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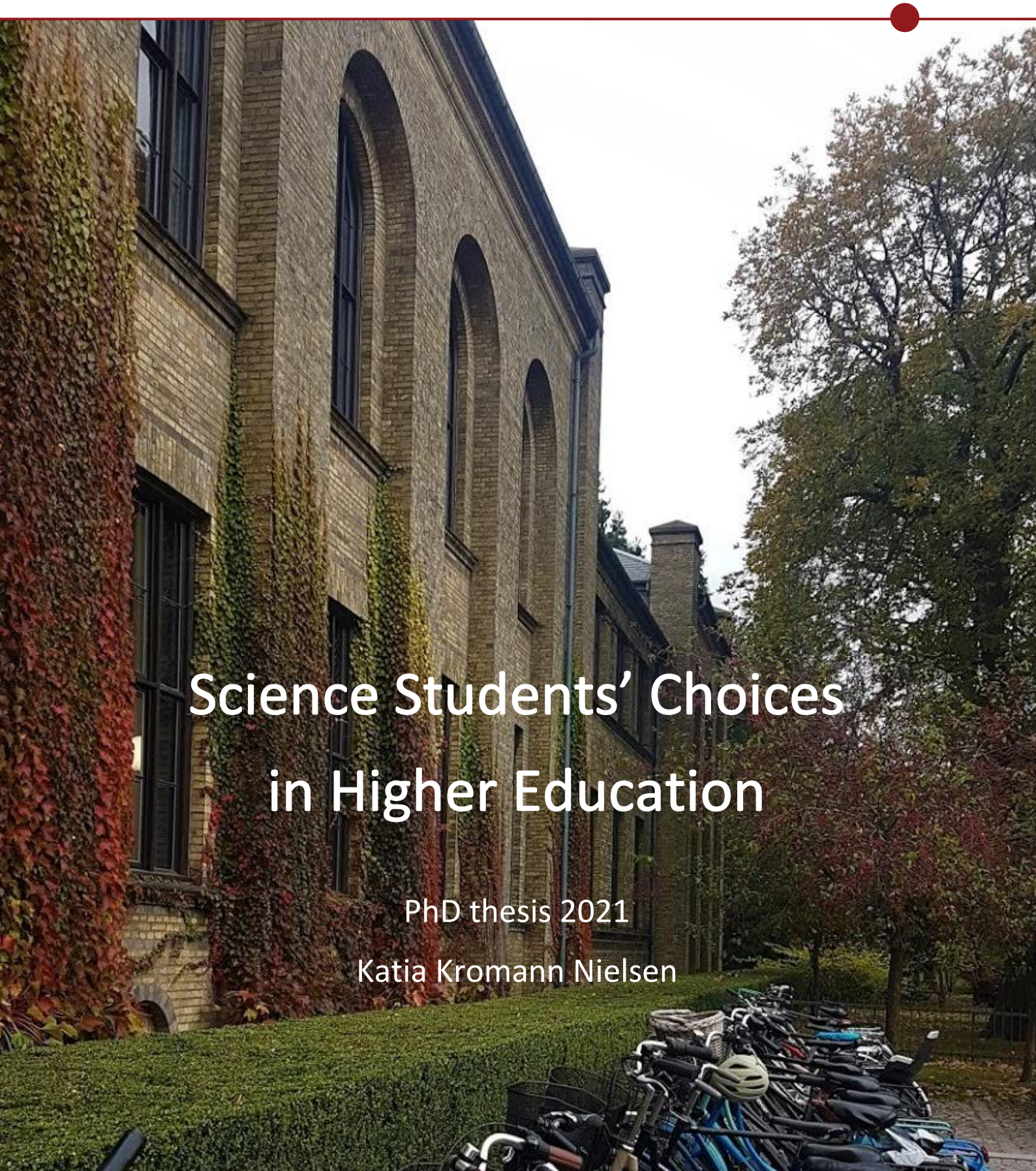

Science Students' Choices in Higher Education

PhD thesis 2021

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The Construction of Desirable and Legitimate Paths and Futures

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To all the students with whom I conducted my fieldwork, thank you for sharing your time and thoughts with me! Thank you for explaining jokes, putting up with my questions and allowing me to be part of your life at the university during lectures, lab exercises and excursions, as well as parties. I have truly enjoyed spending my time with you, and I wish that you all find meaningful educational and personal paths in your lives.

Summary

Within higher education research, a prominent topic has been young peoples' decision-making processes when choosing whether to enter higher education or not and which programme to pursue. However, after entering a specific study programme, students still need to choose a specialisation, elective courses and a master's programme. This thesis examines students' choice processes in higher education, focusing especially on the choice of master's programmes.

The findings in this thesis are based on ethnographic fieldwork among second-year bachelor's students in chemistry, computer science and natural resources. The three programmes are all offered in the Faculty of Science at the University of Copenhagen. However, they differ with regard to the opportunities they offer students after having completed their bachelor's studies. At the programme in chemistry, there are a strong tradition for students to continue directly on to the master's programme in the same department. At the programme in natural resources, there are no designated master's programmes, and depending on students' choices of specialisations and electives, they have different possibilities for continuing on to various master's programmes. Computer science does have a master's programme at the same department that some students continue on to, but unlike the other programmes there are also an actual labour market for computer science students with just a bachelor's degree.

The core of this thesis consists of four papers. The first paper investigates the students' experiences of choosing and explores how they navigate these choices. The paper shows that students experience both opportunities and constraints in navigating higher education choices. Navigating through higher education presents both ambiguities and challenges to the students, who learn as they go along, discover new paths and thus change direction as they move through the landscape of higher education. The paper argues that in this sense making choices is an integral part of being a student and an inherent part of what it means to study.

The second paper focuses on the programmes in natural resources and computer science. It explores students' choice processes regarding choosing a master's programme in relation to their perspectives on the future. The paper shows that, as an aspect of students' choice processes, they consider the possible futures that different choices may lead towards. It was important for students in both programmes to be able to imagine themselves on a path towards possible and desired futures. However, for some students it was difficult to imagine where their educational path was leading or how they could pursue the possible selves they desired, and this could cause doubts and frustration. Thus, even though the future belongs to the realm of the imagination, it has very real influences on the students' current choices and the way they feel about them. The paper also shows that the institutional setting of each study programme plays an important role in providing students with resources and making the future seem more or less pressing.

The third paper examines the programme in chemistry and shows how the culture within this programme affects students' aspirations, and their educational and career choices. It focuses on the specific case of two students, who were both enrolled in a specialisation leading towards a career as

high-school teacher. The paper found that everyday practices and structures formed a culture that positioned research at the centre and left high-school teaching as a less attractive career path. Over time, the culture meant that the two students came to question their aspirations to become high-school teachers. The paper emphasises the role of culture and shows how desirable paths are negotiated and changed over time.

The fourth paper looks at all three programmes to show how students relate to time in relation to their study programmes. The paper unpacks the challenges caused by the temporal structure of higher education and examines how these structures serve both to enable and constrain practices. The paper finds that students relate to several temporal horizons at once and that these horizons require different paces. Sometimes, therefore, the different horizons clashed. An important finding of the paper is that students also adopted strategies to change the pace and make time for immersion and reflection. The paper argues that the students used cracks and openings in the temporal infrastructure to disrupt the direction of the scheduled time.

Resume

Inden for universitetsforskning har et fremtrædende emne været unges beslutningsprocesser, når de skal vælge, om de vil søge ind på en videregående uddannelse eller ej, og hvilket studie de skal følge. Efter at være begyndt på en specifik uddannelse skal de studerende dog stadig træffe en række valg. De skal vælge en specialisering, valgfag og en kandidatuddannelse. Denne afhandling undersøger studerendes valgprocesser på universitetet og fokuserer især på valget af kandidatuddannelse.

Resultaterne i denne afhandling er baseret på etnografisk feltarbejde blandt andetårsstuderende på tre bacheloruddannelser: Kemi, Datalogi og Naturressourcer. Alle tre uddannelser er en del af Det Natur- og Biovidenskabelige Fakultet på Københavns Universitet. De adskiller sig imidlertid fra hinanden med hensyn til de muligheder, de tilbyder studerende efter at have afsluttet en bacheloruddannelse. På Kemi er der en stærk tradition for, at bachelorstuderende fortsætter direkte til kandidatuddannelsen i kemi på samme institut. På Naturressourcer er der ikke én kandidatuddannelse, som ligger direkte i forlængelse af bacheloruddannelsen, men mange forskellige og lige oplagte muligheder. Disse muligheder afhænger også af den enkelte studerendes valg af specialisering og valgfag. På Datalogi er det muligt at fortsætte til kandidatuddannelsen i datalogi på samme institut, hvilket en del studerende også gør. I modsætning til de to andre uddannelser, findes der imidlertid også et egentligt arbejdsmarked for datalogistuderende med kun en bachelorgrad.

Denne afhandling består af fire artikler. Den første artikel undersøger de studerendes oplevelser i forhold til deres valg, samt hvordan de navigerer i forhold til disse valg. Artiklen viser, at studerende oplever både muligheder og begrænsninger, når de skal navigere mellem forskellige valg i forbindelse med deres uddannelse. De studerende oplever både uklarheder og udfordringer, men de lærer også undervejs, som de bevæger sig gennem deres uddannelser, hvordan de skal navigere i uddannelsen. De opdager nye veje og skifter retning efterhånden som landskabet forandrer sig i takt med, at de bevæger sig gennem det. Artiklen viser, at valg i denne forstand er en integreret del af det at være studerende og en iboende del af, hvad det vil sige at studere.

Den anden artikel fokuserer på uddannelserne Naturressourcer og Datalogi. Den udforsker de studerendes valgprocesser med hensyn til at vælge en kandidatuddannelse, og hvordan dette relaterer sig til deres forestillinger om fremtiden. Artiklen viser, at en del af de studerendes valgovervejelser er deres forestillinger om, hvilke mulige fremtider forskellige valg kan føre til. Det var vigtigt for studerende på begge uddannelser, at de kunne forestille sig at være på en vej mod mulige og ønskværdige fremtider. For nogle studerende var det imidlertid vanskeligt at forestille sig, hvor deres uddannelse ville føre dem hen, eller hvordan de kunne bevæge sig mod mulige og ønskværdige fremtidige selv. Dette kunne føre til både tvivl og frustration. Selvom fremtiden kun eksisterer som forestillinger, havde den således en meget virkelig indflydelse på de studerendes valg i nuet og på den måde, de oplevede at skulle træffe disse valg. Artiklen viser også, at de institutionelle rammer på hvert studie spillede en vigtig rolle i forhold til at stille ressourcer til rådighed for de studerende, samt i forhold til hvor presserende fremtiden kom til at forekomme de studerende.

Den tredje artikel fokuserer på uddannelsen Kemi og undersøger, hvordan kulturen på dette studie påvirkede de studerendes ambitioner og deres uddannelses- og karrierevalg. Artiklen tager udgangspunkt i to studerende, som begge havde valgt den specialisering på kemi, der hedder gymnasierettet, og som fører mod en karriere som gymnasielærer. Analysen i denne artikel viser, at strukturer på uddannelsen samt hverdagspraksisser skabte en kultur, der placerede forskning i centrum og efterlod gymnasielærer som en mindre attraktiv karrierevej. Over tid betød kulturen, at de to studerende kom til at sætte spørgsmålstegn ved deres ambitioner om at blive gymnasielærere. Artiklen understreger uddannelseskulturens rolle og viser, hvordan attraktive veje forhandles og ændres over tid.

Den fjerde artikel undersøger, hvordan de studerende på alle tre bacheloruddannelser forholder sig til tid på deres uddannelser. Artiklen fokuserer på de udfordringer, den temporale struktur på universitetet skaber, og hvordan denne struktur skaber både muligheder og begrænsninger for praksis. Analysen i artiklen viser, at de studerende forholder sig til flere temporale horisonter på én gang, og at disse horisonter kræver forskelligt tempo. Derfor kolliderede de forskellige horisonter også ind i mellem. En vigtig pointe i artiklen er, at de studerende også fandt strategier for at ændre universitetets tidsrytmer og på den måde skabe tid til fordybelse og refleksion. Artiklen viser, at de studerende brugte revner og åbninger i den tidsmæssige infrastruktur for at skabe sådanne forandringer i rytmen og den planlagte tid.

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Katia, January 2021

Prologue

At the beginning of May 2017, we received the news that the Independent Research Fund Denmark had given us a grant to explore students' choices of and transitions to master's programmes. The project was due to begin in December 2017.

At that time I had just finished a temporary assignment as a consultant for an anthropological company and was facing unemployment. From experience, I knew that I did not cope especially well with being unemployed. After finishing my master's degree in anthropology, I had spent several months being unemployed, struggling with self-efficacy, trying to make sense of my days, and longing to belong somewhere and among colleagues.

Thus, the news of the grant was especially important to me. I was overjoyed: not only did I now have a job to look forward to, it was even what I considered a dream job. From having more distant and vague ideas about what doing a PhD would be like, I began to consider it in more detail. I now knew who would be my supervisor and where I would be working, which made the idea much more concrete and tangible.

It is always difficult to remember exactly what ideas you had before beginning something new. Like our ideas about who we are and what future we would like, our interpretation of the past and the narratives we tell about it change over time. In my mind, however, one thought stands out when I think back on what I expected the PhD to be like: that is, it would offer me the time to immerse myself in a subject to a level that had not been possible before.

During the last three years I have indeed spend more time working on this project than any other academic project in my life. However, as time passed, I soon found myself entering a daily routine that entailed much more than immersed reading and concerns relating to my PhD project. I found myself in the position of a teacher and a conference participant, as a participant in PhD courses, and as someone working on the development of pedagogical practices for other departments. I deeply appreciate having participated in all these activities and all that I have learned by doing so. Nonetheless, this meant that the continuous, deep immersion that I had imagined was also fragmented by a lot of other tasks and responsibilities. I do not remember any three years passing by so fast ever before.

When I enrolled as a PhD student, above all I was grateful to belong somewhere finally, and what is more, to belong among colleagues whom I both admire and who have taught me a lot. During my bachelor's degree, I had experienced a lot of doubts about my educational trajectory. While I felt captured by the perspective on the world that anthropology offered, I still had doubts about my educational choice and envied those of my peers who presented their studies almost as their only true calling. Half a year into my PhD, however, I finally felt sure that I had made the right choice.

Neither of my parents has a university degree, and I did not know a lot about life as a researcher. I did not have a very elaborate idea about what this really entailed on a day-to-day basis. The possible future paths to which my PhD studies could lead were thus not very clear to me. However, as time

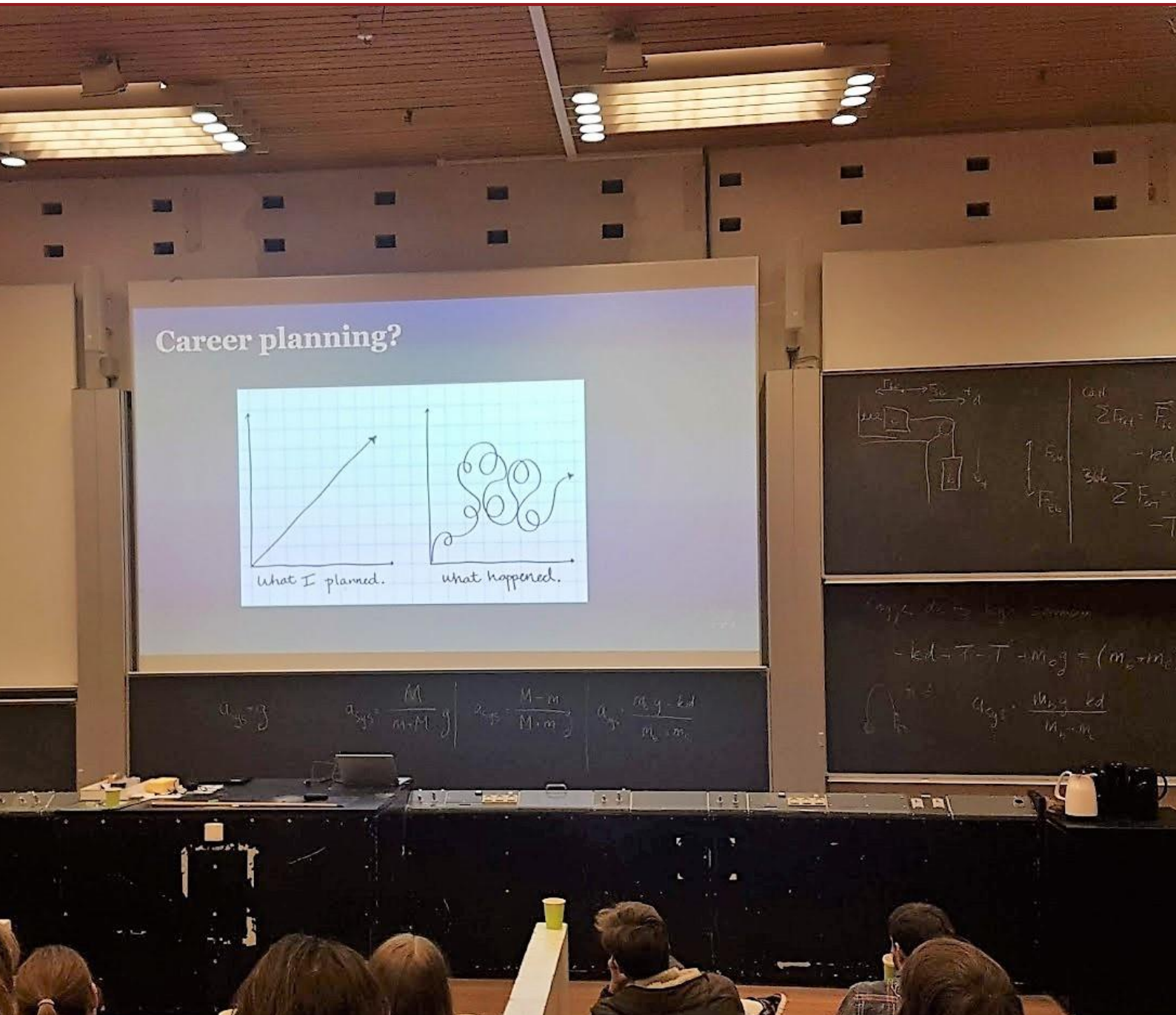
passed I started to feel that I belonged in research, and at the Department of Science Education. The more I learn about educational choices, as well as the world of research, the more clearly I see the contours of possible future paths and feel lucky that I have the opportunity to continue inhabiting this world of curiosity.

As a qualitative researcher, I cannot separate who I am from my work or how I have approached the topics of this thesis. Thus, I find it relevant to share these bits of my own personal journey with you. They serve to give you a glimpse of the researcher behind the study, and thus a perspective on the situated knowledge that I present here. I formulated research questions based on previous research and my knowledge of the empirical field. But I also met the students and thus related to them on a personal level. In my view, this is an inevitable part of being a qualitative researcher – and indeed of being a person.

The four articles that form the body and heart of this thesis examine topics that are relevant to my empirical and theoretical field of study. However, the topics are also easily relatable to my own journey, of which my work has offered me new perspectives and understandings.

Contents

Chapter 1



Introduction

It is a cold day, and even though I do not have a long way to go, I feel the wind cooling my face as I cycle towards campus to attend the annual information day about master's programmes offered at the University of Copenhagen. As I park my bike and enter one of the large buildings, I am met by a girl who offers me a handout of the day's schedule and a list of what master's programmes will be presented in which auditoriums. The master's programmes are grouped so that three to five are presented at each session in the same auditorium. The afternoon is divided into two sessions with a break between them.

For the first round of presentations, I decide to join the session where the master's programme called climate change is being presented. It is a programme that I have heard many students doing the bachelor's programme natural resources mention. It seems like an attractive master's programme to many, but I have also heard that there is a very restricted intake and that students from a variety of backgrounds apply. The presenter emphasizes that there is a high employment rate for those holding the degree and explains the selection criteria. Applicants must hold a relevant bachelor's degree and will be accessed based on the number of so-called 'climate change-related study elements' that the students have completed. After the presentations, the representatives from the master's programmes spread themselves out in the auditorium so that interested students can approach them with further questions. A huge circle of people quickly forms around the person who presented the master's programme climate change. I join the circle, eager to hear what kinds of questions students are raising.

On the other side of the circle, I notice Maja and Tania, two students studying in the bachelor's programme natural resources, and after a while we make our way out of the auditorium together. A huge line is forming in front of a small stand serving free coffee, and several students are gathering around another stand where the student counselling service is ready to answer questions. We join the line for coffee while talking about the presentation and the master's programmes. We soon start discussing the 'climate change-related study elements'. Tania is considering applying for the programme in climate change and now wonders how they decide which courses are related to climate change. Would it, for example, be good for her to choose elective courses with 'climate change' in the title, or how should she make sure that the courses are seen as related? When we reach the front of the line, get our coffees and move away, Tania quickly decides to return to the auditorium, hoping that someone will still be there to answer her questions. While she hurries back towards the auditorium, Maja and I continue the conversation about master's programmes and what session to join after the break.

(February 2019)

Being a bachelor's student at university means participating in coursework and exams, but it also means navigating different choices and finding paths through the higher education system, towards futures that are considered desirable. Over the course of one academic year, I conducted ethnographic fieldwork among second-year students following three science bachelor's programmes at the University of Copenhagen. During the fieldwork, I engaged in both formal and informal activities in order to learn what it meant to be a student on these programmes and how the students navigated the choices they were faced with as part of their studies.

The empirical description above is an example of one of the many extra-curricular activities in which I participated during my fieldwork. The annual information day was one of several events in which students could participate in order to discover what possibilities they had, and thus which paths they could follow. The description also concerns a choices in higher education, choice that has previously received little attention in educational research – that is, the choice of master's programme. An important reason for this lack of attention is that the division of university degrees into a two-cycle system consisting of a bachelor's degree followed by a master's, has only been introduced in many European countries within the last two decades.

The Bologna Process

In Denmark the tradition up until 1993 was that students enrolled in a one-cycle study programme leading to completion of a degree (P. Rasmussen, 2019). In 1993 the two-cycle structure of a bachelor's and a master's degree was introduced, but it was not until the University Act of 2003 (Retsinformation, 2003) that students encountered this division as involving them in making an actual decision. Before the reform, students at Danish universities enrolled for a full five-year master's degree as they would automatically be enrolled into the master's programme, that was considered to be a the natural extension to their bachelor's degree. The reform meant that students now had to apply to enter a master's programme after completion of a bachelor's degree. As a result, the transition to a master's degree became an actual and explicit choice. Students could not simply continue without doing anything.

The University Act of 2003 marks the full implementation of the Bologna 3+2 structure in Denmark. This structure is in conformity with the Bologna Declaration, made in 1999 when 29 countries agreed to engage in a common pursuit to establish a European area of higher education. The idea behind establishing such an area was that it should promote employability for European citizens, as well as increase the competitiveness of the signatory countries. The 1999 declaration mentions several objectives, among them the establishment of a common system of credits in the form of the European Credit Transfer System (ECTS), and the introduction of a two-cycle system, consisting of a bachelor's degree of a minimum of three years duration followed by a two -year master's degree (Bologna Declaration, 1999). Since 1999, other objectives have been added to these original ones, and today 48 countries have committed themselves to implementing the principles and structures of the Declaration (EHEA, 2018).

The introduction of the two-cycle 3+2 structure (or three-cycle 3+2+3 structure when the PhD level is included) is interesting because it is an example of an element in the Bologna process that presents a

change in the higher education system that is more fundamental in some countries than in others. At the same time, it has a direct effect on students' circumstances and the choices they have to make.

The present study focuses on how students make these choices in the context of Danish higher education. Denmark is an interesting case from the point of view of the 3+2 structure and the new decision point the structure has introduced. Until colleagues from my research group conducted the IRIS research project,[1] we assumed that Danish students would continue to perceive higher education study programmes as five-year entities. After all, the implementation of the 3+2 structure did not have a major effect on the way Danish higher education was organised, as the two-cycle system had already been implemented ten years earlier, and the majority of students still continued into a master's programme after completing a bachelor's degree (Produktivitetskommissionen, 2014). The only change for students was thus that they now had to fill out an application form to enter a master's programme. However, as part of the IRIS project, my colleagues interviewed a number of bachelor's students between 2009 and 2011. To their surprise, they found that several of these students talked about the bachelor's degree as an entity in itself and treated completing one as a point at which they could pause and find out what they wanted to do, possibly also taking a break from their studies.

Danish Higher Education

In Denmark, higher education is funded by the state. This means that students do not pay any tuition fees to enter a study programme and that they receive a universal government grant to cover their basic living costs. Many students do have part-time jobs that supplement this grant, but mostly this will only occupy them for some ten to fifteen hours a week. Access to bachelor's programmes is based on the applicant's grade point average from upper secondary school.[2] Students enrol directly into a discipline-specific bachelor's programme lasting three years.

Denmark's present regulations guarantee students enrolment in a master's programme that is considered the natural continuation of their bachelor's programme. However, this is the case only if students apply for enrolment within the first three years of finishing their bachelor's degrees (Ministry of Higher Education and Science, 2019b). Students who wait longer or who apply for a master's programmes other than the one they are guaranteed acceptance into will have to apply on equal terms with other applicants and will be assessed according to the relevant programme's requirements. In accordance with the Bologna process, all bachelor's programmes must qualify for entry into more than a single master's programme (Retsinformation, 2003). Students can also choose to end their studies upon completion of the bachelor's degree, though in the majority of disciplines there is virtually no labour market for bachelor's students.[3] In Denmark it is far more usual for

[1] IRIS stands for 'Interests, Recruitment in Science'. The objective of the project was to examine students' choices of and retention in higher education STEM programmes (Henriksen et al., 2015).
[2] It is also possible to apply to enter a higher education study programme via quota 2 admission. The criteria for this kind of admission is decided by the specific programme, and quota 2 study places are very limited (Ministry of Higher Education and Science, 2020).
[3] Not counting what in Danish are termed vocational bachelor's degrees. These degrees are directed towards a specific profession such as physiotherapist, nurse or teacher. In Denmark they are based at university colleges and last three and a half years.

students to enrol directly in a master's programme within a year of completing their bachelor's degrees (Hauschildt et al., 2018; Ministry of Higher Education and Science, 2018b).

In recent years, this new decision point has attracted political interest, not least due to the increasing number of university students, commonly referred to as 'the mass university' (Scott, 2005; Trow, 1972, 2010) and the 'credential inflation' (Tobbell et al., 2008). In Denmark, the growing number of students has led to the suggestion that more students should complete their university studies with a bachelor's degree, rather than continuing on to a master's programme (Ministry of Higher Education and Science, 2014). Political concern has also been expressed regarding students' choice of programmes, that is, that too many students choose programmes within the fields of the humanities and social sciences, rather than programmes that are considered to be better aligned with the labour market, for example, within the areas of health, science and technology (Brooks, 2019). In 2014 this led to an adjustment of student intake, implying that the intake of students were reduced for programmes that were considered to have 'systematic and notable higher unemployment among graduates' (Ministry of Higher Education and Science, 2018a). The objective was to redirect students towards programmes with better employment prospects. Another political concern has been that the completion times of higher education students, with the general critique being that students progress too slowly through their studies (Brooks, 2019; Nielsen & Sarauw, 2017). This criticism has led to the implementation of the Study Progress Reform, requiring universities to shorten student completion times. The reform has been revised a number of times, most recently in 2019, when it was replaced by a new funding system, which rewards universities financially for timely completion by students (Ministry of Higher Education and Science, 2015; Sarauw & Madsen, 2020). In the same period, and with the same underlying objective, students' legal right to enter a master's programme was also limited to doing so directly after completing a bachelor's degree. However, this too was amended in 2019 by restoring the student's legal right to enter a master's degree up to three years after completing a bachelor's degree (Ministry of Higher Education and Science, 2019a).

As a result, students are now expected to consider their career prospects when choosing a master's programme, and some students will experience limitations concerning which programmes they can choose. This means that the decision point at the end of the bachelor's programme is not only new, it is also considered increasingly important. Hence, while students face a range of possible master's programmes, not all of these might be conveyed or experienced as legitimate and accessible choices or as future paths (cf. Holmegaard et al., 2014a). The choice of a master's programme requires students, to engage once again in a process of choice and reflection leading up to making a decision. However, knowledge of this process is scarce. We do not know whether the components involved in these reflections are different from the process of making other educational choices, nor whether the students experience this process differently. However, this second threshold along the path of higher education could be consequential in the same way as the choice of higher education in terms of equity and allocation.

Despite the growing political interest and limited knowledge, research into this topic is virtually non-existent in Denmark, and even internationally it is scarce. Gaining more insight into students' decision-making processes is therefore of both political and academic relevance. This forms the background to the research project 'Beyond the Bachelor's Degree', of which this PhD study is a part.

The Overall Project: 'Beyond the Bachelor's Degree'

'Beyond the Bachelor's Degree' is a research project exploring students' choices of and transitions to master's programmes. As this overall project constitutes the framework for this PhD, I now present a brief outline of the overall project in order to situate my own research within it.

The overall project has two overarching aims focusing on developing practice and theory respectively:

1. To map the choice processes, transition patterns and experiences of students in the final phase of their bachelor's degree. This will inform present and future initiatives both nationally and at higher-education institutions.
2. To develop a theoretical understanding of the educational choices and transition processes of young people as these processes evolve over time.

The project is designed as a mixed-methods study with four different work packages (WP):

WP 1 serves to coordinate and synthesise the work of the three other WPs. This WP also brings together researchers from Denmark, the UK, Germany and Italy in order to inform and contrast the findings in the project. WP 1 provides a framework for combining findings across the project and thus the benefits of the mixed-methods approach.

WP 2 is a quantitative study that analyses and maps the transition patterns of Danish bachelor students over the last three decades. It will thus be able to account for the long-term trends and the introduction of the 3+2 structure in the Danish higher education system.

WP 3 consists of a longitudinal interview study following students from the final year of their bachelor's degree across their transition into a master's programme. This WP draws on a narrative psychological approach focusing on how students' identity formations interact with their constructions of choice-narratives. This WP follows students from three science bachelor's programmes: chemistry, computer science, and natural resources.

WP 4 consists of an anthropological study examining second-year students' choice processes. This was conducted through ethnographic fieldwork among second year-students, this being a time when the initial induction process into the university has been completed, but before the choice of what to do after one's bachelor's degree has to be made. This WP follows students from the same three study programmes as in WP 3. This PhD constitutes WP 4.

WP 4: An Anthropological Approach

In relation to the larger project, the aim of WP 4 is to contribute findings on students' lived experiences and everyday practices in the three study programmes. The WP thus draws on one of the fundamental approaches in anthropology – directing attention to what people say and what they actually do. The underlying idea behind this approach is that what people say and what they do are not always the same. This is not because people intentionally lie, but because lived lives include both explicit and tacit knowledge (H. Carlone & Johnson, 2012; O'Reilly, 2012). By participating in the daily life of students, I have sought to understand both the explicit aspects of students' choice processes

and the tacit aspects of the local norms that inform what are considered desirable, recognizable and legitimate choices.

Within the framework of the overall project, my main objective in this study has been to explore how students' choices and possible futures are constructed as desirable and legitimate in the institutional setting of the three selected science bachelor's programmes.

Supporting this main objective, I pose the following three research questions:

- How does the choice of master's programme unfold as a choice of relevance for second-year students?
- How are different choices and futures conveyed as desirable and legitimate, as well as undesirable and illegitimate at the study programmes?
- How is the legitimacy of different choices and possible futures negotiated among students and university staff?

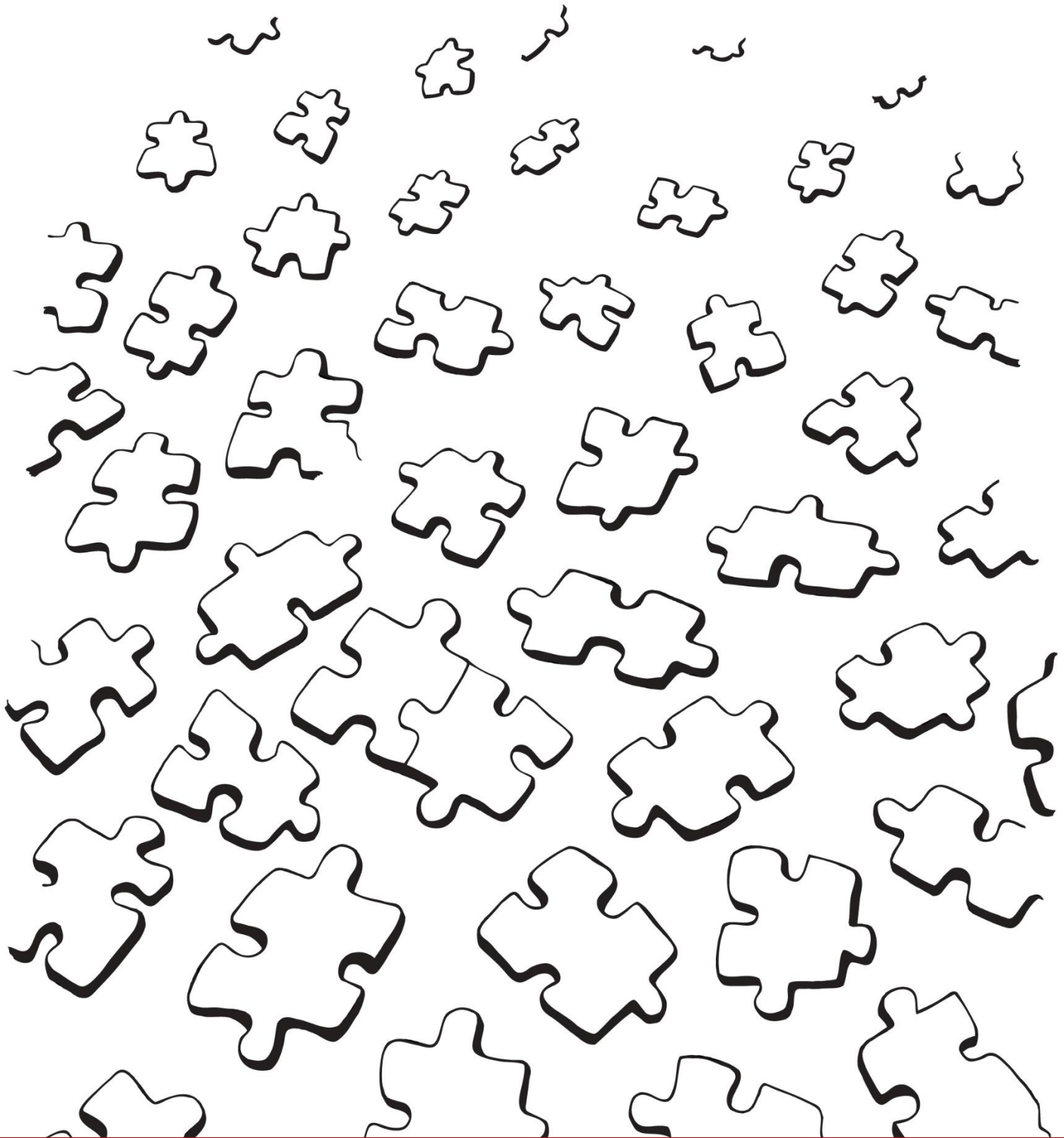
Navigating this Thesis

This thesis presents the main parts of my PhD research. In this introduction, I have outlined the background and context of my PhD research and described the overall project of which it forms a part. In Chapter 2, I present the theoretical framework, consisting of an outline of research within the fields of higher education research and science education research. In Chapter 3, I present the project design and methodological considerations. These three first chapters in combination serve to frame the core of my academic work. Chapter 4, the body of the thesis, consists of four research articles, each of which present perspectives on my research questions and analysis of the empirical material from my fieldwork. I will refer to these as paper 1, 2, 3 and 4.

- **Paper 1:** Choices in higher education – Bachelor students' movements between individual perspectives and institutional constraints
- **Paper 2:** Imagined futures and present choices: Science bachelor students' choice processes in higher education
- **Paper 3:** Choosing (not) to be a chemistry teacher: Students' negotiations of science identities at a research-intensive university
- **Paper 4:** Following patterns and changing pace – Students' strategies in relation to time in higher education

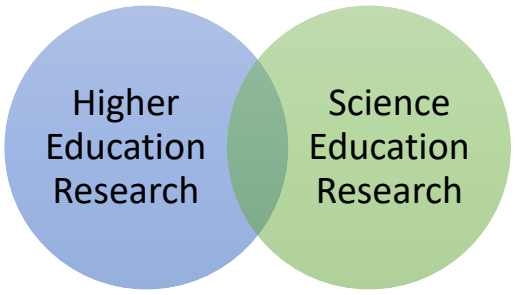
Following the four articles, in Chapter 5 I present a discussion of my findings and themes across the four papers. Chapter 6 collects the overall findings of my research into a conclusion.

Chapter 2



Theoretical Framework

The research presented in this thesis focuses on how science students' choice processes in higher education. It thus inscribes itself in the intersection between the fields of higher education and science education research. In my analysis, I draw on theoretical perspectives from both fields and engage with current empirical and theoretical discussions within each of them. In this chapter, I thus outline some of the major tendencies within both fields and the perspectives that are relevant to this thesis.



I begin the chapter by presenting the scarce literature on students' intentions and choices regarding master's programmes. I then continue by outlining perspectives on educational choices in the higher education literature before incorporating those in the science education literature.

Choosing a master's programme

Research on choices in relation to higher education have tended to focus on students' entry into university (Gale & Parker, 2014; Gregersen et al., forthcoming; Hasse, 2000; Holmegaard, 2012; Kyndt et al., 2017; Madsen, 2018), and students' considerations concerning their choice of career paths (Hodkinson et al., 2006; Hodkinson & Sparkes, 1997; Holmegaard, 2020; Kyndt et al., 2017). With this focus, the literature on such choices is in line with other areas of higher education research, where the main concentration has been on the first and last years of university, rather than the middle years (Milsom et al., 2015; Willcoxson et al., 2011). Clare Milsom and colleagues (2015) argue that the reason for this might be that the middle years of higher education are assumed to be unproblematic. It is hence no surprise that research on students' choices of master's programmes is scarce. Furthermore, as described in the introduction, in most European countries this transition has only been introduced within the last two decades. It thus constitutes a relatively new decision point for students.

The existing literature is generally quantitative in nature and mainly concerns the UK and Germany, though the focus differs, as the situations in the two countries are very different. Whereas Germany traditionally had a one-cycle system like Denmark's, the UK already had a two-cycle system prior to

the Bologna Process. This means that the Bologna Process has brought about different degrees of change, just as the implementation has differed between European countries (Vögtle, 2019).

The research on choices of master's programmes in Germany is of later date. Several of these studies explicitly refer to the Bologna Process and the introduction of the 3+2 structure. The main concern in these studies is whether the new structure has had any positive or negative effects on social stratification in the context of higher education (Horstschräer & Sprietsma, 2015; Neugebauer, 2015; Neugebauer et al., 2016; Sarcletti, 2015). Several German studies have examined the role played by social backgrounds in determining who is likely to continue on to a master's programme after completing a bachelor's degree. The general finding was that students with an academic family background were more likely to do so than those without one (Auspurg & Hinz, 2011; Heine, 2012; Kretschmann et al., 2017; Lörz et al., 2015; Neugebauer et al., 2016).

A rather larger number of studies deal with the UK. Compared with the German studies, they examine students' choices of master's programmes from a greater diversity of perspectives. However, unlike Germany and Denmark, the two-cycle structure is not new to the UK, which significantly also has an established and much larger labour market for students who have only completed a bachelor's degree. Whereas Danish students tend to continue directly on to a master's degree (Hauschildt et al., 2018), in the UK many more students finish their studies at the bachelor's level and only return to university, if at all, after several years in employment. There has thus been a greater focus in the UK literature on exploring the reasons for mature students returning to university to pursue a postgraduate degree, how they gather information on such degrees and what factors influence their choices (Mellors-Bourne et al., 2014; Pollard et al., 2016; Stuart et al., 2008). In line with the German studies, some UK research also considers the role of social background in the transition from undergraduate to postgraduate studies, arguing that inequalities of social class merely move to new parts of the educational system when this expands (Wakeling, 2009; Wakeling & Laurison, 2017). A recent study also highlighted the role of digital communication in postgraduate course selection, adopting a view of students as consumers (Towers & Towers, 2020). This perspective has been prevalent in UK research, a topic I return to below.

The few qualitative studies I have found that are concerned with choices of and transitions to a master's degree have all focused on students' entry into such degrees. Rather than examining bachelor's students choice processes, these works examine how students experience the transition to postgraduate study (Heussi, 2012; McPherson et al., 2017; Symons, 2001; Tobbell et al., 2008, 2010; Tobbell & O'Donnell, 2013, 2015; West, 2012). There is general agreement in this literature that the transition to a master's degree has been neglected as a topic of research. This, it is argued, might be because at this point students are already expected to be 'experts' in the academic environment, the assumption being that the transition will therefore not be difficult, though research shows that this is not the case. Importantly, however, with a few exceptions[4], these studies focus on the UK. Given the differences in both fees and transition patterns, this makes comparisons with Denmark difficult.

Besides these national trends in research on students' choices, a few studies also focus on other national contexts. For example, two Australian studies using questionnaires probe changes in

[4] Symons (2001) focuses on Scotland and Australia, McPherson, Punch and Graham (2017) on Scotland.

students' intentions regarding their future educational trajectories during the course of the second year of their bachelor's studies and between the first, second and third years respectively. The studies showed no change in intentions between these points in their degrees (Denise M. Jepsen & Varhegyi, 2011; Denise Mary Jepsen & Neumann, 2010). Another questionnaire-based study focused on master's students' choices of programmes in Greece (Saiti et al., 2017), and yet another probed the intentions of Turkish undergraduates to pursue a postgraduate degree (İlter, 2020).

Another growing trend in the literature is to examine international students' decisions to pursue master's degrees abroad, especially on international students' experiences of entering new and foreign study environments (e.g. Cadman, 2000; Cargill, 2006; Guilfoyle, 2006; Zhao et al., 2017).

Despite the differences between these studies and my project, what we can learn from these is that social background plays an important role in students' higher education attainments. Furthermore, not even students who are not new to the academic environment can be expected to go about their studies without experiencing difficulties. However, I have not been able to locate any qualitative studies focusing on the decision making process of bachelor's students. Whereas quantitative studies can provide knowledge about specific factors and how these are connected to students choosing or not choosing to pursue a master's degree, these cannot provide any insights into the actual process of choosing, how this is experienced or what elements students consider relevant. The general scarcity of such literature calls for more studies examining this decision point, and how it resembles and differs from other educational choices. It also calls for qualitative studies exploring students' choice processes regarding what to do after they complete a bachelor's degree. This has become especially relevant in light of the Bologna process.

Choice of Higher Education

Within the field of higher education research, the topic of choice, has predominantly concerned young peoples' choices of higher education, and their choice of which study programme to pursue. These studies have offered several different approaches, depending on national contexts, and ranging across various methodological and disciplinary traditions.

Historically, research on choices of higher education have focused on the factors influencing these choices. In a classic review of such literature, Michael Paulsen (1990) identified three distinct disciplinary approaches to higher education choices: psychological, economic and sociological. Each approach represents a different models highlighting specific factors. The psychological approach focused on the influence of the psychological environment of an institution on students and the fit between institution and student. The economic approach viewed choices to pursue higher education as a matter of weighing the costs against the benefits, taking the position that studying is an investment with monetary benefits. In the sociological approach, attention was directed at higher education as a means of status attainment, with the main focus being placed on individual background factors such as race, ethnicity and especially social class (Bergerson, 2009; Paulsen, 1990).

While each of the three approaches pointed to important factors, each was later criticized for not taking into account what the other approaches were saying. In the 1980s this resulted in researchers

seeking to develop more comprehensive and combined models to explain students' choices (Aydın, 2015; Bergerson, 2009; Perna, 2006). As a consequence, several comprehensive models were generated by, for example, David Chapman (1981), Don Hossler and Karen Gallagher (1987), and later extended by, among others, Laura Perna (2006).

In an extensive review, Amy Bergerson (2009) followed up on Paulsen's work (1990). She described the period after the 1990s as being characterized by a general move away from attending to access to higher education towards a focus on equity. Within this overarching theme of equity, Bergerson detects three trends in the literature. The first trend is a move away from comprehensive, general models. With universities becoming mass rather than elite institutions (Scott, 2005; Trow, 1972, 2010), students entering higher education became more diverse, and the idea of developing general models to explain choices was mostly discarded. Studies instead adopted critical perspectives on different groups of students and their diverse experiences. The second trend that Bergerson detected is a greater emphasis on preparation for higher education. These studies focus especially on access to different possibilities in both preparing and accessing information. The third trend is to consider policy-making both federally and nationally in order to understand how policy supports or hinders access to higher education (Bergerson, 2009). Along with these new trends, there was also a change in the methods applied within the field, from mainly quantitative studies towards research using both quantitative and qualitative methods (Bergerson, 2009; Perna, 2006).

Sociological Perspectives

More recent research on choices of higher education continue to draw on a range of different methodological and theoretical perspectives. A persistent theme, though, has been the continued stratification of higher education, despite the massive expansion of students attending higher education (Perna, 2006; Reimer & Thomsen, 2019). Especially in the UK, this has fostered a strong emphasis on widening participation (Breeze et al., 2020; Harrison & Waller, 2018; Wilkins & Burke, 2015), and it has been the prime focus of much sociological research concerning choices in higher education and in education in general (Reay, 2009). In a recent paper, David Reimer and Jens-Peter Thomsen (2019) argued that this research can be divided into two major tendencies: rational choice theory, and studies drawing on Pierre Bourdieu's theory of cultural reproduction.

Rational choice theory sees choices in higher education as involving a rational weighing of costs and benefits, in a similar vein as in the earlier economic models. Within this tradition there are several different approaches, such as relative risk aversion theory (Breen & Goldthorpe, 1997; Reimer & Thomsen, 2019; Stocké, 2019). Based on this approach, students' decisions to enter university, as well as which university and field of study to pursue, 'can be understood as result of considerations regarding the benefits, risks and costs associated with each possible educational choice' (Reimer & Thomsen, 2019, p. 309). Researchers drawing on the work of Bourdieu have generally focused on how class differences affect students' choices. One of the more prominent researchers within this tradition is Diane Reay (1998, 2002), who has argued that class is a key component in understanding higher education choices and pointed out how these choices are also mediated by race, ethnicity and gender. In a collaborative study, Diane Reay, Miriam David and Stephen Ball (2005) proposed to use Bourdieu's concepts of *cultural capital* and *habitus* as a framework for understanding choices in higher education in the context of class differences. Reimer and Thomson (2019) conclude that higher

education stratification persists, even in countries like Denmark, where economic constraints play a minor role. They show how this stratification works both vertically and horizontally. That is, the stratification of higher education influences not only educational attainment, but also which university students enter and their choices of study programmes (Reimer & Thomsen, 2019).

Market Perspectives

Another approach, that has become prevalent in the wake of the privatization and marketization of higher education in many countries, is the focus on higher education as an export industry. Treating higher education as a market means viewing students as consumers, with some studies, for example, examining how universities seek to attract international students through branding and promotion (Aydın, 2015; Komljenovic, 2017). However, while the discourse of students as consumers has been shown to be strong in countries like the UK, market approaches have less explanatory force in Scandinavian countries, where the prevailing social democratic regimes have resisted this discourse to a greater degree (Brooks, 2018).

Psychological Perspectives

In Scandinavia, indeed, several researchers have preferred to draw on psychological perspectives by looking at educational choices as a process related to how students develop identities (Holmegaard et al., 2014b). This tradition has highlighted the need to understand choices as ongoing processes (Hutters, 2004), where individuals weigh different interests (Vulperhorst et al., 2019), as well as possible future horizons (Harrison, 2018; Harrison & Waller, 2018). Some of these studies have emphasized the role of late modernity (Beck & Beck-Gernsheim, 2002), arguing that this cultivates a view of the individual as liberated from class and cultural restraints and thus free to choose (Illeris et al., 2002). However, the view also implies that young peoples' educational choices should represent authenticity. That is, choosing a study programme should be an individual choice made by the young person alone and thus reflect his or her authentic self. The choice of a specific study programme, should furthermore reflect one's personality, making the choice not only a question of *what* to become, but *whom* to become. This also shifted the focus and the responsibility for choosing what was 'right' on to the individual (Illeris et al., 2002). However, the idea that young people are free to choose anything is, according to Illeris and colleagues, both impossible and incorrect:

> First, it is not possible to choose everything. No one can become anything, as this demands a lot of personal and social qualifications. There is a struggle for places, there are events that the individual cannot handle, situations that are experienced as unbearable, and there is no guarantee that happiness is at the end of the road you have embarked upon. It can quickly turn out that the road includes a lot of disadvantages and troubles (Illeris et al., 2002, p. 58 my translation).

Late modernity directs attention away from these constraints and therefore means that the young people are deprived of the possibility to understand limitations and difficulties as something linked to external structural conditions (Illeris et al., 2002). From this perspective, choosing is a process that is influenced and constrained by personal as well as social factors. Past experiences and background factors, as described earlier, are seen as playing an important role in diverse students' choices. While

choosing might be portrayed as an individual endeavour in the dominant discourse, choices are still embedded within social and structural constraints. The focus in this perspective is not to map the differences between diverse groups of students, but to look at students' own experiences and at how individual perspectives develop and change over time.

It is this latter tradition that I draw on in my thesis. Several researchers within the field of science education have also drawn on this tradition, in exploring why some students choose to pursue a science degree. It is to this work that I now turn.

Choosing Science

In research on science education, one question raised by several researchers is why some people choose to pursue a science degree while others do not, or decide to leave the field of science altogether. This has also been discussed as 'the leaking pipeline' in science and STEM[5] (science technology engineering and mathematics) research, a widely used metaphor that has resulted in policy initiatives designed to capture young peoples' interest and hold on to it 'before they drip out of the pipeline' (Lykkegaard & Ulriksen, 2019, p. 1600). However, this idea of a leaking pipeline has also been criticised for homogenising students as a single mass, failing to acknowledge intersecting identities and neglecting to capture the diverse cultural and contextual differences that influence students' choices (Lykkegaard & Ulriksen, 2019; Mendick et al., 2017; Metcalf, 2010). As in the higher education research, this question has been explored using a number of different disciplinary, theoretical and methodological approaches. Moreover, there are certain overlaps in the approaches and tendencies that exist between these two fields.

Studies exploring why some people choose to pursue a science degree and a career within science have concentrated on many of the same factors as those described in the literature reviewed above. Showing, for example, how factors such as socioeconomic background, gender, race and ethnicity can constitute barriers to participation and thus create inequalities (Archer et al., 2015; Barton & Yang, 2000; Holmegaard, 2012; Lykkegaard, 2015; Regan & DeWitt, 2015; Riegle-Crumb et al., 2011; Tytler & Osborne, 2012). A large number of studies have also highlighted the importance of social networks and interpersonal relations for students' choices, for example, with their parents, teachers, friends and peers, as well as prior encounters with tertiary science students and science professionals (Archer et al., 2012, 2020; Lykkegaard, 2015; Mujtaba & Reiss, 2013; Regan & DeWitt, 2015; Sjaastad, 2012).

Another large focus has been on how different attitudes affect peoples' participation in and choice of science careers (Regan & DeWitt, 2015), however an important point is that positive attitudes to school science do not necessarily translate into aspirations to pursue a science career (DeWitt & Archer, 2015). Given diverse political, social and educational systems, the challenges and barriers to participation in science differ between national contexts, as well as within the various disciplines and

[5] The literature distinguishes between science and STEM (science, technology, engineering and mathematics), and while there are differences, this is not a debate nor a distinction that is of relevance to the current study. Mainly I use the term 'science' because all three of the study programs I explore in this study are located at the faculty of science at UCPH.

levels of the educational system (Bøe et al., 2011; Henriksen, 2015). The literature I draw on here is primarily concerned with Europe and North America.

Science Identities

Over the last two decades, a growing number of studies have explored inequalities in science participation through a theoretical focus on identities. In accordance with the aims of this thesis, my focus here is on these studies, and especially on how the notion of identity has been used in understanding young peoples' choices[6].

The studies that have applied an identity lens have focused on various aspects, from 'intra-personal factors and sense of self and sameness to emphasising identity as rooted in external, social and cultural factors' (Lykkegaard & Ulriksen, 2019, p. 1601; Ryder et al., 2015). In line with the above studies, it has been shown how different personal factors, like being a woman, someone from a minority or a person of colour can be experienced as incompatible with the idea and discourse of being a science person (Tytler, 2011; Tytler & Osborne, 2012). Angela Johnson (2007), for example, described the barriers Maori women experienced to their continued participation in science. She argues that science practices advantage males, while disadvantaging females. The first step to changing this, she argues, is 'to recognize that science has a culture, and that certain types of students may find it challenging to understand and navigate this culture' (A. C. Johnson, 2007, p. 819). In a similar vein, several other researchers have looked at inequalities of gender in science from an identity perspective. Several of these studies have shown how such inequalities relate to the positioning of science as masculine, making it difficult for those who do not identify with dominant masculine norms to feel they belong or are recognized within the discipline (Allegrini, 2015; Archer & DeWitt, 2015; Brickhouse, 2001; H. B. Carlone & Johnson, 2007; Godec, 2018; Gonsalves & Danielsson, 2020; Hasse, 2000, 2002; Papafilippou & Bentley, 2017). Looking at science through this lens implies that science, and gender, is something *we do*, and to be recognised as a science person therefore implies doing science in a culturally acknowledged way.

An important contribution to the study of both gender and identities in science is the seminal work by Heidi Carlone and Angela Johnson (2007). In their paper, they develop the model of *science identity* in order to understand and make sense of the experiences of a group of successful women in science. Their model suggests that the construction of science identities involves three interrelated dimensions: performance, recognition and competence. Being perceived as a 'science person' thus requires not just specific competences, but also that individuals can perform in specific ways and that they are recognised by themselves and others as science persons. Identity, in this model, is understood as dynamic and changing over time in the interaction with one's surroundings (H. B. Carlone & Johnson, 2007). From this perspective, the choice over whether to follow a science trajectory or to leave the field entirely relates to the interaction between individuals and their social surroundings.

This model has been widely applied, and the concept of science identity has recently received new theoretical attention. In a recent paper, Lucy Avraamidou (2020) argues for the importance of seeing

[6] For more comprehensive reviews of studies on participation in science, see, for example, Lykkegaard (2015), Tytler (2011), Tytler and Osborne (2012) and Regan and DeWitt (2015).

science identities as intertwined with other identities and she suggest the concept of *intersectionality* should be used as a means of foregrounding this. Science identities, she argues, are connected with emotions and exist within a constant process of becoming:

> The process of becoming a science person is fundamentally a negotiation between our desired identities and the ones assigned by others, which for disadvantaged and underrepresented groups, quite often, these identities are in conflict with each other due to existing systems of oppression, inequalities, as well as social stereotypes (Avraamidou, 2020, p. 19).

In a response to Avraamidou's conceptual paper, Allison Gonsalves (2020) reviews the contributions that this expansion of the concept of science identities has given rise to. She emphasizes how Avraamidou draws attention to science identities as never complete, but as always on the move. Furthermore, Gonsalves stresses that actors encounter and accumulate different cultural resources, and that these 'afford or constrain possibilities for identity work' (Gonsalves, 2020, p. 348).

While I do not focus on class, ethnicity or gender in this thesis, I do draw on the framework of science identities and the perspectives on how these are negotiated and change in the interplay between individual, social and structural contexts. In short, I see the identity lens as a strong theoretical framework that can allow us to unpack the negotiation of different identities, including, but not limited to, gender or class.

Choosing a Science Bachelor's Degree

In relation to higher education, several studies also draw on psychological and identity-oriented traditions. One study, for example, shows how choosing a science higher education programme is related to experiences of failure and success with science, arguing that individuals are not always consciously aware of how these experiences influence their decisions (Rodd et al., 2014). This relates to how science is often perceived as difficult and how self-esteem accordingly plays an important role in students' decisions whether or not to pursue a science degree (Cleaves, 2005).

It has also been suggested that such decisions relate to students 'self-to-prototype' match, implying that they choose profiles they consider match their self-image (Taconis & Kessels, 2009). However, it has since been argued that there are different kinds of prototype matches, suggesting that, while some students relate to a specific discipline, others relate to more general ideas about being a university science student (Lykkegaard & Ulriksen, 2016).

Another strand of research has combined the identity lens with different models, the most widely used being the expectancy-value model developed by Jacquelynne Eccles and colleagues. In several papers, Maria Vetleseter Bøe, Ellen Karoline Henriksen and other colleagues (Bøe et al., 2011; Bøe & Henriksen, 2013, 2015) use the model as a means of understanding how students' choices relate to multiple factors, including the cultural environment, stereotypes that the student encounter, as well as personal beliefs, expectations, motivations and goals.

In line with the higher education literature I have described above, some of the studies of science education that deal with identity also highlight the role of late modernity. For example, Bøe and colleagues (2011; 2015) argue that late modernity has created the perception that young people in

highly developed countries have a large degree of freedom to choose. However, like Illeries et. al.'s previous study (2002) , Bøe and colleagues argue that in reality these choices are constrained by young peoples' backgrounds:

> This means that in reality, they may not make their life choices as freely as it might seem to them. However, their idea that they choose freely makes these perspectives highly relevant for understanding their educational and career choices (Bøe et al., 2011, p. 46).

Another prominent contribution in this area has been the work of Holmegaard and colleagues (Holmegaard 2015; Holmegaard, Madsen, and Ulriksen 2014a, 2014b; Holmegaard, Ulriksen, et al. 2014). In their study, they followed students from upper secondary school through their transition to higher education, looking at students' narratives of their choices and experiences of entering a science study programme. In their research, they highlight how choices are part of identity work and show how choosing is an ongoing process that develops as part of the relationship between the individual and his or her social context:

> The choice must appear unique, authentic and individual. At the same time, the narratives the students construct around their choice are being tried out and validated in the students' social network; they are told, revised, and adjusted based on how the social relations meet and inform the student narratives, but also according to whether the narratives are recognised as a legitimate identity match or not (Holmegaard, Ulriksen, et al. 2014:37).

The choice of what to study is thus perceived as an important decision that young people should make individually and take full responsibility for in that it should reflect their authentic selves – just as described earlier. However, this dominant discourse of late modernity neglects the insight that educational choices are still socially embedded (Holmegaard et al., 2014b).

In a similar vein, Eva Lykkegaard (2015) followed fifteen students from university-distant backgrounds over the course of four and a half years, from the middle of the students' secondary education through their transition into different bachelor's programmes. Lykkegaard looked at the students' reflections and choice narratives and, like previous research, she found that these changed over time. Students' interests come and go, and interests in science can diminish over time, as well as return. This amounts to an additional criticism of the leaking pipeline. As interests and narratives are not stable, students move both in and out of science trajectories (Lykkegaard, 2015; Lykkegaard & Ulriksen, 2019).

Several studies have also emphasized how specific identities are recognized in different disciplinary contexts. For example, there has been a large focus on physics (Danielsson, 2009, 2014; Gonsalves & Danielsson, 2020; Hasse, 2000, 2002; Johansson, 2018), and to some extend also on computer science (Peters, 2017) and engineering (Madsen, 2018; Papafilippou & Bentley, 2017; Stevens et al., 2008).

Summing up

The above overview of theoretical approaches serves to inform my own position within this literature, as well as my theoretical approach and my methodology. From my review of previous research, I take away six key findings in particular:

- Educational choices are processes that unfold over time. Young people consider their choices regarding higher education for a long time before they formally have to make the decision, and they continue to evaluate their choices even after entering a specific study programme. Thus, rather than studying choices as specific points in time, we must approach them as ongoing processes.
- Choosing a study programme and an educational trajectory is not just a question about *what* you want to become; it is also, and more importantly, a question of *who* you want to become. In this way, educational choices can be understood through an identity lens.
- Science identities relate to both personal competences, the ability to perform in a socially recognized way, and the way that individuals recognize themselves as science persons and are recognized by others as such.
- Late modernity has influenced how we perceive educational choices. These are mainly perceived to be an individual endeavour that should be unique and reflect personality and an authentic self.
- Even through choices are portrayed as individual endeavours, these are socially embedded. One's repertoires of possible pathways are informed by one's past experiences and social networks.
- Choices and (science) identities are constructed as good, desirable and legitimate in an interplay between individuals, their social surroundings and dominant social narratives.

Theoretical Approach

In the literature discussed here, we have seen that some studies focus on different levels from the psychological studies focussing on the micro-level of the individual, to studies looking at the meso-level of social interactions and the sociological perspective that emphasizes the macro-level of social structures and cultural discourses. In relation to the identity perspective and students' choices, an important point across these different levels is that the social surroundings plays an important role. This point, along with my anthropological background, has led me to question how choices in higher education take place between individual students and the social and structural framework of the study programmes. Using a composite term, I call this the institutional setting of the study programmes.

While young people's choices of study programmes involves beginning at a new educational institution, their choices of what to do after completing a bachelor's degree are made within a specific institutional setting. Often students will be able to continue in the same programme and thus to stay within the same social and physical environment. As the literature highlights the role of the social surroundings, I find it relevant to direct my focus towards the interaction between how students make choices and the institutional setting of the three bachelor's programmes examined here. Focusing on both allows me to examine differences and similarities across the three programmes as well as how choosing a master's programme differs from or has similarities with choosing to pursue higher education at the outset.

Given my fundamental interest in the interaction between individual students and the structures that surround them, I follow the epistemological approach that in anthropology has been defined as practice theory. The fundamental idea in practice theory is that, while structures inform social life, social life in turn constantly changes and reproduces these structures. In the work of Pierre Bourdieu (1977), practice theory was a response to earlier deterministic structural approaches, as well as approaches focusing on individuals as free agents. In contrast to these perspectives, practice theory proposes that social life is constrained by structures at the same time as it produces them. The relationship between structure and agency is dialectical, as structures form practice, while also constantly being formed, reproduced and reformed by practice (Bourdieu, 1977).

Practice theory has already been applied in the field of science education, for example, in the work of Heidi Carlone and Angela Johnson (2012). In their paper, they discuss different anthropological approaches to science education, including practice theory. They argue that in educational research practice theory is rooted in ideas about situated learning, networks of power and cultural production. The focus in this perspective is on the social level – how the individual exercises agency within the constraining structures of, for example, a classroom and the wider socio-historical context. In their words:

> Practice theory is characterised by its attention to both micro- and macro-level factors, its focus on how individuals exhibit agency within the constraints of larger-scale structure and its (anthropological) focus on patterned, rather than individual, behaviour […] Thus, practice

> theory attends both to larger societal structures and to the ways individuals exhibit agency in everyday practices, working together to fashion cultural meanings that may reflect, contest and/or transform meanings implied by those structures (H. Carlone & Johnson, 2012, pp. 156–157).

Looking at social interactions through this perspective thus means directing attention to how structures constrain what is possible, but also looking at how individuals exercise agency in navigating these structures, thereby challenging, contesting, reforming and reproducing them. Socio-historical meanings influence our present understandings, but at the same time these meanings are shaped through everyday local practices. Cultural meanings are thus not something that exists a priori; rather, culture is produced (H. Carlone & Johnson, 2012).

Summing up, this perspective directs our attention towards students' choices as interrelated with societal and local norms and structures, as well as being something students actively act to give meaning and form to in personal ways. I see practice theory as an epistemological offset to how I have approached students' choices both methodologically and theoretically. While in two of the papers that follow I also draw on psychological approaches to identity, I combine these perspectives with analytical attention to how identities are negotiated in interaction with the institutional setting of the study programmes. In each the four papers, I operationalize this fundamental perspective in different ways, through different theoretical lenses. These are elaborated in each paper, but I present a brief overview of them here.

In paper 1, I suggest looking at choice as wayfaring, and through this perspective, at how the institutional setting of the study programmes serves to constrain and enable students in constructing and pursuing different paths. In paper 2, I focus on students' choices by considering the roles of imagined futures and possible selves. This theoretical perspective draws on the identity literature to probe how ideas about the future influence present choices. The paper also examines how the structures of the different study programmes influence students' experiences of these choices and present them with different possibilities. In paper 3, I draw on theories of science identities to examine how these are challenged over time in interaction with what I describe as a culture of power. In paper 4, I focus on students' experiences of temporality and how in different ways they seek cracks and openings in the temporal structure – or, as I describe it, the temporal infrastructure – of the university. The latter paper stands out, as it does not directly deal with students' choices. It is a result of an analytical interest that arose during the fieldwork and in the following processing of the empirical material. The paper contributes to the thesis as a whole, by adding a focus on daily life at the university, students' experiences and some of the challenges they encountered.

	Paper 1	Paper 2	Paper 3	Paper 4
Theoretical approach	Choice as wayfaring	Choices as related to imagined futures and possible selves	Choices as related to the construction of science identities within a culture of power	Time as infrastructure

The four papers approach students' choices and experiences of their study programmes in different ways. However, they all examine the social interactions and students' ways of navigating between on the one hand their individual perspectives and desires, and on the other hand the institutional settings of the study programmes. By using different theoretical approaches, I have sought to illuminate my research question in different ways. Clive Seale (1999) describes how the use of different methods can provide different perspectives, and he propose the metaphor of a crystal, as this refracts beams of lights in several different directions. In the same manner, I find that the use of different theoretical perspectives, within the overarching focus on structure and agency, have allowed me to cast light on the problem from different angles. This has provided me a more nuanced understanding of students' choice processes.

Following the call made by other researchers (Holmegaard, 2012; Hutters, 2004; Lykkegaard, 2015), I have employed a longitudinal study design that follows students choice processes over time. In the following chapter, I turn to describing my methodological considerations and research design.

Chapter 3

Methodology

In this chapter, I present the methodological approach I used in my research. I describe the field and the fieldwork, and provide an overview of my empirical material and my analytical strategies. Throughout the chapter, I discuss my reasons for the different methodological decisions I have made.

An Explorative Approach

This research project is a qualitative and explorative study of students' choice processes. There are two main reasons for this particular methodological approach. First, as already mentioned, this study is part of a larger research project that combines different methods and approaches. This part of the larger project was thus defined from the onset as a qualitative study designed to add qualitative insights to the overall project. Second, as described in Chapter II, choice processes in higher education have previously received little attention. Applying a qualitative framework built on ethnographic fieldwork has allowed an exploitive approach that is open to unanticipated perspectives.

Ethnographic fieldwork is in its very essence exploratory, a way of studying that entails being open to the field. This does not mean that I entered the field without predefined questions or a theoretical framework, but rather that I allowed myself to pursue new perspectives and be surprised by the field (Malkki, 2007). This openness is an important aspect of the ethnographic method, as it allows the researcher to learn along the way and to incorporate new insights into the study. The anthropologist Kirsten Hastrup (1992) describes fieldwork as a 'voyage of discovery' that confronts us with answers to which we do not already know the questions. Thus, this approach acknowledges that we might not know what are the right questions to ask from the beginning.

This choice of approach has meant that I have allowed for changes in my research design. I have engaged with different theoretical perspectives that might aid in unfolding the empirical material. Empirically this means that, especially at the beginning, I have sought to maintain broad attention while writing extensive fieldnotes (O'Reilly, 2012). The open approach had implications for the way I related to my research participants. In interviews, for example, I always ended by asking students for advice regarding what other activities might benefit my understanding (see below, section on interviews).

Ethnographic fieldwork can be understood as involving a range of methods, most prominently that of participant observation (Musante, 2015). Kathleen and Billie DeWalt (2002) describe this as 'a way to collect data in a relatively unstructured manner in naturalistic settings by ethnographers who observe and/or take part in the common and uncommon activities of the people being studied' (DeWalt & DeWalt, 2002, p. 260). Defined as such, participant observation resembles the encounters with new situations and activities that are part of most peoples' lives, whether meeting one's new in-laws, starting a new job or travelling to another part of the world. In the beginning of such encounters we are often more alert, observing what is going on and how other people are behaving and interacting. Over time the setting becomes more familiar, allowing us to participate more actively. The difference, then, between these kinds of encounters and participant observation as a social scientific method is

the systematic use of this information in combination with an analytic approach and the attention paid to this learning process. By paying close attention to this process, we can begin to understand not only the explicit expectations that exist within the social setting, but also the more implicit norms (DeWalt & DeWalt, 2002; Musante, 2015). As part of my ethnographic fieldwork, I also conducted qualitative interviews with students from each programme. I return to a more detailed description of how I conducted my fieldwork using these methods, but first I present the selected study programmes and outline the field and fieldwork schedule.

Selected Study Programmes

In collaboration with my colleagues in the larger project, we selected three science study programmes at the University of Copenhagen (UCPH). These three programmes served as empirical focus for WP3 as well as my study – WP4.

The choice of three programmes in particular is connected to my focus on the Bologna process. Though it was known from previous research that some students did experience the bachelor's degree as an entity in its own right, we also knew that implementation of the 3+2 structure had had various impacts on various programmes. The three programmes were thus chosen to provide us with a broader variety (Flyvbjerg, 2006) in relation to students choices and the possibilities open to them. The fieldwork was thus multi-sited, both in the direct sense of taking place in several locations, but more importantly by connecting local understandings and practices with the larger perspective of the Bologna process within the EU (cf. Marcus, 1995).

We chose the three bachelor's programmes that offered similarities as well as differences. All three programmes are geographically located in the Faculty of Science at UCPH and share some institutional conditions. For example, in all three programmes the first year consisted of mandatory courses. At the end of the first year, students from all three programmes had to choose a specialisation, and courses in the second and third years included both mandatory and elective courses. All students end their bachelor's degrees with a bachelor's project on an elective topic within their discipline. Geographical proximity was also a practical necessity in that I carried out extensive fieldwork on all three programmes at the same time.

The three programmes differed substantially when it came to the trajectories they offered students at the end of the bachelor's degree. We identified three important circumstances that set the scene for students' choices in different ways. These relate to the structure of the programmes and the available job market. In accordance with the Bologna structure, all bachelor's programmes must give the student access to more than one master's programme (Retsinformation, 2003), but the number of such programmes varies. 1) Some bachelor's programmes have a master's degree as a direct extension that is often considered a natural continuation of the bachelor's degree. 2) Other bachelor's programmes do not automatically lead to a designated master's programme, so students must choose between a number of different continuations, none of which are considered to be more 'natural' than others. 3) A further circumstance that affects students' choices is the existence or otherwise of a labour market for bachelor's students within their specific fields.

The three chosen bachelor's programmes each represent one of these circumstances. The bachelor's programme in chemistry has a tradition of students continuing directly on to the master's programme in chemistry at the same department. The bachelor's programme in natural resources (NR) was established in 2005, after the Bologna declaration, and so was structured to suit it by creating a broader bachelor's degree leading towards several different potential master's programmes. A counterpart to these two programmes is the bachelor's programme in computer science (CS), where, due to the strong labour market for such degrees, students have an actual possibility to leave the university with only a bachelor's degree (or less).

For the purposes of my fieldwork, we chose to follow the second-year students. By the second year, the initial transition process into university has been completed, but students still have to decide what to do after finishing the bachelor's degree. The majority of students were still in the process of finding out which aspects of the discipline they found interesting and wanted to pursue through elective courses and potentially further into their master's programme. By deciding to concentrate on the second-year students, it was also possible to prolong the longitudinal aspect of the overall project. In WP3 and WP4, we could examine students' choice processes and at different stages of their studies in the second and third years, as well as beyond their transitions on to a master's programme. One outcome of choosing this perspective is the analysis in Paper 3.

The Field

The University of Copenhagen (UCPH) was founded in 1479 and is the oldest university in Denmark. It is a research-intensive university with almost 5000 employed researchers[7] and approximately 37,500 students (University of Copenhagen, 2016). It is divided into six faculties (science, health, social sciences, humanities, law and theology), divided into 36 departments. The university has four campuses in Copenhagen: North Compus, Frederiksberg Campus, South Campus and City Campus (see Figure 1).

The three study programmes are all offered in the faculty of science: CS and chemistry are located at North Campus, NR at Frederiksberg Campus.

In all three selected programmes students have mandatory courses throughout their first year. At the end of the first year, they have to choose a specialisation. The second and third years consistes of mandatory courses, as well as restricted and free electives. All the University's study programmes should give students the possibility to complete a semester abroad. This is typically done by placing free elective courses at the beginning of the third year and thereby creating what is called a 'window of mobility' (*mobilitetsvindue*). Some students also choose to use this window of mobility to do an internship.

[7] 9390 emplyees in total.

Figure 1: University of Copenhagen Campus Map

Chemistry

In the Department of Chemistry, 87 students enrolled in the bachelor's programme in 2017, this being the cohort of students I followed. Representatives from the programme management told me, that of these students, they assumed that only 30-35 would complete their bachelor's degrees. At the time of the fieldwork, around 60 students were still enrolled at the bachelor's programme. The chemistry students must choose between three specialisations at the end of their first year: medical chemistry, general chemistry, and high-school oriented. The latter specialisation is directed towards becoming a high school teacher. Very few students choose this specialisation. Depending on which specialisation the Chemistry students have chosen, they may change their choice of specialisation all the way until the third year.

Computer Science

The Department of Computer Science accepted 242 students into its the bachelor's programme in 2017. Whereas the other two programmes have a fairly equal gender distribution, computer science has a large overweight of male students. In the 2017 cohort only counted 30 women. CS students have to choose between three specialisations at the end of their first year: general computer science, data science and high-school oriented. Usually no one takes the third option. In practice, students follow the same courses for the first eighteen months. Then they specialise, taking up a total of only

37.5 ECTS. In computer science, this means that the students can change their specialisation until the second half of their second year, and even choose to use their elective courses to complete some of the mandatory courses from the specialisation they did not choose.

Natural Resources

Natural Resources brands itself as a programme that combines a social science perspective with a natural science perspective. The programme therefore differs a great deal from the other two programmes, which are both mono-disciplinary. Starting in 2005, Natural Resources is the newest of the three programmes. In 2017, 90 students enrolled in it. After the first year, when the students are presented with all the different disciplinary areas that the programme encompasses, they must choose between four specialisations: plant science, environmental science, nature management and environmental economics. Each of the four specialisations points towards a specific master's degree, but the connection between the specialisations and these master's programmes are of different strengths. Compared to the two other programmes, there is more variation in how many students continue on to the master's programme to which they have a legal claim.

The Fieldwork

Based on my initial interest in students' choices within the institutional setting of the university, my point of departure was the participants' lives as students and what happened on campus. I thus chose to follow two courses in each of the three study programmes so as to learn about the discipline and what was communicated by teasers and the curriculum itself. Furthermore, the courses served as a point of entry allowing me to get to know the students and their lives on campus.

In the faculty of science at UCPH, the year is divided into four blocks, each lasting ten weeks, including one so-called 'schedule-free week' (*skemafri uge*). This week is used for students who have failed the exams in the previous block to resit them. The other students use this week as a much-needed break from their studies. As the fieldwork was multi-sited, it was not practically possible for me to follow more than two courses in each programme. At the same time, choosing two different courses allowed me a broader perspective on the discipline. During the fieldwork, I also learned that the different courses offered different opportunities for my involvement, something that came to benefit the study (I elaborate on this below).

Several factors played into the decision of which courses to follow. I wanted to understand the choice process of different students and thus decided to follow courses that were either mandatory or that most of the second-year students would follow. Members of the programme management teams from each of the programmes aided me in this process, as they had insights into the different courses and thus could assist me in choosing a course where I would meet students from most of the different specialisations.

In practice, I also had to choose courses that were not taking place at the same time. At UCPH, courses are organised in a system called 'timetable groups' (*skemagrupper*). Each timetable group is allocated specific time slots so that courses in timetable groups A, B, C and D do not take place at the

same time (see Figure 2). In this way, departments can ensure that courses fit together time wise and that, for example, students' mandatory courses do not clash.

	Monday	Tuesday	Wednesday	Thursday	Friday
Morning 8 – 12	B	A	C	A	B
Afternoon 13 – 17	C	B	C	A	D

Figure 2: Schedule Groups

The only programme where it was not possible to follow a course that was mandatory for all second-year students was at NR. Due to the difference between the specialisations, the NR students only had very few mandatory courses across all four specialisations when beginning their second year. The two courses I chose to follow at NR were attended by students from the two largest specialisations in the programme.

Fieldwork Overview

The following is a sketch of the timeline of the fieldwork. It shows the timing of the different courses I followed and the order of the interviews I conducted. However, I also attended extra-curricular activities on the three programmes and thus spent time there during blocks where I was not following a specific course. In addition, I visited some of the other courses in the programmes, especially when students encouraged me to do so, in order to obtain a better impression of the programme. Interviews were scheduled to take place as depicted in the timeline below, however some interviews ended up taking place at the beginning of the following block. Many of the students had many activities to attend to, and flexibility was thus important in scheduling the interviews.

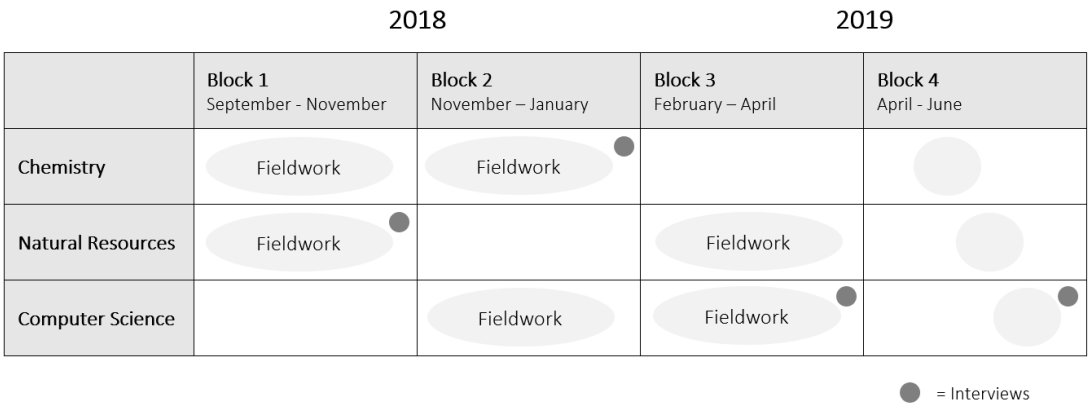


Figure 3: Fieldwork Timeline

Formal and Informal Access

Formal access to conduct the study was initially granted to me by members of the programme management team from each study programme. For each programme, we arranged a meeting during the spring before the fieldwork was due to take place. During these meetings, I also learned more about the programmes, giving me an important initial impression of the department and its views on students' choices and possibilities.

The second part of the more formal access was granted by the teachers who taught the selected courses. In my correspondence with them, I highlighted that I was not performing an evaluation of the course, that my project was not about their teaching and that I was a novice in their field of research. I wrote that I would be happy to elaborate further and answer questions, though most of the teachers agreed to my participation without asking too many questions. This might have been because of the formal access I had already been granted by the management team. However, when I met the teachers in person, I had more elaborate conversations with several of them about my fieldwork and about the respective departments.

All the teachers who were asked agreed to my presence on their courses and also allowed me to introduce myself to the students during the first lecture. In this way, I sought to make sure that students knew from the outset who I was and why I was there. I repeated my introduction at the first lecture of the second course I followed on the programmes, as not all students follow courses in the pre-set order. Some lecturers also forwarded the message on the online learning platform, including my email address, for students to contact me for more information or questions (no one used this possibility). In general, I encouraged questions as a key way of making my presence and purpose clear and promoting open dialogue with both students and university staff.

Obtaining formal access was crucial for the fieldwork, but as Tine Tjørnhøj-Thomsen (2003) points out formal access to an institution does not automatically grant the researcher access to the lives of those within it. Individual participants have to grant informal access, which is continuously negotiated throughout the entire period of fieldwork (Tjørnhøj-Thomsen, 2003). This kind of access was something that evolved over time as I got to know the students, they got to know me and became familiar with the purposes of the fieldwork. Essential in negotiating informal access was thus how I presented myself and how I both positioned myself and was positioned by people in the field (Hasse, 1995). I will elaborate on these topics in the following section, where I describe the fieldwork in more detail.

Arriving in the Field

Arriving in the field for the first time can be an unnerving experience. Even though my project design included both wider theoretical considerations and the practical aspects of selecting courses and being in the field, arriving in the there is something different. The field in this case was already familiar to me in many ways, having been a student at a Danish university only a couple of years previously. Nonetheless, stepping into an auditorium at the faculty of science was new to me, and I did not know what people would make of having an anthropologist present. Contrary to other accounts of doing ethnographic fieldwork at Danish universities (Hasse, 2000; Madsen, 2018), I did

not have the benefit of beginning with the first-year students, where no one knows each other, and social activities are often arranged to support students' socialisation processes (Gregersen et al., forthcoming).

In my initial introductions at the beginning of each course I followed, my aim was to present myself and my research and open up to questions and conversations. In these first encounters, students found my presence a bit odd, and some voiced uncertainties about what I would use the information for. This generally resulted in very good conversations about anthropology, studying, being a PhD student, writing a thesis, what I wrote down in my fieldnotes and what I noticed by taking part in the classes and other activities. The last topic was sometimes difficult, as in the mist of it all I felt unsure what exactly to share, found it difficult to explain early analytical thoughts and did not know what my analysis of the data would end up showing (O'Reilly, 2012). This was especially difficult in the beginning, but I over time found that I could use these conversations to share observations and benefit from the students' reflections (Flick, 2007; Lex, 2013).

I found these conversations important ethically and informative. Through the questions the students asked about the project and anthropology, I learned more about the discipline I have been socialized into and all the things that I have come to take for granted through this socialization. In the same vein, the conversations also taught me about the students and their perspectives on their own academic disciplines and doing research. Even though anthropology and ethnographic fieldwork were unfamiliar to most of the students, the role of being a PhD student was not, offering me a familiar position (Hasse, 1995). Being a white, native Danish female in my early thirties meant that I fitted in with the majority of the students. I was older than the majority of the students, but some were older than me, which meant that my age did not make my presence stand out as odd. I even experienced situations in which a teacher or a student had forgotten that I was not a regular student on the programme. However, not having a background within the natural sciences still made it seem natural for me to ask about a lot of things, and I would often express this by saying 'this might be a stupid question, but what should I wear in lab' or 'what does that refer to' or 'what is the difference between this and that'.

Participant Observation at the University

In my project, doing participant observation meant participating in both academic and social activities with the students (for an overview of the empirical material, see Figure 8). The different structures and the social environment of the programmes offered different opportunities to observe and participate. Some of the courses had large-scale lectures with little or no student activation and thus offered very limited possibilities for small talk and interaction. Likewise, some tutorial classes had strict schedules and were organised with common activities and no group work. Conversely, lab exercises proved to be a valuable way of getting to know students better. The exercises often included waiting time for the students, and thus offered time for conversations both between the students and between them and me. As I had never had lab exercises during my own studies, I could easily take on the role of the novice and ask a lot of naïve and at times dumb questions (DeWalt & DeWalt, 2002), thus gaining an insight into what was going on, what students found interesting and what they were occupied with at the time (Konopinski, 2014, p. 25).

By participating in these formal activities, I soon learned about the other social and informal activities that were taking place on campus. Some of the students acted as 'sponsors' (DeWalt & DeWalt, 2002) by inviting me to participate and making me aware of activities I could join. Especially my participation in these more social and informal activities felt like breaking points in building relations with the students. The social activities I participated in included both extracurricular activities arranged by the faculty, the departments and the students themselves.

For example, I participated in an annual information day providing information about master's programmes arranged by the faculty. The vignette, that I began the introduction with, is a description of this event. I also participated in information meetings about possible elective courses, doing a semester abroad and career possibilities, arranged by the departments. Some of the annual parties were also in part arranged by the departments, for example, the yearly gala party at the department of chemistry.

The students also arranged many different social and academic events, in several of which I participated. At NR and CS, the students had formed several groups or associations based on shared interests. For example, the NR students had an association for students interested in sustainable farming. The group shared links to upcoming conferences and arranged excursions to different sites and farms. I participated in two of these excursions. At CS one of the groups I joined for one of their meetings was a hacker group. Here I learned more about what hacking is and IT security and I tried to solve some of the beginner challenges.

One of the eye-opening student-organised events was the annual revue at CS and Chemistry. I participated in the entire process of planning, preparing and staging the chemistry revue. Personally this was a fun experience, but more importantly all the different sketches and jokes provided great opportunities for me to gain a better understanding of the context and cultural knowledge, that is part of humour (Berge & Johansson, 2020). More than once, I was left wondering about the point of a joke and had to ask students why something was funny.

Parties and Friday bars were also a great way to get to know people in informal settings, and to learn about general topics of conversations and what occupied the students. Sometimes this was an upcoming exam, a sports event, the selection of elective courses or the planning of a party. This were places where I drank beer with the students, danced and enjoyed the evenings. The informal atmosphere (and maybe the involvement of alcohol), resulted in long conversations about topics related and unrelated to my research interest.

Following the students in these diverse settings provided access to learning how students, teachers and other staff talked about the discipline, students' choices and the future, and how they acted and interacted. By participating in the daily activities, I also gained a better understanding of the implicit expectations connected with being a student within that specific programme (Ulriksen, 2009).

Across the three programmes, there were more than 300 second-year students. On top of this there were students from the other years whom I came to know through the extracurricular activities. The relationships I formed with the students were thus very different. Some students I never got to talk to, even though I recognized them from the lectures, others I only talked to a few times, and with yet

others I developed a confidential relationship. Some students also seemed somewhat reluctant to talk to me. In the case of most of them, my impression was that this distancing slowly changed, as I participated in classes on a daily basis as well as in other kinds of events, and also had the chance to explain more fully about my presence and project. I consider the difference in the kinds of relations I developed with students to be one of the premises of doing ethnographic fieldwork. As someone who had obtained formal permission to participate in academic activities, keeping a distance was also a way of students deciding for themselves whether they wanted to take part in my project.

The different kinds of relations I developed were also related to who I am and how I engaged with the students (Marshall & Rossman, 2011). Doing fieldwork is a matter of using yourself in order to understand and learn about someone else. As Tine Gammeltoft described it, 'Human experience can only be understood through human engagement. We understand the experiences of the other by drawing on our own and momentarily enter into their world' (Gammeltoft, 2003, p. 284, my translation). This means that I have engaged with the students in a different way than someone else would, as we draw on different experiences, understandings and assumptions (Agar, 1996). For example, even though I did start learning a programming language during my fieldwork, my position would most likely have been different had I already had some skills that would have allowed me to engage in some of the more discipline-specific activities.

Long Days at the University

One day during the fall, I was walking from one building to another together with one of the chemistry students. We had just attended a two-hour theoretical lecture, and I was happy to get out into the fresh air before our next class began. Alice and I were talking as we walked, and the topic of my research came up. Alice looked at me and asked curiously, 'Are you writing down that we are tired'? To me this was an interesting question, and I had to consider a moment before I answered 'No, not as such'. I sometimes wrote down that I was tired and that others around me seemed to be tired too. I did not keep account of when people were tired or not. I explained this to her and that I thought, that experiencing stuff like that, was part of what doing fieldwork could contribute with. I continued, 'I believe some people, who have never tried to sit through a two-hour lecture, might not know or understand that it can be really tiresome and hard to keep concentrating'. Alice let out a loud sigh, agreeing 'Yeah! It can be so hard'. The conversation continued into a discussion of their schedule and the issue of finding time for studying, having a student job and seeing friends. Finally, we reached the other building and headed in, to sit still and listen for another two hours.

This is an example of one of the many conversations I had with students about both my project and the methodological questions of what I learned from being present and what I was writing down when I took notes – as I was clearly not writing down the equations or chemical reactions shown on the power points or blackboards. The topic of being tired and sitting through long lectures, however, is also an example of the kind of embodied knowledge that participant observation can provide (Bundgaard, 2003; Ingold, 2016; Musante, 2015; O'Reilly, 2012, p. 96). Alice's reaction made it crystal clear to me that she knew exactly what I meant. Sometimes we both felt tired during the lectures, as we started or ended the day with a long lecture with limited student activation and the soft humming of the ventilation installation in the background. Students being tired was not something that I meticulously noted in my fieldnotes, but I have several entries in my notes where I describe my own

state of mind and comment on how I was experiencing the atmosphere. Alice's question points to something that was not directly part of my research questions, but it is an important part of the experience of being a student – an experience that Alice probably would not have highlighted had I asked her in an interview what being a student was like.

Through the fieldwork, I experienced students being happy, concerned, anxious and sad. I laughed with them, and I experienced the exhaustion after spending four hours in a lab or several hours in long lectures. I experienced how fast eight weeks can feel, from the beginning of a course until the teacher suddenly starts talking about exams. I did not take the examination with the students, but when they talked about how fast a block goes, I knew in my body what it felt like. It was some of these insights, which sparked my interest in temporality, and resulted in Paper 4.

From Stranger to Dance Partner

From my anxious feeling on the first day, and being a stranger among people who all knew each other, I slowly got to know people. I learned where to get coffee, where the different auditoriums were located, what it means to use plant keys to identify different species and how to 'talk to the computer' and make it print 'hello world'. I learned what to wear in a lab, that not all chemists work in a lab and that some spend the days in front of computers coding (yes, I was quite surprised). I also learned that ordering a 'GT' in the Friday bar would not result in a Gin and Tonic but a 'Gold Tuborg' (a special kind of beer), which I learned was the appropriate drink to drink. My experiences changed from feeling awkward when I stayed for a beer or decided to hang out on campus to wanting to stay at parties to dance all night (a desire I thought I had left behind with my own days as a bachelor's student). Slowly the campus, the people and the different ways of socialising felt more familiar than strange to me.

Even though I knew the language spoken – mainly Danish and in some situations English – I still learned new expressions, words and pronunciations (O'Reilly, 2012), sometimes without being completely aware of it. For example, I began saying 'lab' pronounced as if it were a Danish word, which I did not realise until a fellow PhD student, from my own department, pointed it out to me. One of the situations in which I became very aware of this transition was during the final rehearsal for the computer science revue. The different revue groups from each of the study programmes at North Campus helped in the preparations for the other groups' respective revues. One of the ways they did so was by showing up as an audience for the final rehearsal before the premiere. Together with the chemistry revue group, I thus watched several of the other groups' rehearsals. This was also the case for the computer science revue, where I had also been helping out by making a few of the props. To my surprise, I found myself laughing at sketches that the chemistry students did not catch the meaning behind, and I found that when one of the chemistry students asked me what the joke was, I could explain the phrases and why it was funny.

When the year dragged to its end, I felt rather odd. I finally felt 'at home' in the field, and now my fieldwork was coming to an end so quickly. In her thesis on engineering students, the anthropologist My Madsen (2018) describes how she became a part of what was going on, not just because she was sharing time and place with the students, but also by taking an active part. She became part of the community of first-year students also emotionally. In much the same way, ending my fieldwork meant

not just ending my routine of biking to Frederiksberg or North Campus, but also stepping out of a community that I finally felt I had become a part of. This feeling was mitigated by the fact that several of the students were leaving to study abroad for half a year at the same time, and so the group of students I had come to know also spread out to different places – both abroad and to participate in elective courses in different departments. I keep in contact with some of the students, just as I have also gone back to see the yearly revue.

Interviews

Who, Where and When

During fieldwork, I interviewed eight students from each programme. I selected my interview participants based on variations in gender, students' selected specialisations and my preliminary insights into their choice procees. When I asked a student to participate in an interview, I mainly did so in person or through email. All but one of the students I asked agreed to participate: the participant who refused initially agreed to participate, but later backed out due to exams and a packed schedule.

Four of the interview participants were students with whom I got in contact with via Facebook. My first intention was to select students based on the courses I was following, but during one of the interviews with a NR student she encouraged me to interview students from all of the four NR specialisations, as she thought NR was such a diverse programme and that it would benefit me to incorporate these perspectives. Based on this advice, I wrote a post in the NR year-group's Facebook page[8]. Likewise, at computer science I decided to write a Facebook post to look for participants studying at the smaller specialisation, as I had not met anyone studying it at that point.

The majority of the interviews took place on the campus in accordance with each of the students' wishes. Two interviews took place at the Department of Science Education and one at my home. For the interviews conducted on the campus, we would often spend the first ten minutes looking for an empty space to sit, as the campus was often filled with students. Sometimes the interviews thus took place in one of the smaller rooms meant for group work, and sometimes in a larger classroom. The interviews also varied in length from forty-five minutes to just over three hours. This variation was a result of how each interview progressed and how much the interviewed student included in their descriptions. As described below, the interviews were kept open, and the conversations thus progressed in different ways, leading to variation in content and length.

The 25 interviews took place at different times throughout the year, and thus the different choices were more or less distant for the students. The first interviews I conducted took place in the first block, and some students were still considering changing the specialisation they had just embarked on. For students who had decided to do a semester abroad, this would typically take place in the first half of their third year. In the interviews I conducted in block four, such stays felt closer to the

[8] I did not succeed in arranging an interview with a student from the smallest of the four NR specialisations, but I did interview two students from the specialisation that I did not follow through courses. Likewise, I never found a computer science student who had chosen the high school-oriented specialisation. From what I learned from the students, no one on their year group had made that choice.

students, and they had often begun to consider topics for their bachelor's projects. The timing of the interviews thus had an impact on the considerations the students had and what were their most pressing concerns in relation to their study paths.

The relationship between when the interview took place and students choice processes also differed across the study programmes. Because the NR students were divided into their chosen specialisations earlier, I assumed that considerations regarding their choices would be more prevalent earlier on in this programme. Conversely, the CS students had to choose a specialisation at the same time as the NR students, but they would follow the same courses in the first eighteen months of their studies. Based on these differences, I chose to interview the NR students first, followed by the chemistry students and then the CS students.

These assumptions proved to be correct. I found it highly beneficial to interview the NR students early on, while many of the CS students had not given the master's programme a lot of thought at that point in time, becoming more concerned about this towards the end of their second year. As described in Paper 2, these structural differences influenced how pressing the different choices seemed to students, as well as how consequential they experienced their various decisions.

The different timing of the interviews meant that my perspective changed as I learned more about the field and got to know the students. Over time I also developed a better sense of the topics I wanted to investigate further in the interview situations (Bundgaard, 2003; Fontein, 2014; Sanjek, 1990). Whereas the earlier interviews helped me get to know the students and thus engage with them further, the later interviews offered me more possibilities in terms of asking about previous informal conversations and events (DeWalt & DeWalt, 2002; Fontein, 2014). Thus, I experienced advantages and disadvantages in both cases.

Interview Approach

The interviews were casual, often helped by the already established relations between myself and the participant, as well as the typically informal setting. Before the interviews, I reminded students of the purpose of the study and promised anonymization. I also asked if they had any questions before we began and asked permission to record our conversation. After turning on the recorder, I started each interview by asking the students to tell me a little bit about themselves. This opened up the interview from the beginning and prompted very different perspectives to emerge. This is an example of the beginning of an interview with a computer science student:

> Interviewer: Okay. I thought, if you could begin by telling me a bit about yourself, what you are doing besides studying and such…
>
> Student: Yes. Well, I have studied computer science for some years. I started in [name of place] and studied there. And I was actually quite happy about that. What ruined it a bit was that I had a partner, who all of a sudden moved to Copenhagen, and there was a lot of group work, which made it a bit tough, because they wanted you to be there all the time… but I wanted to visit her and stuff like that. So I began to perform poorly… [he continues]

The student continued explaining about the differences between studying computer science at the other university where he initially began and studying at UCPH. He had met someone studying computer science at UCPH, and this led him to drop out, move to Copenhagen and start all over again. The long explanation following my question included considerations about the study environment at the department, student organizations, his private life and hobbies. I might have learned these things about him through some of the other questions in my interview guide, but what struck me was the often long and elaborate stories this question opened up, including many things that would not have occurred to me to ask about directly. This opening also allowed students some degree of influence over the initial direction of the interview and encouraged them to highlight perspectives that they found important in their lives.

The interviews were semi-structured based on an interview guide with five main themes and subsequent questions to prompt the conversation. The open question at the beginning of the interview meant that from the outset these took different directions and that we approached the five main themes in my interview guide differently. The five themes were:

- Choice of bachelor's programme
- Choices during the bachelor's programme (specialisation, elective courses etc.)
- The experience of being a second-year student
- Perceptions of the field of study
- Future possibilities

Sometimes the opening led directly into a conversation about the participants' choice of study programme, while at other times we proceeded directly into the theme of being a second-year student. Throughout the interviews, I prompted, asked students questions and directed the conversation towards my themes of interest, but I changed the order of the different topics according to the flow of the conversation, just as I also pursued other topics that came up during the interview (Kvale, 1996; O'Reilly, 2012). In most of the interviews the conversation flowed, and it was possible for me to listen, ask questions and prompt the student without paying much attention to the interview guide. Before finishing the interview, I would look through the guide to make sure that I had covered the themes and any additional questions that I had prepared for the specific participant.

I ended all of the interviews by asking students first, if they had anything further to add, anything they though it important I should know concerning studying at the programme and the choices they had to make. Second, I asked whether they had any recommendations for me in respect of my fieldwork and research, for example, if there was anything they thought I should participate in. I followed several of their recommendations, but not all as some did not make sense in respect of the scope of my project. By asking the students for advice, however, I used them in a sense as experts on the study programme and the different activities that took place there. Like in many other situations, I myself took on the role of a novice (Bundgaard, 2003; DeWalt & DeWalt, 2002).

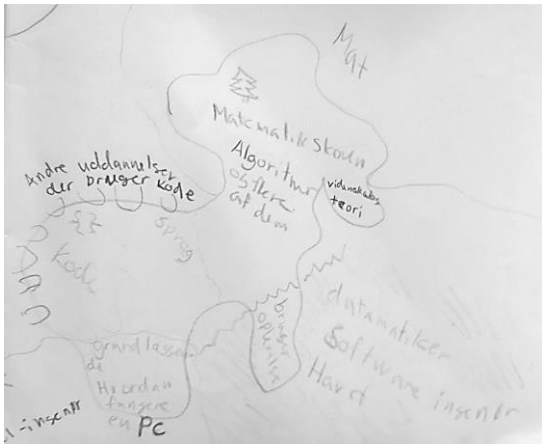
Visual Methods

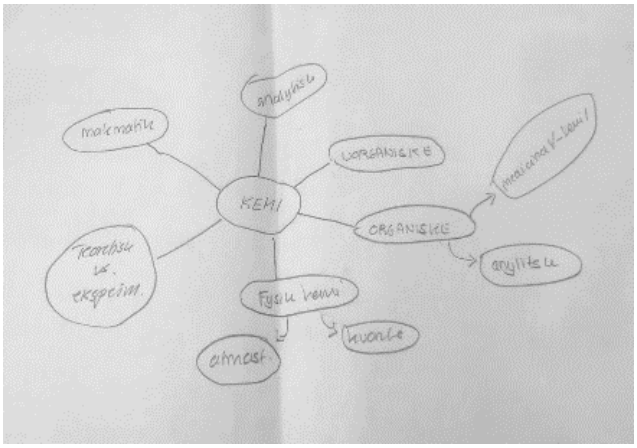
In planning the interviews, some of my methodological considerations concerned how I could best approach the topics of the future and legitimate positions within the study programmes. I was

interested in understanding the considerations underlying students' choices, their perspectives on the future and how these related to dominant norms of what was considered desirable, recognizable and legitimate within the different programmes. However, I was cautious, as I did not want to imply that some paths were more desirable than others, nor did I want to imply that, for example, students should consider the future or have an elaborate career plan (cf. Henderson et al., 2019)[9].

In order to deal with these challenges in approaching these topics during the interviews, I found inspiration in visual methods (Adriansen, 2012; Bagnoli, 2009; Mikkelsen, 2005) and person-centred interviewing (Levi & Hollan, 2015). This led me to design two illustration exercises that I carried out with students during the interviews. I expected that the visualization could support the discussion of these abstract topics, and that the physical exercise of having pen and paper between myself and the participant would aid the conversation by creating a shared project, thus making the co-construction aspect of the qualitative interview physically explicit (cf. Adriansen, 2012; Adriansen & Madsen, 2014).

In the first exercise, I asked students to depict their study programme and its different sub-fields. I asked them to think about their discipline as a country with different areas, and then depict what it would look like, drawing a map over the different parts of the field. An interesting thing about this exercise was that a number of the students initially looked quite sceptical at this suggestion, but as they begun, they typically immersed themselves in the exercise, and drawing the map gave rise to interesting explanations. When the participants started drawing, I prompted them to talk and comment on the illustration as they slowly added things to it. Sometimes these illustrations depicted what looked like countries with borders, while at other times the illustrations took the form of mind-maps. I sought to make it clear along the way that there was no 'right way' to make the illustration and that they were free to depict it in any way they liked. The maps aided my understanding of the discipline and often aided the conversation that followed, as we had something to point to when discussing the discipline. When describing their own interests, several students also spontaneously used the illustration, by placing their own interests on the map.





[9] Also discussed in the methods section in Paper 2.

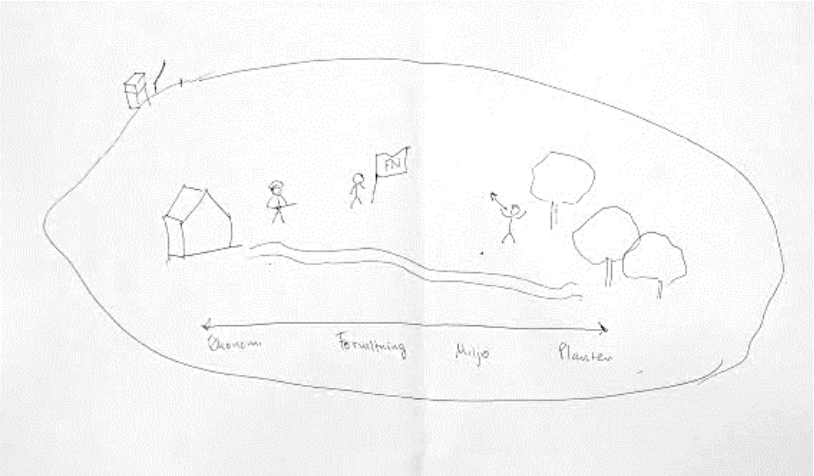
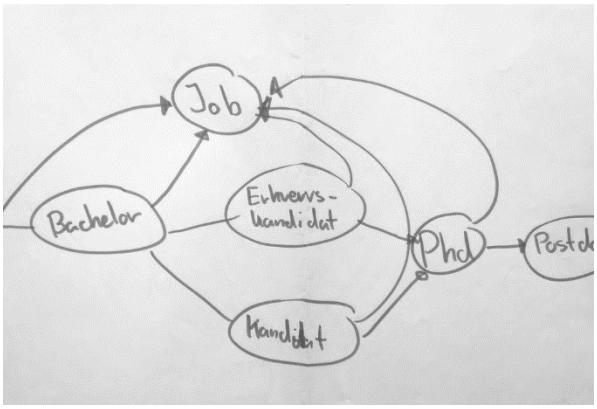
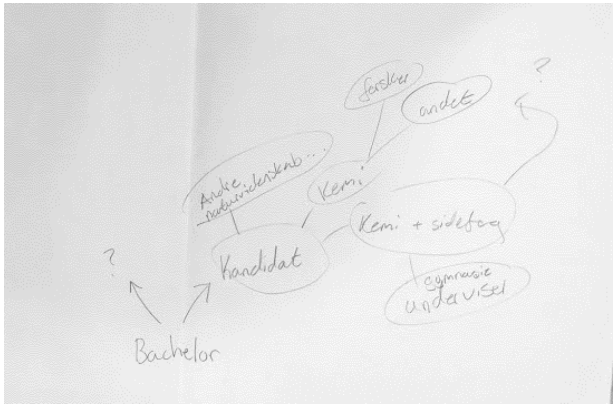


Figure 4: Student's drawings of their fields of study

In the second exercise, I asked the participants to depict the future paths they could pursue with a bachelor's degree from their study programme. Most often the interview unfolded so that this exercise followed the other exercise, by which time the participants had a better impression of the nature of the exercise I was asking them to engage in. These drawings often looked like mind-maps, the end of the bachelor's degree being a point from which other paths branched out. However, the size of the tree, or rather the number of different paths, differed considerably, with the NR illustrations showing many more paths than the illustrations made by the CS and chemistry students. One interesting and unexpected way in which this exercise often evolved was that, without prompting, students added arrows from possible master's programmes towards possible career paths (see also Paper 2).





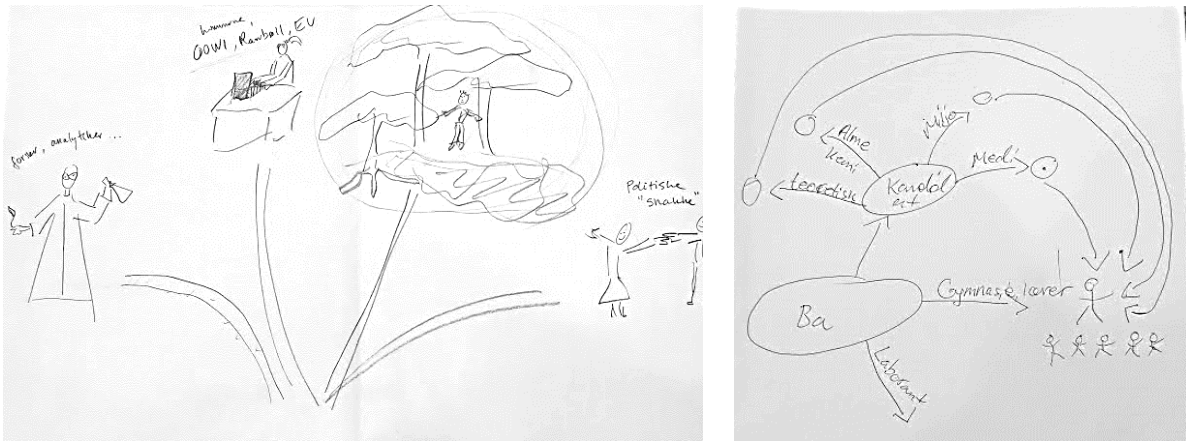


Figure 5: Student's drawings of possible future paths

The aim of these exercises was to use them as a way of engaging students in the conversation. Thus the focus was not so much on the specific drawing as the conversation this opened up (Mikkelsen, 2005). Hence, I did not push students who did not engage in the exercise or who seemed to feel uneasy with my request. The results of these two exercises varied, from elaborate illustrations that gave rise to a lot of questions and reflections to small doodles or a few lines on the paper. A few times I skipped the exercise all together, as a conversation was already flowing around the topics, and I feared the exercise would interrupt rather than aid the conversation. In most cases, however, the exercises gave rise to very interesting conversations and brought up the topic of the future in a way that made it possible to talk about desired paths and challenges.

In approaching the topics of the future an socially legitimate paths, I also found inspiration in person-centred interviewing (Levi & Hollan, 2015). In this approach to interviewing a distinction is made between questions that position the participant as an expert witness on a specific community or practice, and questions that focus on the participant's own experiences of these practices (Levi & Hollan, 2015). In the second illustration exercise, this resulted in an approach where I first asked students, as experts, to illustrate possible paths. Following this, I could turn the topic towards their own considerations about the future and (un)desirable paths. I also asked about paths that were less travelled and whether any of the possibilities were seen as less attractive. By doing so, I sought to understand the relationship between students' dreams and hopes for the future, and how they related to what was recognized within the study programme.

This approach resulted in some very interesting interactions with the interviewees. For example, when I asked the CS students if there were paths that were considered undesirable or that people would find weird if someone chose, this resulted several times in students unhesitatingly pointing at front-end programming and human–computer interaction (HCI). At the time of the interviews, this was not a surprise to me, as it had become clear through other conversations, but students immediate reaction on this point underlined its significance. There were students who liked these areas of the discipline, but their descriptions indicated it could be challenging to have these interests, as they were not part of the dominant narrative among students at the programme. In a similar vein,

the high-school teaching option stood out in my interviews with the chemistry students as something less desirable. Conversely, at NR there were so many paths, and such a variation between what students wanted to pursue with the bachelor's degree, that no path stood out as undesirable or illegitimate[10].

Reflections and Transcriptions

Every time a student agreed to participate in an interview, I felt immensely grateful. Not only did these students, who most of the time had many things to attend to, agree to spend their valuable time with me, they also went to great lengths to answer my questions and share their experiences, reflections and perspectives with me. Thus, I often felt overwhelmed when students thanked me at the end of an interview. I have read descriptions of how interviews can be experienced as a reflective space for students (Barber, 2014), but experiencing being thanked for something I felt they were giving to me still felt special. In this respect, the interview situation was also a way of engaging in a reciprocal relationship and giving something back, as when I shared insights with students and others from the field (DeWalt & DeWalt, 2002; Marshall & Rossman, 2011). The recorded interviews were transcribed, some by myself and some by three student assistants, whom I provided a transcription guide in order to ensure consistency between the four of us.

Fieldnotes

The primary empirical material from my fieldwork consists of descriptive fieldnotes (Emerson et al., 1995; O'Reilly, 2012; Sanjek, 1990). My approach to writing notes differed, according to the situation and the activities. In lectures where everyone was taking notes, I could often write down more elaborate notes right away. During lab exercises, excursions and social events, I would more often make jottings (Emerson et al., 1995) during the activities and then expand them into descriptive fieldnotes later the same day or the next morning. My busy schedule meant that I sometimes felt exhausted, and sometimes I waited too long, which showed up in the fieldnotes as I no longer recalled the exact meaning of my jottings. Roger Sanjek (1990) describes this as 'cooling notes', as jottings over time lose their meaning for the researcher if they are not written out into elaborate fieldnotes. Our memories becomes blurred, the notes oversimplified (Sanjek, 1990).

Depending on the different situations and activities, I either took notes on my computer, in a notebook or on my phone. I soon learned what was appropriate where: for example, during my very first lecture at the department of chemistry, it very quickly became obvious that opening my laptop during a chemistry lecture made me look rather odd:

> I have arrived in good time and sit down on one of the wooden benches in the auditorium. There are only a few other people, and someone in front of me is sitting with a laptop in front of him. I take out my own laptop, while more people arrive. As I look around, I realise that the person in front of me, has put his laptop away and that everyone around me are ready with blocks of paper and pencils. I fold down the screen of my laptop and shove it back into my

[10] Paper 2 unfolds this analysis, focusing on the study programmes of NR and CS, while Paper 3 discusses the case of high-school teaching in the chemistry study programme.

> backpack, replacing it with a notebook that I now feel very glad to have remembered (Fieldnote, September 2018).

I learned that students in the three programmes had very different ways of taking notes (or not) during lectures. The chemistry students explained to me that writing down chemical equations on a laptop was too slow, and that writing them down by hand also gave them a better feeling about what they were doing. I thus continued writing down fieldnotes in a notebook during chemistry lectures, but would normally use my computer during classes and lectures with the NR and CS students. When I made jottings, this would normally be in a smaller notebook or on my phone.

At the beginning I tried to note everything down, but as several researchers have pointed out, this is impossible to keep up, as the task of writing notes can easily exceed the time spend in the field (O'Reilly, 2012; e.g. Sanjek, 1990). My initial fieldnotes includes descriptions of the campus areas, of my first impressions of the place and people, of conversations, of examples used by the teachers and things I did not understand or found curious. Later in the process, as I came to know the field better, I became more focused. Throughout the fieldwork, I continued noting down interesting conversations, the unfolding of events, my experiences, analytical thoughts and things that surprised me. In my notebooks I also made drawings of the physical setting, analytical ideas and chemical molecules – I somehow felt myself drawn to trying to note down the hexagons like the students around me, trying to understand what they meant when they said that it required practice to write chemistry.

I also wrote down fieldnotes immediately after each interview. I wrote down my initial impressions of the conversation, how I had experienced it, whether something had surprised me, what I found interesting and, if relevant, how the student had used specific gestures during the conversation. For example, in my interview with the NR student Max, I founds that he had a very expressive body language, which supported his statements. He knocked his hand on the table to emphasise a point, moved his arms as if he was running to describe his eager motivation, and he showed by placing his hands to his throat how the idea of becoming a specialist within a narrow topic felt like being choked (also discussed in Paper 2).

During the fieldwork, I took a lot of photos with my phone, both during the formal teaching activities and during extracurricular and social activities. These pictures worked as photographic fieldnotes (K. Rasmussen, 2013). My primary use of these was to recall situations, experiences or a certain atmosphere. They represented specific observations or impressions and helped me when I was later writing my fieldnotes. I also find that these have been useful in presenting my material, as they give a visual impression of the field and my fieldwork (cf. K. Rasmussen, 2013). I thus display some of these pictures throughout this thesis.

Ethical Considerations

One of the main ethical considerations in doing qualitative research is communicating what people are agreeing to participate in (e.g. DeWalt & DeWalt, 2002; Marshall & Rossman, 2011; Musante, 2015; O'Reilly, 2012). How do I, as a researcher, make sure that the participants know why I am there? How can I make sure that they know what I am doing and what I will use the information for. This question is especially important when doing ethnographic fieldwork, as this method relies on the

researcher to build relationships with the participants. This places the researcher in a powerful position, one that demands care and attention so that trust and confidence are not violated (Fluehr-Lobban, 2015).

As already described, one of the ways in which I have sought to deal with this concern is by making presentations at the courses I participated in, as well as through written posts on the online learning platform and on social media student groups. Also, I continuously engaged in conversation with students about these topics and encouraged them to ask questions. Still, as time passed and the students got used to my presence, they treated me more and more like one of them, and in doing so, sometimes likely did not think about the purpose of me being there. This in an inherent dilemma in ethnographic fieldwork. On the one hand, we as fieldworkers want participants to know and be aware of the purposes of the research, while on the other hand we want them to get used to our presence in order to allow us to become a sort of insider (DeWalt & DeWalt, 2002; O'Reilly, 2012).

This dilemma relates to the method of using oneself as a way of understanding other people. As already noted, fieldwork is a method that depends on personal engagement with the participants and on the researchers' personal background and experiences (Agar, 1996; Gammeltoft, 2003; Marshall & Rossman, 2011). The role of a researcher is not distinguishable from who one is as a person, and being in the field thus also, as described, involved personal and emotional engagement with the field. It was not always clear to me where the different roles began or ended, as the line between 'me as a person' and 'me as an anthropologist' became intertwined and at times blurred (cf. Madsen, 2018). Sometimes, especially during festive situations, someone would ask me, 'Are you doing research right now as well'? The answer to this question lies somewhere in between my different roles. Participating in different kinds of events, in particular in social and festive events, allowed me and the students to get to know each other better. The fact that we gained shared experiences made it possible for me to take on a different role in more formal, academic activities, a role that allowed me to ask questions and participate. However, as I got to know the students on the three programmes, I also came to enjoy their company, and I truly enjoyed the festive occasions, dancing, singing and partying along with them.

There were also situations where my role as a researcher became more explicit, reminding students of my purpose in being the field. When I attended tutorials with the students, these would most often consist of them working alone or in groups on different tasks like solving a programming problem or working on chemical equations. There would be a tutor, typically a senior student, present to help and answer questions, and most of the time everyone would be focused on the tasks to be solved. In these situations, I used the time to read articles, write fieldnotes and answer mails. Students would often ask what I was doing during these tutorials, and then my position as a PhD student or researcher became more distinct. Likewise, I experienced the interviews as valuable reminders of the purpose of my research for the students (cf. DeWalt & DeWalt, 2002; O'Reilly, 2012). I found that in general the interviews brought me closer to the students, in the sense that we had had a shared experience and an often longer and more intimate conversation than in other situations. Even though I talked with students about the purposes of my research and asked questions in other situations, the interview situations in particular seemed to contribute to their understanding of my research interests and thus helped demystify my role as a researcher.

The concern with communicating the purpose of my presence in the departments became more difficult with respect to the wider communities of students, who I got into contact with in different ways, primarily through social events and activities. How, for example, could I participate in a Friday bar and be sure that the people I talked to knew who I was? Most of those with whom I engaged in these situations were students I already knew, and they knew me. When I met new people, I mentioned my purpose in being there, which often came up quite naturally in the conversation, as it was common for students in these encounters to ask which study programme someone belonged to. Sometimes, however, I also participated in, for example, parties, with a lot of people, music, dancing and alcohol. In these situations, where I met people I did not know, I tried to keep conversations to topics that did not include sensitive information. In this way I sought to avoid someone unknowingly sharing personal information with me while they were in a state where their judgement might be different than during less festive situations (cf. Madsen, 2018).

The empirical material on which this thesis is based has thus been created with the knowledge of my participants. Nonetheless, it is impossible for me to be sure that everyone involved understood what I would be using the material for. One way of dealing with this ethical dilemma is to anonymise one's participants. Some of them told me, mostly jokingly, that I did not need to anonymise their names, but I still have done so. My participants did not know what kinds of analysis I would be making, and like me they don't know how other people will interpret my results and thus the consequences (DeWalt & DeWalt, 2002). Anonymising is an ethical measure taken to protect those who very generously invited me into their lives.

Continued Engagement with the Field

My fieldwork officially ended with the end of the academic year. However, at this time, I had formed relationships with several students and I had become involved in the field. I have thus been in personal contact with several students since the end of my fieldwork, as well as participating in social events at the university. These events provided good opportunities to see those with whom I had spent so much time during the previous year, but they also served as an opportunity for me to describe some of my initial analytical points.

In a notes after one of these events, I wrote to myself that it felt like a kind of 'reality check'. On that particular day, I had been struggling with an analysis and felt unsecure. I wanted to present my findings, but I was afraid to misrepresent the data or not to be true to the different perspectives that students had shared with me. That evening, it was therefore a relief to meet some of the participants, revive my feeling of being in the field and through our conversations restore my trust in the points I had reached in my analysis. In this sense, revisiting the field, sharing my analytical insights with the participants and hearing their reflections also served as a kind of 'member check' (H. B. Carlone & Johnson, 2007; Flick, 2007; Marshall & Rossman, 2011).

Analysing the empirical material

The methodological approach taken in this project is rooted in an anthropological tradition in which analysis is considered to be an ongoing process that is part of the entire project, from the planning to the fieldwork, including writing down fieldnotes and the following coding and writing process

(Emerson et al., 1995). As I had already developed research questions and a theoretical approach prior to the fieldwork, I did not enter the field without preconceived ideas and perspectives. However, at the same time my aim was to stay open to unexpected perspectives that could change my ideas and allow me to perceive the field differently. As described earlier, this is one of the advantages of ethnographic fieldwork, and it is a central aspect of anthropological methodology (Bundgaard et al., 2018; Hastrup, 1992; Malkki, 2007). In this sense, the material already undergoes an analytical process as it is made, and analysis can be seen as an at once inductive and deductive process (Emerson et al., 1995), one that has also been described as an iterative-inductive process, as we move back and forth between theory and the empirical material (O'Reilly, 2012).

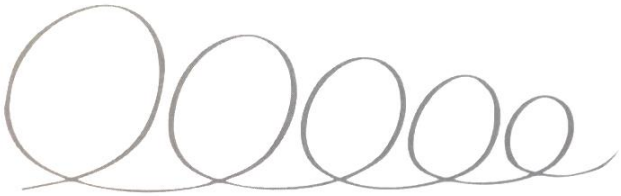


Figure 6: The analytical process (Bundgaard et al., 2018, p. 76)

Instead of a linear process, anthropological analysis can be described as a circular pattern in which each circle represents a movement between the field of research, existing knowledge and literature. The pattern takes the form of a spiral in which each round narrows, in as illustrated in Figure 6 (Bundgaard et al., 2018). This way of understanding analysis has informed my own analytical process.

Figure 7: Fieldwork questions and connections

During the fieldwork, I took analytical notes in separate sections in my fieldnotes. I also made a poster where I wrote down questions, connections and insights as they emerged (see Figure 7). This allowed me to follow visually how the field sparked new questions and how my work progressed. When I sometimes felt lost, this was a very useful tool, and after fieldwork, it showed me how different questions and answers had emerged and given rise to other questions. Making the poster also made the movement between engagement in the field and analytical distance visible as something that took place continuously.

In the process that followed the fieldwork, I incorporated both theoretical and empirical perspectives into my coding of the material. Some nodes are more directly derived from the theoretical framework, for example, the 'identity' node, while other nodes are more directly derived from the empirical material, for example the 'futures I can see myself in' and 'choice as a puzzle' nodes. I coded the fieldnotes and transcribed interviews in a thematic analysis (Braun & Clarke, 2006), thus creating and evolving the themes and nodes along with my reading of the data. The coding evolved through three main stages using the qualitative data analysis software Nvivo.

The first stage was an open coding, where I sought to be as open as possible in order to allow new ideas and insights to emerge from the material (Emerson et al., 1995). Due to the sheer amount of data corpus, I decided to conduct this first stage with only a sample of my material. The sample contained selected fieldnotes representing all the different kinds of activities I had been participating in, as well as interviews with students from all three programmes. I ended up with 130 different nodes divided into 22 themes.

After the first stage of the coding, I printed out the list of themes and notes to get a better overview of the material. This allowed me to move the themes around, in order to find overarching patterns and themes across them. Based on this process, I developed a smaller number of overarching themes for my second stage of coding.

Figure 8: picture of the printed coding process

The second and third stages of the coding were more closed (Emerson et al., 1995). They therefore helped me narrow the focus further and in doing so to discover new connections between the themes

and codes. In the third stage of the coding, I ended up with five main themes, each with a number of nodes and child-nodes:

- The social life
- The study programmes
- Identity
- Temporality
- Choice

The third stage of the coding was linked to each of the articles, where I singled out themes and thus created smaller data sets to be explored in greater depth.

The process of coding was at the same time a way of looking at the material anew from an open perspective, as well as examining links to the existing literature and considerations that had arisen during the fieldwork. For example, the analysis in Paper 1, developed through my fieldwork, where it stood out to me that the choices students had to make seemed to be woven together in different and entangled ways. However, this perspective first really took shape in the coding process, where initially, in the first stage of the coding, I divided the different choices into different nodes. However, this task that proved redundant, as these choices were anyway connected with each other.

From Body to Fieldnotes to Linear Text

How do you write down a whole year of experiences? How do you write down the sounds, the smells and all the feelings? All the joys and frustrations? How do you write down all the personal relationships and what they have taught you? The answer is that you do not. You can only write down a fraction of all this, and by doing so share a glimpse of the colourful and confusing complexity of the lived life.

The journey to understanding social life is no easy undertaking. Social life unfolds in complex ways and assumes a multiplicity of forms. Therefore setting out to understand the social is inherently a challenging affair, and transforming the web of impressions and field notes into linear text is no easy affair either. Judith Okely (1994) describes this as

> …the challenge of transforming the total experience and its messiness into words. No words may adequately redescribe that knowledge, but there are still choices between words. Neither I nor the subjects in the field were poets. It is not surprising that the totality of sensory experience cannot be conveyed (Okely 1994, 45–46).

Some of my first attempts to do this resulted in a feeling that I was amputating vital parts of the social interactions in which I had taken part. It was like cutting away half of the story and thus losing the very complexity of the social web that gave meaning to the sub-parts. In the analyses I present in the four papers, I have sought to overcome the distance between the messiness of the social and the linear text by presenting selected pieces of my empirical material. I incorporate fieldnote extracts, quotes and drawings, and I have elaborated on specific situations, events and conversations, using these to illuminate larger parts of the social life that I got to experience during my fieldwork.

Inevitably, by doing so, I also draw attention to some parts of my material while others are left out (Dalsgård, 2003).

Translation

The primary language used during the fieldwork was Danish. All the interviews were conducted in Danish, and most of the lectures were likewise taught in Danish. The exception was a smaller number of lectures and extra-curricular events that were undertaken in English, often because the teacher was not a native Danish speaker or because the event was directed at both bachelor's and master's students and therefore had to accommodate a broader audience language-wise.

This means that the quotes and field-note extracts I present as part of this thesis have been translated. Translation is not an easy task, nor is it straightforward. I have sought to keep as closely as possible to the wording used by the participants, while still retaining the meaning of their utterances. In some instances this was not possible, for instance in the use of proverbs. In these cases, I have translated in accordance with the meaning rather than the wording, seeking to translate the Danish metaphor into words that make sense in English. This means that I have sometimes changed the wording of, for example, a figure of speech in order to translate the meaning rather than just the words (Bassnett, 2002).

Overview of the Empirical Material

Type of material	Description
Participation in courses	I followed six courses in total, i.e. two courses in each of the three study programmes. These were spread over the first three blocks of the academic year. I have also sporadically visited other courses, to observe a single lecture or participate in a specific excursion.
Extracurricular activities	I participated in both academic and social activities outside the classroom. These included activities organized by the departments such as information meetings about master's programmes, elective courses, doing a semester abroad and how to get your first job. These events also included some yearly parties, e.g. the yearly gala party in the department of chemistry. I also participated in extracurricular activities organized by the students, including meetings in interest groups, e.g. in a computer science hacker group. Some of these groups also arranged excursions that I participated in, e.g. a trip to a biodynamic farm. I also participated in a climate strike arranged across the entire faculty and a number of Friday bars and parties.
Fieldnotes	I took jottings during activities and afterwards wrote these out as descriptive fieldnotes. In total, I have 473 pages of computer written fieldnotes.
Pictures	I took pictures during both the academic and social activities I participated in. I have not coded these, but they have served as visual fieldnotes and helped me recollect impressions, events, emotions etc. They thus helped me in writing out descriptive fieldnotes. Some of these pictures are also shown here in the thesis, to give the reader a visual impression of the field.
Interviews	I conducted 25 interviews with 24 different students, eight from each of the three programmes. The interviews took place in different locations, most of them at the university. The duration of the interviews varied from between 45 min. and 3 hours 10 min. One student I interviewed twice because he studied chemistry on the high school-oriented specialisation. During the fieldwork, I became very interested in this specialisation, and I thus decided to re-interview this student a second time at the beginning of his third year of bachelor's studies. All of the interviews were transcribed verbatim.
Information materials	During the other activities, I collected available information materials about the study programmes and career choices.

Figure 9: Overview of Empirical Material

Chapter 4

Overview of the Contributing Papers

The order of the papers as presented does not correspond with the order in which they were written or finished. I began writing Paper 2 while coding my empirical material. However, this made the process longer, as my analysis evolved along with my coding process. I then began writing Papers 3 and 4, finishing them both within a few weeks of each other. Paper 1 was the last paper I wrote, even though some of the findings presented in it had already caught my attention during fieldwork. Delaying writing this paper gave me a better overview of my data set as a whole, as well as a better understanding of how students' different choices related to each other. The latter is an important and overarching theme in my material, and therefore recommend reading this paper first and then continuing in the presented order. This will allow you to read about the overall themes first and then dive into more specific areas of my material. Papers 1 and 4 presents findings across the three study programmes, while Paper 2 focuses on CS and NR, Paper 3 on chemistry.

Paper 1: Choices in Higher Education

Full title:	Choices in Higher Education – Bachelor Students' Movements Between Individual Perspectives and Institutional Constraints
Authors:	Katia Kromann Nielsen and Lars Ulriksen
Journal:	Studies in Higher Education
Status:	Under review

Within higher education research, the topic of choosing has mainly concerned young peoples' choices of whether or not to enter higher education and their choice of study programme. However, a study programme is often not a fixed package. Nevertheless, choices within higher education has received comparably little attention. This study unpacks second-year students' experiences of choosing, and it explores how they navigate these choices. Drawing on empirical material from ethnographic fieldwork at three bachelor programmes, we found that students experience both opportunities and constraints in navigating higher education choices. Inspired by Ingold (2015, 2016) we suggest a theoretical perspective on choice as wayfaring. We found, that navigating through higher education contains both ambiguities and challenges for students, who learn as they go along, discover new paths and thus change direction as they move through the landscape of higher education. We argue that making choices in this sense is an integral part of being a student and an inherent part of what it means to study.

Paper 2: Imagined Futures and Present Choices

Full title:	Imagined Futures and Present Choices: Science Bachelor Students' Choice Processes in Higher Education
Authors:	Katia Kromann Nielsen, Lars Ulriksen and Henriette Holmegaard
Journal:	Cultural Studies in Science Education
Status:	Under review

This paper explores science bachelor's students' choice processes and considerations regarding choosing a master's programme. In particular, we examine the choice process in relation to the institutional setting of the study programme. The empirical material are from an ethnographic fieldwork carried out at two science bachelor's programmes at a Danish university. The explorative nature of the fieldwork allowed us to gain a better understanding of the complexities of students' choice processes. In the analysis, we combine the theoretical lens of imagined futures and possible selves to examine these choices. An important finding in our study was that the future play an important role in students' choice processes, as they consider the possible futures that different choices may lead towards. It was important for students at both programmes to be able to imagine themselves on a path towards possible and desired futures. However, for some students it was difficult to imagine where their educational path was leading or how they could pursue a desired possible self and this could cause doubts and frustration. The future although in the realm of the imagined, thus had a real influence on the students' present choices, and the way they felt about them. The two study programmes offered students different resources and made the future seem more or less pressing for the students, thus our findings also show, that students choice of master's programme differ from choices of higher education, as the institutional setting of the study programme play an important role in this choice process.

Paper 3: Choosing (not) to be a Chemistry Teacher

Full title:	Choosing (not) to be a Chemistry Teacher: Students' Negotiations of Science Identities at a Research-Intensive University
Authors:	Katia Kromann Nielsen and Lene Møller Madsen
Journal:	Scandinavian Journal of Educational Research
Status:	Under review

In this paper we explore how the culture within a university study programme affects students' aspirations and educational and career choices while in higher education. We do so through the specific case of two university chemistry students who were enrolled on a teacher programme. We followed the chemistry study programme and the students through ethnographic fieldwork, interviews, workshops and written reflections. To understand the changes in the students' aspirations over time, we combine Collins' (2009) 'domains-of-power framework' with the concept of science identity. We found that everyday practices and structures formed a culture of power that positioned research in the centre and high school teaching as a less attractive career path. Over time, the two students came to question their aspirations of becoming high school teachers. Our findings underline the need for a more inclusive culture at the university to support students' diverse career aspirations.

Paper 4: Following Rhythms and Changing Pace

Full title:	Following Patterns and Changing Pace – Students' Strategies in Relation to Time in Higher Education
Authors:	Katia Kromann Nielsen and Lars Ulriksen
Journal:	Teaching in Higher Education
Status:	Accepted with major revisions on the 23th of December 2020. Reviewers' comments focused on the structure of the paper and the integration of the theoretical perspective on infrastructure in the analysis. The paper is still to be revised, according to these comments.

Studies on time and higher education highlight how changes at a macro level influence everyday university practices and that time is experienced and perceived in various ways. This paper adds to these studies by looking at time as an infrastructure. We explore how students relate to time and unpack the challenges caused by the temporal structure of higher education. The analysis presents material from ethnographic fieldwork carried out at three bachelor programmes. Adopting the perspective of time as an infrastructure directs attention to the ways temporal structures serve to both enable and constrain practices. We found that the students related to several temporal horizons, and that these required different kinds of paces. Therefore, the horizons sometimes clashed. However, students also adopted strategies disrupting the pace and direction of the scheduled time. They used cracks and openings in the temporal infrastructure to create time for immersion and reflection.

Chapter 5

Discussion

In this chapter, I discuss the findings presented in the four papers and across them. To broaden out the discussion, I include additional elements from the empirical material that did not find a place within the limited scope and frame of the papers.

Choices in Higher Education

One of the questions that has occupied me in the last three years is how choices regarding master's programmes and other choices *in* higher education are similar to or different from choices *of* higher education. I my research, I found that there are both similarities and differences between them.

Like the choice of higher education, I found that students' choices develop over time and change as they learn about their discipline of study, possibilities within the programme and possible futures. This resembles much of the work that employs an identity perspective on higher education choices, such as that by Henriette Holmegaard (2012), who describes young peoples' choices as processes of negotiation, and the work of Eva Lykkegaard (2015), who describes young peoples' educational narratives as something that they constantly re-write.

This relates to another, very important connection between research on higher education choices and my findings. In the fields of both higher education research and science education research, studies have found that the surroundings play an important role (e.g. Archer et al., 2012; Brooks, 2003; Lykkegaard, 2015). Similarly, I found that the students' surroundings played an important role, especially by providing students with new perspectives and resources. Students learned about the different possibilities and areas of the discipline through courses, from teachers, fellow students, through extracurricular events and sometimes part-time jobs. Holmegaard (2020) has described this as an expansion of students' narrative repertoires.

In my study, I found that senior students especially played an important role in this process, assuming this were made possible by the structure and organisation of the study programmes. For example by having the bachelor's and master's programme located physically so that junior and senior students could meet, having a shared space in which to meet each other, having workshops taught by senior students, and not least having cross-year extracurricular activities. Several chemistry students stressed that it helped, that they were in relatively small year-groups, which made it possible for them to know most of their own year group and even a good number of junior and senior students as well. However, even though the CS study programme had three times more students than NR, the former still managed to provide students with more possibilities to draw on the knowledge of their peers on the programme. As described in Paper 2, part of the reason why it was difficult for the NR students to do the same, is that there are no designated master's programme for NR, and the students thus spread to various other programmes after completing their bachelor's degree. Another reason is that the management team across Frederiksberg Campus, where NR is located, prioritised making connections across programmes to create a community and sense of belonging to the campus, rather than focussing on building communities within the various programmes.

In a review of research on STEM outreach projects, Frederik Jensen (2015) found that personal encounters between young people and university students or professionals played an especially important role in the success of the initiatives, as well as in their duration. When the duration of such initiatives, were extended, this had the best results. Students in higher education do, by definition, have prolonged contact with the field and meet science professionals as part of their studies. However, Jensen's review underlines my findings, namely that study programmes should consider which possible paths and futures are presented through interactions and daily life at the university.

As these examples show, despite the similarities with choice of higher education, an important difference is that the surroundings of such choices are very different. Once students have entered a study programme, the institutional setting of this programme comes to play an important role in students' choices. Across the papers, my co-authors and I have showed this in different ways. One thing that stands out is the level of resources for students, as described above, but another important aspect is the structures that students have to navigate. Furthermore, at this point students are part of a study programme, and here we found that local norms play an important role in forming what is considered legitimate and (un)desirable. I shall return to some of the specific local norms and dominant narratives below when I discuss the similarities and differences between the three study programmes. In all of the programmes, however, this meant that there were local norms that influenced what were recognized as desirable or celebrated science identities. In several of the studies on identity and programme choice, it is stressed that although choices are portrayed as an individual endeavour, in fact they are socially embedded (Bøe et al., 2011; Holmegaard, 2012; Illeris, 2014; Lykkegaard, 2015). The social embeddedness of choices in higher education also relates to students' social networks outside the university, as these continue to influence students, but another prominent social influence and source of recognition at this point are one's peers in the programmes and one's teachers. In their paper on science identities, Heidi Caarlone and Angela Johnson (2007) described this as recognition by 'significant scientific others'. Their findings underline the importance of recognition and the difficulties that students might face if they do not receive recognition of their choice of path. In the papers, we have demonstrated these challenges, especially through the stories of the chemistry student Alex in Paper 3 and the computer science student Emma in Papers 1 and 2.

The social environment of the study programmes thus leads to choices in higher education differing from those of higher education. This is because there are local norms regarding what is recognized, but also in the sense that many students come to experience the social environment as a community of which they are or are not a part. This meant that when students – at least those in CS and Chemistry – were considering what master's programme to pursue, they also considered whether to stay in or leave the community. In Paper 2, we presented the example of Elias, who himself described the choice as very much a question of identity. He felt like a computer scientist and was thus felt reluctant to choose a different master's programme. At CS, few people even considered switching to a different department or university for their master's, but some of the few that did also brought up their reluctance to leave the study environment in chemistry. Just as belonging can be seen as an important factor for students' transitions to university (Tinto, 2017), it also plays an important role in students' choices of master's programmes.

Another similarity is that students in higher education consider several different time horizons in relation to their choices. This echoes the findings by Henriette Holmegaard, Lars Ulriksen and Lene

Madsen (2014a), who write that young people consider several horizons in their choice of a study programme. They consider their immediate interest in the subject, how it would be like being a student at the study programme and future job perspectives. In Paper 1 and 4, we argue that the students in my study also considered and balanced several different temporal horizons as part of their studies and choices. They were concerned with the present block, the immediate future of the next block, and which courses and which master's programme to choose, as well as the longer perspective of their life biographies. The longer perspective included both students' studies, possible future jobs and other future aspects that they wished for in their lives.

In addition to our description in the papers, this longer perspective can be seen from the point of view of Peter Alheit's (1990) description of life biographies. Through societal norms, we form a perspective of how the course of life is supposed to unfold. Different periods of life are considered to be connected to different phases, where we engage in specific events and activities, for example, learning, getting married and being a parent, working and retiring. Alheit calls this the 'building plan of the normal biography' (*Bauplan der Normalbiographie*). He argues that this building plan has shifted, with some elements taking up more or less space than in earlier times, just as the order of the elements have become different, for example, through the idea of lifelong learning, rather than learning as something that belongs at the beginning of the life. I would not contradict this argument, but I also found that at least some students still related very strongly with what can be seen as more traditional ideas about what is a normal biography. This became especially clear in my conversations with the older students, who had often been studying something different before enrolling in the study programmes I was following. Several of them expressed a degree of concern with time as they did not want to prolonging their studies, as they already felt they were 'behind', in the sense that they would be older than most when they finished their studies. This is important, because it influences students' ways of studying and how they navigate their different choices and the challenges they experience along the way. As they move through their studies, they become older and start to consider, in more detail, aspects of life that for most young people are more distant in relation to their initial choice of study programme (Tobbell et al., 2010). Even though Paper 4 does not directly focus on students' choices, it adds to our understanding of the context in which students make these, and the different time horizons they are balancing.

One difference from the description by Holmegaard, Ulriksen and Madsen (2014a) is that the students in my study not only had to consider these different horizons, they also had to juggle them in their attempts to fit them together. Like our description of choice as a puzzle in Paper 1, students had to make sure that their present choices would open up the right paths and fit with their wishes for both their immediate futures and their longer perspectives.

Similarities and Differences Across the Study Programmes

At the start of this project, my colleagues in the larger project and I chose three study programmes to follow more closely through WP 3 and WP 4, the latter being my PhD project. We chose computer science (CS), natural resources (NR) and chemistry to represent variation (Flyvbjerg, 2006). By doing so, we hoped to gain a better understanding of students' various choice processes. The analysis, in Paper 2, clearly showed that the assumption of variation between the three programmes held true.

Through the fieldwork and the analytical work with the empirical material, I found similarities between the programmes, but also significant differences. The programmes were alike, in that all of the students had to deal with some of the same organisational structures, such as the block structure. Students had different experiences of the latter, but across the material, what stood out were experiences of this structure as intense. This finding led to an analytical interest that resulted in Paper 4. Thus, even though this paper does not directly relate to my overall research question, it does provide an important insight into the environment and structures that students had to navigate, and thus an insight into the lives of the second-year students.

Another reoccurring theme across all three programmes was how the different choices that students had to make were intertwined, so that they sometimes became challenging and difficult to make. Several students described making these choices as a puzzle, with pieces that did not always fit neatly together, displaying a yet to be defined and ever-changing picture. This is another point that relates to the ongoing process of educational choices (Holmegaard, 2012; cf. Hutters, 2004; Lykkegaard, 2015).

One important difference between the programmes was, as anticipated, the fact that students faced very different possibilities when finishing their bachelor's degrees. In Paper 2, we examined the differences between the choices and possibilities with which the NR students and the CS students were faced and how they experienced them. If we look at the findings from this paper in relation to the findings in Paper 3, where we discussed the study programme in chemistry, we see three very different contexts. If we look at chemistry through the theoretical framework presented in Paper 2, we see that the chemistry students, like the CS students, did not experience the future as a pressing matter. For the majority of the chemistry students, it seemed a given that they would continue on to the masters programme at the same department. Thus, the more distant future of getting a job seemed quite remote to most of the chemistry students. This difference between the three programmes meant that the choices they had to make, how consequential these felt and how pressing the future seemed were all different.

Another difference was in how the students imagined the future and how clear these ideas were. The chemistry students most often described how they could or could not imagine working in a lab, and those who were considering a research career or aspired to pursue one described this path. Some of the CS students had various experiences with the labour market through part-time jobs and through the narratives of friends and peers. However, some CS students also described a very hazy future for themselves in the labour market, where they were sure to find a job, but just did not know what this would entail. At NR, the future was more present in the sense that the choices they had to make were experienced as consequential, as something that would direct their study path in a specific direction, opening up paths but also closing them. This meant that students experienced the choice of master's programme very differently in the three programmes. For some the choice to continue was almost a given, something natural, in which the idea of stopping at a bachelor's degree was very remote. For some of these students, especially in the chemistry programme, this meant that the impression was indeed more that of a five-year entity than a two-cycle degree. However, for the CS students, and especially for the NR students, the bachelor's degree did stand out as an entity in itself. Several students mentioned the possibility of taking a break before entering a master's programme, and the choice of which master's programme was indeed an important topic among the NR students. My

findings thus support what my colleagues in the IRIS project noticed in their student interviews, namely that a change had occurred in the way students talked about the bachelor's degree. This change did not occur in the same way for all students in all programmes, but I definitely found a change from earlier perceptions of a university degree as a single entity with only one choice, that of which university study programme to pursue.

Some of the differences in students' experiences of choosing were also related to other aspects of the study programmes and the local norms. Future research could add to our understanding of choices in higher education by looking at how the same programmes at different higher education institutions and in different national contexts, might share some of these similarities or weather these are specific for this specific national and institutional setting. Likewise, studies on different programmes could illuminate discipline specific similarities and differences.

In the following, I highlight some of the aspects that stood out to me in each of the programmes. I first discuss the role of the labour market at CS, then the interdisciplinary nature of NR, and lastly the role of research at chemistry.

The Role of a Strong Labour Market

One of the reasons we chose CS as one of the three programmes was the strong labour market for CS students, a labour market that offered positions to graduates with a bachelor's degree or even less. As discussed in Paper 2, there was a general impression among the students that getting a job would not be any sort of problem, and stories were told about students dropping out to start full-time positions. This was also something that the department highlighted themselves. At my first meeting with members of the programme's management team, I was told, for example, that 'all computer scientists are hyped right now'. Similar points were also highlighted at the annual information day about master's programmes at the university. At the presentation of the master's programme in CS, a member of the management team presented the programme and cheerfully emphasized that graduates of their department were very attractive to employers. They had the lowest unemployment rates among science graduates, received the highest salaries among all CS graduates in Denmark, and graduates could go directly into jobs in the industry, the public sector and start-ups.

This perspective on CS was also corroborated by the way companies approached the students. Already from the first day, students were reminded of companies' interest in them, as they received pens, notebooks and other merchandise from companies during the induction period. Companies also sponsored free coffee and tea for the student-driven canteen, and they invited students to a number of different events, for example, free cinema nights. During the fieldwork, students were also invited to a career day, where they could meet different companies that made it very clear to them that their skills were wanted. I participated in this event, and even knowing that companies sponsored all kinds of stuff for the students, I was overwhelmed by the amount of attention companies gave to students. To provide a better impression of this, I offer an insight into my own experience of this day:

> I arrive at the university 10 minutes before the event is going to begin. Everything is lined up, and everyone seems ready. I walk down the long open area where companies have set up. There are a lot of small, round, high tables, and around them people from the different

companies are standing ready. Some of the companies also brought their own stands and booths with logos and information material. There is candy in bowls, one place offers soda, and one of the companies even brought a whole small stand with pick-and-mix candy, like in the stores. The company Danske Bank brought doughnuts, decorated with their own logo in the glaze. As I turn around at the end of the long hall to walk through the area again, a couple of students appear from a door that leads into one of the side buildings. I end up behind them and can deduce from their conversation that they are not computer science students, but they are obviously interested in getting some of the goods. One of them comments, 'we can't code enough'. They spot someone eating a Danske Bank doughnut and head towards the stand. I follow them – I probably can't code enough either.

In front of auditorium 1, the largest auditorium in the building, tables have been set up, ready for the food that will arrive later. Next to the tables, there are also beer taps and a popcorn machine. It seems clear that the companies really want the attention of the students. There is so much stuff displayed to attract them – so much to eat and so much merchandise. As we slowly pass 3 o'clock, the room becomes more and more crowded. The students are talking with company representatives all around me, and a lot of the students walking past me are already carrying various stuff with company logos. Two girls are passing by, each with a mug printed with a company logo on the side and filled with candy.

Quarter past three, there is an introduction in auditorium 1. A man presents different information about computer science. He emphasizes that there is a need for more people within computer science. Then they begin what they call '1 Minute of Madness'. Every company gets one minute to present themselves. A projector shows a huge clock counting down from one. During the introduction, I wondered what this '1 minute of madness' was, but it certainly makes sense now.

As the companies take turns – and there are a lot of them – it soon becomes difficult for me to keep them apart. The companies promise stuff like a personal mentor, good working conditions, fixed working hours, interesting work, and they all encourage the students to come by their stand. The madness continues with a lot of good offers and promises. I read the programme – there are 38 different companies (Fieldnote, May 2019).

The impression of the career day was of a market where the companies tried to sell themselves to the students – or rather, they tried to appear so attractive that the students would want to sell themselves to the companies. The flow of merchandise and sponsored goods, as well as the one-minute pitches on the career day, communicated to the students the fact that they were attractive to employers and were in a market – albeit with the dual role of the buyer and the commodity.

The strong labour market meant that students generally felt secure and confident that there would be a job for them, and it also meant a future full of possibilities. Even though the future thus became present through the display of possible workplaces, in general the CS students had a relaxed attitude regarding their educational choices.

The strong presence of the labour market, however, also had a downside. First, it meant that some students felt unsure that they would be good enough to live up to the narrative of CS students being wanted by every company, and even being headhunted for positions. For example, this concerns were raised by Kimberlie in the interview presented in Paper 2. This topic was not brought up by many, but it did exist. Furthermore, it also meant that there were not really any legitimate positions for students who had finished their degrees and were not offered a job right away – and not all students were. This left me with questions about job security, and how students experience graduating from programmes where there a such a strong narrative about getting a job as something easy and unproblematic. This could be an interesting topic for future research.

Something else that stood out about the CS programme was the strong narratives about what the discipline was about – and what it was not about. This could be connected to the private sector's strong interest in certain competences, but it might also be related to other factors, such as the local norms at the programme. It would go beyond the scope of this project to unpack which factors influenced this framing, but it was clear that the dominant narrative had created very clear ideas about what areas of the discipline were deemed attractive, and thus which paths were seen as desirable and recognizable. As briefly discussed in Paper 2, the general and dominant narrative was that CS was about backend programming and the more nerdy, theoretical areas of the discipline, while areas such as front-end programming and human–computer interaction (HCI) were seen as not really belonging. This narrative persisted, despite the fact that HCI was a mandatory first-year course in the department, which also had a research group specialising in exactly this topic. Some students did comment that they found this narrative a pity, as they considered the field of HCI important, and a few also told me that they desired to follow such a path. However, it is not always easy for students to challenge such narratives or to keep choosing paths that are positioned as less attractive, as is also shown of chemistry students in Paper 3. My findings in CS echo those made by Anne-Kathrin Peters (2017) in her PhD research in two computer-science programmes in Sweden. Peters likewise highlighted how the majority of students met HCI with scepticism and as positioned as something that does not belong within CS.

An example of how this dominant narrative made itself felt is an illustration made by the CS student Eva. During an interview, she tried to explain to me what CS was about, and conversely what it was not about. In front of us lay some of the papers she had already used to make the illustration exercises that were part of my interview approach. She picked up a pen and made the illustration depicted below (Figure 10). Explaining to me that you could see the field as divided into several layers, she placed the user at one end and the hardware at the other, the discipline of CS being about the bottom part.

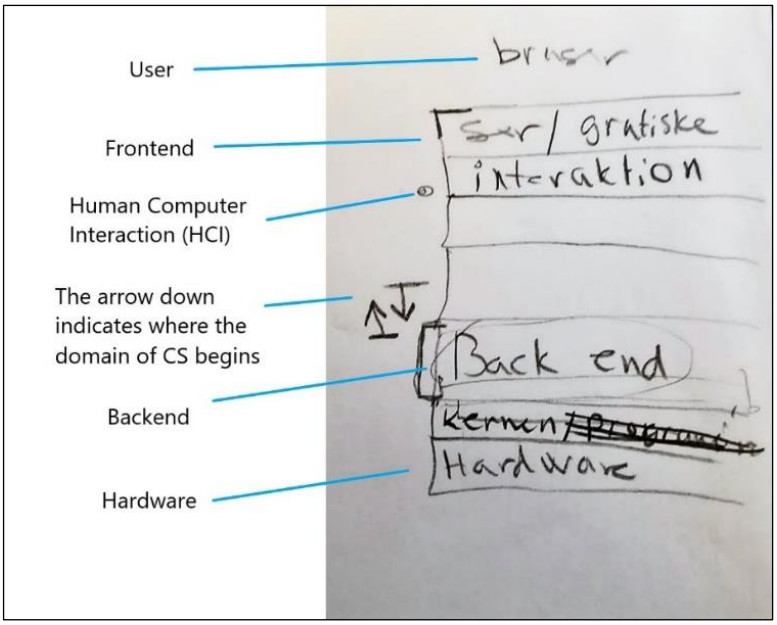


Figure 10: Eva's illustration of the areas of CS. The text on the left is my translation of the captions

Making Sense of the Study Programme

Another difference between the programmes originated in their very different disciplinary orientations. Whereas computer science and chemistry both presented students with a quite highly defined field of study, natural resources was made up of a combination of several different disciplines, merged together in one bachelor's degree. Hence, in addition to NR students not having a designated master's programme, they also had to find out, how this combination made sense to themselves. This fitted well with these students' mostly broad, interdisciplinary interests, but it also presented them with some challenges. One challenge was to see the connection between some of the basic courses and their wider interests. Here I will introduce one more excerpt from my fieldnotes to illustrate this challenge. The following is a description of a conversation that took place during a break:

> Samuel and Rebecca are talking about the course in biochemistry that we are attending. Rebecca says that she hopes some of 'the other' comes later. If not, she will be disappointed. I join the conversation by asking what she means by saying 'the other'. She thinks a bit as they try to explain, then says 'the more practical stuff'. Then she says that if, for instance, you should offer advice about what crop to plant, then you would not use this. Rebecca makes a gesture towards the computer and the papers in front of her. Samuels adds that he finds the analogy with a driver's licence rather good. Taking a driver's license is not really like driving a car (Fieldnote, January 2019).

Rebecca's comment and Samuels's analogy suggests that they do not expect the study programme necessarily to resemble what they will be doing later in their careers. However, they both hope that the connection will become more apparent later in their studies.

This might be a concern for students at other programmes as well, but it did not stand out as a concern for the CS and chemistry students. At NR, this challenge can be linked closely with the programme's interdisciplinary focus. This is mainly of the two kinds that Erich Jantsch (1947) has labelled 'multidisciplinarity' and 'pluridisciplinarity'. This refers to the students being introduced to a number of disciplines presented in parallel and with little or no explicit linking of one discipline with another, nor to future careers. This mixture of different disciplines was reflected in the different teachers who taught the different courses in the programme. The first-year course in environmental economics, for example, was taught by an economist, and the students also had teachers from the departments of mathematics and chemistry. I do not mean to suggest that this is a necessarily a bad thing. Having teachers from different departments meant that students were taught by people with specific competences and knowledge to share with the students. However, the mixture of different teachers and different disciplinary areas also, to a large degree, left it up to the students to establish the relationships between the various disciplinary elements. This made it more of a challenge to see the coherence and make sense of these elements.

This calls for programmes, especially interdisciplinary programmes, to pay close attention to how meaning is created between the different elements of the programme. Studying NR does not leave you with a definite title as with chemists or computer scientists, and even though these titles in themselves are broad, they still serve to frame the studies more than was the case with NR.

Studying at a Research-Intensive University

In the chemistry study programme, the research environment was very present, both in the structure of the programme and in the consciousness of the students. In Paper 3, we unfolded how research stood out in the dominant culture and across what, inspired by Patricia Collins (2009) and Angela Johnson (2020), we described as different 'domains of power'. The role of research as a path was something that stood out to me more than any other influence on possible and desirable paths at the programme. An interesting addition to our discussion in Paper 3 is the difference this focus made in terms of how different teachers and professors came to be role models in a more direct sense than in the other programmes, where research did not stand out as a desirable path.

At both CS and NR, research was mentioned but to a lesser degree. Lectures at one of the courses I followed with the NR students would often talk about their own research, and at CS, I even met a PhD student, who participated in one of the social events. However, at neither programmes research had such a prominent role as at chemistry, where almost all teachers often made comments about their research, and the PhD students at the programme were very much part of both the academic and social environment. Looking at this from the department's point of view, it made sense to have students participate in the work of the research groups, as they could contribute by doing experiments and other work for the group, while at the same time allowing the professors to recruit talented students into their research group.

As discussed in Paper 3, this created a very clear path for students who aspired to research careers. It was early on made clear to them how they could embark on such a path, and early on they acquired experience with this kind of work by being integrated into the research groups through research internships, as well as when doing their bachelor's project and a master's thesis. However, for students who did not identify with this path of doing research in the university or the private sector, achieving recognition could be a challenge.

Methodological Reflections

I will end this chapter with a short discussion of my methodological framework and the insights that this approach provided. In my research design, I followed the call to conduct longitudinal research in order to grasp the ongoing processes of educational choices, a call made by researchers such as Camilla Hutters (2004), Henriette Holmegaard (2012) and Eva Lykkegaard (2015). My findings support their arguments for research to follow choice processes as these evolve over time. In my research, my longitudinal design allowed me to gain a better insight into the complexity of students' choices, how these choices unfolded over time, and what influenced them. Unlike these three researchers, however, all of whom approached young peoples' processes of choosing through qualitative interviews, my methodological approach consisted of ethnographic fieldwork. My fieldwork allowed me not only to talk with the students and hear their perspectives and narratives, but also to experience these study environments myself. The methods thus provided a way of understanding both the explicit and tacit norms at the study programmes. My presence gave me a better understanding of both the programmes and daily life at the university. Through the insights I gained from that, I was able to ask different kinds of questions in my conversations and interviews with the students.

In the articles, we present several examples, of insights I gained through doing fieldwork. For example, in Paper 3, we show how becoming a high-school teacher was positioned as undesirable within the chemistry study programme. I do not think I would have understood the extent of the narrative of becoming a high-school teacher as easy and undesirable had I not experienced some of the situations in which it stood out by its absence or the occasions on which high-school teaching was the punchline of a joke or sketch.

Another example serves to illustrate the kinds of insights that ethnographic fieldwork opened up for me. At the beginning of this chapter, I described the role of senior students in CS and chemistry, and how they were resources in expanding the second-year students' repertoires. I began thinking about the role of senior students after hanging out at the student-run canteen at CS and while spending time with the chemistry students during extra-curricular activities and parties. I would often hear students on both programmes discuss information that they had heard from senior students and have conversations with senior students about a specific course, a strategy for an exam or what it was like to work in a specific research group. I did not experience this at NR, but the point at which this absence really became clear to me was during a lecture in a course I attended with the NR students as well as students from other programmes. However, the students from the different programmes mainly kept to themselves:

> It is afternoon, and we are having a lecture about plants. I am sitting with a couple of the others in a row at the back of the small auditorium. We are asked to do a group exercise. Before we can begin, the girl sitting alone on the row behind us leans in and asks if she can join our group. The others nod, and one of them asks if she is studying biology or biotechnology. She smiles and says that she studies natural resources. She is a third-year student. Next to this course, she is doing her bachelor's project. Someone asks what it is about, and I follow up with a few more questions. However, none of the others ask any further questions. It is already one and half month into the specific course, and I am surprised that none of the others knows that she is studying what they are. Most surprising to me is that they do not ask her any more questions, as I am used to the many comments and questions made to senior students of the other programmes (Fieldnote, March 2019).

This situation is significant because it highlighted the structure of the student community at NR. Not all students knew each other on the two other programmes, but this situation illustrates a general tendency at NR of low contact between the year groups, something several of the students also confirmed when I asked them about it later. The situation was also significant to me as it was at that moment that I realized how pronounced this difference was.

By doing ethnographic fieldwork that includes interviews, I had the opportunity both to experience and to see what people were doing, and also to hear what they said and how they experienced different situations. Based on my experience of the fieldwork and on the findings that I have presented in this thesis, I find that ethnographic fieldwork is a valuable way of exploring higher education students' choice processes and the interaction between the students and the institutional setting of the study programmes. Further research could benefit from this methodological approach to explore some of the aspects I could not include within the scope of this project, such as the roles of gender, ethnicity and social background in navigating choices in higher education and seeing the possibilities in different paths.

As far as the overall project is concerned, we are still comparing insights and findings. I will therefore not elaborate on these here, but merely highlight the benefits of a mixed-methods approach as that followed in this. The different methods in the overall project have pointed to some of the same, but also different findings. Like any other method, the ethnographic fieldwork has limitations, one of these being the extend of generalisability for the findings. Contrary, the statistical mapping of students choices, cannot illuminate how students experience choosing and how choices unfolds as processes over time. However, across the different methods applied, we have been able to gain insights that expand the findings of each of the separate WPs.

Chapter 6

Conclusion

In this last chapter, I present an overall conclusion. As I have already presented and discussed my findings in the previous chapter, I will here only summarise my findings in relation to my overall research question.

In this thesis, I have examined how students' choices and possible futures are constructed as desirable and legitimate in the institutional setting of three bachelor's science programmes. I have approached this question through ethnographic fieldwork focusing on the interaction between students and their study programmes. For the purposes of the fieldwork, I have followed second-year students in the bachelor's programmes in chemistry, computer science and natural resources.

Starting at university means participating in coursework and exams, but students also need to navigate different choices and find their paths through their study programmes. Choosing a study programme is far from a fixed package, as students need to choose a specialisation, elective courses and a master's programme. For the second-year students in my study, these choices unfolded and changed over time as they participated in new courses, learned more about the discipline and experienced what they found interesting. Students also learned from teachers and fellow students, through extracurricular events and sometimes part-time jobs. Students drew on past experiences in their choice processes, but new experiences also provided them with new perspectives on possible future paths and where different choices might lead them. Students paths through higher education hence do not follow neat, pre-defined maps, but unfold along the way as students move. In this sense, making choices is an integral part of being a student and an inherent part of what it means to study.

Many students experienced challenges and ambiguities related to these choices, as these were mutually entangled in the sense that choice of specialisation or elective courses could influence what would be possible later on. In making choices, students thus had to consider the present, their immediate futures and longer perspectives of possible and desirable career paths, as well as who they could become within these more distant futures. The second-year students' choices unfolded in different ways in the three programmes. This was largely due to differences in the structure of the programmes, which meant that students had different opportunities and faced different constraints on their choices. In the bachelor's programme in chemistry, there was a strong tradition for students to continue directly on to the master's programme in chemistry at the same department. For the students in the bachelor's programme in natural resources, there was no direct continuation in the sense of a single designated master's programme. Rather, the students would spread out to various different master's programmes, some at the same department, some at other departments. Furthermore, admission to some of these programmes depended on students' choice of specialisation and elective courses. Contrary to the two other programmes, computer science has a strong labour market for bachelor's students. This means that stopping with a bachelor's degree, or even short of that, is an actual possibility. The labour market and the structure of the programmes meant that what students chose during their studies was experienced as having varying degrees of consequence for later opportunities, and what paths would be opened or closed as a result of each

choice. The choices, and the future, thus seemed more or less a pressing matter depending on the programme.

The social environment of the programmes also contributed to making some paths appear more clearly, while other paths received limited attention. In computer science and chemistry, there were strong narratives about desirable paths, making these stand out as legitimate, while other paths were conveyed as less attractive. In computer science, the aspects that were considered nerdy and theoretical received recognition, and attractive paths would incorporate them, such as back-end programming. In chemistry, what stood out as attractive more than any other path was doing research, either at the university or in the private industry. For students who did not identify with the dominant narratives, it could be challenging for them to find their own paths. This was the case, for example, for a computer science student who wanted to work in an interdisciplinary field, using her computer science skills to solve socio-scientific issues, maybe in the public sector. Furthermore the entire area of the field, which was concerned with front-end programming and human–computer interaction (HCI), was portrayed by the majority as something that did not belong within the field of computer science. In both computer science and chemistry, high-school teaching was one of the paths that were singled out as especially unattractive. In chemistry this path was conveyed as something easy, something one could always return to, and thus more of a contingency plan than something worth aspiring towards. In natural resources, there were no strong narratives related to what was considered desirable and legitimate, making it easier for students to pursue diverse paths. However, this also meant that it was more challenging for students to navigate the different choices because no clear paths stood out as obvious to follow and because it was less clear where the different choices would lead.

The construction and reproduction of choices and paths as desirable and legitimate to pursue happened through both the structures of the programmes and in the daily social interactions between university staff and students, as well as in the interactions between students themselves. In lectures, for example, some teachers made comments about the purpose of learning something and thus pointed out specific paths, while other paths were never mentioned. Likewise, at extracurricular events, some paths stood out by receiving attention, being mentioned and discussed, while, for example, the path of high-school teaching mainly stood out by its absence. Among students, one way in which certain areas stood out was through student-organised interest groups. In the programme on natural resources, one group, for example, focused on sustainable farming, a theme that very much represented the general desire among the majority to get out and make a difference to the environment. Students also very strongly displayed norms of what was attractive through humour, for example, at the annual revue. Interest in the areas that were in accordance with the dominant narrative received attention and recognition from both fellow students and teachers. While some structures were challenged by students trying to find their own paths and pace, I also found it was often difficult for students to challenge dominant narratives about what is desirable and considered legitimate.

This thesis contributes to our understandings of choices in higher education, but further research within the field is needed to explore differences across national, institutional and disciplinary contexts. Future research could also contribute to a better understanding of how diverse students experience and navigate these choices.

Epilogue

> Walking through the university campus area, I am struck by the emptiness of the large dark windows looking at me from the sides of the buildings all around me. It looks as if the entire university has been abandoned, stripped of the very essence of its role as a higher education institution. Without the movement of people and the social encounters that normally take place within and around them, these buildings have lost any resemblance to the place where I one and a half years ago conducted my fieldwork (January 2021).

The COVID-19 pandemic has impacted the world around us in detrimental ways, and the university, like all other areas and institutions in our society, has been challenged by having to find new ways of functioning. Its social life has moved online, reminding us that the campus itself consists merely of buildings, and that these are not what constitutes a university.

My empirical material has not been affected by the pandemic, as I finished my fieldwork before COVID-19 spread across the world. As a result, the articles in this thesis do not touch upon the consequences of the pandemic for students. Nonetheless, with the whole of society on lockdown, sitting in front of my desk at home it is almost impossible not to think about my research in the light of the pandemic.

My research shows that the choice of a particular study programme in higher education is far from being a fixed package, as it entails complex and ongoing decision-making processes. Students must construct paths by choosing a specialisation, elective courses and a master's programme. Navigating these choices involves fitting different choices together into a path that leads towards desirable futures. In doing so, students draw on the social networks that the institutional setting of the university make available to them.

My findings show that it is important to support students in finding these paths through higher education and their sharing of knowledge. In light of the pandemic and the lack of a physical study environment, I can only imagine that such support is even more crucial. Hopefully, students and staff can soon return to campus, but the challenges that the pandemic has posed to students underlines the importance of spaces for social and informal encounters both between students themselves and between students and staff.

Other Contributions and Publications

National Publications

'Tiden går så hurtigt' – Studielivets tid og rytmer (forthcoming). In: *Jordens Folk.* Aarhus: Dansk Etnografisk Forening

Contributions at International Conferences

Gregersen, Andrea Fransiska Møller and Nielsen, Katia Kromann. *Investigating the Implicit and Tacit Aspects of Higher Education – Methodological Approaches*. Paper presented at the Society of Research in Higher Education (SRHE) Newer & Early Career Researchers Conference, Newport, Wales, December 2018.

Nielsen, Katia Kromann and Lars Ulriksen: *Imagining the future – possible selves in higher education*. Paper presented at the European Sceince Education Research Association (ESERA) Conference, Bologna, Italy, August 2019

Nielsen, Katia Kromann, Andrea Fransiska Møller Gregersen and Henriette T. Holmegaard: *Becoming a Computer Science Student: First year higher education students' identity work and academic integration process*. Paper presented at the European Sceince Education Research Association (ESERA) Conference, Bologna, Italy, August 2019

Nielsen, Katia Kromann: *Beyond the Bachelor's Degree – Legitimate Choices and Imagined Futures*. Poster presented at the European Sceince Education Research Association (ESERA) Conference, Bologna, Italy, August 2019

The following three contributions were accepted for presentations at international conferences, which were later cancelled due to Covid-19:

Nielsen, Katia Kromann and Henriette Holmegaard. *Negotiating, resisting and aligning narratives about the future. An ethnographic study of higher education science students' possible selves*. Paper accepted for presentation at the NARST annual international conference, 2020

Holmegaard, Henriette and Katia Kromann Nielsen: *STEM students' narratives of possible future selves.* Poster accepted for presentation at the NARST annual international conference, 2020

Madsen, Lene Møller, Henriette T. Holmegaard and Katia Kromann Nielsen. *Science students' post-bachelor choice narratives*. Paper accepted for presentation at the European Conference on Educational Researc (ECER), 2020.

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