.

As explained, bridging the gap between the theoretical concepts and empirical data seemed to require a set of intermediate concepts that would provide methodological access to the micro level of the data, that is, discourse. The three intermediate concepts (alignments, turning points and discursive manifestations of contradictions) originate from different social scientific fields: sociolinguistics, sociology and activity theory and are methodologically related to discourse analysis and narrative analysis. As such, they functioned as windows to the social reality that was revealed in the interview data. The data analysis was conducted with the help of these three concepts that also steered the process of selecting data for the analysis. When alignments were studied with the help of *I* and *we* constructions, I focused on those sets of thematically coded data that were related to self-image as a physicist. When turning points were analyzed, I chose narratives that described the interviewee's decision to leave his/her university career. When examining discursive manifestations of contradictions, I looked for ruptures, tensions and conflicts that the interviewees revealed when accounting for their work.

As stated, systematic data analysis was guided by the intermediate concepts. After having chosen the sets of data for analysis, I went through them several times and organized them with the help of Excel software. Then I classified the data according to the emic categories that could be identified in the data. Even though my methodological approach to the data was qualitative, I decided to provide certain numeric information about the observations I made based on the data. Thus, numbers of interview extracts in the empirical chapters are not meant to quantify qualitative data, but rather to give the reader an idea of whether a large or a small group of people is referred to especially in cases where different categorizations, such as those based on gender, are made. It is worth noticing that even though in this study gender is not defined as a solely biological category but rather as produced in various organizational processes,

I nevertheless made the choice to organize the data analysis reports mainly along the gender axis (male-female). While being aware of possible stereotyping effects of this choice, I considered these categories necessary in order to maintain the sense of politics and subjecthood of the study. Without the embodied categories of women and men, gender research may fail to address the material and asymmetrical power relations that often cause gender inequality in organizations. (See also Thomas & Davies, 2002, p. 392).

After the actual data analysis, I started to write the empirical chapters. My original intention was to protect the anonymity of the interviewees by identifying them by numeric codes (P201, etc.) only. However, as in the preliminary stage of this study in the UPGEM project, each interviewee was given a random code name (a musical instrument), it proved rather difficult to give up these names in this latter phase of data reporting. After all, I made the decision to stay with these code names when referring to interview excerpts. However, all personal information has been removed from these excerpts so that the anonymity of the interviewees is guaranteed.[20]

As to the writing process, my aim was to bridge the intermediate concepts and the results of empirical data analysis with the theoretical concepts. Therefore, I made the decision to introduce the intermediate concepts in the beginning of each respective empirical chapter in order to provide the reader with an opportunity to follow and assess the data analysis as well as possible. Bridging the theoretical concepts and empirical data was done in the conclusion of each chapter.

Thus, the structure of the three empirical chapters is as follows. First, the theoretical background of the intermediate analytical concept is introduced with some examples from previous research. Secondly, the use of the intermediate concept in this study is defined. Thirdly, the actual data analysis is reported and fourthly, the analysis results are contextualized and discussed in light of the theoretical concept of hegemony. In the conclusion of each empirical chapter, the possible relationship between the analysis results and careers of women and men is considered.

[20] The list of the codes is given in Appendix 5.

5 ALIGNMENTS THROUGH *I* AND *WE* IN THE NARRATIVES OF THE PHYSICISTS

5.1 The concept of alignment

Studies in sociolinguistics have described the complex issue of variation of speaker's roles and positions in a communicative situation. This linguistic phenomenon is theorized in several terms such as participation frameworks (Goodwin, 1994), footing, positioning (Davies & Harré, 1990), alignment (Goffmann, 1979, 1981), framing technique (Maynard, 1984) and involvement strategy (Tannen, 1994). These terms are sometimes used as synonyms and they all are relational concepts. They reflect the network of locations, moral orders and forms of discourse that can be produced in speech (Mühlhäusler & Harré, 1990, p. 95).

Here, I consider the term *alignment* that refers to a position that a person seems to be prepared to take in a social situation; alignments are displayed attitudes toward other people and the material being talked about in a communication situation (Goffman, 1979). Alignments can also be defined as a culturally dependent linguistic strategy for displaying the status and distance of a speaker (Tannen, 1994, p. 212). I chose this particular notion for the basis of my analysis because it captures both the cultural and individual aspect of speaker positioning. Alignments refer to the possible postures, stances or self-projections that the speaker may assume in relation to the speech context and to the other people involved. They are expressed in speech in the way we manage the production or reception of an utterance. Alignments may shift even within one sentence as they reflect not only direct human relations, but also the speaker's relation to different affiliations within and without (Maynard, 1984, p. 69). A speaker may shift his/her alignment by changing the socially-based sources of self-identification in his/her speech; the speaker may display himself in various positions as a member of a group, office, category, or relationship (see Goffmann, 1981, pp. 144–145).

One of the lexical cues for alignment is the use of self-referring pronouns (especially *I* and *we*). Mühlhäusler & Harré (1990) suggest, that the pronoun *I* can be used as indexical in a dual sense. First, it may index the speaker's physical location, as in the utterance "I can feel the draft." Here, the speaker indicates the point of view from which the world is observed and the sensory modality by which the observation was made. Secondly, the speaker may index his/her moral location as in the utterance "I think I can feel the draft." Here, the speaker states his/her moral responsibility for the statement and his/her degree of commitment to the content of the statement (Mühlhausler & Harré, 1990, p. 94). Thus, the utterance *I* itself does not display any position, but it is the composite

of "I + predicate" which allows the examination of the alignments that are produced in the speech (Chiang, 2009, pp. 257–258).

Studies of institutional speech have shown that the personal pronouns *I* and *we* function in various and contradictory ways when employed in a professional context. Generally, by choosing the self-referring pronoun *we*, a speaker indicates that he/she speaks as a representative of or on behalf of an institution or some other group. Employing the plural *we* instead of the singular *I*, an individual professional may deny involvement in duties he/she performs as a professional (for example, as a judge) or diminish his/her personal responsibility in decision making situations (Drew & Heritage, 1992, p. 31). At the same time, by referring to *we*, an individual may project something larger than his/her role implicates (Maynard, 1987, p. 66). Furthermore, the collective *we* ("we ought to do this") can be employed as a strategy to create a symmetric relationship between the speaker and listener or to persuade the listener to agree with the speaker, as in West's example of a doctor giving instructions to a patient (West, 1990, p. 99). The use of "we" can also be a means for distancing the speaker from the audience, as in case of a British MP arguing for his party's opinions against the other groups (Iñigo-Mora, 2004). The plural prononun "we" as well may function in contra positioning different groups for instance in mailing list discussions (Freeman, 2011).

In another institutional context, a religious community, the use of the first person *I* may be a more powerful strategy when boosting individual professional authority. For instance, a pastor may emphasize his/her authority by referring to his/her own interpretation of the Bible: "I think by this Jesus means that..." (Smith, 1993). Different aspects of professional power and self-positioning may also be expressed by the use of *I* constructions; for instance, a male professor who deals with a PhD student may express different capacities by either referring to his personal power ("I can manage any topic you want") or his positional obligations and duties ("What I'm trying to work out with you is that there are multiple dimensions...") (Chiang, 2009).

Some of the studies to which I have referred suggest that men and women employ self-referring pronouns differently in institutional speech. In her study on Baptist University, Francis Lee Smith (1993) analyzed the *I* and *we* constructions in both male and female students' sermons. She shows that male students employed both *I* and *we* more frequently than female students in order to prove credibility in their sermons. Thus, they represented themselves more often as religious authorities who have the capacity to interpret the Bible and teach it to others. Most female students, on the contrary, did not frequently use personal pronouns in their sermons thus retreating from the responsibility for interpreting the text themselves. By doing this, they adapted a low-profile position as preachers (Smith, 1993, p. 172). Candace West (1990) who has examined doctor-patient interaction concludes that female physicians more often

than their male colleagues employed directions that facilitate a positive patient response. By coupling directives (ought, have to) with the collective *we* rather than addressing the patient directly, female doctors built proposals for joint activity which the patients could more easily undertake (West, 1990, p. 108). These studies have been realized in line with Deborah Tannen's idea (1994) that the relation between gender and language can best be analyzed by focusing on the different positions or alignments in speech rather than linking language and gender directly. After having asked how individuals position themselves with respect to the situation, it can be asked where women and men tend to fall in this pattern. (Tannen, 1994, p. 200).

5.2 Alignment as a conceptual tool for analysis

In my study, I am focusing on the alignments the physicists take up when discussing their careers and professional selves. More specifically, I aim at understanding how *I* and *we* function as alignment strategies in these narratives. I use the concept of alignment in a general sense to describe the ways in which physicists position themselves as individuals and as group members. I am interested in what resources the physicists use when building their self-portrayal as scientists: who are the speakers representing, whose authority is claimed and/or denied and what kinds of affiliations are built into their *I* and *we* constructions? My use of the term alignment differs from its established use in sociolinguistics in that I do not analyze the interactional relationship between the speaker and the audience (cf. Tannen, 1993), but rather concentrate on understanding the processes of alignment that take place within the interviewees' narratives. This choice is motivated by the nature of my research data: I am dealing with interviews that are asymmetrical communicative events. Thus, studying the interaction between the interviewee and interviewer is not the focus of my research (see also, Bamberg, 1997, p. 336).

After having analyzed the use of *I* and *we* as alignment strategies in the interviews, I continue and ask if there is a gendered tendency in the use of different strategies. As previous analysis of my research data (Vainio, 2008) suggests, there is a gendered pattern in how male and female physicists perceive group work and individual achievement. Even though most male and female physicists conducted both group work and individual work, their desire for joint work activities differed in the interviews. Men generally seemed to accept solitary work as a part of academic work, whereas many women considered the lack of group work in their departments to be a problem. Some men claimed that they had made a conscious choice to conduct individual research, while women tended to make efforts to develop collaborative work (Vainio, 2008, p. 242). Thus, it may be assumed that when displaying alignments in their professional lives, female physicists would be more likely to position themselves as members

of a group or community, while male physicists would be more inclined to display themselves as individuals.

The data analysis proceeds in the following way. Adhering to the idea that choice of self-referring pronouns reflects the individual's institutional orientation or alignment, I begin the analysis by choosing the *I* and *we* constructions that reference the self-positioning of the interviewees. Based on the content analysis conducted during the UPGEM project, I have chosen five thematic categories in the interview material for closer scrutiny.[21] These categories are: 1) stereotypes, 2) identity, 3) self-esteem, 4) teamwork, and 5) competition. The next step in my analysis is the qualitative analysis of these categories. This I do by examining the "I + predicate" and "we + predicate" constructions in order to determine what is predicated on *I* and *we* (see Chiang, 2009, p. 259). Subsequently, I focus on the possible gendered patterns of the alignments to see if women and men show different professional positioning in their alignments. Finally, I ask how hegemony becomes reproduced and/or contested in the alignments and how this might affect the careers of male and female physicists. As the preliminary research hypothesis was set from the gender perspective, I organize the data analysis results along the gender axis.

The analysis of *I* and *we* constructions begun by extracting some statistics from the interview data. First, all *I* forms[22] and *we* forms[23] were counted from the text material, as Atlas.ti enabled this type of function. The results were summed in a table with numbers of *I* forms and *we* forms in each individual interview. Secondly, the relative numbers of *I* forms and *we* forms in the interviews were counted and presented in percentages (the percentage of *I* forms and *we* forms per the total number of *I* forms and *we* forms). The purpose of this operation was to extrapolate two extremes from the data, that is, the interviewee who used most *I* forms (and least *we* forms) and the interviewee who used most *we* forms and least *I* forms. The interviewee with the relatively highest number of *I* forms scored 568 (93%) *I* forms and only 43 (7%) *we* forms. Respectively, the interviewee who used fewer *I* forms in relation to the *we* forms amounted to 278 *I* forms (69%) and 126 *we* forms (31%).[24] The two extremes were then analyzed from the point of view of alignments; the background assumption was that the interviewees' different usage of *I* and *we* would indicate differences in their professional positioning and self–images. In the first part of the analysis, I pursue a detailed analysis of the alignments in these two interviews which are called here by code names Soprano and Guitar. In the second part of the

[21] See the chapter on the methods of analysis for more detailed description of the analysis and definitions of the thematic categories.

[22] Including I, me, my, mine, I'm, I'd, I've, I'll

[23] Including we, us, our, ours, we're, we'd, we've, we'll

[24] See appendix 6 for the complete table of numbers of I – and we –forms.

analysis, I further explore the alignments of four thematic categories in the entire interview data.

5.3 Two interviewees, two types of alignments

The interviewee who used the least *I* constructions (278/69%) and most *we* constructions (126/31%) was a female senior scientist who represented a relatively old and established field of physics. Her entire career has taken place within the same institute apart from some stays abroad. She depicted her career path in a rather straightforward manner; she had been employed at her home department continuously from the time she was a PhD student and thus there were no major gaps or twists in her career narrative. When accounting for her career path from Master's studies to today, Soprano seemed to strongly orientate to the position structure of her department. For her, the scientist's career was quite clearly laid out and the steps were logical and easy to follow from project worker to assistant and from senior assistant to professor. This is reflected in the use of declarative verb forms when describing the twists of her career path: "That's when I was a senior assistant and then I was a lecturer for a while too" *P235 (139)* [25] and "So I was already employed here, in this division. So that's when the decision to become a researcher was made, actually." *P235 (202)* Soprano thus presents her career path as independent from that of other people, a feature that is reflected in the lack of competitive or critical situations in her story. Even when Soprano accounted for how she attained her current position, she explained that there was no real competition, but the post was designed for her. The following excerpt describes this process of advancement.

> JV: Is it true that your lecturer position was just changed into a professorship, or did you have to apply for it?
>
> SOPRANO: Yes; no; I had to apply for it.
>
> JV: Yes, yes. Was there a lot of competition for it?
>
> SOPRANO: No, not really. The field was defined very specifically. There weren't that many of us in Finland.
>
> *P235 (149:159)*

An interesting tension can be observed in the Soprano's narrative about her professional development. She seems to have proceeded in a very determined way and feels being appreciated professionally, yet she describes the decisive

[25] Here, P235 stands for the number of the interview and the numbers in parenthesis (139) indicate the rows of text in the Atlas.ti analysis software. A similar logic is used when identifying all the following interview quotations.

moments in her career path as coincidences or unexpected events. Examples of these descriptions are: “Well, I happened to get a job here” *P235 (222)* and “I could never imagine that I would become a professor.” *P235 (1092)*

Soprano has been working in the same field of physics for her entire academic career and her professional self-image is strongly based on her specialization area and her established position in Finland and abroad. At the same time, she presents herself as motivated by the challenges of science and not by the possibility of climbing up the academic ladder which she describes as opportunism. When presenting her professional ambitions, Soprano defines her reasons for being a scientist in terms of inner personal motivation and passion for science. In the following excerpt, Soprano presents herself as “no exception” when it comes to her reasons for pursuing an academic career.

> JV: Right. Yes, yes. Okay. Would you say that studying physics is fun?
>
> SOPRANO: Yes, of course it's fun.
>
> JV: What makes it especially fun?
>
> SOPRANO: Well the fact that you can discover something new and that it never gets boring and there are always challenging problems. I think that it's the most common reason—that it's difficult and challenging. That is why people do this. And I'm no exception.
>
> *P235 (1026:1040)*

Having been one of the rare women in her field throughout her career, Soprano does not find her professional points of identification in female scientists, but in the group of physicists in general. Unlike many other female interviewees (for example, Guitar, see second type of alignment presented below), she is able to identify with the “nerdy” image of physicists that seems to prevail in the society. The “nerdy” factor is above all manifested in a strong work orientation which means that other spheres of life and social relations receive less attention. Soprano, too, represents herself as strongly committed to her work and sees this alignment as customary in her circle of colleagues.

> JV: How would you rate physicists' tendency to give their families high enough priority in relation to work? Do physicists prioritize their families enough? If you think about your colleagues here?
>
> SOPRANO: Well, I'd say that work is prioritized quite a lot.
>
> JV: Work is prioritized?
>
> SOPRANO: Yes.
>
> JV: Is it prioritized too much?

> SOPRANO: Well, it's hard to say; it depends on personal circumstances. I think that most, and especially the older people, [men] have wives who take care of the home.
>
> JV: Right. Right. What's your situation like? How have you divided household chores, etc.?
>
> SOPRANO: My husband is also a researcher... but not at the university, though so we don't stress about the home so much.
>
> *P235 (572:594)*

The above excerpts suggest that Soprano's professional self-image is not dependent on the fact that she is a so-called token woman in her field. She is able to identify with her colleagues and even the stereotypes drawn by outsiders. When accounting for her career, Soprano often presents herself as a part of a working community, which is reflected in her frequent use of *we* constructions. In the following, I examine them.

The vast majority of *we* constructions in Soprano's interview was related to her immediate working environment, the Division of Z. She described her work activities at the division in an exclusively plural mode, even though she discussed her own research interests in a more individual manner. This probably reflects Soprano's strong identity as a teacher, supervisor and member of the university staff. Another set of *we* constructions referred to the entire Department of Physics. When employing a "departmental we", Soprano mostly referred to the administrative tasks such as planning and co-coordinating work activities in the department. The commitment to the "departmental we" seemed to correlate with the generally positive view that Soprano had of her home department. At the same time, she assumed a shared responsibility for departmental issues such as the division of labor and resources. Below, Soprano considers the current changes in the department structure and finances:

> SOPRANO: I know a few other departments where they've had things divided equally, like exactly; they've had their own budgets. Even then when the funds of the department were cut, when the situation wasn't clear yet, and every division had to get by on its own. There are certain departments that have had things much worse, but we've tried to get the right people to the right jobs by discussion and centralization. So that has helped a lot.
>
> *P235 (1264:1268)*

Soprano's positive outlook on her home department is highlighted by contrastive examples from other university departments where mergers of divisions have led to a less positive balance between different research units. She also assumes a collective aspect on questions like gender equality in the department, which she

sees as an important goal to reach. In the following, she tells about a gender equality study to which she had contributed:

> SOPRANO: This study of ours was meant to find out how we could get more people here. If we had a fifty-fifty proportion of females and males here, the equality problem would be solved.
>
> JV: Yes, in a way. Probably so.
>
> SOPRANO: In some ways anyway.
>
> *P235 (1396:1400)*

When accounting for the research conducted in her division, Soprano referred to collective activities rather than individual achievements. In general, she described the prestige of her field of research to be high in both the Finnish academic society and on an international level despite the relatively small size and scarce resources of the division. This is due to both the quality of research and researcher training at Soprano's department. Being a professor responsible for both research and teaching, Soprano identifies with the positive feedback the division has received. In the following, two examples of this identification are given. In the first excerpt, Soprano reflects on the appreciation her division has gained in the Department of Physics:

> JV: How about the appreciation your division receives in relation to other divisions in the department?
>
> SOPRANO: Yes, it's appreciated as well. Since we are doing quite modern basic research and have a good publications record, we are thought to be an important division in this department, even though we are not very large.
>
> *P235 (1278:1280)*

In the second excerpt, Soprano accounts for the high quality of researcher training in her division that has been recognized by research collaborators abroad. Here, the "we" refers to her division.

> SOPRANO: But the equipment that we have should be kept up to date, because if a researcher were to go abroad, it would be good to be able to screen samples beforehand at home. The postgraduate and graduate students are also appreciated because they have worked here for many months... So our people have always been very much appreciated there, also the students, because they've worked here for many months.
>
> *P235 (1688:1696)*

In sum, in her interview, Soprano seems to take up mainly conformist alignments in relation to the profession of physicist and in relation to her colleagues. The high level of conformity with a larger group can be considered in relation to the observation that she often replaces the personal pronoun *I* with the passive pronoun "one" or "you." When describing her career path, Soprano mostly employs declarative *I* constructions with few ambiguous or conditional tones. This use of pronouns might be a matter of personal speech habit, but it may also be indicative of a rather strong identification with her profession. This idea becomes conformed in that Soprano identifies herself with both the public images of physicists and with the colleagues in her immediate work environment. Being fascinated by science and willing to devote time and effort to research, Soprano feels akin to most of her colleagues. At the same time, she presents herself as being appreciated in her work and capable of influencing the issues in her work environment. Considering these positive points of identification, it also seems natural that Soprano often employs the inclusive pronoun *we* when accounting for her work; *we* means both Soprano's home division and the entire Department of Physics.

The interviewee who used the most *I* constructions is here called Guitar, a female PhD who left academia soon after she completed her dissertation. At the time of the interview, she was working as an application specialist in a company. In her speech, *I* constructions are the prevailing mode (568/93%), whereas *we* constructions are very rare (43/7%). The field of physics in which Guitar works is an interdisciplinary field with a combination of physics, chemistry and mathematics. Pursuing a PhD in this particular field was a conscious choice for Guitar and when defining her personal interests in physics, she positioned herself "in between" the natural sciences. Like Soprano's career path, her academic career also followed quite a clear path from Master's thesis to PhD.

However, when accounting for her career choices, Guitar often indexed moral responsibility in her story ("I was thinking that I'll go there for a short while to see how it is" *P226 (460)*) or she expressed emotional engagement when explaining her actions ("But at that point I didn't necessarily think that I would do a doctoral dissertation on it, but at first it felt good. The further on I got with it, the more I felt like I might as well keep going." *P226 (275)*) These verb choices seem to a certain extent to function as distancing her from the story; at the same time, she assumes an explanatory position when describing her own past. This use of *I* constructions is very different from that of Soprano, who mainly used declarative verb forms when relating to her career and thus did not impose an explanatory/evaluative view on her professional past.

For Guitar, completing the PhD was a career objective as such; when working at the university, she did not plan her career ahead, but aimed at doing her present work as well as possible: "At the time I didn't feel like it was actually enough to be able to publish something that other people would read." *P226*

(352) However, it was not clear to her whether or not her supervisors really appreciated her work, or was it more important that she was bringing the department credits by completing her PhD. This uncertainty is reflected in the excerpt below, in which Guitar reflects on her status in the department. Here, Guitar distances herself from the story by assuming a moral responsibility for her statements. Her use of such *I* constructions as "I think," "I don't know," and "I wasn't able to think" probably reflects the rather vague professional self-esteem that she had as a junior scientist that may be related to the fact that in academic communities, feedback is often indirect.

> JV: Did you feel that your own research was appreciated? Was it valued?
>
> GUITAR: Well, I can't really... I wasn't really able to think about it from the perspective of research, but rather from that of my doctoral dissertation.
>
> JV: Yes.
>
> GUITAR: But I do feel that I managed to bring forth new information and through that, yes, I think that yes, the research, too was—or I don't know whether it was valued so much. I think they appreciated the fact that I was doing the doctorate more, but they didn't think that the research as such was so...
>
> JV: Oh, I see. Even though it brings about new information?
>
> GUITAR: Yes, it does, but for the department the fact that I was doing a doctoral degree was more important.
>
> JV: Because it...
>
> GUITAR: Brings in money [laughter].
>
> *P226 (894:908)*

Despite the rather ambiguous feedback she had experienced, Guitar felt that her academic past had provided her with various skills so that she is prepared for almost anything, not least within an academic environment. When considering her options for returning to an academic career, Guitar assumes that she would need a research task that would be something "really fabulous" that would have an important societal application.

> JV: Yes, true. Okay. You already said that you've been thinking that you might even return to the university... What would make you go back to being a full-time researcher?
>
> GUITAR: I can't, I really can't come up with anything. If I found a research subject on which I thought that I had something very special to give, or if I came up with a new idea as to how or what I'd like to study regarding that. Something

> that would solve some major issues... that I would feel that it had some significance, some greater significance.
>
> JV: What type of things?
>
> GUITAR: Well if, what could I say now? Well, like there are these these so-called grand challenge projects, these great challenges. If there were some huge issue and I'd feel that I'm on the verge of discovering the solution to that... what could there be? I daren't say.
>
> JV: Maybe something to do with the environment?
>
> GUITAR: Maybe something to do with the environment, or maybe if I could discover a solution to something related to cancer... or something really fabulous like that.
>
> *P226 (1547:1586)*

In this excerpt, Guitar identified with research projects that are targeted at solving major problems such as curing cancer. Yet, she employed verbs mostly in the conditional form ("If I found," "I'd like to study," "I'd feel"), which may reflect the relatively distant positioning she has taken in relation to the research world.

When accounting for her professional points of identification, Guitar mainly referred to her supervisor whom she considered to be both her mentor and role model. Guitar found herself to be like her supervisor in the sense that they both are persistent and determined to reach goals in research. However, she saw herself as less devoted to science than her supervisor; this attitude became evident when she had to decide whether or not to go abroad to work as a post doc. Guitar decided to stay in her native country because she preferred her life in Finland over the opportunity to advance her academic career. Another reason she identified was that willingness to oppose the idea of going abroad that seems to be a sort of "must" for a physicists' career. In the excerpt below, Guitar presents herself as a "rebel" who opposed the prevailing conventions and rules in academia.[26]

> GUITAR: It actually troubled me how highly going abroad was esteemed that it brings a huge amount of added value—you've been abroad so you can have this position here. I wanted to rebel; I won't go.
>
> *P226 (760:768)*

In Guitar's case, the decision not to go abroad was combined with her wish to work in a more practically oriented environment. Having not been committed exclusively to research in her career, Guitar defined her professional interests as

[26] The issue of going abroad is examined also in the empirical chapter Turning point.

broader than just research: “As I had been in the university for so long, it seemed interesting to see things from a different angle... to move into the business world through that.” *P226 (452)*

When discussing the stereotypes connected to physicists, Guitar adhered to the generally accepted idea of a physicist as a “mad (male) professor.” This stereotype was something from which she wanted to distance herself.

> JV: How would you describe a stereotype that people in Finland attach to physicists? Is there such a thing?
>
> GUITAR: Aren't they all men with Einstein hair? I think that's quite typical.
>
> JV: What else does this Einstein-type consist of in people's minds? Did you think that it is absent-minded or somehow mad?
>
> GUITAR: Well, scientists all are mad. In all films [laughter]. Maybe it's just that, and they are rarely women.
>
> JV: Yes, true. How do you see yourself in relation to this stereotype?
>
> GUITAR: Well, I don't quite see myself as that type.
>
> *P226 (1313:1337)*

Though Guitar was not able to identify with the prevailing image of a physicist, she nevertheless made the observation that the stereotypes of physicists actually are in the process of transformation due to the growing number of female physicists. As more women enter physics and gain public visibility, the image of physicists has to change towards a more heterogenic mode. However, Guitar did not express strong identification with female physicists as a group, either.

As mentioned, Guitar used the plural pronoun *we* very seldom in her speech. Moreover, for Guitar, *we* did not refer to the entire division or department, but to her and her supervisor and in some cases the research group to which she belonged as in the following excerpt:

> GUITAR: What we studied changed a bit, but developing the methods was in the background; we were trying to find... the best possible material for nappies.
>
> *P226 (319:335)*

Guitar mostly referred to her closest colleagues when using the plural pronoun *we* probably because, while she was working on her PhD, she mostly co-operated with her supervisor, a senior scholar who was the leader of a research group. Thus, Guitar’s most immediate working environment consisted of her supervisor, who, however, spent a lot of time abroad, and her colleagues in the research group. At the same time, she had the feeling that the laboratory in which she was working was not valued by the department. In the following

excerpt, it is exceptional that Guitar refers to the whole laboratory in her *we* constructions.

> GUITAR: Our department didn't really support this field physics; they had their own specializations that they supported, so... nobody said it out loud as such, that they were running it down, but they didn't open up any positions in that field.
>
> *P226 (416)*

Moreover, the personal relations within the group were complicated, and as a PhD student dependent on the help of senior scientists, Guitar felt obliged to act as a mediator in conflict situations. The rather uneasy situation in the research group was reflected also in the division of labor. Even though the research group actually worked on joint publications, Guitar defined her work as mostly an individual achievement.

> JV: You said that you did a lot of work on the computer, so would you define your work during those times as group work or individual work?
>
> GUITAR: More as individual work, even though we did, after all, work together on publications, but it was always really like one person doing one particular part.
>
> JV: I see, and then they were compiled?
>
> GUITAR: Yes.
>
> *P226 (934:940)*

Considering the relatively lonely position Guitar had as a PhD student and the few positive points of identification in both the immediate working environment and the department, the rare occurrence of the plural pronoun *we* becomes understandable. Moreover, Guitar expressed the feeling of not being valued as a researcher, but rather as a source of income for the department. It is thus not surprising that on the level of speech, she was not able to identify with her division or department or physicists as a group. This distancing was reflected in the frequent use of the singular first person pronoun *I* in her narratives.

In sum, when accounting for her professional past, Guitar seems to take up alignments that position her in the margins of or even outside the academic community. In her *I* constructions, she makes an effort to distance herself from the prevailing stereotypes about physicists and the conventions of an academic career, such as going abroad as a post-doctoral fellow or committing herself exclusively to research. Being happy with her current employment in the private sector, she could only imagine returning to research if she would be able to work on a "fabulous" research problem. These alignments together with the experience of not being valued as a researcher may have influenced the rare use of the plural pronoun *we* in Guitar's narratives. As a researcher and physicist,

she positioned herself as an individual without a strong background in the academic community, while the plural pronoun *we* includes only her few closest colleagues.

5.4 Patterns of alignments in the entire data set

The analysis of the interviews with Soprano and Guitar show that when taking up alignments in relation to their profession and working environment, the two interviewees employed the first person pronouns *I* and *we* differently. Moreover, the alignments revolved around such issues as professional identity, self-esteem, identification with one's field of science and working environment. Considering the thematic coding of the interview data,[27] the most focal codes in terms of alignments seemed to be the following: stereotypes, identity, self-esteem, teamwork and competition. Throughout the entire corpus of data, the following instances occurred: stereotype, 56 times; identity, 214; self-esteem, 62; teamwork, 69, and competition, 68 times. As in this study, a qualitative data analysis was conducted, a more detailed numeric analysis of the *I* and *we* constructions and the selected codes proved not to be relevant.

In the rest of this chapter, I analyze the entire interview data from the point of view of these codes. Due to the vast amount of data, the linguistic analysis of alignments is necessarily left on a more general level than the detailed examination of the two interviews with Soprano and Guitar. Thus, the aim of this part of analysis is to look for patterns and tendencies of alignments on the level of the entire research data. I ask what professional positioning and alignments are utilized in the *I* and *we* constructions. Moreover, my special focus is on the gender aspect; I ask whether women and men position themselves differently when accounting for their professional selves. My aim is also to explore what the alignments reveal about resistance and integration in terms of hegemony.

Stereotypes

The first set of *I* constructions related to the professional images of the interviewees was coded as Stereotypes. Here, the interviewees were asked to describe the public images that they think are related to physicists. They were also asked to position themselves in relation to the stereotypes.

The majority (13 female and 15 male interviewees) described the stereotypical physicist as a nerd—an introverted, over-specialized scientist who has little or no interests outside of his/her own field. The interviewees often connected the physical appearance of the stereotypical physicist with an

[27] See section 4.4 for more detailed description of the process of coding and definition of the codes.

Einstein-type “mad professor” with disheveled hair and shabby clothes, in most cases, a male scientist. These stereotypes were presented by both female and male interviewees, and in their *I* constructions, a large majority of them distanced themselves from that image. In these *I* constructions, the interviewees typically employed declarative verb forms in order to emphasize their inability to identify with the image of a nerdy physicist (“I'm very far from that” *P207 (775)*; “I’m not interested in it!” *P208 (514)*; “I'm not like that.” *P209 (638)*; “Well, I don’t fit the stereotype at all.” *P210 (579)*). Even so, three female and four male interviewees admitted that they fit the stereotype to a degree. These interviewees mainly identified with the image of a physicist who is very devoted to his/her work and easily becomes absorbed in it. Here is an example of this type of identification by a male interviewee:

> XYLOPHONE: Well, I, in a way, like, there I feel like there is a stereotype of me, as an astronomer and a researcher who doesn’t really think about anything but it, or, like, is really absorbed in his own work. Which is true in a way true, but I do find it very one-sided, this picture, because I do have an interest in the entire field of science, or across different scientific fields… but sometimes I myself do sort of become aware of it, that wait a minute, I am a little bit stereotypical.
>
> *P217 (753:791)*

It is notable that this interviewee mainly employs verbs that reflect moral responsibility for the statements (“I feel”, “I find”, “I myself sort of become aware”). By doing this, the interviewee probably attempts to verify the stereotype by looking at himself from the outsider’s point of view.

The positive attributes the interviewees connected with physicists were thoroughness and the ability to understand abstractions as well as large and complex entities. However, in some cases these attributes carried meanings that were not unequivocally positive. Some interviewees had experienced being singled out as abnormal by other people because of their profession. Physics is generally considered very difficult and distanced from everyday life and people who do physics for their work are thought to be somewhat peculiar. Female physicists had especially experienced this image to be in conflict with their identity as a woman or a mother. The following excerpt reflects a conflict between the role of mother and that of physicist. The interviewee describes how a casual discussion at a playground results in embarrassed silence when she reveals her occupation; the other parents do not seem to be able to relate to her professional role as a physicist.

> FAGOT: I don't really know what kind of image we have… I have found that it's a very good way to silence everybody at the playground, when they ask you what you do. "I'm a physicist." [laughs]
>
> JV: Really? Why do you think they're silent?

FAGOT: I guess people think they won't understand anything about the work, or something, so they don't ask anything, so they won't seem stupid.

P205 (708:726)

From this excerpt, it can be derived that the public image of physicists is rather obscure even to the interviewee herself. She is not sure about what other people think about her profession, but she has found that they cannot really relate to her work. The uncertainty is reflected in the use of predicates like "I don't really know" and "I guess." By doing this, the interviewee at the same time takes up an alignment that marginalizes her from the everyday conversation with other mothers around the sand-box.

In the interviews, the plural pronoun *we* was rather rarely used (10 *we* constructions per 56 quotes) in terms of stereotypes. The *we* constructions employed were related to the public images of physicists as arrogant, strange and self-sufficient. The interviewees did not generally relate to these perceptions, but in cases where the inclusive *we* was used, the interviewees did not distance themselves totally from those images either, as in the following example.

MOUTH-HARP: Physics is—it's just—when you're the best...

JV: But what makes it the best?

MOUTH-HARP: You understand things better than other people. You're able to reduce. The great thing about physics is that you can reduce things more than any other science.

JV: What things?

MOUTH-HARP: Well, that's the thing. The things you can reduce are useless. I find this stereotype pretty silly myself, but it's there. We can reduce things into a single equation. For example we can reduce the universe into the equation $s = k \log W$. That's the definition of entropy. Ludvig Boltzmann wanted that on his gravestone. He came up with it. It's typical for a physicist's conception of the world. It's one equation.

P211 (748:794)

In the excerpt above, the interviewee associates physicists (that is, *we*) with one of the great names of physics history, Ludvig Boltzmann. According to the interviewee, it is the specific ability to reduce things mathematically that makes physicists think that they understand things better than other people. While presenting this stereotype in an ironic tone, the interviewee nevertheless includes himself in the group of physicists who in some ways are above normal people.

Identity

After having discussed the stereotypes, the interviewees often moved on to describe themselves as physics professionals and as members of certain fields of physics. These *I* and *we* constructions were found under the code Identity, which included references to the interviewees' personal identities as physicists, but also references to qualities of different fields of physics in general. Here, the numeric distribution of *I* and *we* constructions is not mentioned as the theme Identity did not form as clear categories as did such other themes as Stereotypes and Self-Esteem.

From an outsider's point of view, all physicists seem to form one, monolithic professional group. When interviewing the Finnish physicists, however, it soon became evident that there are several subgroups within physics. Moreover, some of the interviewees did not find it easy to locate themselves in one specific group. This was especially the case in the fields of applied physics: geophysics, atmospheric physics and material physics. In their *I* constructions, these interviewees defined themselves as representatives of these particular fields and only secondarily as physicists: "I'm closer to the stereotypical geophysicist." *P201 (712)*; "I am a pretty ordinary geophysicist girl." *P206 (752)*, and "But I see myself more as an engineer than a physicist." *P209 (36)*

Even though this distinction was made by both female and male interviewees, there appeared to be an interesting qualitative difference in their responses. Some (3) male interviewees who worked in applied physics mentioned having faced "racism" within physics departments; whereas theoretical physics was considered the most difficult and "pure" field of physics, applied physics was labeled easy and "not pure." This categorization implied that only representatives of "pure" physics were considered real physicists. Hence, some interviewees were cautious even when describing themselves as physicists.

> LUTE: Well, this is about how you define someone as a physicist. Because our ex-department's professors wouldn't consider them [materials scientists] physicists.
>
> JV: Okay.
>
> LUTE: This is exactly my identity crisis. At the university, I avoided using the word physicist, as I represented materials science, but here [in current work place] I'm a physicist now.
>
> *P227 (1869:1881)*

Here, a male physicist accounts for his two-fold self-image as a physicist. His ambiguous self-image is reflected on the level of *I* constructions. When accounting for his former workplace, he uses verb forms that distance him from the "real" physicists ("I avoided using the word 'physicist,' as I represented

materials science"), while when explaining his current status, he employs a declarative verb form ("I'm a physicist now"). From a wider perspective, this excerpt can be considered as an example of a boundary[28] making process between different subgroups in physics. It reflects the privileged status of "pure" physics and its representatives' power to label some disciplinary groups as "non-physicists."

The female interviewees did not report this positioning problem, but in their *I* constructions indicated that they preferred identification with groups other than traditional physicists. Being between two fields of physics was not a problem for them; on the contrary, some (5) female interviewees considered collaboration with different fields of physics a professional advantage and some (3) had made a conscious choice to work between two departments.

> JV: Yes, yes. You have a rather extraordinary position there, sort of in between the two...
>
> BONGO DRUM: Yes. And when you are between the two, you don't have be so... commit yourself and be so much like you belong to a certain group. So, so that's something I've I realized. And I also think that's why my state of being has improved over the years here, between aerosol physics and meteorology, because I'm not so much like... in it anymore. I do know what the situation is and people talk to me and so on. But I'm not so much labeled as anything.
>
> *P222 (115:1129)*

Here, a female physicist who has consciously made the decision to stay out of the disciplinary groups in her department accounts for her position in "between the two." For her, not being labeled "as anything," is a positive thing that has improved her status in the department as she is able to move in between the different fields and research groups.

Even though the above examples cannot be said to represent a major trend in the data, they may be considered indicative of the inner hierarchies and boundaries within physics and of the different ways of responding. On the basis of the interview data, it seems that some (3) female physicists took up alignments that located them outside the traditional disciplinary boundaries of physics in rather unproblematic ways, while some of the male interviewees (4) were more conscious of the prestige and hierarchical structures even while denouncing them in their positioning. Male physicists thus seemed to be actively involved with boundary-making in their field of science when taking up alignments as physicists or non-physicists, whereas female physicists either were not concerned about the boundaries or ignored them.

[28] Here, the term boundary is used as an everyday term, not as a theoretical notion.

In their *we* constructions relating to professional identity, the interviewees mostly referred to their immediate working environment, a research group, laboratory or department, but also to their field of physics in general. When making these references, the interviewees often declared the authority of the field of physics in which they worked. Those researchers who worked in basic research often employed *we* constructions in order to justify the meaning of their work in relation to societal needs.

> JV: I can believe that. Now, how would finding this particle affect things in practice?
>
> ENGLISH HORN: [laughs] I have no idea! We do basic physics research and we don't really focus on what can be done with this in practice. When this comes up I like to mention for example that back when the electron was found, people didn't understand [it]. It was like "what good is that?" The scientist excitedly says they've found this electron thing, he found it, and nobody could quite see what good it would do, but today, all electronics is based on that find. Your recorders, cell phones, computers. The equipment our labs are filled with.
>
> *P209 (30:34)*

In the excerpt above, the interviewee identifies herself with the larger group of physicists who do basic research. She argues that even though basic research does not focus on practical applications of science, many of the inventions of modern society are based on the breakthroughs that basic research, that is, the *we*, has made. In this excerpt, identification with the great inventions in physics history is used for legitimating basic research, even though its implications may be seen only later on.

The relation of physicists to the larger world emerged in other discussions. Even though the role of basic research was largely recognized by the interviewees, some (4) interviewees assumed that physicists as a group should probably take a more active stand towards current societal problems.

> SOPRANO: But also if you want to take a stand on that particular topic as a researcher, you'd have to know an awful lot about it. Otherwise you're on the same level as everyone else. But there are some things that we talk about within the faculty, such as global warming and things like that.
>
> *P235 (338:342)*

Here, the plural *we* refers to physicists as an academic field and their special expertise that could be used in order to enhance the general consciousness about major societal issues such as climate change.

Self-esteem

The third group of interview excerpts that was closely related to the interviewees' professional positioning and alignments was coded as Self-esteem. In this category, there were both accounts of how the interviewees perceived the appreciation they personally received and their perception of the appreciation of their research group and the field of physics where they worked.

When asked to assess their own professional qualities, most of the interviewees' *I* constructions (14 females and 11 males) revealed rather positive self-esteem. These interviewees defined themselves as good physicists and they indicated that their work at the university was sufficiently appreciated by both their colleagues and others in the broader field of physics. Yet these interviewees often assumed a moral responsibility about their self-evaluations by employing verbs such as *think, guess* and *feel*: "Yes, I do get positive feedback." *P212 (662)*; "I think it's [interviewee's work] appreciated." *P201 (584)*; "I do feel that it [the interviewee's work] is appreciated." *P203 (386)*; "I guess it's [the interviewee's work] well enough appreciated; I haven't had any complaints from anybody." *P204 (576)*. In these *I* constructions, the interviewees do not make explicit statements about other people's thoughts about their qualities as researchers, but rather present their own interpretations of the matter. Despite the overall positive self-perception of the interviewees, specifying their own strengths and weaknesses as physicists proved to be a difficult task for some. An issue that came up frequently was connected to the indirect or vague nature of feedback in academic work communities. In some (5) cases it had been difficult for the interviewees to decide whether their contributions to research were appreciated for the work itself or for other reasons, such as departmental finances (see analysis of Guitar). Another group of interviewees (4) referred to the lack of feedback in academia, but perhaps in a less concerned way. Many of them assumed it was natural that positive feedback at work was indirect and came through scientific discussion.

Those interviewees who indicated a positive self-esteem as physicists often presented themselves as able to connect things and bring different themes into interaction in research. In this group of interviewees, there were four male physicists who specifically discussed creativity, playfulness and the urge to experiment as a scientist's most important qualities.

> RECORDER: Well, it's an important thing to have a good imagination in this line of work, I'd say. Everything else can be learnt but… like I said before, like the enthusiasm of little boys regarding something. I don't know if it's creativity or what. A little bit creativity, anyhow. And I believe that I possess that, too. I find connecting things interesting, and I think it's quite important and it's something that isn't perhaps so much emphasized. Nowadays when you read newspapers, you see a lot of that; like there should be innovativeness in industry and the like. That is emphasized a lot, and I think that many of these guys possess a lot of exactly that quality.
>
> JV: Right, yes. You just mentioned "like little boys" and at some point, you also talked about little girls. So were there actually playful little girls [laughter]?
>
> RECORDER: Well, we didn't actually have many girls there. It's so strongly a male-dominated field.
>
> *P229 (1407:1419)*

The *I* constructions above indicate that the interviewee identifies himself with a creative (and playful) group of scientists, yet he expresses a certain ambivalence in defining these qualities by verb choices like "I don't know if it's creativity or what," "I believe," "I suppose." What is clear, however, is that the interviewee sees innovativeness as the most important quality of a scientist, and he associates this image with male physicists. He also defines creativity as an inherent quality, something that cannot be learned. This observation is in line with Cathrine Hasse's (2002a) study on play in physics showing that male physics students engaging in playful activities were often praised by their teachers and perceived as potential future scientists (Hasse, 2002a, pp. 266–268). Thus, play can be seen as an unofficial premise for taking part in the research activity that entails identifying with a group of male scientists who have the enthusiasm of little boys.

Interestingly enough, even though most interviewees assessed their own qualities as good or sufficient, when comparing themselves with their colleagues, they most typically assumed that their colleagues were more perseverant or meticulous than they themselves were. In their *I* constructions, eight interviewees (5 women and 3 men) even positioned themselves as less intelligent or theoretically and mathematically less gifted than their colleagues. Also in these accounts, the interviewees mostly employed expressions that stated their own perception of the issue, as in the following examples:

UKULELE: I felt that I wasn't good enough at maths.

P232 (1957)

ALTO: I guess I didn't have that burning for the basics of physics. Even though I liked it, I lacked that deeper understanding of where those things come from.

P218 (508)

FORTEPIANO: Well, I wouldn't mind being as clever as they [interviewee's colleagues] are. It always feels like the others are cleverer, if they are clever.

P233 (1984)

Predicates such as "I feel" and "I guess" point to the fact that the speaker is presenting his/her own idea and not necessarily an objective fact. What was symptomatic of these *I* constructions was that the rather negative perception of individual abilities did not correlate with the academic achievements of the interviewees, as five of the above-mentioned interviewees had their doctorates in physics. Some (3) of them also stated that they were performing better in other tasks than in doing research. By saying this, the interviewees were justifying their functions in the department as project managers, for example. There were also interviewees who indicated that they lacked interest in scientific work and found their colleagues more enthusiastic and devoted to physics than they were.

TIMPANI: What qualities do I lack? A desire to progress in a university career [laughs]. What other things were...? I guess we had a certain group of us who were very similar. I think that in some things I was more practical, or in a way, practical is a too positive a word. I am more of an iron-forger, and they are, like, brain-workers.

P213 (514:524)

In the interview excerpt above, a female interviewee who had left academia positions herself as an "iron-forger" in relation to her ex-colleagues who were oriented to an academic career and thus "brain-workers." This type of alignment was commonly taken up by interviewees who had left academia; by presenting themselves as less suitable for academic work they were explaining their unwillingness to pursue a lifelong career in the university.

The interviewees employed the plural pronoun *we* usually when accounting for the appreciation of their own field of research. *We* could thus refer to a research group, a department or a broader field of physics. Generally, the interviewees perceived the appreciation of their own field to be good on an international level, but there were also interviewees (9) who indicated that their field was lacking appreciation in their own universities. This lack of appreciation was reflected mainly in the amount of financial resources allotted to their

departments and the size of the research groups. In these *we* constructions, the interviewees often compared their home division/research group/laboratory with other units in their institution that seemed to receive more appreciation. Interviewees working in theoretical research and basic research especially indicated that applied fields of physics seemed to carry more importance at the moment.

> JV: How would you estimate how your research group is valued within the department?
>
> ACCORDION: Well, that has been discussed. Well, you can imagine that here in our institute where the hot topic is environmental issues and then there are we, who are doing basic research. And then when you start to think about the realities of life, is anyone really interested in what is going on in Mars, when the earth is under threat of an accelerating greenhouse effect. So there is a little bit of that, or maybe it's just my group that thinks that we are sensing that.
>
> *P200 (618:628)*

Here, the interviewee refers to a wider research political issue that is visible in her institute, namely that the interest in environmental research has increased in recent years while other areas of research like space research have gained less attention. In this *we* construction, basic research as opposed to environmental research is seen as less important as it carries no direct implications in issues such as climate change.

Teamwork

While issues of stereotypes, identity and self-esteem directly addressed the question about the professional alignments of the physicists, there were also other themes relating to the professional self-images of the interviewees. When representing themselves as physicists, many interviewees discussed the interpersonal relationships and collaboration at their work. These themes were coded as Teamwork and in the following, I analyze the *I* and *we* constructions in this category.

In general, the amount of teamwork in physics research seemed to be connected to the field of physics itself: the more experimental the research, the more references to group work the interviewees made in their *I* constructions. Many of the interviewees representing experimental physics highlighted the importance of teamwork in modern science as a precondition for any breakthroughs. This is especially the case in particle and nuclear physics, where large-scale experiments essentially require group work. Even so, there were also experimentalists who depicted themselves as predominantly individual workers.

The positive sides to teamwork were mostly discussed by the female interviewees who in their *I* constructions often implied that they preferred group

work over individual work. They also frequently referred to the lack of co-operation at work as a problem by describing academic research as being too solitary and emphasizing their need for human interaction at work; two of the interviewees had also attempted to change their work to a more collaborative mode. The following quotations reflect this type of professional alignment.

> CEMBALO: "Well, I've always thought we're a big group of ants and out of all of us each one of us does our part."
>
> *P202 (185)*

> FLUTE: "And then I started to feel like, I long for some other motivation in the job apart from doing research for the sake of research... you are with people there but nevertheless in the end it's about you toiling away on your own. Performing the actual work is really quite lonesome."
>
> *P224 (703)*

> BONGO DRUM: "Well, I'm trying to make it more of group work... so it's like, it's one of the reasons why I stepped on the brakes a bit at the end of the summer. I mean because... I did everything by myself."
>
> *P222 (2218)*

Even those female interviewees who considered their work mostly individual emphasized the importance of good team spirit and collegial support in the work place. In the following excerpt, a female physicist positions herself exclusively as a group worker:

> FIDDLE: Yes, well, I'm a team worker by nature, so I find it very difficult to do work alone, or I don't really like to work, like that, alone. I think it's good to talk about those, like, problems. Because of actually, what I just said, that if you have a problem, that is because you haven't formulated it, and then when you discuss things, it helps in the formulating.
>
> *P210 (367)*

Here, the interviewee is employing evaluative expressions in her *I* constructions, such as "I find it very difficult," "I think it's good," "I don't really like" By doing so, she emphasizes the personal importance that mutual problem solving has for her.

The male interviewees indicated a rather different alignment in relation to teamwork in their *I* constructions: 10 out of 18 male interviewees represented themselves as mainly individual workers, and, unlike their female counterparts, few of them considered working alone to be a problem. Some (2) stated that they ended up doing research individually by conscious decision. Some (3) male interviewees described their research as predominantly individual work, even

though it was obvious from their narratives that they frequently collaborated with their colleagues. These interviewees rarely commented on individual work in a negative sense, but rather assumed that it was a traditional way to work in science that needs not to be challenged.

> JV: Would you say that your own work is more individual or teamwork, or is it both?
>
> CYMBAL: There's some teamwork involved, but mainly it's this traditional solitary toiling of a university researcher. My field of research is, after all, a pretty small part of this division.
>
> *P223 (335)*

The *we* constructions related to teamwork reflected the above-mentioned themes. When employing the pronoun *we*, the interviewees usually referred to their closest collaborators either in Finland or abroad. Often, *we* meant a research group that was collaborative in a true sense, as in the excerpt below:

> JV: Yes. Is your work mostly individual work or group work?
>
> XYLOPHONE: Well, it is actually largely group work. Let's say, it's almost—what would it be—30% group and 70% individual work, or 40–60, something like that; I don't know, I can't really say exactly. Of course, everything we do, we discuss with colleagues; there is very little that is done completely alone, because we have sort of bigger projects, so we do the projects together and for that reason, we also need to discuss the work to bring it forward.
>
> *P217 (425:439)*

In the *we* constructions above, the interviewee positions himself in a group of colleagues that discusses everyone's work and pursues joint endeavors. However, in all cases *we* did not indicate that the interviewee actually perceived his/her work as team work. In these instances, *we* often referred to a PhD supervisor with whom a PhD student was supposed to work, but eventually the since the supervisor did not have time for supervising, the student ended up working alone.

> JV: Yeah, right. So the team would have been you and the supervisor?
>
> TRIANGLE: Yes. We were supposed to think about it together, decide how to go on, but he didn't have time. He must've had like five or six projects going, and they were all wide open.
>
> *P214 (506:524)*

Competition

The last set of alignments was connected to the thematic code Competition. The issue of competition proved to be essential in terms of how the interviewees positioned themselves in relation to their immediate environment and colleagues. Academia in Finland is often considered to be a competitive working environment in which talented individuals compete for scarce financial resources and positions; thus, competition is a fact that every scientist has supposedly faced in his/her career.

When asked about competition in their work or career, however, female and male interviewees took up rather different alignments in their *I* constructions. Female interviewees often mentioned that the competition was generally fierce in academia, but they found it hard to point out competitive events in their own careers. Nearly all female interviewees (16 out of 18) indicated that competition had had little or no influence on their academic careers. Interestingly, some (4) female interviewees indicated that they had consciously opted out of the development in the scientific careers because they did not want to compete. In the following, there are two examples:

> STEEL DRUM: Well, I could still say, about the age thing, that when thinking about a scientific career, the development of a scientific career, you have to start young, if you want to aim for professor, and so on, but... I have done everything in the opposite direction. I didn't aim for professor, because I didn't have interest in that.
>
> *P231 (278)*
>
> JV: How do you perceive that in your job description? Or probably after you have finished your dissertation?
>
> BONGO DRUM: Well I do think that that I'm not in a professor tube, so to speak, so... you can easily see that after your doctorate; you end up working somewhere other than the university.
>
> *P222 (2424:2430)*

In these *I* constructions, the interviewees were taking up alignments that excluded them from the sharpest edge of the academic competition, that is, competition over professorships. Some (2) interviewees also stated that the fact that they did not participate in the competition for research funding gave their colleagues an advantaged position. One female interviewee defined competition as a predominantly male issue and assumed that competition is harder for male physicists than for their female colleagues.

> FAGOT: I don't know if maybe their [men's] fight is bloodier. About who's smarter. It seems sometimes that they're trying so hard to be something super-intelligent. Some of them at least. A huge need to prove themselves to the younger ones.
>
> JV: So women don't necessarily do that?
>
> FAGOT: Maybe some do. I don't.
>
> *P205 (742:746)*

Here, the interviewee also takes up an alignment that sets her apart from the intellectual fight in academia.

Male interviewees, on the other hand, revealed a very different perception of competition in their *I* constructions: 12 out of 18 male interviewees stated that there was a lot of competition in academia, and they were of the opinion that competition had affected their personal career paths. Competition was generally considered to be inherent in the academic world, in both a positive and negative sense. Competition was seen as a career booster that motivated both individual researchers and research groups to maximize their efforts when doing science. In the excerpt below, a male interviewee compares physics with a football game and positions himself as being familiar with the idea of competing with others. He also takes up a rather positive alignment in relation to competition. At the same time, he admits that competition may not suit everyone.

> JV: Do you feel like the competition may have had an effect on your own career development in any way, positively or negatively?
>
> RECORDER: I believe it was quite positive... I had quite a good situation in that before this I used to play football quite seriously, so taking things forward in a group and a type of competition against others is a familiar thing to me. So perhaps, just off the top of my head, for me it was easy to understand that it's nice to—because you always have that aspect too—that it's nice to show off to others, like this is how we do these things. I don't think it never, but I know, or can well understand, that it may not suit everybody and it may also, if it goes wrong, turn against itself, so you need to able to maintain it as a positive thing.
>
> *P228 (1048:1066)*

In his *I* constructions, the interviewee indicates that he is aware of both sides of competition; by employing the predicates "I believe," "I don't think," and "I know, or can well understand," he assumes the moral responsibility for what he said about competition in his career and leaves the option open to other interpretations.

As the previous excerpt suggests, competition within academia and between research groups had also affected some (5) male interviewees' careers negatively, on both formal and informal levels. Male interviewees who had left

academia said that they became tired of the ongoing competition for scarce resources which materialized in backstabbing and different kinds of hierarchies and pecking orders. In one case, a male interviewee had to leave academia because there was no longer any job available for him in his department. Some (2) interviewees had grown weary of the prevailing competition in the university and decided to change employment as is evident in the excerpt below. In his *I* constructions, the interviewee positions himself in a vicious cycle of academic competition: there was always more work to do than one could do.

> LUTE: When the time for applying came around, I was indecisive: I could have done research, but somehow I had done research for quite a long time and in some ways it was really hard in my opinion. The fact that you've never done enough... starts to get to you over time. That, that no matter how fast you do things, you should always have been able to do more.
>
> *P227 (898:956)*

The *we* constructions related to competition also revealed the same gendered pattern. Both female and male physicists recognized that in academia, there is generally competition over financial resources and prestige. However, female interviewees almost exclusively stated that in their working environment, there was no competition. The lack of competition was seen as resulting from good collegial relationships: “We all helped each other and we didn’t compete with each other” *P202 (509)* or because of diverse research interests: “We have many research groups here with their own profiles. We don't compete with each other.” *P235 (1232)*. Even when it came to the competition over funding, female physicists often argued that they were all in the same boat with their colleagues. Thus, the female interviewees did not position themselves against their colleagues in the professional competition, but rather took up alignments that revealed a high degree of affiliation with them.

The male interviewees mostly considered competition to affect their lives even on the level of their immediate working environment. In their *we* constructions, the male interviewees explicitly described situations in which research groups fought over money and research results. They also recognized that in many cases there is constant competition for funding “in the house,” that is, amongst their circle of colleagues. While the majority (14) of the male physicists took competition as a natural part of academic work, at the same time five of them indicated that they did not want to identify with it. The male interviewees also tended to see competition in academia as child play with humorous aspects, as the example given by one of the male senior scientists showed:

> CELLO: In Finland, if you earn more than the norm, it is a terrible thing, and once when I came from abroad, I brought a brand new car to the department and parked it there. After that a friend of mine said that it was a very foolish thing to do, that he drives an old, ancient Golf, but his friendships do work. This also connects to the male-dominated framework that we work in. This is definitely a competition, which is measured with such concrete things as that. It is, it is like, like a sandbox with toys, and it isn't necessarily, the research evaluation side isn't always what is being examined.
>
> *P208 (335)*

In this rather ironic description, the interviewee positions himself as an outsider in the "sandbox with toys;" however, at the same time, by using inclusive *we* pronoun ("the male dominated framework we work in"), he admits that he too takes part in the competition.

5.5 Summary

To summarize, the analysis of two individual interviews (Soprano and Guitar) suggests that the interviewee using the highest relative number of *we* constructions (Soprano) seemed to identify strongly with her immediate working environment and also with physicists as a professional group. She expressed a positive self-image both as a representative of her field and as a member of her division and assumed a position of responsibility in relation to her immediate work environment. The interviewee who employed the highest number of *I* constructions (Guitar) took up alignments that positioned her in the margins of her former department. She could not find many positive points of identification in her circle of colleagues and presented her work as a scientist as rather lonely. Interestingly, both of the interviewees using the highest and lowest relative numbers of *we* constructions were female. Thus, contrary to what was assumed at the beginning of this chapter, the connection between *I* and *we* constructions and gender cannot be said to be quite straightforward.

The thematic analysis of the entire interview data, however, suggests that the interviewees' professional alignments were gendered to a certain extent. This conclusion can be drawn mainly on the basis of the analysis of *I* constructions as the *we* constructions were limited in number and showed less gender-based variety.

The alignments that the interviewees took up when discussing the stereotypes of physicists were not clearly gendered. In their *I* constructions, most female and male interviewees articulated that they could not identify with the prevailing stereotype of a physicist, an introverted male nerd. At the same time, there were interviewees (both male and female) who could relate to this stereotype to a certain extent. The plural pronoun *we* was employed rather rarely in relation to stereotypes, but those interviewees who used it seemed to include themselves in

the stereotypes, at least to some extent. What was specific for female interviewees was that some (3) of them had experienced a conflict between their identity as women and as physicists. Male physicists did not express such problems in their alignments.

When accounting for their professional identities, some (4) interviewees positioned themselves primarily as representatives of their own field (for instance, geophysics) and only secondarily physics. While this distinction was made by both male and female physicists, male physicists proved to be rather conscious of the inner hierarchies and boundaries between different fields of physics, whereas female physicists seemed to be less concerned with these boundaries and more willing to cross them. In their *we* constructions, both male and female physicists identified with their immediate work environment, but also with the broader field of physics. In most cases, the interviewee strongly identified with the *we*.

The interviewees took up different types of alignments when discussing their self-esteem as physicists. In their *I* constructions, most interviewees presented themselves as adequate physicists, yet these self-evaluations were typically presented as the interviewee's own perceptions and not as objective facts. Furthermore, when comparing their qualities with those of their colleagues, both male and female interviewees expressed that they did not feel as competent as their colleagues. It was thus evident that both women and men felt inferior in relation to their colleagues, even though in many cases they were academically equally qualified. This tendency was obviously related to the fact that many interviewees felt the feedback in the academic world to be vague or insufficient. A gendered tendency could be identified when the interviewees accounted for their professional strengths. Some (4) male interviewees identified themselves with a metaphor of a playful boy as the equivalent of a good scientist; this metaphor was not present in women's narratives.

When accounting for teamwork as part of their job as physicists, both female and male interviewees acknowledged that teamwork was a precondition for any breakthrough especially in experimental physics. However, in their *I* constructions, female physicists assumed a more personal and positive position towards teamwork as their male counterparts. In their *I* constructions, male interviewees more rarely than female interviewees discussed the lack of collegial support as a problem for their career. In the *we* constructions, *we* could refer to team work in a true sense, but the description was not always accurate or complete. This was the case when *we* was used to refer to a two-person team, in which only one person performed the work as the second person was too busy.

The alignments in terms of the theme competition proved to be the most gendered ones. While female interviewees in their *I* constructions generally distanced themselves from the issue of academic competition, most male interviewees positioned themselves within the competition. For them,

competition was an integral part of university life and they could recognize its positive and negative implications for an individual. Also to *we* constructions about competition indicated a gendered tendency, though to a lesser degree. When referring to *we* as their immediate circle of colleagues, female interviewees were more likely to present *we* as mutually supportive, while male interviewees identified competitive situations also "in the house."

The alignments manifested in *I* and *we* constructions can be also considered in terms of hegemony. Here, a specific focus is on the idea of hegemony as a dialectical continuum between integration and resistance. The analysis of the two interviews (Soprano and Guitar) reveals two rather different positions in relation to the academic community and physics as a field of science. Whereas in her alignments, Soprano seemed to identify herself strongly with her professional field and the stereotypes connected to physicists, Guitar distanced herself from the physics community in which she used to work. Hence, considering the continuum depicted by Mumby (1997, p. 365), it can be stated that Soprano's alignments are closer to "total integration," while Guitar's alignments bring her closer to "widespread resistance."

Furthermore, the thematic analysis of alignments in the entire data revealed certain gendered aspects that can be examined from the point of view of integration and resistance. In their alignments, female interviewees performed resistance against the prevailing stereotypes of physicists, against the traditional individualistic mode of research work, as well as against the competitive nature of academia as a workplace. Especially in terms of competition, the majority (16) of female interviewees took up an alignment that distanced them from the competition. Respectively, in their alignments, male interviewees indicated a rather high degree of integration in the academic competition and individualistic mode of research work as 12 out of 18 male interviewees indicated that competition was an integral part of academic work. Furthermore, integration of the image of a playful boy as an attribute of a good scientist was expressed in some (4) male interviews.

When considering the above observations from the point of view of male and female careers in the university, it can be suggested that women and men seem to position themselves differently in relation to the realities of the academic work environment. Women took up positive alignments towards teamwork, while men seemed to identify with the traditional mode of individual work in research. Based on this limited piece of analysis, women thus seem to be more prepared for the current trend in physics research with research groups overruling individual research projects. Men, for their part, seem to orientate more to the image of a lone scientist that has been prevailing in Finland until the boom of higher education sector in 1960's. However, in terms of professional self-images, women showed less integration with the prevailing idea of a nerdy physicist, which might in some cases hamper their identification with their

professional groups. This tendency also becomes intelligible when looking at the gendered history of physics in Finland: due to the female underrepresentation in the field, female physicists often have lacked professional role models and points of identification. The analysis also shows a gendered tendency in how women and men position themselves in the context of academic competition: female physicists generally had little or no personal experiences of competition in their careers, whereas male physicists clearly recognized competitive situations in their professional trajectories. Thus it can be stated that the female interviewees opted out of the competition, at least on a narrative level, whereas male interviewees perceived the idea of competition as being more natural and even positive. It can be concluded that male physicists participate in the ongoing competition in the academic world more consciously than their female counterparts, where the possibility of both advancing one's career and the risk of losing the competition are played out. Keeping away from most competitive situations, female physicists play it safe in terms of their careers, but may in some cases be hindered from advancing up the academic hierarchy.

6 TURNING POINTS

6.1 The concept of turning point

The concept of *turning point* can be defined as a short consequential shift that redirects a process. It describes a change in a trajectory; it points to a break in a sequence that leads from past to the future (Yair, 2009, p. 353). Often, turning points are referred to as sudden and surprising changes that transform the life course of an individual or a society. Whether instantaneous or prolonged, turning points are moments of critical change. As Abbott (1997, p. 93) puts it, turning points "give rise to changes of overall direction or regime, and do so in a determinate fashion." Moreover, Abbott (1997, p. 102) defines turning points as "points at which the interlocked networks of relation that preserve stability come unglued and the (normal) perpetual change of social life takes over." Thus, the concept of turning point implies the idea that change is the normal nature of things, while stability is arbitrary, yet common.

The concept of turning point is a general one, describing changes of trajectories at different levels. It has been applied in multiple fields of the social sciences: life history (Hareven & Masaoka, 1988), criminology (Hanks & Carr, 2008; Uggen, 2000) and studies on teamwork (Kärkkäinen, 1999) and learning (Yair, 2009). The definition of the concept varies slightly from field to field, but in most cases, a strong narrative element emerges in the definition (Abbott, 1997, p. 89). Turning points are differentiated from minor ripples by looking at them from a sufficient time perspective in order to ensure that the direction of a trajectory has indeed been changed. This means that turning points can be identified as turning points only in hindsight; they have to be defined in terms of the future as well as the past and present. Thus, the narrative quality of turning points is connected to the three-fold temporal aspect of the concept. Turning points require a backward-looking perspective for joining together three aspects: a prior steady state, a critical event, and the ensuing establishment of a new trajectory (Yair, 2009, p. 353). Within the narrative, turning points are "middle movements" that break the inertia of one trajectory and reshuffle the actors, their motivations and actions. Turning points in individual lives are sometimes connected to major societal upheavals like an economic depression or a war, but in life historical research, turning points are considered at least to some extent to be subjective interpretations of past transitions. For instance, when studying people's perceptions of transitions in their lives or pupils' positive learning experiences, subjective interpretations are the focus of the analysis. (Hareven & Masaoka, 1988; Yair, 2009).

In my study, I use the concept of turning point as defined above for analyzing changes and transitions in physicists' career paths. As the focus of my study is

that of academic careers, I do not include turning points that preceded the academic career in the analysis. For instance, the decision to become a physicist certainly is a turning point in an individual's life, but it does not fit the scope of academic work life. By identifying and analyzing these moments of change, their conditions and following trajectories, I aim to understand the dynamics and mechanisms that lead some physicists to leave their university careers. Thus, I am especially interested in turning points that indicate a profound change in a physicists' career. However, less dramatic changes may also be relevant for an individual career. For instance, an interesting turning point can be a moment when a scientist chooses to stay in the academic career, but does so in a technical or administrative position.

How can be turning points be identified in empirical research? Abbott (1997, pp. 94–95) suggests a methodological principle that he calls the "moving window strategy." For Abbott, trajectories represent some sort of causal consistency, a constant development, or regression. Turning points, by contrast, are characterized by a chaotic internal regime and irregular transitions. A true turning point can be identified by observing its consequences: it separates two trajectories that differ either in direction or in nature. In order to understand the nature and consequences of a turning point, both the trajectory preceding the turning point and the following trajectory need to be assessed. Yair (2009) has analyzed narratives about positive turning points in pupil's school careers. When analyzing the interview data, he distinguished three dimensions of the narratives: the nature of the activity that led to the positive turning point, the psychological experience during the episode and the long-term outcomes of the turning point. In his research, Yair (2009) aims to open the "black box" of change by documenting the types of positive turning points, analyzing the structure of the turning point narratives, revealing the micro-level processes that take place during the turning point, and considering the organizational preconditions of turning points.

Another model for analyzing turning points is offered by Hanks & Carr (2008, pp. 110–111). They have interviewed imprisoned women about the turning points in their life histories. They asked the interviewees to mark important events in their lives along a line on a paper. These turning point events were then classified by their nature and number and analyzed in order to examine women's life transitions that may have set their trajectories towards crime later in life.

Merja Kärkkäinen (1999) has studied the process of object formation in teachers' teamwork by identifying turning points in interaction. In her study, she operationalizes turning points with the help of three concepts: disturbance clusters, questioning and interaction of different voices (Kärkkäinen, 1999, p. 111). These discursive indicators of turning points are identified in observational

data, their functions are analyzed and the learning outcome is stated. (i.e., Kärkkäinen, 1999, p. 117).

6.2 Turning point as a conceptual tool for analysis

In my study, I use the criteria set by Abbott (1997) for operationalizing the turning points. Thus, the hallmarks of turning points are as follows: turning points are narrative constructions about change or transformation in the interviewee's personal career path, they have to be observed retrospectively and they have to separate two trajectories that differ in quality or direction. More specifically, turning point narratives have to have the three-fold structure suggested by Yair (2009). Thus, I am looking for stories that contain 1) a description of a priori stable status, 2) a description of the moment of transformation, and 3) a description of a new trajectory. As the interviewees were not explicitly asked to identify turning points in their careers, the discussion of turning points is manifested in different ways in the interviews. They may be identified by the interviewees themselves (cf. Hanks & Carr, 2008) or they may be reconstructed by the interview analyst. Consequently, I do not expect the stories to have a clear linear form; elements of the turning point narrative may appear as scattered throughout the interview. My task as a researcher is to gather them and reconstruct the narrative.

In the actual data analysis, I apply an analysis scheme provided by Yair (2009) for organizing the narratives about turning points. Firstly, I ask what has been turned around in the turning points? I am looking for the transformations that take place in the interface of status quo and a critical moment in a person's life. These can be either individual or social transformations, sudden changes or long-term developments. In order to answer this question, I document the types of turning points and categorize them according to the quality of the turning point. Secondly, I ask what transpires in the midst of the turning point. Here, I am interested in the personal interpretations that the interviewee's give to the transformations that they have experienced. In order to answer this question, I detail the features that dominate the turning point settings: frustration, mistrust, sense of lacking authority, and an urge to find new options. Thirdly, I ask what are the organizational conditions of turning points? Here, I aim to put the individual experiences of turning points in a larger framework and to illustrate the possible connections between institutional, economic, and social changes and the transformations in individual lives. By doing this three-step analysis, I aim to "open the black box of change" (Yair, 2009) and identify both overt and more subtle factors behind physicists' career path transitions. I also ask how hegemony becomes contested or reproduced in the turning points. Finally, I focus on the question of gender: I ask if the turning point narratives are gendered

and if so, how do integration and resistance affect the career twists of women and men?

6.3 Two types of turning points

When applying the above frame of analysis in the interview data, I soon became aware of the fact that turning points in people's career narratives can be of different scales and take place on different levels. In some interviews, a turning point could be a major transformation in an individual's career such as losing a job in academia. In some other interviews, a turning point could be identified when a PhD student met a professor who helped him/her to discover an interesting research topic. Acknowledging that it is impossible to judge the importance and meaning of turning points for individuals' lives, in the analysis I made the decision to focus on those turning points that brought a major change in the interviewee's career path, that is, a decision to leave academia. Following this selection criterion, I identified altogether 18 turning point narratives [29]which I then categorized content-wise further in two types of turning points. These types are here called 1) Pushed out from academia 2) Pulled out from academia. Both categories contain narratives about the decision to leave academia. However, Pushed-out narratives are characterized by a situation in which the interviewee felt he/she had no other option but to leave academia. Pulled-out narratives, on the other hand, include stories about a voluntary choice to quit an academic career.

In the following, I present an analysis of the two types of turning points. Following the analytical frame sketched out in section 6.2, I start by identifying the three-fold structure in the turning point narratives (status quo, turning point, new trajectory). After presenting the structure of the turning point narratives, I go on analyzing the substance of these turning points and the personal interpretations the interviewees give to the transformations. Finally, I examine the institutional and organizational conditions for the turning points. In order to describe the two types of turning points, I reconstructed and analyzed two turning point narratives (interviewees Recorder and Timpani) in depth. These two narratives were chosen because they can be seen as good representatives of the two categories. Moreover, both narratives were "thick" in the sense that they provided enough contexts for the analysis. In this analysis, they function as "model" narratives of the two different types of turning points. The overall analysis of the turning point narratives is also partly presented in a story form and here, features of many interviews are combined.

[29] Includes 18 interviews with physicists who had left their academic careers. See section 4.3 for more detailed description of the interviewees.

Turning point type 1 “Pushed-out”

The first group of turning point narratives (5 narratives) revolved around the decision to leave academia as an unwanted career change. Firstly, there were three cases in which the interviewee was forced to leave his/her academic career or had felt that he/she had no other option but to leave. Secondly, there were two interviewees whose reason to leave their academic careers was less urgent, but who stated that under other circumstances, they would have liked to stay in the university. In these cases, the interviewee found his/her work in academia interesting and rewarding, but the working conditions conflicted with the realities of his/her private life. Thus, a salient point in all these narratives is the fact that the interviewee preferred to stay in the academic career. However, at the same time, there were factors in the academic work environment that made the interviewee leave the university career. Because of the conflict between individual motivations and workplace realities that resulted in the interviewee’s decision to leave academia, I call these narratives “Pushed-out” narratives.

An example of a pushed-out narrative is a story told by a male interviewee called Recorder. In his narrative, the status quo is as follows:

> JV: Well, first of all, please tell me what kind of a position or employment you had in Institute of Z when you left it? What did you study?
>
> RECORDER: Yes... my title was researcher and at the same time I was also a coordinator in a D project... there's a laboratory in Germany called Q, which was like the national laboratory of Germany up until then, like some Finnish laboratory could be, and they decided that—it's a project of a milliard euro—and they'd open it up for other countries, too, and then they'd upgrade the whole machinery very significantly. Finland has also expressed its willingness to participate in the new laboratory, and I was coordinating the preparations for Finland's participation here in Finland, and simultaneously working on my own research, so I was in the Department Y, because I had been placed in the Department Y by Institute of Z.
>
> *P228 (13:23)*

In the *status quo* situation, Recorder is working as a post-doc researcher in international research collaboration. He is passionate about his work as an experimental physicist; he devotes a significant amount of time to the work and his career is progressing well. However, the work is very time consuming and involves a lot of travelling. As Recoder has a family, too, reconciling work schedules and family responsibilities becomes increasingly difficult. Recorder describes the conflict and the ensuing *turning point* in the following way:

> JV: I see. When you moved from Institute of Z to Center for S, what happened there? Was it part of the same continuum, too?

> RECORDER: I mean I had been there [in the university] a long time already, and I knew a lot of people, so it's difficult to stop it altogether because it was quite fun after all, so… but this was nevertheless sort of like a clear break from the basic research, but it was due to, on the other hand, that doing basic research is by no means an 8 to 4 job, and we have a small child, who happened to come along, was born, when we were abroad, and my wife wanted to work more, too, so it, it doesn't really work if the hubby is working from dawn till dusk. So there was like a bit of pressure to look round for other options.
>
> *P228 (261:275)*

In the turning point episode, Recorder feels that he has to make a compromise between his career ambitions and family responsibilities. He decides to apply for a job in a state-funded organization, where his job description also includes research. In his narrative, Recorder considers this *new trajectory* following the turning point in a predominantly positive way. The regular working hours and less mobility requirements in the work make the work life more compatible with family life.

> JV: True, yes. Well, you already mentioned the 8 to 4 workdays, but were there some other things that changed when you came to work here from the university?
>
> RECORDER: I think that's been the thing for me. Well, in my case another one is that I travelled a lot towards the end, so in addition to the long hours, a lot of, even though I tried to keep it down, a lot of travelling, so that increased. It made life a constant bugger. We'd always be sitting down with a calendar, trying to figure out how to arrange things.
>
> *P228 (386:388)*

Recorder admits that leaving academia was at that point the best thing he could do for his family, but he nevertheless considers returning to university a likely option for him in the future.

> JV: Yes, true. What might make you go back to the university altogether?
>
> RECORDER: Well, there's nothing. I don't have anything at all against it. There wouldn't be anything provided that time would be—especially now with the second baby on the way, so it wouldn't make sense just now because I know what it's like... Give it a few years and if everything goes… Well, of course it would be good to have funding for a relatively long period of time, but mostly it's just that time ought to be right for it, like other things ought to click into place.
>
> *P228 (1777:1807)*

Even though Recorder says that he is happy with his choice to leave academia, the emotional aspects of his narrative are rather ambiguous. His love for physics research can be detected when he discusses the research work, but also when he

justifies his reasons for leaving academia as a moral question: “But it's just that; I’ve come to realize that there are other things in life that you must do. So you can't just be devoted to yourself or to your science.” *P228 (368)* So, for Recorder, leaving research work is about compromising between his devotion to science and other important aspects of life, such as family. In retrospect, he considers his decision to leave the university as a good thing, but at the same time, he looks toward the future when he probably will be able to return to research work. Meanwhile, Recorder has maintained collaboration contacts with his former colleagues and has continued doing research on a smaller scale. These facts considered, Recorder sees the new trajectory of his career as satisfying because it has not diverged too much from research work.

The institutional conditions for this turning point narrative can be related to the work practices of experimental physics. The long working hours that are necessary for running large scale experiments are not easily reconciled with family responsibilities. Moreover, international research collaborations typically demand frequent travelling which may be equally incompatible with family responsibilities. Even though universities have introduced family-friendly politics like an option for part-time work or remote work, they did not seem to be options for an ambitious researcher like Recorder. In his narrative, he conceded that he had no other alternatives but to choose between academic work and more family-friendly work. Thus, even though Recorder’s decision to leave academia was uncompelled, it can be said that the realities of the experimental research work pushed him away from the academic work environment. His passion for science, however, has remained the same.

In general, the structure of the Pushed-out narratives may look like the following. In the *status quo* situation of pushed-out narratives, the interviewee works as a researcher in the department and is happy with his/her work. The colleagues are nice, the university pay is not huge but tolerable, and the substance of the work is interesting. In all the Pushed-out narratives, the academic career is a goal toward which the interviewee has actually aimed. For him or her, research was a natural choice or even a calling. An example of this is provided in the following excerpt in which the interviewee describes his career in science as something he has been prepared for since childhood.

> JV: Yes, right. Good. Well, when you were at the university, did you think that physics research is not something you want to do?
>
> BASS: No. As I said before, ever since I was a kid, I've been a dangerous man with a screwdriver in hand.
>
> *P221 (542:548)*

However, there are certain elements in the work environment that complicate the interviewee's life: temporary employment makes life insecure, personal conflicts with supervisors cause troubles, ongoing competition in the department is tiresome, and irregular working hours and frequent travelling are problematic in terms of family life. In the Pushed-out narratives, the problems typically begin small until the situation grows too difficult to handle or psychologically unbearable. In the following, a PhD student describes the development of a personal crisis with his/her supervisor that was only taken up when it was too late to solve the conflict. In retrospect, the interviewee recognizes a point when it still would have been possible to change supervisors and to continue PhD studies.

> MOUTH-HARP: And it was or, it's hard to say, it got very personal, there were personal chemistry issues, and it's difficult in the university if there are problems like that between a supervisor and a student; the only solution is for the student to leave.
>
> JV: Yes, probably, especially if the field is as narrow as yours, so that there aren't any other...
>
> MOUTH-HARP: In retrospect, when it was looked into—if I had taken the matter up sooner, I maybe could have gotten another supervisor, but we just didn't take it up until it was too late.
>
> *P211 (38:42)*

The turning point in the pushed-out narratives typically occurs when the difficult situation goes overboard, that is, some sort of crisis breaks out. In most cases, however, the interviewee had anticipated the situation and started to search for alternative employment. When the moment came, the interviewees made their decision to leave academia knowing that they would be hired somewhere else. Interestingly, in two narratives the turning point episode revolved around the issues of pay and employment relationship even though the original problem may have appeared to be something else. For instance, one interviewee who had severe problems with his/her supervisor, indicated that the low salary and short term contracts in the university were the ultimate reason for him/her to leave academia.

> JV: If you do write your dissertation, will you write it outside the university, or have you thought of applying for a grant?
>
> FAGOT: No, that won't work. It just won't work at this point, with the kids so big and wanting to play hockey and whatnot. We can't get along on any grants. The postgraduate school salary was okay, with some bonuses... Yes, in the end there I had a post graduate school position, but for some reason they still gave me these four-month contracts. They might have written an explanatory note to go with it

> [laughs]. That really was what made me get angry in the end. There had been talk about at least a year, but it was written until the end of the year.
>
> *P205 (832:838)*

Even though leaving the university was sometimes the only realistic option in the Pushed-out narratives, the decision was not unambiguous. All the interviewees expressed that they would have liked to stay in their academic careers and considered the positive sides of their former employment to be significant. One example is a senior scientist who found the lack of permanent positions in the university so problematic that he/she finally ended up leaving. He/she preferred a permanent position and economic stability over the academic career, but still had very mixed feelings about leaving the university.

> JV: What would you say the underlying reasons were, then, for giving up your successful research career at the university?
>
> STEEL DRUM: Well, maybe the most important reason was the post, this permanent post. I was used to the fact that I had had a permanent position from when I was young. So at this point, I didn't dare throw myself into this sort of… I knew I would lose my permanent post. So maybe it was this, playing it safe, and then if I hadn't gotten this, I think I might have stayed there, because I had the post of senior assistant for the next year. So there was this, I happened to get this; these are really difficult decisions.
>
> JV: Would you have wanted to stay at the university?
>
> STEEL DRUM: Yes, definitely, I would have wanted a lectureship there.
>
> JV: Did it seem to be completely clogged at that stage?
>
> STEEL DRUM: Yes it did, that at that stage there weren't really—and I had to make a decision.
>
> *P231 (193:199)*

The *new trajectories* following the turning points in pushed-out narratives were predominantly positively colored. After having left academia, all interviewees found new permanent employment that matched their qualifications either in private sector or in public sector. Almost all interviewees (4) had stayed in some kind of touch with their former research institutions and continued research co-operation. Some interviewees (2) even considered it possible that they would return to the academia in the future.

What is turned around in type 1 "Pushed-out" turning points"?

In the narratives analyzed above, the turning points were similar in the sense that even though the interviewees had not planned to leave their research work in

academia, their new employments proved to be satisfactory. The positive sides of the new jobs were that the interviewees' employment eventually became more permanent and their salaries increased.

As shown, the pushed-out narratives reflect ambiguity. As an academic career was something that the interviewees had pursued in their lives, the decision to give up the career was not easy. On the one hand, the interviewees missed their jobs in the university; on the other hand, they expressed relief and satisfaction about having eliminated the negative aspects of university life. In most cases, the interviewees reported that they had less freedom in their current work than in the university, and thus felt more constrained by their jobs. The interviewees also missed their university colleagues and research collaborators. Those interviewees who suffered from economic instability and competition in the university world emphasized the importance of getting a permanent position and being in a less competitive work atmosphere. Those interviewees who had experienced problems in their collegial relationships (conflicts with supervisors, etc.) emphasized their need to escape from the harmful work atmosphere. In these cases, moving to a new employment situation solved the problem and the interviewees felt that they were treated fairly and appreciated in their current workplaces.

What had not changed in the turning points were the interviewees' personal ambitions and goals in research. As the interviewees were motivated in doing scientific work, they preserved their interest in research even when working outside academia. In these cases, the interviewees succeeded in combining academic research with non-academic work, as the following interview excerpt illustrates.

> STEEL DRUM: And actually, already then we talked about, when I applied, that I would come and more or less run this X project, hat we would build a moving laboratory vehicle with which we could then measure those traffic emissions, so that I could continue, in some form, doing this scientific research... When I came here, I spent the first year writing applications, and then this came this, Y program, and we got on board with that, and from there—it began in 2002—it was made into a bigger consortium and this Z project was born... From there we built this, I led the building of, and a car laboratory is of course, a car in a technical sense- So this moving laboratory, and it has been constantly developed for different purposes, and I have gotten equipment, and learned to measure. I used to be a model maker, because I had been working on the model. I had been watching, of course, to see how people take measurements at the university and used their data. I had been involved with a number of projects and had a number of international contacts as well, so it was good that I had connections in every direction.
>
> *P231 (27)*

Here, the interviewee considers his/her experience and connections in the university as an asset in terms of his/her current work. He/she has not put the research work aside, but has integrated it in his/her new job responsibilities.

Institutional conditions for type 1 "Pushed-out" turning points

The above analysis of Pushed-out narratives presents two aspects of university life that can be considered as institutional conditions for the turning points. Firstly, there are problems in interpersonal relations (that can at least in some cases be identified as harassment) that could not be adequately handled at the departmental level. From the narratives, it is evident that identifying and controlling a colleague's inappropriate behavior was not an easy task for department leaders and the schisms became seriously aggravated before they were tackled. At worst, the collegial network at the department could even function to protect the troublemaker. In the quotation below, a PhD student was seriously harassed by a colleague, but felt that he/she was unlikely to receive any support from the rest of the department personnel. It was only when a new supervisor entered the department that the harassment case began to unravel. Unfortunately, this happened too late from the point of view of the researcher being harassed, and he/she decided to leave academia:

> FAGOT: It started to unravel when NN became the boss. These other people were all his [the harasser] friends, men his age, I wasn't really ever able to tell them "this guy is messed up".
>
> *P205 (131)*

The phenomenon of men supporting and protecting other men is also recognized in previous studies on universities as workplaces. (Husu, 2001). Being part of the "old boys' network," male academics tend to get support and collegial help from their (male) supervisors more easily than their female counterparts. Sadly, this tendency to back up the same-sex colleagues sometimes extends even to cases of obvious misconduct, such as sexual harassment or bullying (Husu, 2001, pp. 253–234).

Secondly, the pushed-out narratives refer to a larger phenomenon of the university funding model and position structure. Changes in university finances during recent decades have led to the rising amount of external funding and fixed-term contracts in the departments.[30] Consequently, competition over permanent positions has increased. Some (2) interviewees indicated that the constant competition was the reason why they were pushed out from the university; they either grew tired of the in-fighting or they were left concretely without a position as the following quote illustrates. The interviewee had to

[30] See section 2.3 for more information about the changes in Finnish research funding.

leave the university because his/her contract as a university lecturer was not renewed after ten years of work at the department.

> BASS: As to the university financing, they got a new payroll system which increased costs by seven percent in four years, but the total payroll wasn't increased in proportion, so there's less—in reality there's less to be shared out per head, so some heads must fall.
>
> JV: This is extremely interesting; I mean I've been at the university for a long time myself, first in administration and now as a researcher, but, well, not once have I actually heard so far that it had this sort of consequences, the new system, but I suppose it has.
>
> BASS: They don't want to talk about it to outsiders at all. The head of the department told the staff about it but he failed to mention that it results in eliminating people.
>
> *P221 (276:284)*

Here, the interviewee refers to the new, performance-based salary system that was introduced in the Finnish universities in 2006. As the interviewee's example indicates, the new salary system has in some cases decreased the amount of money available in the departments, which again is manifested in the pressure to reducing the numbers of department personnel. However, the above case in which the interviewee's contract was not renewed was unique in my interview data. More frequently, the competition for positions and research funding was reflected in the interviewees' narratives as tiresome and the source of an unpleasant atmosphere in the department. Moreover, the interviewees considered that the economic insecurity and short-term perspective in academic work to eat up their motivation to do research. In two pushed-out narratives, these were factors in the interviewees' decisions to leave the university.

Turning point type 2 "Pulled-out"

The second set of turning point narratives (13 narratives) was also related to the interviewees' decisions to leave academia. However, in contrast to the "pushed-out" narratives, these narratives did not reflect ambiguity or unwillingness to leave the university, but rather an urge to change careers. The interviewees wanted to quit their jobs as researchers and longed for new challenges in their careers. In these narratives, the decision to leave the university was motivated by personal career ambitions and most interviewees (8) found their new employment in industry or other private sector organizations that could provide them with more versatile career potential and considerably higher pay than the university. Because both the interviewees' personal goals and the career options outside the university seemed to influence the interviewees' decisions to leave

their academic careers, I call these turning point narratives "Pulled-out" narratives.

In the following, I reconstruct an example of a Pulled-out narrative related by a female interviewee called Timpani. In the *status quo* situation, Timpani was relatively happy with her work at the university; she had a relatively secure position as a project researcher, where she could conduct her PhD research. She was a member of an established research group whose supervisor has managed to provide the researchers with interesting research projects and rather stable funding:

> TIMPANI: I was in a pretty secure, or good position, because I actually got, my contract was for my actual work that I got my PhD from; my contracts were quite long, so they weren't as some people have, for half a year at a time.
>
> *P213 (176)*

However, the status quo was interrupted by a sudden suggestion by professors who wanted to move Timpani's employment from one department to another. Timpani experienced pressure from the potential change, and saw it as worsening her working conditions and moving her backwards in her career. The *turning point* arrived because of this episode; Timpani became frustrated by being subjected to the professors' power play and consequently, she decided to leave. At first sight, it might look as if Timpani actually was pushed out from academia; however, when analyzing her narrative further, it became clear that the episode described was just the last straw that broke the camel's back. Unlike in the narrative from Recorder, Timpani clearly points out that her long-term ambitions lie in industry and not in academia.

> TIMPANI: Well, I was pressured to move over to work at the Institute of X, which could have been, on the one hand, kind of fun, but I it would have been a step backwards in my research. I would have become someone who just maintained equipment at the Institute of X, and this was one of those things, like, two professors had decided this between themselves, and it was so shady that I decided that I would rather leave. Industry has been my main area of interest, from the beginning; I didn't actually think that I would necessarily... have to be at the university or doing research.
>
> *P213 (52)*

Here, Timpani indicates that leaving academia and research was actually a natural choice for her, for she had been interested in industry "from the beginning." The *new trajectory* follows the turning point as Timpani was recruited to a technology company. Even though she left the university with her PhD still unfinished, she has been able to finish her dissertation while working at the new job. When looking back her career, Timpani reflects on the

consequences of the turning point for her career. She considers her work outside academia to be rewarding, especially in terms of career advancement. The problem that Timpani saw in her previous job in the university is mainly connected to the structure of the academic community: the power to make decisions and move things forward is centralized to the professors and junior scientists have limited opportunities to affect the content of their work and career development. According to Timpani, the opposite is true in her current employment where she is able to actively make decisions and take responsibility for larger entities.

> TIMPANI: Of course, I came to Company F directly as a product development manager, but within content development, and company development in general, I have much better opportunities now... at the university I didn't see that I would have much of an opportunity to—there were so many of us— and I wanted to be able to actively decide things; then I don't see how I would have had even the opportunity to do that at the university.
>
> *P213 (215)*

The features that dominate Timpani's turning point can be identified in the following way. On interactional and emotional levels, the dominant features of the turning point seem to be a sense of being subject to the wielding of power and a sense of mistrust of colleagues. These uneasy feelings led to frustration and a need for a personal solution to the situation. Timpani felt that she was introduced to the idea of changing jobs in a rather "shady" way *P213 (56)*. She perceived herself as being pressured and as a "pawn in the professors' game." *P213 (64)* As a result, she became motivated to look for employment elsewhere in the private sector, which she actually had considered earlier. On an organizational level, there is a situation typical of the project-funding model at the university: a new project is started, money is allocated to it, but it is unclear who is going to do the actual work in the project. Timpani is seen as a potential employee for the new project, but this would imply that her work contract and conditions would change. The attempt to make Timpani to move to the new job is made by her supervisor without real negotiation. Even though this might be a normal way to manage temporary contracts in universities, Timpani does not agree with it. She has already been unsatisfied with her opportunities to affect her own career in the university, and this particular event makes her determined to move over to the private sector.

It is important to note that as Abbott (1997, p. 101) points out, turning points do not happen in a historical vacuum. The potential for change is embedded in the present, but for it to unlock, action is needed. Timpani had recognized many problems at the university before she decided to change her career path. For her, a major problem was that she was not able to organize her own research work or take more responsibility for her own research.

> TIMPANI: I do think that when I was at the university, there wasn't any sort of a lodestar for why I was doing what I was doing, so it was largely that, many things were done because we had funding for them. So it wasn't that accepted that when I was a young researcher, but when I started to become pretty qualified at what I did, I would have wanted to be in a position to better affect the goals of the research, and why we were doing something, and how we were fitting the different things we did together in order to gain the biggest possible benefit, but I didn't really have a chance to affect that.
>
> *P213 (141)*

However, not until the professors tried to pressure Timpani to move to the new project, did she reach the turning point that led to a transformation in her career path. In contrast to the Recorder's narrative, Timpani's narrative reflects that her motivation for a career move came from her unhappiness with the working conditions in the university and her willingness to pursue career in industry. Whereas Recorder saw his career in the university as very satisfying and he only changed jobs for family reasons, Timpani expressed her own will to move away from the university.

As for the long-term consequences, the turning point in Timpani's narrative seems to lead to a new, more satisfying career trajectory. In her interview, she contrasts the framework of the university to that of private sector employer. Timpani's university career was characterized by short-term contracts, and little authority or control of the organization of her work; in her current work as a product development manager she is able to influence the goals and contents of her work, exercise authority and plan her work life. She does not regret leaving her university career, but considers her current employment to better suit her personal abilities and career goals. In terms of individual outcomes, this turning point can be described as bearing positive consequences.

In all the pulled-out narratives, the *status quo* descriptions were rather similar. The interviewee had been working as a PhD student in his/her department after graduating. The reasons for pursuing a PhD varied from narrative to narrative, yet, for many interviewees (9) the decision to continue PhD studies resulted from the fact that they received a job in the department. The interviewee was generally happy with his/her work as a researcher; the workmates were nice and the job was interesting. However, certain factors in the academic working life did not satisfy the interviewee fully. Most likely, the lack of inner motivation to do science as a life career combined with low pay and vague organizational structures in the university were issues that made the interviewee unhappy. Long working hours are a norm in most university departments; often there is also an implicit requirement to go abroad as a post doc. These requirements ask for flexibility and prove to be problematic especially for those interviewees who have a family. Besides, the career path in the university after the PhD seems rather insecure as there are very few

permanent positions available and the competition for funding is especially challenging for post-doctoral researchers. At the same time, the interviewee becomes aware of the career options outside academia. In industry, the marketing sector and other private sector companies, there are plenty of jobs available for a physicist with a PhD (or MSc). After summing up the pros and cons of his/her current employment, the interviewee begins to consider a career change. Below, an interviewee describes the process through which he/she ended up leaving the university.

> JV: Did you ever feel that it was not the kind of research you would have liked to do?
>
> BANJO: In the beginning, I felt that that was actually quite nice what I did, but after I'd been doing it for three or four years, I started to wonder whether I was going to be able to do it for the rest of my life, the same job. I started thinking that maybe I ought to get some other kind of job somewhere else. The university was a bit too big of an organization for me, so I thought it best to start looking for something on a smaller-scale.
>
> JV: Okay. Was there something particular that started to bug you or that you got bored with or...?
>
> BANJO: Well, it was always the salary; that was a bit problematic at the university. You didn't have to go very far and you would've gotten nearly twice the amount of money.
>
> *P220 (337:355)*

In the case of 10 interviewees, *the turning point* episode in pulled-out narratives took place soon after the interviewee had finished his/her PhD. He/she might stay in the academia for another year as a post doc, but the decision to leave academia has matured in the interviewee's mind and the turning point seems inevitable. The turning point thus consists of two elements: finishing the PhD and finding a new job. In these pulled-out narratives, this transformation process is typically presented as smooth and non-problematic. Even though some of the interviewees (2) had been offered a job his/her department, he/she is determined to change employment, and as soon as the new employment could be found, he/she was ready to go. In some narratives (3), however, the turning point was reached before the PhD was completed. In these cases, the interviewee felt unsatisfied with his/her PhD studies and as an interesting job opportunity occurred, he/she made the decision to drop his/her studies and concentrate on embarking on a new career trajectory. Below, an interviewee accounts for his/her new job that was so time consuming that it made it impossible to continue with PhD.

JV: Did you think about continuing that topic to do your doctoral dissertation on that or what?

ORGAN: Yes, at some point, yes. But then this Å project came and took me over so that very quickly I was doing 16-hour work days and spent all my weekends on that, too, so I dropped the idea of a dissertation quite soon.

P228 (238:240)

The *new trajectories* following the turning points in pulled-out narratives generally bear a positive tone. The interviewee has found a job where he/she feels able to use his/her capacities more fully than in the university. Moreover, the career options seem better in the current employment than in the university. In all cases, the interviewee's financial situation has improved as his/her current pay is higher than at the university. The economic security of the new trajectory plays an important role especially in the narratives in which the interviewee has a family or is planning to start one. Even more importantly, in many (5) pulled-out narratives, the interviewee indicates that in the current employment, he/she is able to use his/her abilities and realize his/her ambitions more fully than he/she could at the university. The interviewee concedes that obtaining PhD is a great achievement in his/her career path, but that he/she wants to devote the rest of his/her working life to something other than research.

JV: Right. Would you have wanted to stay at the University in some circumstances?

ALTO: I think in the long run, no. I can make better use of my abilities in the business world.

JV: What abilities are those?

ALTO: I can cope with pretty hectic work, and handle large concepts as a manager. Over there I think I would've felt there was a kind of a ceiling holding me down; here there's nothing holding me down. I can do anything with my abilities.

JV: You previously mentioned a glass ceiling; did you mean specifically concerning women?

ALTO: I do think there was a bit of a glass ceiling for women there, at least back then. I don't know how it is now; it's been five years since I left.

P218 (125:135)

In the excerpt above, a female interviewee contrasts her current career opportunities with those at the university. She describes a phenomenon that in gender equality studies is called "the glass ceiling," (Rosser, 2004) which refers to the limits for women who want to proceed in their careers. Here, the

interviewee refers to her experience that she was not fully able to use her abilities in the academic world. By referring to a "ceiling" she probably means that in academia, she could not climb up the career ladder as fast as she would have liked. In the interviewee's current employment, the situation is the opposite as her career advancement is dependent only on her own capacity. This issue was also addressed by other interviewees who considered the academic position structure problematic in terms of career advancement. They considered the lack of a tenure track system and inadequate personal career planning as great disadvantages in the Finnish university system.

What is turned around in type 2 "Pulled-out" turning points"?

In the Pulled-out narratives, the turning points revolve around leaving a career as a researcher and entering a new career path. In the narratives, this transformation often includes a point of comparison. The interviewee weighs his/her interests and ambitions in professional life and his/her personal goals outside of working life (family, etc.). He/she compares the pay, working hours, mobility requirements and continuity of the job contract in the university and in other organizations. In all Pulled-out narratives, the interviewee comes to the conclusion that his/her professional ambitions and personal life goals will more likely be met in a job outside the university. Staying in the university, in turn, would make realizing these goals more difficult.

The emotional tone of the Pulled-out narratives was predominantly happy and content. Because the interviewees made a conscious decision to leave the university and were satisfied with their current working lives, they did not express feelings of loss or sadness when describing their current careers. However, many (6) interviewees indicated that their relationships with their ex-colleagues were warm and that they still stayed in touch with their former departments. In the following, I consider the personal meanings that the interviewees discussed in relation to their decision to leave the university.

One of the most discussed issues in the Pulled-out narratives was the academic structure in the Finnish universities. Many (8) interviewees had faced the problem that after the PhD, there were very few positions available in their home departments. Thus, they considered options for career advancement to be much more promising outside the university. In all cases, the interviewee had found a permanent position that made it easier to proceed in his/her career. In the following excerpt, the interviewee accounts very thoroughly for the reasons that led him to leave academia after finishing his PhD. For him, issues of organization structure such as lack of career options and stiff competition over the few positions were the most important factors when he decided to change jobs.

> UKULELE: I started to feel like leaving the university... I nevertheless saw that I had no future... I have to be like the best all the time in order to get position. So, well, I got this feeling that I'll never ever be good enough and because I, after all, had a colleague whom I knew to be extremely competent. So then I got this small, I wouldn't say feeling of inferiority but perhaps as a realist I noted that perhaps this is not my field, or like my organization for the rest of my life. It was like that. And then, then I got the feeling that I'll apply for a job somewhere else. So, to summarize, the two things: personal career development and the fact that I wanted to do something else after the project, and secondly, the organization couldn't necessarily offer the positions.
>
> *P232 (211:256)*

There were also interviewees (6) who were especially discontent with the personnel management and supervision of work in the university. In their narratives, the interviewees indicated that the lack of overall planning of the work and scarce resources in the university were decisive factors when they decided leave academia. For them, the advantages of a private sector job were mostly connected with better organization of work and better material resources that made the work more rewarding. In the interview excerpt below, an interviewee reflects on the differences between the university job and his current work.

> SITAR: There are plus and down sides to it, but everything works like an oiled machine here. There are more powers here than there were at the university. Okay, the company decides everything, of course, or rather, in what direction things go, there's like this company policy, but there are better resources, and then the backup system is on a different level. Here you don't have to—at the university, a lot of time was spent on secondary things. You had to hassle with the computer, adjust the settings and try to tune in the Linux nets. In general, you did a lot of things that were not part of the job description at all. Here there are professionals to take care of all that. Like, for example, if the phone isn't working, you don't have to go and look for the wires yourself. There's someone to take care of it... you need an article from the library, you don't have to go and dig it up at the Otaniemi library, but instead all you have to do is e-mail the library personnel and they will deliver it to you by fax.
>
> *P230 (635:647)*

In many narratives (7), personal working motivation was a focal aspect of the turning point. In these narratives, the interviewees expressed that they were not motivated by the scientific career or "research for the sake of research," but longed for more practically-oriented goals in their work. The work motivational problems arose in connection with the fact that a great part of the research conducted in universities is not directly applicable to industry or to society; furthermore, the research process itself may last many years and is thus unlimited in scope. These interviewees mostly reported that they preferred

clearly defined work assignments that would bear an immediate social meaning. In the interview quotation below, a PhD student who left the university reflects on the nature of astronomy research. For him/her, the most problematic aspect in research work was that the research problems were not specified and the work thus seemed an endless task.

> JV: Right. Did you feel that physics research was not the work you wanted to do?
>
> TRIANGLE: No, I didn't feel that, but I wanted more specifically defined problems to solve. The project I was in had been going on forever when I joined it, and there was white noise, and I left, and it went on who knows how long. It really bugged me that no matter how hard I worked, the work never got finished, especially as the time scale of studying these phenomena, it's, like, tens of millions of years. The evolutionary stages. You take one measurement, that doesn't tell you anything, but...
>
> JV: In astronomy the subject is so eternal; I guess the topicality of research subjects is a bit different than in some fields that are more contemporary. How fast does the knowledge change?
>
> TRIANGLE: It changes, as the equipment gets better all the time, and it's just... At least the problem that I was trying to solve was so complex that you couldn't really say. It was just guesswork, and I got tired of guessing.
>
> *P214 (215:227)*

In their current professions, these interviewees saw their objectives as being more tangible and rewarding in terms of goal setting and feedback. In their narratives, the turning point was often loaded with a feeling of relief at finding their place in the work world; it can be stated that they were "pulled out" from research by other work descriptions that better suited their personal motivation.

In some (4) Pulled-out narratives, the interviewees discussed the question of mobility in relation to their decision to leave the university. International contacts and going abroad as a post doc are often considered a *condition sine qua non* for a successful researcher's career. In most physics departments, post-doctoral researchers are assumed to be employed abroad at least for some amount of time. International mobility is also one of the objectives of Finnish research politics, and public research funding organizations even provide extra grants to those scientists who move abroad with their families (Academy of Finland, 2011). However, leaving their native country was not an attractive option for female interviewees who had families. For these interviewees, going abroad with their families seemed to be a rather unlikely option. They often mentioned their children's well-being (i.e., health insurance and schools) as well as the career interests of their spouses as reasons for their decision to stay in Finland. At the same time, they were conscious of the fact that unwillingness to work abroad might, to a certain extent, be a hindrance to their careers in

academia. The need to stay in their native country had in effect been the reason for leaving the university for three of the female interviewees who wanted to start a family after having completed the PhD degree. These young women considered going abroad as post-doctoral researchers too unstable an option in terms of maternity leave and job security, and decided instead to find permanent employment outside academia. One male interviewee also mentioned this unwillingness to go abroad as a reason for leaving academia. In the following, a female interviewee explains how her priorities in life have affected her career choices:

> CEMBALO: The idea was at that time that it would be nice to have more children, so then going to be a post-doc somewhere and then coming back to have more children; that didn't really seem possible either. So yes, I would say that family has always been a priority for me, a sort of obvious number one, so that has affected my decisions, and that has maybe taken me away from the university world; that is probably true.
>
> *P209 (601)*

Thus, family obligations can be said to be the factor that pulled four interviewees from the academic world. Their private life goals and responsibilities overcame the need to advance their careers in academia and consequently, they made the choice to move to a job that required less international mobility.

Institutional conditions for type 2 "Pulled-out" turning points

In the Pulled-out narratives, the institutional conditions for the turning points were embedded in the comparisons between university and other workplaces. The institutional condition that appeared most frequently in the turning point narratives was the current position structure in the Finnish universities that created a bottleneck in terms of the interviewees' post-doctoral career prospects. As presented before, recent developments in research funding in the Finnish universities have led to a situation in which most of the research personnel are hired on a temporary basis with external project funds (Aarrevaara & Pekkola, 2010). At the same time, doctoral education in Finland has gained in volume and, consequently, more and more PhDs are competing over scarce research funds. This asymmetry between the numbers of academic positions and competent researchers was reflected in many (8) Pulled-out narratives. While a career in the university seemed blocked or highly insecure for many interviewees, the employers outside the university could provide the interviewees with permanent positions, better pay and more career options. The following excerpt characterizes this choice between a rather insecure career path of a post-doc researcher and alternative employment:

JV: Good. So you already mentioned that you never actually thought about following a researcher's career in academia or in the university, but could you specify the reasons why you left after your PhD?

BALALAIKA: Because you have to leave the lot. You have to make the choice: either you're pursuing science and then it means you're searching for funding yourself, because before you got the PhD degree the university would help you, but when you receive the PhD, it means that you will educate younger people and it means that you have to search for funding yourself, and you should be interested in science.

P219 (568:578)

The problems of fixed-term contracts in the university career were also raised also by those interviewees (3 females and 1 male) who had a family or planned to have one. In these narratives, the problem of reconciling work and family was either related to the mobility requirements of a post-doc career or to short-term contracts, which made one's life economically insecure. As the following interview excerpt indicates, these interviewees considered temporary employment too unstable an option in terms of starting a family.

GUITAR: So if I think about being at the university and thought, say, of having children then, in temporary employment it's not so… I don't think that if you stay at the university, you think about having children straight away.

JV: Oh, is that so?

GUITAR: Yes, I mean if you think you have temporary employment, it's not necessarily so easy. You know, with the maternity allowance, and you may not be able to come back to a temporary job. The thing with permanent ones is that you dare to think about your future ahead and buy a place to live and so on.

P216 (1630:1642)

Thus, in these Pulled-out narratives, employers who required less mobility from their employees and could provide a permanent position were considered as more attractive and family-friendly than the university. It also worth noticing that even though the Pulled-out narratives were generally underlining the interviewee's voluntary decision to leave the academic career, the narrated career choice might as well indicate received cultural discourse emphasizing the individual responsibility of one's own conditions (Fenwick, 2008b, p. 17). In cases where no secure long-term employment was available or the work required frequent travelling abroad, scientists with a family to support might in fact have no other choices than to leave the university.

6.4 Summary

To sum up, the previous analysis covers 18 turning-point narratives indicating a major transformation in the interviewees' careers. In all cases, the interviewee had made the decision to leave his/her academic career. The 18 narratives could be classified in two types of turning points which I here call Pushed-out from academia narratives and Pulled-out from academia narratives. In the former category, the interviewee has an inner motivation to stay in the university, but external reasons make him/her leave academia. In the latter category, both the interviewee's inner motivation and external factors seem to draw him/her away from an academic career.

In the Pushed-out narratives, the turning point becomes facilitated either by a workplace crisis (harassment, bullying, termination) or factors in the personal life (need for secure employment, need to spend more time with family). The interviewee feels that his/her realistic option is to leave the university, but the decision is ambiguous. The interviewee's personal motivation and love for science remains despite the career change and some (2) interviewees even consider returning to academia at some point. In Pulled-out narratives, the turning point typically takes place shortly after the interviewee has finished his/her PhD; in some cases even before that. In Pushed-out narratives, the interviewees indicate that their career ambitions and personal life goals require that they move away from academia. Many (7) of them consider the position structure and organization of work in the university unsatisfactory. At the same time, permanent positions and better pay provided by other employers attract especially those interviewees who are planning to start a family. Most of the interviewees have good relations with their former departments, but do not intend to continue academic research work. They perceive research work as a part of their professional history, but target different careers in organization management or education.

Thus, the differences between Pushed-out narratives and Pulled-out narratives could mainly be identified as intra-personal. The structural problems of Finnish academia (low pay, lack of career options, lack of permanent positions) seemed to affect the interviewees rather similarly, but there was a difference between Pushed-out narratives and Pulled-out narratives as to how the interviewees could manage the circumstances. With the outer working conditions being more or less the same for everyone, interviewees in Pulled-out narratives seemed to be less satisfied with the working conditions in academia than those in Pushed-out narratives; in Pulled-out narratives the interviewees preferred job security, attractive salary and the more versatile career options available outside the university. Many (6) Pulled-out narratives also indicated that the interviewees' work orientation was pragmatic and societal, rather than purely epistemic, while interviewees in Pushed-out narratives emphasized their love for science and willingness to continue research work even outside

academia. Even though the low pay and fixed-term contracts were also mentioned as problems, in the Pushed out narratives, for these interviewees they were generally not the ultimate reasons for leaving.

As to the gender differences in the narratives, women and men seemed to perceive the problems of Finnish university work life in rather similar ways. Both female and male interviewees discussed the lack of permanent positions and economic insecurity as major reasons for leaving academia. Both male and female interviewees had been subjected to power play and harassment in academia. However, when justifying their decisions to leave the university, female interviewees mentioned family issues more often than their male colleagues. Going abroad in order to advance their careers was a less attractive option for female interviewees than male interviewees, and they were also more worried about the effects of fixed-term contracts on their families economic stability than men.

The two different types of turning points can also be examined from the perspective of hegemony as a dialectical continuum (see Mumby, 1997, p. 365). On one end of this continuum, there is total integration and on the other end there is widespread resistance. My analysis of turning points shows that even though both Pushed-out narratives and Pulled-out narratives presented resistance in the sense that the interviewee left the university, Pulled-out narratives contained much more resistance to the prevailing working conditions in academia (career options, pay, organization of work, personal ambitions and goals). Pushed-out narratives, on the other hand, problematized certain specific features of academic work (harassment, problems in reconciling work and family, lack of permanent positions), but in general they revealed a high level of integration with the goals of research work and academia as a workplace. Therefore, Pushed-out narratives can be said to reflect less resistance against the prevailing working conditions in the universities than the Pulled-out narratives.

In response to the question of how resistance and integration might affect the careers of male and female physicists, this piece of analysis does not provide clear evidence. The gender differences of the turning point narratives were not very pronounced in the interview data, yet the Pulled-out narratives indicate certain aspects of resistance that can be said to be gendered. Here, issues related to the reconciliation of academic work and family (especially short-term contracts and mobility requirements) were sites for female resistance. Hence, the data analysis suggests that male interviewees expressed slightly more integration with academic working conditions when it comes to economic insecurity and mobility requirements whereas women were more resistant to these factors. Thus, in some cases, women with a family seemed to be more likely to leave their academic careers than men with families.

7 DISCURSIVE MANIFESTATIONS OF CONTRADICTIONS

7.1 The concept of contradiction in discourse analytical studies

According to the Oxford dictionary, the noun *contradiction* has at least three meanings. Firstly, contradiction means a combination of statements, ideas, or features that are opposed to one another; secondly, contradiction can be a situation in which inconsistent elements are present and thirdly, contradiction may mean the statement of a position opposite to one already made (Contradiction, 2011). These ordinary meanings attributed to contradiction are often also reflected in studies on work organizations and their development. Contradiction is a broad term that can be used to describe different types of problems, tensions, conflicts and dilemmas that appear in people's conversation when they discuss their work and its problems. Hence, the concept of contradiction itself often is left vaguely defined which makes empirical analysis of contradictions difficult. (For a more comprehensive critique of the use of the concept of contradiction in organizational studies, see Engeström & Sannino, 2011).

Several studies on organizational talk have endeavored to grasp the discursive construction of contradictions (see, for instance, Ayers, 2009; Ford, 2006). However, these studies seem to rely on the very general definition of contradictions, and at the same time, they lack the linguistic operationalization of contradictions. In other words, contradictions are identified and described without setting clear criteria for recognizing them. In their article on *discursive manifestations of contradictions*, Yrjö Engeström and Annalisa Sannino (2011) strive to overcome this problem and establish an analytical framework for identifying different types of discursive manifestations of contradictions. When classifying the types of manifestations, Engeström and Sannino make use of the linguistic cues that people use when making sense of the problems they face at work. These cues are the use of the plural pronoun we, use of negatives (most often "no"), particles ("but") and hesitations ("on one hand, on the other hand). According to Engeström and Sannino, looking at the occurrence of these linguistic elements can help the researcher locate discursive manifestations of contradictions that, in turn, point to possible underlying historical contradictions (Engeström & Sannino, 2011, p. 375).

In the following, I give a brief overview of the four types of discursive manifestations of contradictions and consider their use in this study. As Engeström and Sannino (2010, p. 373) suggest, this is not meant to be an exhaustive typology of manifestations. However, many of the phenomena that

are commonly used in the literature as equivalents for contradictions (conflict, dilemma, tension, and opposition) seem to fall into these categories, which makes it easier to deal with them even in empirical research.

7.2 Discursive manifestations of contradiction as a tool for analysis

The four categories of possible manifestations of contradictions as described by Engeström and Sannino (2011) are: double binds; critical conflicts; conflicts, and dilemmas. *Double binds* are described as processes in which actors repeatedly face pressing and equally unacceptable alternatives, situations that cannot be solved individually, but require collective action. Double binds are processes that tend to aggravate to the point of crisis and unpredictable consequences. In speech, double binds are typically expressed by means of rhetorical questions indicating a cul-de-sac and the urge to do something about an impossible situation. A complementary marker of a double bind can be seen in the transition from the use of singular pronouns to the plural; most often this is done by substituting an individual *I* with a collective *we*. The resolution of a double bind situation typically requires collective action and can be identified in expressions like "let's do that" (Engerström & Sannino, 2011, p. 374).

Critical conflicts are situations of impossibility or unintelligibility that typically involve feelings of being violated or guilty, often silenced. Critical conflicts become manifested in personal, emotionally and morally charged accounts that employ narrative structure and strong metaphors. Their resolutions require finding new personal sense and negotiating a new meaning of the initial situation.

Conflicts take the form of resistance, disagreement, argument and criticism. In speech, they are often indicated by negative expression like "no," "I disagree," "this is not true." The resolution of conflicts typically occurs by means of finding a compromise or submitting to authority or majority.

Dilemmas are elements of decision-making, moral reasoning, social representation and ideology. They may appear as contrary themes in discourse; they may take the form of expression or exchange of incompatible evaluations. Dilemmas are commonly expressed by hedges or hesitations: "on the one hand, on the other hand" and "yes, but." In discourse, dilemmas are typically reproduced rather than resolved with the help of denial or reformulation.

In this section of my study, I base my data analysis on the categorization provided by Engeström and Sannino (2011). As the framework suggests, I analyze my interview data according to the linguistic cues of discursive manifestations of contradictions. After having identified the possible manifestations of contradictions, I attempt to locate them in the larger cultural-historical context of Finnish university physics. I aim to understand the ways in

which hegemony becomes reproduced and contested in the discursive manifestations of contradictions. Furthermore, I focus on the gender aspect of the data. I ask whether the discursive manifestations of contradictions reveal gendered patterns, and if so, what do these patterns reveal about the effects of hegemony in the careers of male and female physicists?

However, as Engeström's and Sannino's (2011) analytical framework is developed specifically for group discussion data gathered through intervention methodology, some modifications are needed when analyzing the interview data. In contrast to study data in which a group of colleagues vividly discusses the disadvantages of their work, my interview data consist of interviews with individual physicists who reflect on their career paths. This retrospect mode often means that *in situ* manifestations of conflicts are rather rare, but conflicts appear in narratives of past situations. Thus, identifying conflicts requires paying attention not only to singular linguistic markers (such as "no," "I disagree"), but also to narratives and recollections of situations in which people's ideas and behavior clash. At the same time, the retrospective mode of accounting about conflicts involves less emotional coloring than in situ accounts, which makes it more complicated for the researcher to recognize critical conflicts that by definition are manifested in "personal, emotionally and morally charged accounts." Here, too, attention must be paid to the conflict narrative as a whole in order to track past episodes in which the interviewee found him/herself in a situation perceived as impossible or unintelligible, and felt violated, guilty or silenced.

It is also worth noticing that distinguishing the four types of discursive manifestations of contradictions was not always simple as narratives often contain features of multiple types of discursive manifestations of contradictions. For instance, a dilemma could bear some elements of a conflict and a conflict could look like a double bind. My strategy to identify the different types of discursive manifestations of contradictions was to examine the linguistic cues in the context of an entire narrative. For instance, by looking at how a problematic situation was solved, it became possible to distinguish between dilemma and conflict. To exemplify, when interviewees described a conflict caused by department mergers, they described an unsatisfactory state of affairs which finally was solved by the interviewees by accepting the situation. On the other hand, when interviewees described dilemmas in reconciling work and family, the dilemmas did not become resolved in the course of the interview, but rather were repeated.

When analyzing the interview data according to the criteria explained above, I identified 48 quotations indicating a conflict, 45 quotations indicating a dilemma, 57 quotations indicating a double bind and 11 quotations indicating a critical conflict. In the following data analysis, I have chosen themes from each category that I considered most focal. However, I have purposely excluded

critical conflicts as an analytical category in order to protect the anonymity of the interviewees, because accounts of critical conflicts included severe cases of harassment and other workplace bullying in the university departments and thus revealed intimate information about the interviewees.

However, as sexual harassment appeared as a theme in both the category of critical conflicts and conflicts, I made the decision to merge these accounts in the analytical category of conflicts. This solution made it possible to analyze all cases of sexual harassment thematically, yet the aspect of critical conflicts was lost at the same time. Nevertheless, I preferred this mode of analysis over a detailed exploration of critical conflicts which would have necessarily violated the interviewees' anonymity.

7.3 Conflicts

In the interview data, I identified two main sources of conflicts that were vividly discussed by the interviewees. Firstly, sexual harassment caused conflicts between male and female members of the working communities. Secondly, changes in the universities' department structures gave rise to clashes between representatives of different fields of physics. In the following, I analyze these two sources of conflicts.

Sexual harassment

The first set of narratives about conflicts revolved around the theme of sexual harassment, a theme that was mostly discussed by female interviewees: ten female interviewees had either experienced sexual harassment or could relate second-hand experiences, whereas only two male interviewees could identify cases of sexual harassment in their working environment. In the cases reported, the harassment was verbal in nature; the interviewees had also been harassed by their male colleagues through e-mail and on the telephone. In most cases, the harasser was the interviewee's close colleague or supervisor, which did not make matters easier for the harassed women.

In the data analysis, I classified these accounts as critical conflicts or as conflicts depending on the emotional intensity of the narratives. Sexual harassment essentially means injuring other person's intimate sphere, and thus there is an element of conflict embedded in each of these narratives. Being subjected to jokes or insulting comments as a woman or a man necessarily means that a person has to confront the harasser and set her/his own limits. Interestingly enough, despite the abusive aspect of the instances in which they had been harassed, the interviewees indicated their disagreement by using such rather mild expressions as: "And some people are like, if they've had enough to drink, they may say or do something that isn't really necessarily OK." *P210 (331)* Sometimes the interviewee was even empathetic towards a male colleague

who had been transgressing her intimate border; in one case, a male supervisor had encouraged female students to go swimming naked during a department's sauna evening event. The interviewee commented on her supervisor's behavior in the following way: "I guess someone could also see it (the supervisor's behavior) as very awkward. In a way, it does reflect the fact that this person thought that he was taking things forward, and supporting equality, but the ways in which he did it were—they just weren't necessarily good." *P213 (291)*

When accounting for the instances in which they had been harassed, the interviewees sometimes took part of the responsibility, assuming that the harasser had misinterpreted their messages. Even though Finnish universities gender equality plans provide clear procedures as to how to deal with sexual harassment, the interviewees had seldom taken the harassment cases to their superiors. In these narratives, harassment was represented as a conflict that was part of collegial relationships. It is a mode of workplace interaction that the interviewee tolerates even though he/she doesn't accept it. This attitude is reflected in the following interview excerpt.

> JV: Would you be surprised if one of your colleagues told you that sexual harassment or some kind of discrimination was a problem here?
>
> TRUMPET: No, because I know that there is discrimination and harassment here.
>
> JV: Right. In what form?
>
> TRUMPET: Well, for instance, when I've been in a workshop for a week, with other people from here, when they have had enough to drink, I received all sorts of propositions. I haven't taken it that seriously, or taken it anywhere, but somebody [else] might be bothered by it. I can, maybe, take stuff like that a bit more than some.
>
> JV: What have you done in those situations?
>
> TRUMPET: What have I done? I'm kind of quick-tempered. I've probably snapped at them... That stuff is never talked about afterwards.
>
> *P206 (333:347)*

In the following excerpt, a female interviewee accounts for an instance in which she was harassed and she describes the resolution of the situation:

> BONGO DRUM: So, when I went to work at the Department of X, an employer sent me... an e-mail asking if I could go over to sleep at his place... naked and so on, and the thing is that he had previously sent these to a woman I used to study with...That was when we were studying and she sort of changed and I was like what's, what's wrong with her and so on. But she never said anything about it. But when I got one of them, I immediately went over to shout that, "you just don't send this sort of e-mails. You just don't send them."In a way that people around

> definitely heard. Then he left and went to the Institute of Y, and he went abroad for a couple of years, and now he's working here again. This is one of those things... The relations are fine; our relations are fine and so on. Because I took it like this: everything's fine if he stops it. That he just doesn't realize that you can't do something like that.
>
> JV: But that's absolutely outrageous. In fact that's very direct and in such a format that you can prove it.
>
> BONGO DRUM: Yes for I got e-mails, but nevertheless... I'm still of the opinion that it was just a matter of not, not knowing where to draw the line. That, as such... we may still send e-mails about any nonsense with this person. And so on. So it's all—even though we both remember what once happened. And also there are these—like this person sometimes gave me a massage. So of course—like if you keep clear distance, therefore it's—it's not so easy to cross the line. It's not, not so like this is something you weren't allowed to do. Even though it's nice of you to give me a massage, you still shouldn't have sent me those e-mails.
>
> *P222 (1974:2146)*

In the narrative, the interviewee describes her negative reaction to the harassment in a rather vivid way. Here, too, the interviewee emphasizes her own initiative when tackling harassment. (“I immediately went over to shout that, “You just don't send this sort of e-mails. You just don't send them.”). The resolution of the situation is a kind of a compromise; the interviewee excuses the harasser by making the interpretation that he just did not know the limits of an appropriate behavior and states: “Because personally I took it like this: everything's fine if he like stops it. That he just doesn't realize that you can't do something like that.”

In contrast to their female colleagues, male interviewees rarely reported conflicts that were related to sexual harassment. Those who could give examples (3) emphasized that this was not the case in their own division, but somewhere else in the university. However, some (4) male interviewees mentioned that humor in the workplace was sometimes rude, which may have insulted some. These interviewees thus confirmed the idea that talk can also be interpreted as sexual harassment and recognized the possibility of a conflict situation, but in general, they saw workplace jokes as harmless. It is also worth remarking that three younger female interviewees mentioned that they could take bold humor and could thus adapt to the male work environment. Bold humor and rude jokes were considered a natural part of the social interaction in physics institutions, while being insulted by such jokes was not.

The male interviewees (7) who emphasized the objective, tolerant and gender-neutral atmosphere of their work communities confirmed the traditional idea of the natural sciences as objective, neutral and genderless; being male or female is considered irrelevant from the point of view of research work

(Traweek, 1988). The belief in the objectivity and neutrality of physics as a working environment was repeated even in the female interviews, but on a closer scrutiny, it seemed that women were rather avoiding conflict situations by adapting to a male workplace culture in different ways. In some of the female interviews (5), gender neutrality actually involved playing down one's femininity (see also, Gherardi & Poggio, 2001, p. 254). In these cases, female physicists indicated that they had adopted a male way of behaving in the workplace. Two female interviewees even defined their roles in their former workplaces as being "one of the guys." Thus, masculinity was perceived as a norm in the workplace and femininity an attribute to overcome to be able to function adequately in the scientific community. While these female physicists had indeed escaped the gender issues by adapting to masculine behavior, in other female interviews, gender difference was all but invisible. These women indicated that it is important to take their place as women and draw the line when interacting with their male colleagues by preventing male patronizing and sexual harassment with self-assertiveness and "loudness."

> SOPRANO: I think that those women who stay in this field are rather self-assertive people. They know their place and won't put up with indecent behavior. I suppose you have to have a certain mindset since it is known that this place is like that.
>
> *P235 (852:856)*

In these cases, gender difference was perceived as embedded in the professional relationships, but it was also seen as the responsibility of the women to maintain the border and avoid possible conflicts. Men were represented as rather uncontrolled and irresponsible subjects when it came to interaction with women. This view was also confirmed in the interview excerpt from Bongo Drum, in which a woman who had been subjected to sexual harassment tended to emphasize her own agency when fighting against harassment. Indeed, conflicts related to sexual harassment might be seen as the tip of an iceberg. The above examples of sexual harassment and the prevailing image of tough and self-assertive female physicists may be indications of power play that is often veiled in an image of the gender neutrality of the natural sciences. When ignoring or playing down gender difference, the members of a workplace accept the dominant (male) mode of interaction as a condition that one has to meet in order to function fully in the community. Consequently, sexual harassment may be unrecognized by men and played by women who take the responsibility for controlling male behavior.

Changes in the universities' department structures

Another source of conflicts in the interview material was the issue of departmental mergers. In recent years, the Finnish universities have engaged in a number of structural changes targeted at diminishing the number of administrative units. These changes have in many cases led to mergers on departmental levels and small departments have been annexed to larger ones. Because of these mergers, many former departments lost their administrative and financial authority and became divisions of a larger department.

Those interviewees (7) who had faced departmental mergers accounted for the past events in a rather critical manner. Even though they could see the positive influences of the mergers in that the division's administrative workload had lessened, they expressed feelings of loss of the departmental identity. At the same time, small departments that had managed to avoid mergers were criticized for rebelling against the university changes. These narratives were recollections of past confrontations that were related in a rather negative tone. Thus, I have classified these narratives as conflicts.

In the following excerpt, a male interviewee accounts for the past merger of his department to a larger department. The conflict situation is reflected in the description of the merger as a "non-voluntary" act as the will of the department staff was ignored by the university administration. In the narrative, there is also a feeling of injustice as the department had been doing fine in evaluations and yet, according to the interviewee, "no one in the bureaucracy seemed to listen to these views." The interviewee described the effects of the merger with such negative attributes as "general slump" and "recession." However, the conflict has been resolved to the extent that the department staff has submitted to the authority of the university management. This resolution is reflected in the last sentence: "And then after that slump, you just go on, or we hope that life needs to go on."

> JV: Ok, when did it change again? When did the department of X become the division of X and how did that affect your work, or did it in any way?
>
> FRENCH HORN: Well, yes these changes do always have an effect. That, that, when a smaller joins a bigger, or is joined to a bigger department; it was non-voluntary... The staff would have wanted to continue as an independent science department, or see it as something else. It became, it was seen as a general slump here, then. The way I understand it, is that it is quite a common feature when these large bureaucratic changes are being made.
>
> JV: Mmm, what do you mean by slump?
>
> FRENCH HORN: Well, I mean a recession. That after that... the university evaluation was made back in '99, [it was a] research evaluation for the first time. Four departments in our faculty received 7 out of 7, and we were one of them, and a few months after that it was announced that we would be merged, and then,

> quite widely elsewhere as well, I heard some astonished comments as to why work structures should be broken apart. So, in one way that did seem to have quite a negative effect, that there was an effort to work towards something, and then, again, no one in the bureaucracy seemed to listen to these views, and then after that slump, you just go on, or we hope that life needs to go on.
>
> *P225 (110:113)*

The loss of authority following a departmental merger is also reflected in the next interview excerpt. Here, the conflict is about a situation in which the interviewee felt that the new department head wanted to intrude on the substance of his work. The disagreement is here expressed by strong negatives like, "At its worst, the department head, who knows nothing about meteorology, told us we couldn't give a lecture course under the title it had always had." The resolution of the situation was that the title of the course was changed and the interviewee had to submit to the authority of the department head. In this example, a feeling of unfairness can also be traced as the interviewee clearly states that the decision to change the name of the course violated his status as an expert of his own field.

> JV: Which of these changes has affected your own career the most? How did, for example, the departmental fusion affect you?
>
> CYMBAL: Well. It has probably had some effect... but I don't know if the effect has been positive or negative. Small departments are problematic too, especially nowadays since there's more administrative stuff, so it's more difficult to run a department. You can see here that meteorologists have less say in their own things than before. At its worst the department head, who knows nothing about our field, told us we couldn't give a lecture course under the title it's always had.
>
> JV: But that's actually quite a political statement, isn't it?
>
> CYMBAL: It is a political statement, and to me it says something about how in big units like these, the people who end up in charge tend to have a need to intervene in just [about] everything, in matters that aren't in their (field).
>
> *P223 (185:195)*

The conflicts surrounding the department mergers may be interpreted as indications of a contradiction between the administrative and economic preferences of the university administration and the professional identity and autonomy of the scientists. As small research units are merged into larger ones, the individuals often feel that administrative heads are trivializing their expertise. However, the interview excerpts show that a resolution to the situation can be found by submitting to the new department structures and building a new identity as members of a larger department.

7.4 Dilemmas

In the interview data, there was one theme that dominated the analytical category of dilemma, namely, reconciling work and family. Both female and male interviewees accounted for the trouble of fitting together an academic career and family responsibilities. In the following section, I analyze the dilemmas raised in these narratives.

Reconciling work and family

In general, issues of family life were widely discussed by both male and female interviewees. The persistent problem of time management was at the core of these accounts; both family and research work were seen as time consuming which caused dilemmas for the interviewees. However, women and men seemed to respond to these dilemmas in rather different ways. Male interviewees, independent of their family status, tended to see family as a private issue and a person's success in an academic career as dependent upon personal characteristics and ambitions. By contrast, female interviewees with families (11) considered family and work inversely related. Even though they had been able to combine family and work very successfully, they were conscious of potential complications in fitting family responsibilities to an academic career. In the following section, the dilemmas of reconciling work and family are investigated from the gender perspective.

Issues related to lack of time at work were raised by female interviewees with children who sometimes had the experience of not working enough because of family responsibilities. They considered academia to be a flexible, but demanding work environment; flexible working hours were not seen as diminishing the actual amount of work. Time management proved to be especially problematic when a person's academic merits were assessed, for example, in obtaining research grants. Some female interviewees (2) with children indicated that their publications would be more numerous if they would put in as many working hours as their male colleagues. This, in turn, would make it easier for them to receive research funding. Notwithstanding the high priority given to family, female interviewees with children expressed ambiguous feelings about balancing family responsibilities and career ambitions. On the one hand, they idealized colleagues without family responsibilities who could dedicate themselves to research; on the other hand, they found themselves privileged to be able to invest time and effort in their children. Even though the dilemma of reconciling work and family could not be solved during the interviews, female interviewees indicated that they nevertheless managed to accomplish a lot both at work and at home. They were used to working effectively, organizing their activities efficiently and working flexibly at home (i.e., during holidays and in the evening). Shortening and changing plans, taking

time off work as well as limiting informal communication during the work day (i.e., having fewer coffee breaks) were normal ways of coping with limited time resources.

In the following interview excerpt, a female interviewee reflects on the dilemma between motherhood and an academic career. The interviewee points to contradictory aspects connected to the question of reconciling family and academic career: she sees her career restricted by the fact that she is a mother who cannot devote as much time to work as she used to. She does not express hesitation about her situation, though, but rather states an incompatible situation that is permanent but that she has accepted. Thus, the initial contradiction between motherhood and academic career is not solved, but is reproduced during the discourse.

> ENGLISH HORN: Mmm. Maybe I'll say that I do think that there's a difference between women and men, when they have families. It can be an obstacle for a woman. Although we don't think about it as an obstacle, because seriously, the child is the most important thing in the world, or if there are several, they all are the most important things in the world. But, so far, I've been doing research for all this time, and I haven't counted the hours or the trouble I've been through. Many people graduate faster than I did, but I did other things there, but I have put a lot of time and energy in this. Evenings and weekends and nights and vacations and free time. Long hours, long years, long weeks. But now that I have a child, I can't do that anymore. Maybe the fathers who have wives at home, or the young, or whatever age, who don't have children, they can give themselves over to the work much more. I claim that I'm as efficient in eight hours as many other people are in twelve hours, but damn it, I used to do fifteen hours.
>
> JV: Yeah, to think what you accomplished then...
>
> ENGLISH HORN: Exactly. You get more accomplished if you can put more time and resources in this.
>
> *P209 (740:744)*

The previous interviewee excerpt is in line with a study that reveals that lack of time to invest in the family is generally viewed as a significant problem among white-collar workers in Finland (Salmi & Lammi-Taskula, 2004). Women especially often have the experience of not having spent enough time with their children, spouses or parents. It thus seems that Finnish employees' families are more often affected by their work than the reverse (Salmi & Lammi-Taskula, 2004, pp. 118–119). However, the opposite is true for mothers of small children, who relatively often experience problems with such requirements as overtime work or work-related travel (Salmi & Lammi-Taskula, 2004, p. 37).

The dilemma of reconciling work and family was also recognized by male interviewees, but the pressure to control the time used for work was not a strong complaint among them. Only two male interviewees explicated that academic

work was severely intersecting their family lives. Giving work responsibilities priority when needed was self-evident for male interviewees: working exceptionally long or irregular hours was not considered a problem, but was seen as a normal part of research-work. Many (9) of the male interviewees indicated that they often became so engaged in their work that it became difficult to control the time spent and only three of them mentioned having sacrificed an important task owing to family responsibilities. Nevertheless, those male interviewees who had a long career in academia admitted that their devotion to work had affected their family lives to the point that their spouses had been forced to take the major responsibility for family-related tasks and raising children. In the following excerpt, a male interviewee reflects on a dilemma, but also a transformation in priorities that he has recently undergone.

> JV: How would you describe the priorities of physics researchers? Are their families and spouses high enough in their priorities compared to work?
>
> MANDOLIN: I don't know. I think, in hindsight, that I have neglected my family, my wife and children, outrageously, especially in the early years; when I was at home, I wanted to read or do something on the computer; I was very dedicated to my work. Now I've become more indifferent; maybe on my way to work or back I'll read a book on the bus, if there's a problem bugging me, but otherwise I try to keep home life and work separate now.
>
> JV: In retrospect, what do you think was the reason that your work was so consuming?
>
> MANDOLIN: I don't know. I can't say what it was. I guess I didn't see it from other people's point of view, my family's point of view.
>
> *P234 (197:203)*

In the following interview excerpt, the dilemma of reconciling work and family is repeated by another male interviewee. He admits that research work often captures his attention even at home; a situation that inevitably means that the family suffers.

> JV: What do you think, do physics researchers, or in this situation here geo-physicists, value their own family highly enough in a value hierarchy in relation to work?
>
> FRENCH HORN: Well, yes. Of course I can't answer on anyone else's behalf.
>
> JV: What about on your behalf?
>
> FRENCH HORN: Well, it does suffer, that side of things, you can't help it.
>
> JV: Yes, in what way?

> FRENCH HORN: Well, in this sort of a job—you are in it 24 hours a day, so there are often times when you work at home quite a lot and are lost in these thoughts and then, of course, the situation is different than if you were in a normal 9-to-5 job.
>
> *P225 (238:248)*

In this narrative, as in English Horn's narrative, the problem of work and family does not become solved, but rather reproduced. However, it is obvious that while French Horn deals with this dilemma by letting his family yield to the work, English Horn has made the decision to let her work yield to the family.

To conclude, both female and male interviewees could identify dilemmatic aspects of reconciling work and family, but the genders had different ways of responding to these dilemmas. According to the interview data, the family interfered with female researchers' work, limiting their time available for work, whereas for male researchers, work was not significantly affected by the demands of their private lives but in some cases it even intruded on their family life. However, those female interviewees who did not have children indicated that they were willing to sacrifice their private life obligations for their work. On the other hand, three male interviewees in the younger generation identified family obligations—for example, problems in childcare when both parents worked—as a major factor affecting their decision to leave academia. This observation might be indicative of a transformation in family roles: in younger generation families; it is not self-evident that the husband's career is given priority, but rather the wife's professional ambitions and the family's well-being also count when career decisions are made.

The dilemma of reconciling work and family may be an indicative of a contradiction between two parallel activity systems: work and family (Engeström, 1999a). These two activity systems employ the same resource, namely, the individual's time. The dilemma mentioned in the interview excerpts is that time used for work is time away from family and vice versa. The interview data suggests that women with families are more likely to compromise their working hours, while men tend to compromise the time devoted to their families. When considering the academic meriting system and career advancement, it is obvious that those scientists who can devote substantial time to work are more advantaged—a logic that seems to favor men and women without family responsibilities. This idea of a disembodied worker who is fully able to devote him/herself to work has been introduced also by feminist organization researchers (Acker, 1992). They suggest that the ideal type of an employee postulated by modern organizations is a (male) person without physical and social needs.

7.5 Double binds

The double binds identified in the interview data were connected to changes in the universities. The interviewees discussed the increasing amount of administrative work in the departments and project work as a typical mode of academic employment. These collective level transformations were seen as sources of many problems in the current work life of the scientists.

Administrative work

The majority of double binds identified in the interviews were attributed to the consequences of administrative and financial changes in Finnish universities during the past twenty years. These double binds were typically expressed by using the plural pronoun *we* to emphasize the collective aspect of the problems. Moreover, the need for transformative actions on the level of whole university system was indicated in these narratives.

In the 1990s, the Finnish universities underwent a transformation from management by budget allocations to management by results, bringing structural changes to university administration and increased reporting and assessment of academic work. At the same time, the share of competing research funding has grown in the university budget, with increased pressure for research groups to apply for external funding. Consequently, project work and fixed-term positions have become the prevailing form of employment. These changes combined with increasing numbers of graduate and postgraduate students, ongoing international evaluation and development projects in higher education have affected the work of professors and senior researchers alike by increasing the number of administrative and managerial tasks and, in many cases, diminishing the time available for research (Puhakka & Rautopuro, 2010, pp. 44–45).

In the following interviewee excerpt, the double bind situation is connected to the increasing administrative tasks of university personnel. The degree system in Finnish universities was renewed in 2005; this change has created much planning and tutoring work for university departments. Alongside the new degree system, universities have moved into a new payroll system that involves a more detailed schedule for planning and assessing individual work than before. The university departments are also subjected to various types of quality assessment processes that require extra reports and documentation from the department personnel. At the same time, competition over research funding and positions is a prevailing phenomenon in the university. The merit system based on publications requires time for research work which, again, is shortened by the new tasks introduced to the departments.

Here, the double bind is primarily expressed by moving from singular person pronouns to plural forms. Decisions made by the Ministry of Education are presented as senseless and coming from above and the Ministry is referred to as

an abstract actor (“they”). As a reaction the university employees (“we”) feel powerless and frustrated: “But as a work environment this is due to all these crazy humbug decisions they've made the atmosphere has gone quite bad. Before we got these constant sanctions all kinds of quality tests and evaluations.” Due to the growing number of planning, reporting and assessing tasks at the department, the actual time for doing research is diminished. Previously, as the interviewee sees it, the same duties were carried out as “voluntary work” at the department. The employees were better motivated and the work atmosphere was better, too. Secondly, there is a rhetorical question posed by the interviewee to demonstrate the double bind created by the new degree system with limited study time and requirements for student mobility: “So may I ask when does any student have the guts or time to go on any exchange programs abroad?” Even though the new degree system is meant to promote academic mobility in Europe, it is actually resulting in more rigid degree system than the previous one. These might be indicative of a contradiction that revolves around the reform projects that are meant to promote the quality of university teaching and research, but that result in decreasing the time for teaching and doing research by increasing the number of other tasks at the department. The double bind cannot be solved by an individual and not even by one university. A more profound change in university steering and management is at stake.

> JV: Right. Now that you have a great point of view on the development of the university as a whole as well as your own field from the last twenty years, how would you describe the progress, or the regression, in your own field of research or at the university?
>
> FORTEPIANO: Well, the research, it goes on—there are some top researchers here that have had excellent students helping them too. But as a work environment this is due to all these crazy humbug decisions they've made the atmosphere has gone quite bad. Before we got these constant sanctions, all kinds of quality tests and evaluations. I've got nothing against them as such, just as long as they are sensible and don't happen every year, and as long as they're not some sort of a big deal that prevent us from doing everything else, or then there are these all kinds of courses that you have to take in order to know how to get paid in this new payroll system. The Ministry of Education forces us to adopt this new kind of system of degrees and curricula, which is supposed to make universities more international and standardize European degrees and thus enable more freedom of mobility. But as a matter of fact this new system is much more rigid than the old one. From the point of view of the yearly schedule, for example. Now the Bachelor's degree is obligatory before you can get your Master's degree. So may I ask when does any student have the guts or time to go on any exchange programs abroad? There's no appropriate term or a year left for it anymore.
>
> *P233 (727:809)*

The double bind between administrative and research work was discussed vividly especially by male interviewees (5) who identified the growing amount of administrative work as a concrete indication of the negative transformations taking place in academia. Administrative work, often equated with bureaucracy, was seen as a compulsory burden for scientists, who preferred scientific work. Some (4) of the male interviewees, who actually left research, also mentioned the administrative work at their former university departments as being a clearly negative issue. Two of the younger generation male interviewees went so far as to state that the growing amount of administrative work especially in higher academic posts might be a reason for them to eventually leave the university. A professor's post was seen as one of "salesman" with the main responsibility for gathering funds for younger researchers. In the following excerpt, a male interviewee accounts for the double bind between embarking on an academic career and administrative duties that is embedded in the Finnish university system.

> OBOE: I don't want to use bad words, but this new salary system is moving towards a pretty bad direction; this shouldn't happen.
>
> JV: What do you think is especially bad about it?
>
> OBOE: Well, specifically that there is this top-down thinking. When it should be that we are given free reign. That do what you like and then the science community will evaluate your results, and not so that some big bureaucracy says that you do this and we will evaluate your results, and what personally bothers me the most is every minute spent doing useless bureaucracy.
>
> JV: Is there a lot of bureaucracy that you have to deal with?
>
> OBOE: Actually, no, but the little that I have, I wish I didn't have. But bureaucracy is bureaucracy and I think the aim should be to decrease not increase, and now it feels especially that they are increasing [it].
>
> *P212 (265:273)*

Here, the double bind is primarily articulated in the interviewee's account of the management system that he calls "top-down thinking." For him, the principles of scientific research are seriously threatened by the university bureaucracy that attempts to assume the functions of a scientific community in evaluating research. The need to do something about the impossible situation is reflected in that the interviewee gives direct suggestions as to how things should be ("this shouldn't happen," "it should be that we are given free reign," "bureaucracy should decrease not increase.")

A minor but interesting observation is that female interviewees seemed not to perceive administrative and managerial tasks as negatively as their male counterparts did. Some (4) of the female interviewees considered administrative

and managerial tasks pleasant or even their personal strengths; five female interviewees who had left academia indicated that they were professionally more interested in management and administration than in research. This attitude was reflected by one of the female interviewees who had assumed major responsibility for the research management and device upkeep in her department. In the following excerpt, she presents a dilemma[31] of how to allocate time for research and practical work:

> ACCORDION: Yes, well, I do think that part of the reason that these practical jobs, this upkeep of the measuring device net, that they are on my shoulders... is because of, on the one hand that I'm not a very good researcher, but on the other hand that I'm so good at some of the practical side of things, and that has maybe allowed other researchers more freedom to just do research because I've been more in charge of these practical things. On the other hand, it has been easier for me, because I feel like that pressure of expectation isn't that great on me. So it doesn't matter if I don't have quite so many publications. On the other hand it's a bit of a double-edged sword, because do I then push myself enough, because I can always blame the practical side of things, that I can't do these things because I have so much other work.
>
> *P200 (608)*

When looking at the different meanings attributed to administrative and managerial work in the universities, it can be stated that even though these duties are performed by both male and female physicists, women may be more likely to take over administrative or supportive tasks in scientific working communities because they perceive them to be meaningful and important. Furthermore, when examining the issue of administrative work from the perspective of academic structures, the following observations can be made. While the number of administrative tasks in university departments has increased, the position structure has remained rather stable so that the most appreciated positions (professor posts) can be attained mainly on scholarly merit. Consequently, engaging in activities other than research can be seen as not beneficial for the physicist striving for a successful scientific career. Meanwhile, researchers who prefer administrative tasks may distance themselves from scientific work. Men expressed a stronger need to concentrate on scientific work only, whereas female interviewees indicated a willingness to do both research and administrative work. Hence, even though female physicists seem to adapt to the changing academic working environment better than their male counterparts, some may

[31] This interview excerpt is classified as "dilemma" because it presents and reproduces two incompatible evaluations, namely, practical tasks and scientific tasks. However, the excerpt also carries features of a critical conflict, as the two aspects of work are presented as emotionally conflicting. It might also be categorised as a double bind because the interviewee presents it as an individual problem inherent to academic working life.

distance themselves from scientific work by doing administrative work and thus lose the chance to attain the highest academic positions.

Short-term contracts

The next set of double binds was connected to the funding structure and lack of permanent positions in academia. Both male and female interviewees considered economic instability to be one of the most negative aspects of the academic career especially for young researchers. In the following excerpts, a female interviewee describes a double bind situation that exists between the scientist's high professional motivation and the structural realities at the university, that is, short-term contracts. This double bind situation might be an indication of a contradiction between the short-term contracts in the university and researchers' needs for economic stability.

> JV: The other job opportunities, the options you have thought about, would they have been permanent positions?
>
> ENGLISH HORN: I think there are permanent positions everywhere except in the university. Because, this is a situation here, where it's… is it legal to keep people like this for years and years? The government gets to do that, but it issues pretty strict orders for everybody else about how this can't be done. The people I know who work somewhere else, they all pretty much have permanent positions by now.
>
> *P209 (162:164)*
>
> JV: Do you have any suggestions or thoughts about how to make an academic career more appealing to physicists?
>
> ENGLISH HORN: Well, the same things probably apply to everybody. It's the contracts. If we have single mothers in their forties working in two-year stretches, then if somebody offers anything even remotely sensible and more secure, people will go. All these fancy new salary systems and all that, they are nothing. We need to get the basics right. To give grown people a chance to make a career here, because they have kids and a mortgage.
>
> *P209 (730:732)*

The linguistic cues to double bind can be found in the rhetoric question "Because, this is a situation here, where it's... is it legal to keep people like this for years and years?" and a suggestion for collective transformation:"We need to get the basics right, to give grown people a chance to make a career here, because they have kids and a mortgage."

Problems in funding

Finally, one more double bind that was connected to the present funding model in science was pointed out by two male researchers. They discussed the problem that is created when funding organizations require exact research plans; the researcher needs to know the results of a study even before conducting it. According to the interviewees, this funding practice actually hinders true scientific research that necessarily needs the option to make mistakes and even produce zero-results. In the following excerpt, an interviewee compares the Finnish research policies with industrial production where "you need to know the results before you can get financing." The double bind becomes manifested in that two incompatible models are put together (industrial production and scientific research) and the problem is represented on an over individual level (the Finnish research policy). Moreover, the narrative includes a description of an impossible situation that requires a transformation of the whole university system: "The financial base should be in order in universities, so that people would be allowed to obtain both negative and positive results."

> BASS: Well, people do leave and therefore positions are opened, but I know that my superior, for example, doesn't want to give up his professorship. He's got just what he's been after his whole life and is most certainly not going anywhere. And with regard to financing, I don't think there'll be any changes for a long time because it would require taking back all these efficiency mantras. The Finnish research policy is currently drafted in such a way that it requires universities to work like factories: you need to know the results before you can get financing.
>
> JV: True, that's what it's pretty much about. Do you have any suggestions about how to make a career in the university more appealing to physicists?
>
> BASS: Well, that takes us back to the basic question, financing. In England, for example, they've got triple the number of staff members per student compared to Finland. And because all of them do not teach, there are also more researchers. Research groups often have one or two key persons on whom it depends whether the research survives or goes down, but you can never know beforehand who these people are. However, when the core funding is cut down, they need to reduce the number of people and then mistakes like this can happen. If financing was in order, people could truly study and marvel. Science works like this: if the phrasing of the research question goes wrong, it's nevertheless a result. If someone has worked on something for a long time and obtained a zero result, it may still be of vast importance to someone else. This emphasis on effectiveness of today comes directly from industrial production, where they think that a zero result is a blunder, and I don't think that sort of thinking suits scientific work. The financial base should be in order in universities, so that people would be allowed to obtain both negative and positive results. Because you can't do science without making mistakes. The history of science is full of examples of this; I mean mistakes that have taken science huge leaps ahead. Nearly all Nobel prizes have,

after all, been given for things that had originally started from either mistakes or accidents.

P221 (2047:2051)

Here, the double bind probably indicates a contradiction between the time and resources that are needed in scientific research and the efficiency requirements of the financers of science. The interviewees pointed out that taking risks and making mistakes is crucial for any scientific field to go forward. However, this type of ”vein” research is not favored by the financing organizations who prefer research results that bear immediate applications.

7.6 Summary

To sum up, the analysis of the interview data revealed several types of discursive manifestations of contradiction. First, there were conflicts and critical conflicts related to sexual harassment. They pointed to a contradiction between masculine power and women in the context of physics departments. However, in the everyday life of physicists, these indications of contradiction were often downplayed by women and ignored by men. Another set of conflicts reflected tensions in a situation in which small departments are merged into larger administrative units. Here, the underlying contradiction might be between the economic trends that favor large departments and the professional identity of individual scientists. Dilemmas in the interview data revolved around the vast theme of reconciling academic work and family. The problem of time management discussed by both women and men pointed to a contradiction between two activity systems, namely, work and family, that both compete over the limited time resources of an individual. The double binds identifiable in the data were numerous, but almost all of them pointed to the structural and financial changes in the Finnish universities and possible contradictions between the current efficiency demands and the very essence of independent scientific work. Firstly, the increased administrative and managerial tasks in the departments were considered as corrupting the research work as the scientific staff’s time is used for other duties than research. Secondly, economic instability and fixed-term contracts typical of the Finnish universities were seen as highly problematic for talented young scientists who have families to support. Thirdly, the current research funding system was perceived as problematic in terms of free academic research and risk taking in science.

When reviewing the gendered aspects of the above discursive manifestations of contradictions, the following observations can be made. A pronounced gender difference in the interview data could be identified in terms of conflicts related to sexual harassment. Even though male interviewees were, at some level, conscious of physics as a masculine environment, most still did not identify

sexual harassment in their immediate work settings. At the same time, female physicists largely adapted to the male-dominated environment by either simulating male social behavior (i.e., being able to take bold humor) or keeping the border and regulating men's behavior. Even in cases of severe border crossings like sexual harassment, female interviewees tended to understand, even though they did not accept male behavior. This analysis gives a rather gloomy and stable picture of physics institutes as workplace environments. However, some of the scientists indicated that the growing number of women entering physics institutions might result in a new type of collegiality and changes to the masculine social environment.

The dilemmas of reconciling work and family were also revealed to be gendered to an extent. Both female and male interviewees considered research work to be time consuming, but the genders had different priorities when managing the time used for work and for family. According to the Finnish interview data, the family interfered with female researchers' work, limiting their available time for work, whereas for male researchers, work was not significantly affected by the demands of their private lives, but in some cases work even intruded on their family life. These observations are in accordance with the idea of asymmetrical permeability of work and family created in the 1970s: a woman's work has to yield to her family's needs whereas a man's family has to yield to his work (Pleck, 1977, p. 423). In terms of activity theory, women and men tended to allocate the scarce time resources between two activity systems differently: women with children were often unable to put in as many hours in work as their male colleagues while men with children often prioritized their work over their families. At the same time, the academic merit system still favors those scientists who are able to produce the most publications. Thus, in terms of career advancement, this gendered tendency in terms of work and time allocation seems to put women and men with children in unequal positions.

A third gendered aspect of the discursive manifestations of contradictions could be identified in the double bind narratives about administrative work. The growing number of administrative and managerial duties in the Finnish universities was perceived as problematic especially by male scientists, who preferred research work and considered bureaucracy useless in terms of the ultimate functions of the scientific community. Women, too, discussed administrative work, but in less negative tones. Even though female interviewees admitted that doing administrative work means less time for research work, some (4) of them indicated that they actually preferred administrative and supportive tasks in their own departments. This observation suggests that the division of labor within university departments may produce gender differences in physicists' careers. The interview data, though limited in quantity, suggest that male physicists prefer research to administrative tasks and may thus be more

likely to pursue a purely scientific career. Some female physicists, for their part, seemed to be more willing to take care of administrative and managerial tasks in the department, which may lead to another type of career path with fewer academic merits.

When considering these observations from the perspective of hegemony, I looked at the ways in which integration and resistance was produced in the discursive manifestations of contradictions and how gender intersects with these observations. In the case of conflicts caused by sexual harassment, resistance against the male dominance in workplace becomes (understandably) more pronounced by women than by men as ten female interviewees could report on sexual harassment cases (either personal or second-hand experiences). In terms of dilemmas of reconciling work and family, both women and men seem to accept the prevailing conventions of academic work, but by prioritizing family over work, women tend to resist the underlying assumption of a disembodied worker while men, though conscious of the problems of reconciling work and family, integrated with the assumption. When discussing the double bind situations caused by increased administrative work, male interviewees (9) expressed clearly more resistance against the university changes than female interviewees as some (4) of them even stated that they preferred administrative work to scientific work.

When considering these manifestations of resistance and integration from the point of view of male and female careers in the universities, it can be stated that male physicists more often integrated with the ideal of a disembodied academic worker, whereas they resisted the growing number of non-scientific tasks (such as administrative work) in the university environment. Female physicists, for their part, resisted male dominance in the workplace in terms of sexual harassment. They also expressed resistance against the ideal of disembodied worker by prioritizing family responsibilities. When considering the interplay of hegemony and female and male careers in physics, these observations suggest that men tend to integrate more easily with the traditional idea of academic work including the image of disembodied and gender-neutral scientists with no other obligations than research work. Female physicists, on the other hand, tend to resist this ideal, but integrate more with the current changes in the university; their willingness to do administrative work is an example of this integration. Thus, it could be said that whereas men seem to integrate more to the traditional mode of work in the academic environment, women might be more apt to take up the challenges set by the current changes in the university sector. However, as long as only research work counts as merit in the academic scene, women who prioritize their families and prefer administrative work might run the risk of excluding themselves from the highest academic positions.

8 DISCUSSION

This study attempted to create interplay between a set of empirical data and three theoretical concepts: hegemony (Gramsci), contradiction (Engeström) and gendered organizational processes (Acker). This was done with the help of three intermediate concepts: alignments, turning points and discursive manifestations of contradiction. While in the empirical chapters I have focused on understanding the relationship between data and the intermediate concepts, in this chapter I consider the data analysis results in terms of the theoretical resources of the study. I begin by discussing the model of gendered organizational processes and proceed to considering the concept of contradiction. Finally, I ask how the data analysis results inform the notion of hegemony. The theoretical concepts are here dealt with in reverse order rather than the order that was utilized in the theoretical chapter, in which hegemony was first introduced, followed by contradiction and gendered organizational processes. The reason for this choice is that the implications of data analysis to the concept of hegemony also include aspects of the discussion about gendered organizational processes and contradictions.

8.1 Gendered organizational processes and previous research

In the three empirical chapters, the data analysis was conducted in terms of three intermediate concepts: alignments, turning points and discursive manifestations of contradictions. The analysis revealed gendered aspects in the alignments that the physicists took up in relation to their professional identity and working environment. Moreover, the turning point narratives were gendered to some extent and gender difference was also indicated in the discursive manifestations of contradictions. When looking at the data analysis results in the empirical chapters, it can be stated that despite the assumption of physics as gender-neutral, a "culture of no culture" (Traweek, 1988), the reality of the gender balance in Finnish university physics departments is different. In the context of Finnish academia, there are existing practices and conventions that do put women and men in asymmetric gendered positions in terms of career. Moreover, both women and men participate in producing and reproducing these practices and conventions. The model of gendered organizational processes (Acker, 1992) attempts to capture the ways in which gender differences are constructed, reconstructed and challenged in the everyday life of an organization: its structures, symbols and interaction. Acker introduces four types of gendered processes: structural, symbolic, interactional and intrapersonal (mental).

The *structural* processes refer to the production of gender differences in the gendering of jobs, wages and hierarchies. The *symbolic* processes imply stories or pictures that justify the gender difference at work (Acker, 1992, pp. 252–253). The *interactional* processes cover interplay where gender differences are produced, such as sexual harassment. The *mental* processes mean the processes through which an individual makes sense of his/her place in an organization as a man or a woman (Acker, 1992, p. 253).

Acker's model is more extensively presented in the Theory chapter and it provides a framework for reflecting on and discussing the results of my empirical analyses. As shown in the chapter Introduction, the statistics on the gender gap in physics suggest that the structural processes of physics are gendered as women are underrepresented at all levels of academic hierarchy. While the gendered structural processes can be discovered through quantitative studies, the qualitative analysis of the interview data reveals gendered aspects of alignments, turning points and discursive manifestations of contradictions. These gendered aspects can be interpreted as social dynamics that produce gender difference in mental, symbolic and interactional and processes. In the following, I discuss them in connection with previous research.[32]

Mental gendered processes

The analysis of alignments and discursive manifestations of contradictions revealed several themes connected to the interviewees' professional self-images that were somewhat gendered. The interviewees discussed many aspects of their self-understanding in relation to their profession and the academic work environment covering issues of professional identity, teamwork, competition and administrative work as a part of a scientist's work. The issues of professional identity, teamwork, competition and administrative work can also be examined from the point of view of gendered organizational processes that take place on a mental (intrapersonal) level (Acker, 1992, p. 253). Mental gendered processes refer to organizational identities and positions that the individuals perceive as suitable and possible. Based on the data analysis, it can be stated that gender difference becomes produced on the mental level, as male physicists were more likely to identify themselves with the image of a physicist as a playful boy, while women did not relate to that image; furthermore, some women found difficulties in combining the identity of a woman/mother with that of a physicist. At the same time, women assumed organizational positions with more collective than individual aspects. Male physicists, on the other hand, were more likely to emphasize their position as competitive academic individuals. These mental dimension gendered processes also have implications in real life career stories,

[32] Acker's model is also applied in earlier analysis on the same data (Vainio, 2008; Rolin & Vainio, 2011) and the following discussion is partly based on these studies.

as a willingness to collaborate and take up administrative tasks in the university may enable female physicists to pursue more diverse careers. However, by opting out of competition at work, female physicists in some cases may lose the option to advance in the academic hierarchy while male physicists use competition as a natural way to proceed in their careers.

While some female physicists expressed problems in combining their identities as physicists and women/mother, some male physicists explicitly identified themselves with the masculine image of a playful boy. The latter observation accords with Cathrine Hasse's studies on play in physics education showing that male physics students engaging in playful activities were often praised by their teachers and perceived as potential future scientists (Hasse, 2002a, pp. 266–268). Thus, play can be seen as an unofficial premise for taking part in the research activity that entails identifying with a group of male scientists who have the enthusiasm of little boys. This trait characterizes a group to which women have little or no access. This exclusive idea about a good physicist might also partly explain the observation that female physicists often perceive themselves as outsiders in a male-dominated work environment (Tala, 2006) and find it difficult to combine the identity of a woman/mother with that of a physicist. Moreover, the lack of diverse and positive (female) role models may contribute to the fact that so few women reach the highest ladders of the scientific hierarchy (Benney, 2006, p. 23).

Furthermore, in the analysis on alignments, women expressed more positive attitudes towards teamwork and less interest in professional competition than their male counterparts did. Male interviewees viewed competition as a natural part of their work, with both positive and negative implications, whereas female interviewees rarely recognized competitive situations in their own career paths or else deliberately avoided competition. Instead of competing with their colleagues, female physicists opted for a more collaborative work mode and took up administrative and supportive tasks in their work place while many men perceived administrative work as a distraction from the actual research work. This observation resonates with the assumption that the competitive nature of academic work and especially such 'hard' fields of science as physics is seen as a way to sustain masculinity in academic communities. Meritocracy as a base of academic promotion is a seemingly egalitarian and objective model of evaluating different professionals, but it omits other than academic aspects in people's lives such as reproduction and family care responsibilities. As a result, meritocracy has the tendency to reinforce the advantage men have in the academic workplace (Knights & Richards, 2003, pp. 218–219). My analysis of the interview data with physicists suggests that women may exclude themselves from the competition because they do not identify themselves with the masculine undertone of competition. However, this observation cannot be said to be a universal one. A study on Danish physicists shows that women are keen to

participate in competition, but only if the rules are transparent (Hasse et al., 2008b, p. 76).

Symbolic gendered processes

The problem of how to reconcile an academic career and family life occurred when analyzing both turning points and discursive manifestations of contradictions in the interview data. Both male and female interviewees discussed difficulties in balancing work and family and observed that becoming a top scientist demands long working hours because publications are the most important considerations for success in academia. However, women and men seemed to solve the problem differently; women with children were more likely to modify their academic ambitions, limit their international mobility or even leave academia in favor of their families. Men with families, on the other hand, often admitted that they had compromised family life because of work.

The issues of reconciling work and family and international mobility can be seen in gendered organizational processes with structural and symbolic dimensions (Acker, 1992, 257–258). The interview data suggests that structural level gendered processes take place in families, where the division of domestic labor often leads to the fact that women's work has to yield to family responsibilities. However, as Rolin & Vainio (2011) show, the issues of reconciliation of work and family and international mobility are also questions of symbolic gendered processes. Even though the issues of reconciliation of work and family and international mobility appear to be gender neutral, they imply an ideal of a (male) scientist who is able to dedicate himself to work without physical or social restrictions or who at least has someone to take care of domestic duties and childcare in his absence (Acker, 1992, p. 257). At the same time, this image of a disembodied worker (Acker, 1992) excludes a (female) physicist who is not able to live up to this ideal and is then seen as a less ambitious or serious scientist.

These observations are in accordance with the idea of asymmetrical permeability of work and family created in the 1970s: a woman's work has to yield to her family's needs whereas a man's family has to yield to his work (Pleck, 1977, p. 423). Thus, the gender differences produced by the division of labor in families are also reflected in the context of research work: mothers of young children are often unable to put in as many hours as their male colleagues or as female researchers who do not have children. These (female) physicists may not be able to participate in the so-called long working hours culture (Ylijoki & Mäntylä, 2003) typical of the academic community. According to Ylijoki & Mäntylä, the implicit assumption that researchers should work long hours is not only related to academic productivity, but also to performing one's commitment to work. Thus, long working hours can be interpreted as a scientist's strategy to gain a competitive edge by achieving visibility and a good

reputation (Rolin & Vainio, 2011). When a long working hour's culture is promoted, an ideal worker is constructed as a man without the burden of family responsibilities. Conversely, this image of an ideal scientist excludes female and male physicists who have children insofar as they are not able or willing to dedicate as much time to their work as their colleagues without family responsibilities. In the Dutch context, this image of a (male) ideal worker contributes to the fact that part-time jobs and less demanding jobs are tailored for women with small children (Benschop & Doorewaard, 1998). However, in my interview data, this aspect was not explicitly present (see also Rolin & Vainio, 2011).

In the interview data, the issue of international mobility existed parallel to the question of working hours. In the analysis of turning points, female physicists more often than male physicists reported that the mobility requirements in the university contributed to their decision to leave academia. This observation becomes meaningful in relation to the fact that international mobility is seen as an important component of a successful scientist's career. Equality plans of some academic communities seek to promote scientists' international mobility by providing extra funding so that those researchers with children can go abroad (Rolin & Vainio, 2011; Academy of Finland, 2011). The ideal of international mobility is related to the image of an ideal scientist who is flexible in terms of both working hours and working site. Consequently, for a physicist, staying in one's native country may be considered as a professional disadvantage (Rolin & Vainio, 2011). Thus, even though the mobility requirement appears to treat women and men equally, it has gendered outcomes because female physicists with children are more likely to prefer to stay in their native countries than their male counterparts are. This gendered tendency also seems to be typical in the Finnish context. In contrast, in Poland female and male physicists both perceived the opportunity to work abroad as a positive option for them and their families (Miazek & Vainio, 2008).

Interactional gendered processes

Sexual harassment was an issue that came up in the analysis of both turning points and discursive manifestations of contradictions. In these accounts, it became evident that sexual harassment exists in the academic communities; however, women and men expressed different ideas about the gendered nature of their working environment. The male interviewees rarely reported sexual harassment, and those who did, emphasized that these episodes took place somewhere else in the university, but not in their own unit. Female interviewees, on the other hand, could identify cases of sexual harassment in their personal histories or second-hand experiences.

Sexual harassment represents an interactional gendered organizational process (Acker 1992, p. 253; Vainio 2008, p. 228).[33] As stated by the interviewees, male standards of behavior are largely accepted as the social code in physics departments, and it is left to the women to adapt to this norm or to control the men's behavior in cases of sexual harassment. These tacit rules of behavior, often misleadingly interpreted as indicators of gender neutrality at work (Korvajärvi, 2002), may in fact result in the marginalization of feminine modes of interaction in physicists' working communities. At the same time, women may themselves participate in marginalizing themselves in the workplace interaction. By being assertive or "loud" women may in fact limit the roles available to them in the physics community.

Interestingly, the data reveal that female physicists chose to either tolerate sexual harassment (for instance, blatant jokes) or to control men's behavior instead of contacting the equality advisor (see Rolin & Vainio, 2011). Liisa Husu (2001) also shows that intervening in sexual harassment had in some cases seriously affected the harassed person's academic career (2001, pp. 252–253). Women might ignore or repress the problem in fear of retaliation. Moreover, as Kantola (2008, p. 217) argues, the difficulty in seeing oneself as a victim might also be a reason for not bringing up problems like gender discrimination or sexual harassment in the work place.

The female physicists' strategies to cope with sexual harassment may also be understood as attempts to downplay their femininity (Gherardi & Poggio, 2001). To avoid being singled out as a woman, a female physicist is expected to behave as if she were "one of the guys." In the context of physics departments, this behavior often implies accepting off-color humor. This observation is in line with a study from van den Brink & Stobbe (2009) who identified a "paradox of visibility" in a traditionally male dominated academic culture of earth sciences. Female students were downplaying their femininity in order to fit the mainstream culture of the department, but at the same time, in order to be noticed as promising scientists, they had to excel in numerous situations. To some extent, this type of double standard for female visibility could also be detected in my interview data.

The four dimensions of gendered organizational processes illustrate that seemingly gender-neutral workplace practices and conventions may affect women and men differently. Gendering processes on different dimensions sometimes are interconnected, and their outcome may enforce the gender difference. In my data, this was specifically the case with the issue of reconciling work and family. The data suggest that while the division of domestic labor still treats women and men differently, the subtle requirements of academic work

[33] Sexual harassment can also be considered a gendered process with a mental dimension. The interview data suggests that women who adapt to the male dominated interaction build up a self-image of being assertive or "loud." For more on this dimension, see Rolin & Vainio, 2011.

(working hours, international mobility) also often put women and men in unequal positions. Thus, gendering processes on a structural and symbolic level contribute to the image of a disembodied (male) academic worker.

Sexual harassment is another example of an interconnected gendered process. While the most visible instances of sexual harassment take place in interactions between women and men, there is also the mental dimension in which women (and men) produce and reproduce organizational roles and positions suitable for them. The data show that these mental processes may reinforce the interactional gendered processes and limit the female modes of interaction in the work place.

Acker's model provides a useful framework for discussing the multiple ways in which gender difference becomes produced, reproduced and challenged in work organizations. However, it is limited in describing the dynamics of gendered processes in the social reality and does not necessarily locate them in their wider cultural and historical context. Therefore, in this study, I have made use of the activity theoretical concept of contradiction that opens up an analytical perspective for understanding both the history and future of the issue of gender difference in academia.

8.2 Contradictions

In the data analysis, I also attempted to tackle the issue of contradiction by looking at how it becomes manifested in discourse. In activity theory, contradictions are seen as vital for the transformation and development of any activity system (Ilyenkov, 1977, p. 330; Engeström, 1987). An activity system transforms and develops through contradictions that may first appear as individual deviations or ruptures, but later develop into a universal norm. Contradictions are historically evolving and systemic tensions that take place within different elements of an activity system and even between different activity systems (Engeström, 1987). As shown in the chapter on Theoretical resources of the study, contradiction is also a constituent of the notion of hegemony, as it captures the idea of social ruptures as a potential source of transformation. At the same time, understanding contradictions and their function in the hegemonic struggle involves understanding the social, historical and economic context of the contradictions. In the following, I consider the data analysis results from the perspective of potential historical contradictions.

Sexual harassment was the most important source of conflict narratives in the interview data. These discursive manifestations of contradictions can be seen as referring to a severe contradiction between individuals and within a work community. It has to do with power relations as some people subject other people to their sexual power. In activity theoretical terms, sexual harassment may be considered as an indication of a secondary contradiction (Engeström, 1987, p. 90)—a situation in which different elements of an activity system

collide. In the case of sexual harassment, a tension between (traditional/old) rules and (new) community is implied. As shown in the chapter 2, the academic community of physics has traditionally been largely male dominated. Women in physics have been very few until the recent decades and even today, they are underrepresented in most fields of physics. Being the dominant group, men have been in the position of determining the rules and norms of the academic work as well as the modes of social behavior in the academic community. At the same time, based on the ideal of objective science, these rules and norms have been perceived as gender neutral. When women have entered the physics community and the community composition has become more heterogenic, the traditional rules remain in the community. The interview data suggests that it has often remained the task of female physicists to adapt to the masculine mode of behavior at their work place. However, this tendency might be in transformation as the number of women increases in physics. Women may not just adapt to the rules but also change them.

The data analysis revealed dilemmatic narratives that revolved around the problem of reconciling work and family. Academic work as well as family life was perceived time as consuming by the interviewees. However, women were more likely to compromise their work for the family, whereas men did the opposite. Here, the demands of two separate activity systems (work and home) seem to collide and thus, a quaternary contradiction may be at stake. A quaternary contradiction may take place when there is a clash between one activity system and another activity system that produces instruments, subjects, rules or objects that are embedded in the central activity (Engeström, 1987, pp. 90–91). In addition to this quaternary contradiction, the dilemmatic narratives in the data indicate that a secondary contradiction may also be at stake. This secondary contradiction concerns traditional rules and the new community. The interviewees refer to a merit system in academia that is traditionally based on the number of scientific publications. This meritocratic system favors those researchers who can devote the most time to their work and, consequently, produce the most publications. These rules and norms seem to stem from the times when the community of scientists was comprised of men while women were not part of academia and mostly responsible for the domestic duties at home. However, as women now comprise the bulk of the research personnel in physics and the division of domestic labor at home has also become increasingly gender equal, the academic merit rules have been modified. The university Equality plans have tackled the issue of reconciling work and family, and measures have been taken in order to make the academic careers of women and men equal. For instance, taking maternity leave may not shorten the length of a researcher's temporary funding. When granting research funding, research councils are now asked to take the applicant's academic age into consideration, not their physical age (Academy of Finland, 2005). This means that maternity

and care leave do not count as a potentially productive period in the applicant's work history. Nevertheless, the interview data suggest that certain workplace rules (such as the need to work excessive hours and exercise international mobility) are still perceived as problematic by women. Even though the Equality plans to some extent recognize these problems, they pay less attention to how to actually transform these rules and cultural expectations (Rolin & Vainio, 2011).

Finally, in the interview data, a set of narratives could be identified as double bind narratives. These stories covered a variety of university changes and their consequences for the university research personnel. In past decades, the transformations in the university management and economics have brought changes in research funding and in the work of university staff. Generally, the amount of planning, reporting and monitoring work has grown along with the pressure to gain external research funding. The interviewees thought that the new demands of academic work are not easily combined with the idea of free and independent research. Some of them also perceived that the quality of research might suffer as more and more of the researcher's working hours were spent on other than research work. Here, a tertiary contradiction (Engeström, 1987, p. 90) could be at stake as the double bind narratives referred to a clash between an activity system and a culturally more advanced activity system. A tertiary contradiction typically takes place in a situation where new work procedures are implemented but the staff resists them. The double bind narratives relate to the change in the academic setting in Finland where transformations in university politics and economy have brought a new mode of academic work with demands from the corporate world such as profit responsibility. These changes are usually implemented from above by the university management and are not easily accepted by the university research stuff that identifies itself with the more traditional mode of academic work. This double bind was clearly stated by those interviewees who denounced the increased number of administrative tasks in the university. Moreover, the interviewees widely shared the experience that the increased amount work done on research funding applications and reporting is corrupting the actual research work. This possible contradiction between the traditional ideal of scientific work and new managerial thinking has been manifested in recent years in protest actions the Finnish universities (see, the pamphlet written by Heikki Patomäki, 2005). It remains to be seen whether these protests actually affect university political decision-making.

Three types of possible contradictions (secondary, tertiary and quaternary contradictions) have been detected in the data analysis results. However, in the case of dilemmatic narratives, both quaternary and secondary contradictions were interconnected. The data suggested that the problem of reconciling work and family was related to a collision between the neighboring activity systems of work and family while, at the same time, there was also a clash between the

traditional rules of academic work and the new academic community that consists of both men and women. This double emergence of contradictions can be seen as reinforcing the analysis result that even in the 2000s in Finland, the issue of balancing work and family life has been to certain extent affected by tacit rules that seem to stem from earlier centuries.

8.3 Hegemony

As shown in the chapter Theoretical resources of the study, the notion of contradiction is embedded in Gramsci's dialectical understanding of hegemony. Even though the concept of hegemony carries the aspect of consent, it does not refer to an unchangeable status quo but rather to a process of struggle between resistance and consent (Mumby, 1997, pp. 365–366). Hegemony is constructed out of people's responses to competing worldviews and ideologies; the notion of hegemony implies two poles (total integration—widespread resistance) and oscillation between them. Thus, hegemony involves some kind of emotional and moral acceptance of the prevailing social order and those people maintaining it; nevertheless, it may contain seeds of a contradictory consciousness that under some circumstances can develop into resistance and even revolutionary activity (Jackson Lears, 1985, pp. 570–571; Mumby, 1997, p. 366). Gramsci describes the process of rising contradictory consciousness as a matter of individual activities that may first appear arbitrary but that are needed in order for a social group to organize meaningfully (Gramsci, 1971). Thus, hegemony implies a constant struggle between competing worldviews and transpires in consent as well as in contradictory consciousnesses. Consequently, hegemony may be studied through instances of integration and resistance that sometimes takes the form of contradiction.

The relation between the notions of hegemony and gender is theoretically less obvious, but in terms of human history, gender has always been a constituent of dominance relations. Thus, gender theory may contribute to the notion of hegemony by making this aspect visible. When gender is understood as a social dynamic rather than just a biological fact, it is possible to identify the multiple ways in which gender difference becomes produced in work organizations. In this study, I have utilized Acker's (1992) model of gendered organizational processes in order to illustrate the different dimensions of gendered processes in Finnish university physics departments. Gendered organizational processes that take place in structural, interactional, symbolic and mental dimensions are part of the social and historical dynamics that may be reflected in contradictions and hegemonic struggle.

Gramsci's notion of hegemony is a theoretical concept and as such, it does not lend itself directly to analysis of empirical data. Therefore, a set of intermediate concepts was needed in order to grasp the manifestations of

hegemony in my interview data. The three intermediate concepts (alignments, turning points and discursive manifestations of contradictions) provide discourse analytical tools for analyzing instances of resistance and integration in the interview data. At the same time, the intermediate concept functioned as a window or gateway to the dialectical concept of hegemony. By observing how integration and resistance are displayed in the interviews, it becomes possible to comment on the hegemonic relations to which they refer.

The results of the data analysis illustrate a set of instances of integration and resistance and they also show how they relate to gender. Concerning alignments, female interviewees performed resistance against the prevailing male stereotypes of physicists as well as against the competitive nature of academia as a workplace. The instances of resistance were especially strong in terms of competition. On the contrary, female interviewees integrated with the idea of teamwork. Respectively, in their alignments, male interviewees indicated a rather high degree of integration in the academic competition and individualistic mode of research work. Furthermore, integration of the image of a playful boy as an attribute of a good scientist was expressed in some male interviews.

The analysis of Turning points indicated no clear gendered tendency, yet the Pulled-out narratives included certain aspects of resistance that can be said to be gendered. Here, issues related to the reconciliation of academic work and family (especially short-term contracts and mobility requirements) were sites for female resistance. Hence, the data analysis suggests that male interviewees expressed slightly more integration with the academic working conditions in terms of economic insecurity and mobility requirements, whereas women were more resistant to these factors. In general, Pulled-out narratives contained much more resistance against the prevailing working conditions in academia (career options, pay, organization of work, personal ambitions in working life). Pushed-out narratives, on the other hand, problematized certain specific features of the academic work (harassment, problems in reconciling work and family, lack of permanent positions), but in general they revealed a high level of integration with the goals of research work and academia as a workplace. Therefore, Pushed-out narratives can be said to reflect less resistance against the prevailing working conditions in the universities than the Pulled-out narratives.

The analysis of discursive manifestations of contradictions shows a third set of instances of integration and resistance. In the case of conflicts caused by sexual harassment, resistance against the male dominance in the workplace become more pronounced by women than by men as most female interviewees could report on sexual harassment cases. In terms of the dilemma of reconciling work and family, both women and men seemed to accept the prevailing conventions of academic work, but by prioritizing family over work, women tended to resist the underlying assumption of a disembodied worker. At the same time men, though conscious of the problems of reconciling work and family,

integrated this assumption. When discussing the double bind situations caused by increased administrative work, male interviewees expressed resistance against the university changes that have increased the administrative workload. Female interviewees expressed integration with these changes as some of them even stated that they preferred administrative work over scientific work.

These results concerning each intermediate concept inform an understanding of hegemony and gender. The tentative illustration of hegemony and gender proposed in the chapter Data and methods consisted of two axes, one represented hegemony and the other represented gender. In this picture, the horizontal axis of hegemony was drawn between two poles: total integration and widespread resistance (Mumby, 1997). The two poles of the vertical axis of gender were female and male. When considering the analysis results in relation to these two axes, they seem to cluster in different corners of the four fields. The issues of competition, sexual harassment and the image of a disembodied worker are placed between the axis "female" and "widespread resistance," while administrative work goes to the field between "male" and "widespread resistance." Furthermore, the issues of individualistic work, competition, the image of a playful boy and the disembodied worker cluster between the axis "male" and "total integration" whereas team work and administrative work remain in the corner between "female" and "total integration."

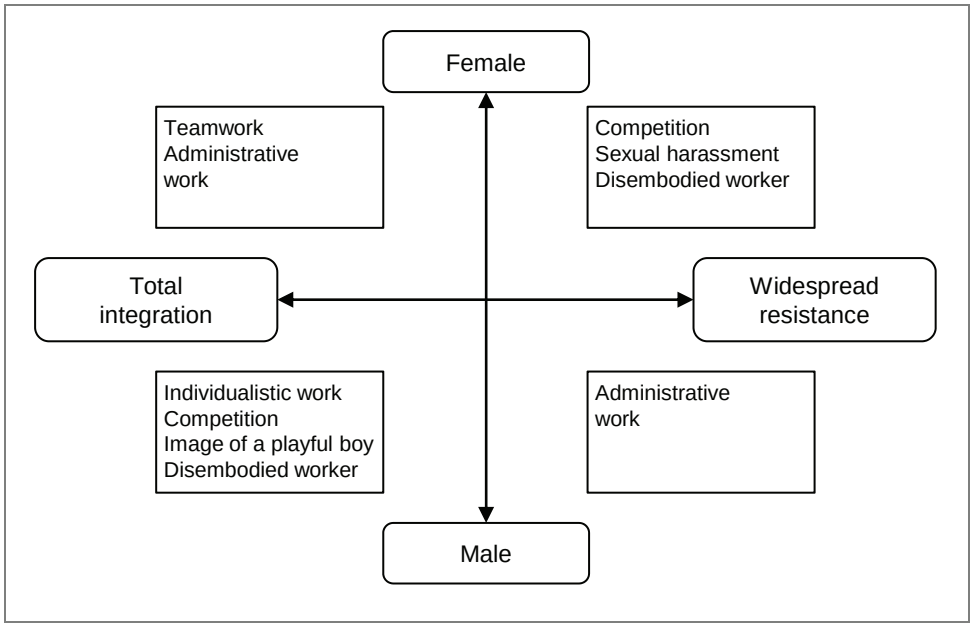


Figure 9. Sites of male and female integration/resistance

This four-field diagram makes it possible to observe the sites of female and male resistance in the data. In summary, it may be stated that male integration clusters around something that could be called traditional academic work: they seemed to accept the idea of an individualistic, competitive career that is best pursued by a person with boyish playfulness and flexibility in terms of working hours and geographical mobility (a disembodied worker). On the contrary, female resistance is targeted against competition and the idea of a disembodied worker as well as sexual harassment at work. When looking at sites of female integration, women expressed integration with teamwork in opposition to the individualistic work mode. Moreover, they seemed to accept the increased amount of administrative work as a part of research work—a phenomenon brought by changes in university politics and management. It is noteworthy that the male interviewees explicitly resisted this phenomenon. Following the idea that hegemony can be observed through the instances of integration and resistance, the data analysis suggests that in the Finnish university, two different hegemonic forces are at play. On one hand, there is the hegemonic idea of traditional academic work that has its roots in the ideal of free and independent science. In this view, the scientist is perceived as a competitive, yet playful, individual. Here, the hegemonic undertone seems to stem from the past tradition in Finnish academia where especially physics research was in the hands of individual (male) scientists who were firmly committed to their field. As the four field diagram indicates, male interviewees integrated with this hegemonic force while female interviewees seemed to resist it to an extent. However, at the same time, changes in university economics and management have brought a new mode of academic work with the idea of accountability and increased administrative and managerial tasks. The transformations in research funding have also changed academic work towards a more project-oriented mode that often increases economic instability especially in young researchers' lives. At the same time, the amount of time used for applying for funding has increased a researchers' work. Based on the data analysis, both male and female interviewees resisted the economic instability in a researcher's career. However, while male interviewees unequivocally seemed to resist all the university changes, female interviewees showed more willingness to integrate with the emergent hegemonic force by accepting administrative tasks as a part of their academic work.

8.4 Responses to the research questions

The previous discussion brings us back to the research questions posed in the chapter on Research questions, data and methods. Firstly, I asked *How hegemony reproduces itself or becomes contested in the careers pursued by male and female university physicists.* To answer this question, analysis on

alignments, turning points and discursive manifestations of contradictions was conducted. The analysis results revealed the manifold ways in which individual physicists either reproduced or contested hegemony in their lives. Male physicists who aligned with certain professional images (playful boy) and modes of academic work (individualistic and competitive) reproduced hegemony. In their narratives about turning points and discursive manifestations of contradiction, male interviewees reproduced the idea of a disembodied academic worker. Female interviewees, for their part, reproduced another type of hegemony by aligning themselves with teamwork in research. At the same time, the analysis of discursive manifestations of contradiction showed that by accepting administrative tasks as part of the academic work, female physicists were more likely to reproduce the emergent managerial hegemony in the universities. Male interviewees who resisted the idea of taking up more administrative tasks contested this hegemony. Female interviewees contested hegemony by aligning themselves against competition in the academic work. Furthermore, in the interviews with women, discursive manifestations of contradictions revealed resistance against sexual harassment and the image of a disembodied worker in the academic communities.

My second research question was *What makes hegemony reproduced in some cases and contested in some others?* The data analysis discussed in connection with the theoretical resources provides some ideas about the reasons for reproducing and contesting hegemony. The reproduction of hegemony especially in the case of male interviewees seems to be connected to the willingness to retain control over the traditional rules and practices of academic work. At the same time, female interviewees partly contested the same rules and practices. This contestation is in my view a result of a contradiction between the traditional rules and practices defined by men and the new community that consists of both men and women. Even though the data suggest that women to a certain extent have been able to adapt to the masculine undertone of their work places, it seems inevitable that they are not willing to live up to all the norms and expectations of the male dominated academic community. Thus, they contested the hegemony that was reproduced by the male interviewees. The contestation of hegemony in the male interviews, on the contrary, seemed to be motivated at least in part by the need to retain the traditional hegemonic ideal of academic work. The male interviewees perceived the new mode of academic work brought by changes in university funding and politics as threatening the university as a site of free and independent science. The emergent hegemony was contested in order to defend this idea. The observation that female interviewees reproduced some of the features of the emergent hegemony (administrative work and teamwork) may say something about women's ability to adapt to the prevailing rules and practices at work which was also indicated in relation to the traditional hegemony.

As the third research question, I asked *How hegemony affects the careers of male and female university physicists.* When considering the statistical data provided in the chapter Introduction, it must be stated that historically, hegemony has favored male careers in university physics. Physics as a field of study has not been attractive to women, and those women who have entered physics have mostly embarked on careers outside academia. Men are still in the majority in physics departments and they seem to advance in their academic careers more quickly than women do. This observation becomes intelligible in light of the data analysis that shows that the rules and conventions of academic work have been modified by men. Moreover, the images of the physicist as well as modes of interaction at work are masculine from the outset. These factors together with the fact that women also engage in self-marginalizing activities may contribute to the fact that many women do not wish to lead an ambitious academic career in physics. However, the overall picture is not that bleak. In the data, there were also traces of emergent hegemony that to a certain extent seemed to match women better than the previous one. Women expressed more willingness to integrate with the new modes of academic work than did their male counterparts, which might be an indication of a change in the balance in the traditionally male dominated university physics environment.

The Gramscian idea of hegemonic struggle, resistance and integration thus becomes concrete in the interview data with Finnish male and female physicists. The aspects of contradiction and gender further deepen this picture. What is especially interesting is that integration with traditional and emergent hegemonies proved to be gendered while at the same time, resistance against these hegemonies was also gendered. An interesting task for future research would be to observe the consequences of the instances of resistance and potential contradictions identified in this research. Will they lead to widespread protests and transformations in the academic setting or will the most resistant individuals just leave academia? In the case of the protests, will women and men engage in different transformative actions?

Nevertheless, it has to be noted that the contradictory aspects of hegemony presented here are not just negative or problematic in terms of the academic work life. Quite the contrary, in an activity theoretical sense, contradictions have to be seen as a potential for transformation and change. Considering the historical developments in Finnish academia pictured in the chapter History, it can be suggested that instead of enforcing the gendered processes or gender gap, the identified sites of resistance might be impetuses for reformative actions in the university departments. One of the transformations in the physics community in recent decades has been that more and more females have entered the traditionally male dominated scientific field. While the rules and practices of the physics communities have historically been defined by men, the data analysis reveals instances of female resistance against some of the rules. Indeed,

as shown in the chapter history, the contradiction between the traditional rules and new scientific community has already led to widespread awareness of gender equality in the universities as well as concrete measures that make the academic careers equally accessible to everyone. Even though work remains to be done in the gender equality sector, the analysis of the hegemonic struggle shows that current achievements in gender equality are strongly connected to female resistance and that resistance is also the driving force for future developments.

Another set of historical changes is also presented in the chapter History, namely transformations in the university funding and administrative structures. While the amount of external research funding has grown in the universities, there has also been a change occurring in the organization and management of academic work. The data analysis shows that male resistance against these changes was especially strict in terms of increased administrative tasks, reporting and planning. The data analysis also suggests that here, male resistance against these tasks combined with women's willingness to take up administrative tasks might lead to a gendered division of labor in the academic communities. However, the depicted contradiction between the traditional ideals of academic work and the new modes of administration and management in the universities might also be a seed for alternative development. Considering the volume of the changes in the academic work, it should be evident that the old male dominated rules will no longer apply. Both the capacities of male and female academics are equally needed in order to keep up the status of universities as research institutions. Without collegial consensus and a unified will to make academia an attractive work place for both men and women, universities may gradually lose their best human potential to other employers.

9 CONCLUSIONS

This study addresses the issue of the gender gap in the academic world, more specifically in the field of physics in Finland. It takes its point of departure the statistical fact that women and men embark on different academic careers and that men cluster in the highest academic positions. As the statistics do not explain the cultural and historical phenomena behind the gender gap in physics, this study has utilized qualitative research data, namely interviews with 36 women and men who work or have been working in physics departments, to explore the roots of this gap. The semi-structured interviews covered different spheres of academic work life, the interviewees' professional self-images, personal career histories and plans, and family issues. The data was collected mainly in the metropolitan area of Helsinki between 2006–2007 as a part of the European UPGEM study. In order to understand the social, cultural and historical context of the interview data, a historical overview of physics as an academic field in Finland was included in this study. Moreover, in this study history is considered as constitutive of the present status of Finnish university physics as well as developmental trends in gender equality and university politics.

International studies suggest that the cultural and historical reasons for the gender gap in physics are related to issues of power and cultural perceptions of gender. In line with these studies, three concepts were selected to highlight the cultural and dialectical processes behind social cohesion and perceived differences between women and men. The three concepts are hegemony (Gramsci), contradiction (Marx/Engeström) and gendered organizational processes (Acker). The notion of hegemony refers to a state of societal consent that is constantly produced and reproduced through processes of resistance and integration. Hegemony is understood not as a stable status quo, but as a struggle between different ideas, practices and values. The notion of contradiction originates from the Marxist idea of the fundamental inconsistency between the use value and the exchange value of goods. Within activity theory, contradictions are considered the driving force of development. The notion of gendered organizational processes covers structural, symbolic, interactional and mental processes through which gender difference becomes produced in work organizations. Gender is not considered solely as a biological category, but rather a social dynamic that becomes reproduced or challenged in different organizational settings.

These theoretical concepts enable understanding instances of resistance and integration as well as gendered processes in the university organization. At the same time, they focus on the potential for transformation and change that

become possible when contradictions are identified and dealt with in human activities. Theoretical concepts were also utilized in formulating the three research questions of this study. They were:

1. How does hegemony reproduce itself or become contested in the careers pursued by male and female university physicists?
2. What causes hegemony to be reproduced in some cases and contested in some others?
3. How does hegemony affect the careers of male and female university physicists?

In order to bridge the three theoretical concepts and the empirical data, intermediate concepts were needed. In this study, three intermediate concepts were chosen, namely: alignments, turning points and discursive manifestations of contradictions. The notion of alignment covers the different positions and footings that an individual may assume in relation to other people or institutions. The notion of turning point refers to a transformation in an individual's life presented in a narrative form. The term discursive manifestation of contradiction covers a variety of linguistic cues that indicate a conflict, a dilemma or a double bind situation. When analyzing the interview data, the three intermediate concepts were mainly identified with the help of discourse and narrative analytical tools.

The analysis of the three intermediate concepts revealed several gendered areas of resistance and integration in the data. In terms of alignments, female interviewees performed resistance against the prevailing male stereotypes of physicists as well as against the competitive nature of academia as a workplace, but integrated with the idea of teamwork. Respectively, in their alignments, male interviewees indicated integration with academic competition and the individualistic mode of research work as well as the image of a playful boy as an attribute of a good scientist.

The analysis of turning points indicated no clearly gendered tendency, yet issues related to reconciliation of academic work and family (especially short-term contracts and mobility requirements) were sites for female resistance. Hence, the data analysis suggests that male interviewees expressed slightly more integration with the academic working conditions when it comes to economic insecurity and mobility requirements, whereas women expressed more resistance against these characteristics of university work.

The analysis of discursive manifestations of contradictions showed that in the case of conflicts caused by sexual harassment, resistance against male dominance in the workplace was more pronounced by women than men as most female interviewees could report an example of sexual harassment. In terms of

dilemmas of reconciling work and family, both women and men seemed to accept the prevailing conventions of academic work, but by prioritizing family over work, women tended to resist the underlying assumption of a disembodied worker. At the same time men, though conscious of the problems of reconciling work and family, integrated with this assumption. When discussing the double bind situations caused by increased administrative work, male interviewees expressed resistance against the university changes that have increased the administrative workload, while female interviewees expressed slightly more integration with these changes as some of them even stated that they preferred administrative work to scientific work.

In the Discussion chapter, the data analysis results were discussed in relation to the three theoretical concepts of the study. The analysis results pointed to a set of gendered processes in the academic community of physics and historical contradictions between different elements of the activity of research work. For instance, sexual harassment can be interpreted as an interactional gendered process that has its roots in a contradiction between traditional male dominated interactional rules and the current community of physicists where women are also present. The issue of reconciliation of work and family suggests a symbolic gendered process in which the ideal image of a scientific worker implies a male researcher without family duties. The mobility requirements and the promotion of long working hours in the research communities indicate that the implicit rules in the research communities still reflect the time when women did not participate in scientific work. Here, a contradiction between the traditional rules for organizing research work independent of family duties and the contemporary reality in which both male and female physicists participate, can be traced.

The data analysis results also informed the main theoretical concept of this study, hegemony. The dialectical notion of hegemony calls for identifying processes through which hegemony becomes reproduced and/or contested. In the data, gendered instances of integration and resistance clustered around two poles. In general, women expressed resistance against what can be called the traditional mode of academic work, while men integrated with it. On the other hand, men strongly resisted some of the current developmental trends in the academic work environment, whereas women seemed to integrate with them more easily. Based on these observations of integration and resistance, it can be suggested that in the context of Finnish universities, two types of hegemonic forces are at play. Male interviewees found their site of integration in the hegemonic idea of traditional academic work whereas female interviewees expressed resistance against some of its features such as competition and the cultural assumption of a disembodied worker. Male resistance was targeted at the emerging hegemonic idea of a managerial university, whereas female interviewees could integrate with it to an extent.

When considering the data analysis results from the point of view of the gender gap in physicists' academic careers, it can be suggested that men are more adapted to the prevailing images and norms of research work. They identified themselves with the idea of a lone scientist more often than women who preferred teamwork did. Moreover, men expressed more willingness to engage in academic competition than women did, and it was generally easier for them than for women to prioritize work over family. At the same time, women adapt to the male dominated workplace interaction in order to survive sexual harassment and some women seemed to engage in self-marginalizing processes by adopting a role of a "one of the guys." In terms of division of labor in the departments, women demonstrated more willingness to take up administrative and supportive tasks than men, who preferred research work. These different preferences and modes of interaction in the everyday academic work situations might contribute to the fact that women and men are likely to pursue different academic careers. Women's interest in more co-operative and less competitive work including administrative and managerial tasks may result in a situation in which more women are selected for supportive tasks in the university departments; they may choose to leave academia altogether. Men's preferences for research work, on the contrary, may steer their career choices so that they are more merited in academic competition and thus more likely to end up in the highest research positions than their female counterparts are.

Possible future implications of the study

This study has pointed out themes on gender that are not new in the research and academic communities. The problem of reconciling work and family, women's and men's different professional identities and issues of sexual harassment have been discussed by many studies worldwide. However, as Yvonne Hirdman (2003) has pointed out, historical synthesis combined with theory is needed in order to truly understand the increasingly more complicated world (Hirdman, 2003). This study has endeavored to put these well-known issues of academic life in a theoretical framework that enables a more in-depth understanding of them in their historical, social and cultural contexts by analyzing how gender and hegemony are intertwined in the academic community of physics in Finland. However, this study is just an initial attempt to construct a framework for understanding the gendered instances of resistance and integration. Further empirical research on academic communities is needed in order to determine to what extent the framework suggested functions in other academic fields and cultural circumstances.

This study took its point of departure in the statistical fact that scientific and decision-making power in universities is gendered. Women and men, though rather equally represented in absolute numbers, are segregated in academic communities so that men cluster in the top academic positions while women

remain at the lower levels of this hierarchy. Moreover, there are academic fields such as physics that have historically been male dominated. The analysis of integration and resistance suggests that even though horizontal and vertical gender segregation in universities is visible, its connection to power manifests itself in a rather indirect manner.

In the interview data, individual responses to the prevailing norms and conventions of academic work become manifested in personal accounts on resistance and integration. These accounts are situated and often can be interpreted as not gendered but rather as individual choices or preferences in relation to generally accepted workplace practices or conventions. However, when cumulating in individual lives and in an organizational reality, these situated and personal choices may reveal gendered patterns in the processes by which scientists are selected, excluded, and empowered in their academic careers. For instance, women's decisions to stay away from the most intense professional competition are often manifested as personal choices that do not pose a challenge to the prevailing merit systems and selection processes in academia. However, an individual female physicist's decision to avoid the competition may not be solely adaptation to prevailing norms and/or hegemony, but also resistance against the academic selection processes and a statement for alternative merit standards. Therefore, the concept of hegemony describes the struggle over ideas and values in this study particularly well.

The concept of hegemony calls for identifying not only overt forms of societal control/ power but also more subtle processes through which power is produced and challenged. In future research, it might be worthwhile to consider the possibilities to combine the theoretical notions of hegemony and gender system introduced by Hirdman (1990). Gender system can be seen as describing the multiple gendered patterns visible in our society based on perceived difference between women and men and on the idea of male primacy. Hirdman (1990) maintains that this generally accepted gender system forms the basis of our social, political and economic system and in this sense, it could be considered parallel with the concept of hegemony.

The concept of hegemony also highlights the importance of identifying seeds of contradictory consciousness that may give rise to a wider transformation in a human community. This study shows that instances of resistance are present in the community of physics even though not all of them have yet visibly affected the prevailing hegemonies. In future research, more attention should be paid to the ways in which these embryonic instances of resistance in gendered power relations could be identified and documented.

Moreover, the concept of hegemony involves the idea of dialectical processes of contradiction and transformation vital for any social community. The data analysis results point to the existence of two hegemonic forces (the traditional idea of academic work and the new managerialism) that are at play in the current

Finnish university setting. Integration and resistance in the interview data suggest that these hegemonies are constantly reproduced and challenged in the processes of everyday academic work life and in some cases, these processes may also be gendered. In the interview data, one example of these processes was related to a contradiction between old and emergent modes of work. Male interviewees described the current developmental trends in academic work with a growing number of managerial and administrative tasks as problematic, whereas some female interviewees did not express negative attitudes related to administrative tasks.

Contradiction as a historical dialectical concept highlights the idea that even though contradictions may be perceived as highly problematic and negative in everyday work life, they also carry the potential for transformation and change. In the data analysis, contradictions between traditional male-dominated workplace rules and the current work community with both genders were identified. Although this contradiction is still present in academic work life, it has already generated several changes and resulted in the establishment university gender equality plans. Perceived problems in reconciling work and family have been the impetus for enhancing equal opportunity policies in academia. Considering these aspects, this study opens up new research problems in relation to the current changes in academic organizations and scientific cultures. For instance, research on the individual and collective level protests against the managerial changes in the universities would be highly interesting as would as analysis of their effects on the university administration. Moreover, the potential gendered effects of the current university changes would deserve further study.

As to the potential political implications of this study, the research results suggest that the gender gap in the universities is a problem that has to be approached from multiple angles. The co-existence of the long history of family-friendly workplace politics and prevailing vertical gender segregation in academia indicates that the gender gap cannot be simply solved by legislative measures such as gender equality plans. Gender segregation in academic work has its roots in historical times when women had no entry to the scientific community and as shown in this study, the academic community of physics still echoes its historical male domination. The remnants of the history can be observed in the ways in which the academic work is organized, in the modes of workplace interaction and in the professional identities of the scientists. In order to bring about a permanent change in the gender balance of the academic communities, more understanding of the historical hegemonic processes behind the current academic work should be attained. Subsequently, a more thorough transformation in the workplace culture of physics should be promoted in order to enable the emergence of new hegemony that reflects a more gender-balanced academic community. The concrete legislative measures already taken are

invaluable and they have largely shaped the structures of Finnish academic life to guarantee equal opportunities for everyone. However, only when the hegemonic, unwritten rules and conventions of academic life are explicated and challenged, a more profound cultural change in the academic communities may become possible.

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APPENDIXES

Appendix 1. UPGEM Questionnaire

Theme 1: Career path

1. Could you explain to me your position in the physics institution and briefly describe what you work with? (Follow up: To leavers: What was your position when you left and what did you work with?)

2. Could you describe your career path until now (draw it as a timeline)?

2a. Did somebody in your family or a personal relationship inspire you to become a physicist?
(Follow up: Father, mother, grandparents or a teacher. Or was it rather a particular event, science fiction books or other inspiration)

2b. What or who made you decide to study physics at the university? (Follow up: Did particular persons encourage your decision?)

2c. Why did you decide to study for a PhD? (Follow up: (Did particular people encourage your decision?)

2d. How did you come to work in the field of research in which you are now? (Follow up: Did you choose it because of the people in the field, or the field itself?)

2e. Have you changed your interests in your field of research along this timeline, and if so, why? (Follow up: Because of people you met, or for scientific reasons?)

2f. What kind of difference do/did you hope to make in the science of physics? (Follow up: Have your expectations of your own contribution to physics been fulfilled so far?)

3. Was there any moment that you thought that maybe physics was not what you wanted to do? (Follow up: If you have considered other careers, what did they have to offer, that physics does not have?)

4. How do you think the field of physics and academia as a workplace has changed in the past 20 years?

4a. How do other people in your institute (or former institute) talk about these changes?

4b. If you have experienced these changes yourself, what has affected you the most (positive and/or negative)?

5. Do you think a religious country (Catholic/Protestant) can influence the field of physics?

(Follow up: Either in relation to conceptions of physics or in relation to conceptions of family)

Questions for stayers:

1. Do you know anyone who left physics, either as a field or this institute?
2. Do you have any idea why they left?
3. Would you think these reasons for leaving are typical?
4. Do other of your colleagues talk about leaving for the same or other reasons?

Questions for leavers:

5. What were the reasons that you left academia?
6. What do you do now?
7. Would you have liked to stay within academia? (Follow up: Do you regret leaving?)
8. Can you describe the differences between your current work and your work in academia? (Follow up: What is the most important gain or loss following your decision to leave?)

Theme 2: Family

1. Do you remain in any stable relationship?
2. If yes, could you describe your partner's education and his/her profession?
3. Do you have any children? (Follow up: How many? What age? If you do not have your own family yet, do you plan to start one in the near future?)
4. Do you think the other physicists (in your present or former workplace) prioritize their families (partner/children/parents/relatives) enough? (Follow up: What about you?)
5. Would you sacrifice important work to honour obligations to your family?
6. How do you combine your family and work responsibilities? (Follow up: What's the division of your household chores? To leavers: was this connected with decisions for leaving?))
7. Do (or did) your male and female colleagues talk about how they manage these responsibilities in different ways?
8. Have you ever gone abroad in order to do your research? (Follow up: If yes, did your family go with you? What impact did your stay there have on your family life? If not, do you take such an opportunity into account?)
9. Has your family supported you during your academic career (Follow up: Both financially and emotionally)?
10. Do you know any people who left physics because of some family obligations? (Follow up: If yes, do you think it is symptomatic of the field of physics?)
11. Would you be surprised if any of your colleagues ever mentioned sexual harassment or other kinds of harassment as a problem at the workplace?

Theme 3: Work environment

1. Where are (or were) your closest colleagues situated, next door or in another country?
2. Do (or did) you consider your work in physics mostly an individual or group work?
3. Where do you work best—at home or in the office—and why?
4. Do you consider doing physics fun work? Why/why not?
5. Would you describe your present working conditions as satisfying when it comes to:

5a. Security in the job contract (Follow up: for example, possibilities of a permanent position)
5b. Payment
5c. Travelling/mobility
5d. Balance between work time and free time
5e. Promotion

(Follow up: To leavers: were any of these issues important for the decision to leave physics?)

6. Do (did) you have easy access to all the tools and meetings important for your work? (Follow up: Computers, databases, experimental equipment, participation in conferences, meetings abroad with colleagues etc.)
7. Who do (did) you negotiate with to gain access to these tools and opportunities, and how did the last negotiation go?
8. How would you describe the hierarchy/leadership at your (former) work place?
9. Do you have, or have had, a mentor at work, who has/is helping with your career? (Follow up: Male or female? Did the gender matter?)
10. What is the best thing you can say about your (former) colleagues at work? (Follow up: Support, help, understanding, having lunch together, joking)
11. What is the worst? (Follow up: lack of support, help, understanding, loneliness, power play)
12. With whom did you author your last article? Was this typical?
13. Could you show me the article you are most proud of and explain to me why?
14. If you had an opportunity to change your work environment (incl. promotion to a higher level in the hierarchy at the workplace, resources, people, hierarchy, building, rules, etc.) what would you change? Why?

15. Have you already tried to change these or other things, and if so, what happened?
16. Do you feel that there is (was) a strong competition in your work place?
17. Do you think that the competition at work might (have had an) effect on your career path? How?
18. Explain how you think the prestige of your (former) work is estimated in relation to others colleagues (or lack of prestige)?
19. How do you perceive the prestige of

    a) your own group

    b) your department/

    c) your field of research?
20. DILEMMA: We have all had the experience of being in situations at work where we have had to make a decision but were not sure what was the right thing to do. Could you describe to me a situation where you were not sure what was the right thing to do?

    (Follow up: If no dilemma is mentioned, use prefabricated)

Theme 4: Identity

1. Think about the physicist you have met whom you admire the most. Could you describe his/her qualities and explain why you value these?
2. What do you have in common with this person?
3. Do you have a same-sex role model, and if not, why not?
4. What qualities do the other physicists in your community have that you think you lack yourself?
5. Almost every profession has some stereotypes. Could you possibly tell me if you know what is the image of the physicist in society?
6. How do you relate yourself to this stereotype?
7. Has this stereotype image changed in the last 20 years, and if so, how?
8. How would you think your career would be different if you were a man/woman?

Theme 5: Future

1. What will you be doing ten years from now?
2. How do you think you would describe your present workplace and field in ten years?
3. What determines if this future expectation comes true?
4. What would have to happen so that you would stay in academia/return to academia?
5. Do you have any good ideas for how to make physics in academia a more attractive career path?

Appendix 2. Letter of information

Danmarks
The Danish Pædagogiske Universitet
University of Education



Concerning the European UPGEM Project

To whom it may concern

I hereby confirm that Jenny Vainio is a research assistant in the UPGEM-project which is financed through the 6th Framework Programme by the European Commission until 2008. The project gathers fieldwork data and conducts interviews with physicists in five European countries, with the aim of redressing brain drain in physics – not least in the case of female physicists. We hope you shall give the project your full support. Any interview material gathered in the project will be handled with great delicacy and utmost care. Upon request, we shall be happy to offer you the translated interview for your inspection and correct errors or delete any statements at your wish. All use of the interview material will be anonymized by omitting all proper nouns such as personal names and names of workplaces etc. The results of the project will be published on the webpage www.dpu.dk in the summer 2008, at the latest. We shall be happy to answer any questions concerning the project; you may direct these to the address below.

The Danish University of Education
Department of Educational Psychology
Tuborgvej 164
DK-2400 Copenhagen NV

Kind regards
Dr. Cathrine Hasse, UPGEM Co-ordinator & Research Responsible

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Cathrine Hasse, PhD, Professor
Danish University of Education (DPU)
Department of Educational Psychology
Tuborgvej 164
DK 2400
Copenhagen NV
Denmark
Tlf: +45 8888 9482
Fax: +45 8888 9707

Appendix 3. Codes & definitions

Below, a detailed list of thematic codes and their definitions is presented as a table. This list was created by the project coordinator Cathrine Hasse for the UPGEM project. In my study, I take this thematic coding as a preliminary point of departure for the qualitative data analysis.

Code	Definition
Motivation	Quotes with a reference to what has motivated persons to study physics in the past. It can be people, books, parents, or movies, or even good teachers at all levels from primary school, high school to university.
Family member	A reference to a physicist in the family, but not a husband or wife as this belongs to 'double star.'
Mentor	Refers to a person or persons who have supported or obstructed the interviewee's career path in physics.
Professor	Refers to professors within physics institutes (who are working there now or before) including statements about the power or powerlessness of professors in the academic institutes and hierarchies.
Identity	References connected to interviewees' personal identity as physicists, but also references to qualities in other physicists they either admire or dislike.
Stereotypes	Refers mainly to stereotypical notions of physicists in society or even among physicists themselves.
Self-esteem	Refers to a person's estimates of him- or herself in relation to his or her work life, both academically and socially.
Future-past	Relates to the progression or the opposite of career paths. It is basically related to reflections on people's personal life stories as physicists or as something else.
Competition	Refers to issues of competition. It can be competition for jobs, prestige, funding on both a personal and general level of experience.
Double star	References to either personal or general knowledge of physicists married to physicists—either married now or living together shall be married or shall live together in the future or having been married or lived together in the past.
Chilly	References to social (not physical) aspects which make the workplace an unpleasant or pleasant place to stay, e.g., when the social climate is experienced as lonely and hostile or cozy and friendly.
Discrimination	References directly to discriminatory practices in relation to gender, ethnicity, or age.
Harassment	References to episodes in the interviewee's own or others' career path that can be judged as harassment.
Sexual harassment	References to or negations of sexual harassment taking place.
Turning point	Refers to major turning points that have taken place in a person's personal career path.
Teaching	Explicit references to teaching—personally or generally.

Code	Definition
Administrators	References to administration, personally or generally, but also references to the necessity of getting money for funding, arranging courses, and sitting on evaluation committees.
Dissemination	References to dissemination of physics personally, generally, or scientifically.
Publications	References to scientific publications in journals, personally or generally.
Diversity interest	References to the field in which the physicists work or references to what the interviewee thinks of the different fields of physics.
Teamwork	Refers to individual and group work in physics.
Children	References to children, personally or generally.
Maternity leave	References to maternity leave, personally or generally.
Abroad	References to going abroad or going on professional fieldtrips or longer travels (for example to CERN), personally or generally.
Family responsibilities	References to double workload, but also support from families (or lack of support) financial or in the form of help in general. It refers to both individual and general experiences.
Male snatchers	References to a personal or general choice of another career, other paths rather than a university career because of better opportunities to support a family or for other reasons.
Pay	References to pay, raises, economic rewards, salaries or earnings in the interview.
Artifacts	Statements concerning the physical aspects of the workplace environment: bookshelves, doors, tables, computers, wallpaper, doorbells, nameplates, paintings.
Working environment	Statements about the physical working environment, not the social (covered by the code ‘chilly’).
Happy stayer	Quotes where interviewees explicitly express happiness and satisfaction with their work life in academia, or explicit unhappiness and dissatisfaction.
High school	References to a particular kind of high school background for example, ‘mathematical,’ ‘scientific’ or ‘classical.’
Academic structure	All (more or less explicit) references to the local structuring of academic work life.
Change	Refers to changes, often political, in society. Apart from the external political change, the code also refers to internal changes in academic life in general.
Class mobility	Statements about how the interviewees’ background is either the same or different from their parents.

Appendix 4. Distribution of codes per interviewee

Appendix 4 Distribution of codes per interviewee

	Abroad	Academic Structure	Administrators	Artefacts	Change	Children	Chilly	Class Mobility	Competition	Discrimination	Dissemination	Diversity Interest	Double Star	Family Member	Family Responsibility	Future - Past	Happy Stayer	Harassment	High School	Identity	Male Snatchers	Maternity Leave	Mentor	Motivation	Pay	Professor	Publications	Self-esteem	Sexual Harassment	Stereotypes	Teaching	Teamwork	Turning Point	Working Environment	TOTALS:
P200: Accordion.rtf	1	3	6	5	10	5	4	1	2	0	1	6	1	0	8	6	0	1	8	3	3	2	4	2	0	4	7	0	3	0	4	2	1	113
P201: cornet.rtf	3	1	1	5	5	5	1	0	1	1	3	7	2	0	3	4	1	1	0	4	3	4	1	2	1	3	5	3	0	1	0	4	0	2	83
P202: cembalo.rtf	5	1	0	3	2	6	3	0	2	1	0	2	4	1	5	3	1	0	1	4	1	2	1	2	1	3	2	0	2	3	4	5	4	2	76
P203: contrafagot.rtf	3	5	2	2	3	0	1	1	4	1	0	5	0	0	3	7	1	0	0	4	1	0	2	2	3	2	2	3	1	2	0	4	3	1	75
P204: saxophone.rtf	2	2	0	2	3	2	3	0	1	0	0	6	0	0	2	7	2	0	0	3	0	0	1	1	1	1	1	1	2	1	0	1	0	4	50
P205: fagot.rtf	2	5	0	2	4	3	4	0	2	0	0	4	0	0	4	8	0	5	0	5	0	0	2	1	5	0	3	1	2	2	2	1	4	1	72
P206: trumpet.rtf	4	6	1	6	3	3	3	0	2	0	1	3	2	0	4	6	3	1	1	5	1	1	3	1	4	10	2	1	1	1	3	3	0	3	88
P207: tuba.rtf	5	10	2	6	6	1	2	0	1	0	0	5	0	0	3	9	3	0	1	5	1	0	4	1	6	2	1	1	1	2	6	2	2	4	92
P208: Cello.doc	3	15	4	2	5	1	2	0	4	4	1	0	0	0	5	2	2	0	0	6	0	0	2	1	6	3	1	1	3	1	1	1	1	1	81
P209: english horn.doc	3	6	4	2	3	4	2	1	2	1	1	5	0	0	8	6	5	0	2	9	0	3	2	1	2	1	2	1	2	2	0	2	0	2	104
P210: Fiddle.doc	4	9	1	1	4	2	2	0	1	0	2	3	0	0	3	4	0	0	0	8	1	0	2	1	4	4	2	2	1	1	1	1	0	3	67
P211: mouth-harp.doc	1	5	0	1	0	1	4	0	2	2	0	1	0	0	5	7	2	0	1	6	0	1	5	1	4	8	1	7	0	1	0	1	4	3	74
P212: oboe.doc	4	8	5	4	7	1	1	0	3	1	0	4	0	0	2	5	2	0	0	5	0	0	1	1	3	1	1	1	1	1	1	1	0	4	68
P213: timpani.doc	2	9	0	7	3	2	2	1	3	0	1	3	0	0	3	8	1	1	1	5	0	0	2	0	4	4	2	0	1	1	3	1	1	1	71
P214: triangle.doc	2	10	1	1	3	1	3	0	1	1	1	3	0	1	2	9	3	1	0	6	1	0	6	2	4	1	1	1	1	2	2	1	6	3	80
P215: vibrafone.doc	4	3	0	2	3	1	1	0	2	1	0	3	0	0	2	7	4	1	0	4	0	0	4	1	1	0	1	1	1	1	1	1	0	2	55
P216: viola.doc	3	7	4	3	3	2	0	1	2	0	3	1	1	0	8	6	1	0	0	5	0	2	1	1	1	0	1	1	0	1	1	2	1	1	65
P217: xylophone.doc	3	8	5	2	4	2	1	0	1	1	0	2	0	0	4	8	2	0	0	4	2	0	2	1	3	0	1	1	1	1	0	1	0	4	64
P218: Alto.doc	1	6	1	1	2	1	2	0	1	2	0	3	0	0	3	5	2	0	1	3	0	0	1	1	4	2	1	1	1	1	2	1	2	1	52
P219: balalaika.doc	3	3	2	1	2	1	1	0	1	0	0	2	1	0	3	8	2	0	0	7	0	1	1	1	2	0	3	1	1	1	0	2	1	2	53
P220: banjo.doc	1	7	2	2	4	1	1	0	1	1	0	3	0	1	2	6	3	0	1	4	0	0	1	1	5	3	1	1	0	1	0	1	2	1	57
P221: bass.doc	1	9	0	3	9	2	2	0	3	1	1	3	0	0	4	7	4	0	1	7	0	0	2	1	4	1	2	4	1	2	0	2	2	2	80
P222: bongo drum.doc	2	4	0	0	3	1	0	1	5	1	0	5	0	1	4	7	1	0	1	9	0	2	4	1	2	9	1	1	2	1	6	4	2	3	83
P223: cymbal.doc	2	9	4	1	5	1	1	0	2	0	0	3	0	0	4	5	2	0	0	5	0	1	2	1	2	1	2	1	1	1	2	1	1	2	62
P224: flute.doc	4	5	0	1	4	3	3	0	3	3	1	4	0	0	2	7	6	0	0	10	0	1	1	0	2	1	2	4	0	2	1	1	4	1	76
P225: french horn.doc	3	7	5	1	5	2	1	0	1	2	0	4	0	0	6	6	1	0	0	4	0	1	1	0	2	0	2	0	1	2	0	3	1	2	63
P226: guitar.doc	3	3	0	2	3	2	3	0	1	2	0	3	3	0	6	6	5	0	0	6	0	1	4	1	1	0	3	1	0	1	3	2	1	2	68
P227: lute.doc	3	8	1	4	4	1	4	2	3	1	1	3	0	0	6	7	5	0	0	7	0	1	1	1	2	3	3	1	1	1	3	2	2	1	82
P228: organ.doc	1	5	1	0	2	0	2	1	1	1	2	1	0	0	3	6	2	0	0	2	0	0	2	1	2	1	1	1	0	1	2	1	1	0	44
P229: recorder.doc	2	7	3	3	2	1	1	0	1	1	1	1	0	2	9	8	4	0	0	9	0	0	5	1	0	1	1	1	1	2	0	2	2	1	76
P230: sitar.doc	4	6	1	1	2	1	2	1	3	1	0	5	1	0	3	5	4	1	0	3	0	3	3	1	2	3	3	0	0	1	1	1	3	1	66
P231: steel drum.doc	3	8	0	1	3	2	3	0	2	0	0	5	1	0	5	7	2	0	0	9	0	0	1	0	3	1	2	0	1	1	4	4	4	1	76
P232: ukulele.doc	2	7	5	2	3	1	2	0	1	0	1	2	0	1	4	7	3	0	1	7	0	0	2	1	1	5	1	3	1	1	1	2	2	2	71
P233: fortepiano.doc	11	7	5	1	3	2	2	1	2	0	1	3	0	0	6	6	3	0	0	8	0	1	1	2	3	0	2	3	1	2	4	1	0	2	266
P234: mandolin.doc	2	5	0	3	4	2	3	0	1	0	0	5	1	0	3	9	3	1	0	11	0	0	1	1	3	0	2	1	0	2	0	1	1	2	67
P235: soprano.doc	3	12	2	1	9	4	1	0	3	2	0	2	1	0	4	7	4	1	0	7	0	0	1	1	3	1	3	2	1	2	4	2	0	2	85
TOTALS:	**105**	**231**	**68**	**84**	**142**	**71**	**75**	**11**	**68**	**37**	**18**	**124**	**18**	**9**	**151**	**231**	**89**	**14**	**14**	**214**	**14**	**28**	**77**	**40**	**98**	**75**	**68**	**62**	**30**	**56**	**56**	**69**	**59**	**73**	**2805**

Appendix 5. List of code names of the interviewees

Primary document	Code name of the interviewee	Male/Female
P200	Accordion	Female
P201	Cornet	Female
P202	Cembalo	Female
P203	Contrafagot	Male
P204	Saxophone	Male
P205	Fagot	Female
P206	Trumpet	Female
P207	Tuba	Male
P208	Cello	Male
P209	English Horn	Female
P210	Fiddle	Female
P211	Mouth Harp	Male
P212	Oboe	Male
P213	Timpani	Female
P214	Triangle	Male
P215	Vibrafone	Female
P216	Viola	Female
P217	Xylophone	Male
P218	Alto	Female
P219	Balalaika	Female
P220	Banjo	Male
P221	Bass	Male
P222	Bongo Drum	Female
P223	Cymbal	Male
P224	Flute	Female
P225	French Horn	Male
P226	Guitar	Female
P227	Lute	Male

Primary document	Code name of the interviewee	Male/Female
P228	Organ	Female
P229	Recorder	Male
P230	Sitar	Male
P231	Steel Drum	Female
P232	Ukulele	Male
P233	Fortepiano	Male
P234	Mandolin	Male
P235	Soprano	Female

Appendix 6. Distribution of *I* and *we* constructions per interviewee

primary document	P200	P201	P202	P203	P204	P205	P206	P207	P208	P209	P210	P211	P212	P213	P214	P215	P216	P217	P218	P219	P220	P221	P222	P223	P224	P225	P226	P227	P228	P229	P230	P231	P232	P233	P234	P235	Total
words																																					
I	451	306	606	426	191	196	298	326	357	419	336	318	423	669	430	555	252	318	339	260	311	326	625	203	389	233	485	396	412	355	235	519	563	308	330	239	13405
I'D	5	0	0	0	1	0	0	0	0	0	3	0	0	1	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	15
I'LL	2	1	1	0	1	0	0	0	1	0	10	1	1	2	0	2	2	6	1	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	34
I'M	39	2	15	13	0	0	0	0	4	1	25	0	15	5	0	34	12	13	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	1	0	182
I'VE	29	1	29	23	1	0	0	0	3	0	25	1	14	3	0	22	17	16	2	0	0	4	0	0	0	2	1	0	1	0	0	3	0	0	0	0	197
ME	32	20	35	18	14	24	20	28	19	39	27	41	25	62	21	49	11	16	33	19	30	17	50	24	17	9	16	24	36	25	20	23	33	39	22	12	950
MY	70	35	125	68	24	39	54	32	37	85	58	81	56	126	52	52	45	61	69	33	26	62	124	51	66	30	57	59	68	55	32	53	53	63	86	27	2114
MYSELF	2	5	9	18	4	2	7	3	7	11	4	2	1	4	5	7	6	8	3	2	2	1	10	7	3	5	8	2	14	3	3	4	5	3	4	0	184
sum (I)	630	370	820	566	236	261	379	389	428	555	488	444	535	872	508	723	345	440	447	314	369	411	809	285	475	279	568	482	532	438	291	603	654	414	443	**278**	
OUR	14	22	11	20	7	3	11	17	13	56	23	7	28	19	6	15	6	18	14	6	13	25	24	9	17	10	6	18	13	10	8	4	17	8	22	27	547
OURS	1	0	0	1	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	1	1	10
OURSELVES	0	3	2	0	0	0	1	3	0	1	1	3	3	0	1	0	0	0	0	0	0	2	1	1	0	0	0	2	0	1	0	1	0	0	1	1	28
US	4	9	10	3	4	2	5	15	22	8	11	12	8	8	1	5	8	16	6	3	4	5	2	9	4	7	2	9	5	2	8	1	12	5	4	7	246
WE	62	81	106	66	44	20	40	75	77	142	87	62	131	124	30	87	65	87	51	47	35	50	46	21	43	60	35	88	94	52	73	62	84	58	67	90	2442
WE'D	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
WE'LL	3	0	0	0	0	0	0	0	0	0	1	0	5	2	0	0	1	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17
WE'RE	6	0	2	4	0	0	0	0	0	0	12	0	7	0	3	1	8	11	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	55
WE'VE	7	0	5	3	0	0	0	0	0	0	4	0	5	0	0	3	1	4	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	34
sum (we)	98	115	136	97	55	25	57	110	113	208	139	85	187	155	41	111	89	141	71	56	52	83	74	41	64	80	43	117	112	65	89	68	114	71	95	126	
total	728	485	956	663	291	286	436	499	541	763	627	529	722	1027	549	834	434	581	518	370	421	494	883	326	539	359	611	599	644	503	380	671	768	485	538	404	20464
percentage we	14	24	14	15	19	8,7	13	22	21	27	22	16	26	15,1	7,5	13,3	21	24	13,7	15	12	17	8,4	13	12	22	7	20	17	13	23	10	15	14,6	18	**31**	
percentage I	87	76	86	85	81	91	87	78	79	73	78	84	74	84,9	93	86,7	80	76	86,3	85	88	83	92	87	88	78	93	81	83	87	77	90	85	85,4	82	**69**	