



## Autobiographical narratives with focus on science



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**IND's studenterserie nr. 77, 2019**

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# “I CAN’T SEE MYSELF STUDYING SOMETHING THAT’S NOT INTERESTING”

**Autobiographical narratives  
with focus on science**



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*(Master i scienceundervisning)*

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Submitted on: April 25<sup>th</sup> 2019

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## Abstract

This multiple case study is based on seven autobiographical narratives and the corresponding semi-structured interviews and aims to elucidate how family values and life experiences shape technical college (HTX) students' science identity and science futures. The empirical data was analyzed using Pierre Bourdieu's capital theory, Archer and co-worker's science capital theory and Niklas Luhmann's systems theory as the main theoretical viewpoints. The analysis suggested that interest in science, starting from upper secondary school was the main reason for more or less all the informants' orientation towards science studies both with respect to secondary education, HTX, and their plans of future studies. Science careers with similar professional areas seemed typically be valued by their professional content and not by parameters such as parental pressure, future salary or chance of employment. To develop an analytical and didactic-pedagogical tool based on Archer and co-workers science capital suitable for use in Denmark further work is needed.

## *Dansk resume*

*Dette multiple-case studie er baseret på syv autobiografiske narrativer og tilsvarende semi-strukturerede interviews og har til formål at belyse rollen af familieværdier og livserfaringer i HTX elevernes naturvidenskabsidentitet og eventuelle naturvidenskabelige fremtid. De empiriske data blev analyseret baseret primært på Pierre Bourdieus kapitalteori, Archer og kollegaers science-kapital teori og Niklas Luhmanns systemteori. Interessen for naturvidenskab, der startede fra folkeskolens udskolingsniveauet, var underbyggende for informanternes orientering mod naturvidenskab både med hensyn til valg af HTX og deres planer for fremtidige studier. Fremtidige arbejdsområder med lignende fagligt indhold blev typisk vurderet baseret på arbejdets faglige indhold og ikke på parametre som fx pres fra forældremes side, fremtidige løn eller beskæftigelse. For at udvikle et analytisk og didaktisk-pædagogisk værktøj egnet til brug i Danmark baseret på Archer & co. science kapital, er yderligere arbejde nødvendigt.*

## Preface and acknowledgments

This master’s thesis contributes by 20 ECTS for the 60 ECTS of the Master in science education (*Master i scienceundervisning, MiSU*) organized by University of Aarhus and University of Copenhagen.<sup>ii</sup>

I want to thank my supervisor professor Helle Mathiasen from the Department of Science Education, University of Copenhagen, for fruitful discussions and for letting me jump into new intellectual challenges during the writing process.

I am immensely grateful for the seven informants who gave their stories in my hands to be written and in my mind to be analyzed. Without them this study would not have been possible. *Tusind tak!*

Kompetencefonden 2015 at *Selandia Erhvervsrettede Uddannelser* has supported part of my studies in the MiSU study program for which I am grateful. I would also like to thank head-of-school Niels-Erik Hybholt, vice head-of-school emerita Helle Purup and pedagogical leader Mads Munkholm Teglskov, from *Teknisk Gymnasium ZBC Slagelse*.

The three years of MiSU has introduced me to the core group of MiSU2016-2019 students and top-class teachers. Thank you, all of you.

The full list of thank-you-for-making-this-possible would be much too long if I named all who have a rightful place on it. Therefore I must summarize: thank you all.

To my ‘Laughing Fellow-Rower<sup>iii</sup>’.

The sea may be rough but you never stop rowing.



## Chapter 1: Introduction

### 1.1 A guide to the reader

This thesis has been organized in seven chapters, references and appendixes 1-4. Each main chapter is divided in sections, and some further to sub-sections. The numbering of the chapters orients the reader. Footnotes are used for explaining words, concepts, and for additional information. The narratives and the short transcribed answers to the semi-structured interviews are to be found in appendixes 2 and 3. In chapter 4 'Findings' cross-references to the theoretical background presented in chapter 2 are indicated with page numbers of this thesis, and not by citations.

Figure texts and expressions in languages other than English are typeset in italics. Quotations from literature and from the semi-structured interviews are typeset in italics in double quotes "X". Quotations from the written narratives are also written in double quotes "X" but typeset as normal text. This is to emphasize that the written narratives are text written by me based on the narrative interviews while the quotations from the semi-structured interviews are the actual words of the informants. Concepts known from literature or introduced in this thesis are marked with single quotes 'X'. Single quotes are also used for quotes inside quotes. Appendix 4 explains nomenclature for school levels in Denmark used in this work. All figures are drawn by the author<sup>1</sup>, and when relevant, references are given in the figure text.

### 1.2 The purpose of the study

School-children and secondary school students with challenged social backgrounds or with family backgrounds diverging from that of society's expectations are visible and debatable topics (e.g. Matthiesen, 2016; Rasmussen, 2016, Hansen, 2003; Ulriksen, Murning, et al. 2009). Similarly, the overachieving top-grade girls ('12-tals piger') have in the last few years received much attention (e.g. Agerbo, 2017; Hansen, 2017; Østebø & Szücs, 2018). Something is missing in this debate, though, and this leads easily to a polarized loser/winner-image of the society.

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1 One figure includes elements from sources, references are given

The present study is a multiple case study, a collection of seven autobiographical narratives by informants who have chosen a secondary youth education with a strong STEM<sup>2</sup>-profile, technical college (HTX<sup>3</sup>). As a teacher I have heard many stories been told. It is impossible to bring them all to light, how interesting they all might be. With this study, I hope that I can give a voice to some of them.

### 1.3 The research question

***How do technical college (HTX) students see themselves, their future and studying science in the light of their family values and life experiences?***

It is not the aim of this multiple case study to investigate the socio-economic status of the informants nor the levels of e.g. their cultural or scientific capital. The focus is in the informants' own view on themselves, their future and studying science. The study is a multiple case study, with emphasis equally on both: 'multiple' –seven individuals as informants –, and 'case study' – aiming to shine a light on the individual life stories without generalizations.

## Chapter 2: Theoretical framework

In the following I introduce the reader to the underlying psychological and sociological theories as well as the epistemological principles this case study is based on. The viewpoint of this study is that of the interpretive research paradigm combined with critical social theory, although in a what one could call a light version: with a purely observatory standpoint without demanding changes in the society.

### 2.1 Stories and realities

Telling stories is and has always been a part of human life and stories are deeply embedded in culture. Famously, Ludwig Wittgenstein wrote in 'Tractacus': "*The Limits of My Language Mean the Limits of My World*" (Wittgenstein, 1922 5:6). The language of the stories has a dualistic nature

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2 Science-Engineering-Technology-Mathematics

3 See Appendix 4 for the nomenclature of Danish schools used in this work

of both mediating thoughts and being one with the thoughts. In the end it is difficult to differentiate which is the underlying process: the thought or the language (Bruner, 1991; Vygotsky, 1978 p. 33).

Different historical periods have different ontological perspectives. In the post-modern world, constructivism has challenged the views of positivism (Raskin, 2002). The epistemological color palette of the present study lies close to radical constructivism, but not limited to a monochromatic set of colors. Different constructivist views on knowledge are reviewed shortly in Table 1.

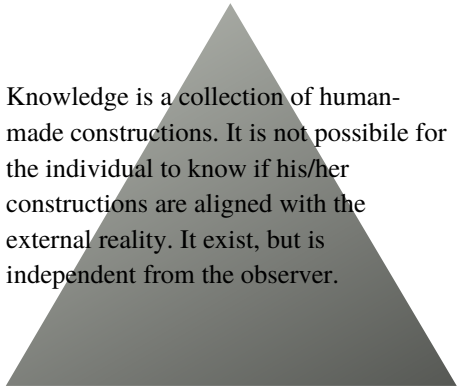
Type of constructivism	Short description	View on knowledge and reality	
<b>Personal</b>	Individuals are 'personal scientists' who test their constructions constantly	 <p>Knowledge is a collection of human-made constructions. It is not possible for the individual to know if his/her constructions are aligned with the external reality. It exist, but is independent from the observer.</p>	epistemological
<b>Individual</b>	Individuals construct knowledge through understanding repeated events		
<b>Radical</b>	Individuals construct each their own models of the world where they act in. Objective knowledge of the external world is not possible.		
<b>Social<sup>4</sup></b>	Individuals are social co-operating actors that revise their constructed knowledge together with other.	Knowledge is a product of a group of communicating and negotiating observers. External, observer-independent reality does not exist.	hermeneutic

Table 1: Types of constructivist theories. The gray triangle in column second from right margin illustrates how well the different constructivist theories fit with the underlying principles. The table is composed by the author based on and inspired by literature (Galbin, 2014; Gong, Liu et al., 2018; Raskin, 2002; Stetsenko & Arievitch, 1997).

## 2.2 Living a narrative?

A narrative is a sequence of events but not a story. It is an academic tool used in various disciplines from literature science to sociology (Kreiswirth, 2000, Ryan, 2007). Narratives are composed of smaller parts, some of which can be verified from external sources, some impossible to verify by any verification or falsification method. Whether a narrative can be seen as realistic or 'true' is only a consideration whether the narrative appears to be realistic (Bruner, 1991). Narratives are inherently hermeneutic and are both a vehicle of meaning-making and interpretation of meaning. In

<sup>4</sup> Some modern social constructivists prefer the the concept to be called social constructionism (Raskin, 2002). I focus here on the classical vygotsgian socian constructivism only.

stead of just picking up the best-fitting events from a pool of ready-made memories and put them in the right order, the narrator constructs the narrative at the moment it is composed (Bruner, 1991).

Wittgenstein's world was limited by his language (Wittgenstein, 1922, 5:6) but deeper understanding on how reality participates in forming human cognition underlines the need of providing more fine-tuned presentations for it (Bruner, 1991). It is not enough to limit ones reality with language or even by events occurring around us, one needs to use the language to tell about the events to form, to construct, ones reality. As Bruner puts it, narratives "*operate(s) as an instrument of mind in the construction of reality*" (Bruner, 1991).

The narrative mode of the mind composes narratives which, rather than being true accounts of particular happenings, are constructed autobiographical stories and strongly dependent on among other things the narrator's cognitive abilities. As the minds' organization of life events happens through narratives, the life becomes a set of iterations of stories. Life can therefore not be seen as something that is or was independent of context but something told and interpreted, re-told and re-interpreted (Bruner, 1987, 1991). Narratives need to appear realistic but as reality is what each of us constructs (see section 2.1), can narratives only refer to the internal reality and therefore be internally coherent (Bruner, 1991). In stead of describing life as such describes a narrative a cognitive construction of life. "*Narrative imitates life, life imitates narrative*" (Bruner, 1987). Narratives refer to one's internal reality at the time when the narrative is told (Bruner, 1991).

While different definitions of the Self are found in different psychological disciplines, the narrative psychology sees the Self structured through narratives (Polkinghorne, 1991). According to Bruner, autobiographical narratives bear clues of the Self and its development. The life events one experiences give arise to the development of the Self. These events and experiences can however only be constructed through the mechanisms through which we filter the world. The Self and our conception of it develops thus in a circular feedback loop with the constructive meaning-making processes of the mind (Bruner, 1997). We integrate and disintegrate events, impressions and plots from our lives and from around us into our narratives forming the Self (Polkinghorne, 1991).

Flow of time is inherently bound to narratives: they are a description of events happening during a period of time. This time span is not the time measured by clocks or calendars (Bruner, 1991). Narratives do not follow a linear time even though the narrative's events do happen in time. This 'within-time-ness' as Ricoeur (1980) calls it has some tie-lines with the generally acceptable time (e.g. calendar), but underlines the personal element of time, arising from the meaning-making coupled to the narrative constructive process of the mind.

### 2.3. System, communication and time

The corner stone for Niklas Luhmann's systems theory is the concept of a system, different from their environment and it is this difference that fundamentally defines the system. What is on the inside is, and has to be, different from the outside. Inside, are the systems' operations as the system cannot operate in its environment<sup>5</sup> (Luhmann, 2007 p. 87-95).

Luhmann describes several systems, with different features, all obeying the same general principles of his systems theory. Systems relevant for this work are sketched in Figure 1 (Luhmann, 2000 p. 37).

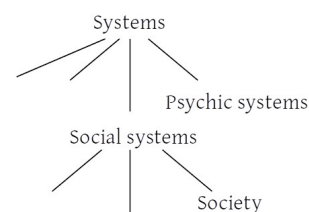


Figure 1: Systems relevant for this work. Drawn based on (Luhmann, 2000 p. 37)

Systems are autopoietic<sup>6</sup>: they produce themselves through their own operations. Social systems –societies– produce themselves through communication, and psychic systems, –individuals– through cognitive

actions, thoughts. As systems can only operate inside themselves, autopoiesis reproduces the system but not the external world, and thereby creates also in a way the system's boundaries (Luhmann, 1997 p. 48-51, 94-95; 2007 p. 65-86). Systems can be composed of partial systems, divided from their respective environments by boundaries (Luhmann, 2000 p. 42).

To know that one is not like the environment<sup>7</sup> it is necessary to observe. To observe is a system's operation – and at the same time the purpose of observation is to observe system's operations<sup>8</sup>. The observer is however bound inside itself and cannot rise above the system and the environment.

<sup>5</sup> Operative closure is a central concept in systems theory but will not be considered further here.

<sup>6</sup> Self-reproducing (from latin 'auto': self and 'poiesis': production)

<sup>7</sup> Difference makes a system

<sup>8</sup> Other operations, that is to say

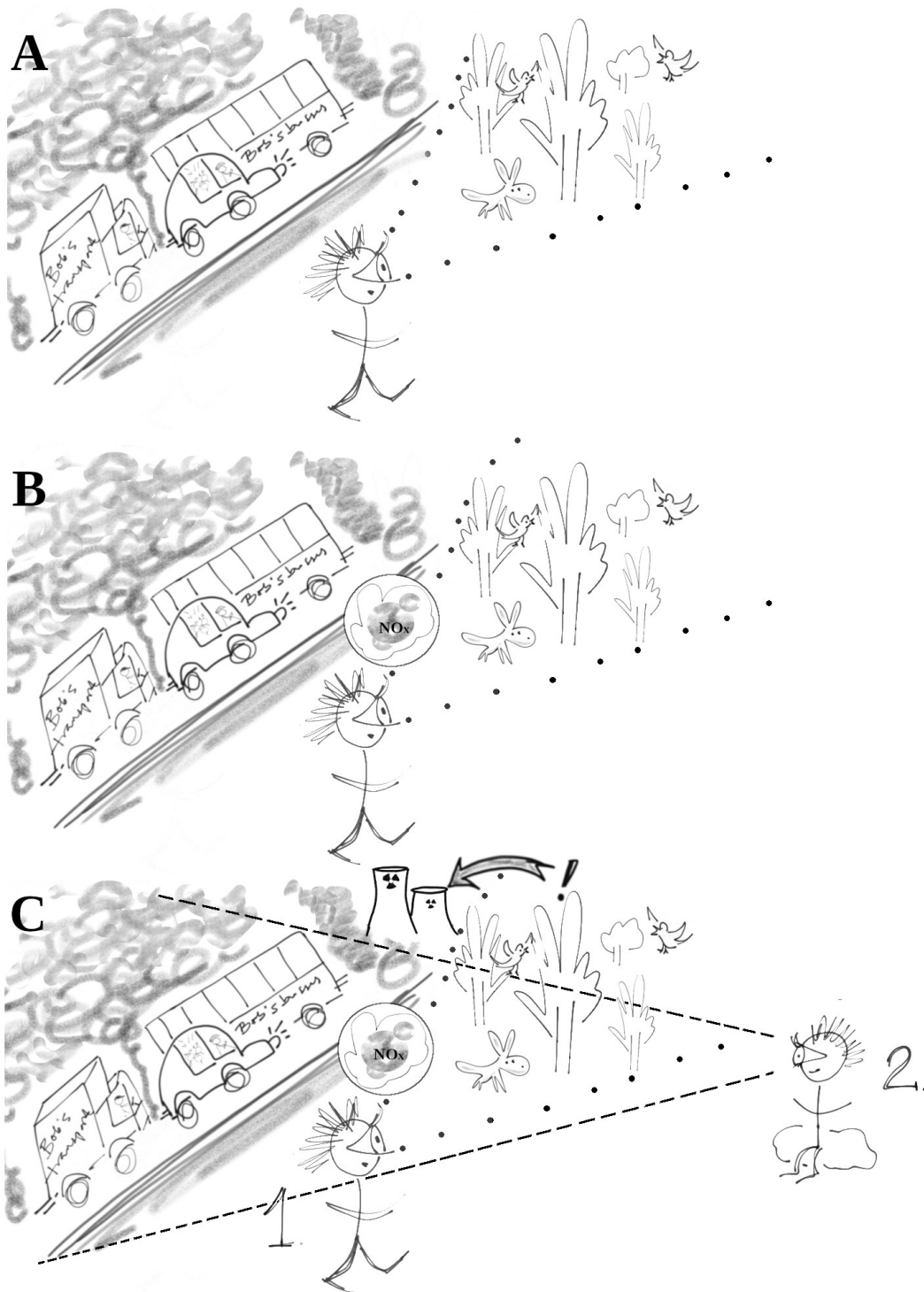


Figure 2: Observation and the blind point. The observer can only focus on one observation, here a forest with animals (A) The highway is invisible, in the blind point. By a speculative choice of distinction, smell of exhaust gases (NO<sub>x</sub>; B), leading to a 2. order observation the blind point can be displaced (2). The 2. order observer observes the 1. order observation (1). The blind spot is only displaced, not removed and neither observer can see the blind point in the intersection of their fields of view (arrow; C). Drawn with inspiration from (Luhmann 2007, p. 148)

The observer cannot observe itself<sup>9</sup>, and every observation gives rise to something invisible, something left in the 'blind point' (Luhmann, 1997 p. 48-51, 2000 p. 71, 2007 p. 131-135; Reese-Schäfer, 1999 p. 20-23). A second order observation gives a possibility to observe the observation<sup>10</sup>. Second order observations, when chosen well, can elucidate what is hidden in the 'blind point' but only by moving, not removing it (Luhmann 2007, p. 148). Figure 2 gives an example on this.

Social systems are, according to Luhmann, self-referential<sup>11</sup>, autopoietic systems that are composed only of communication (Luhmann, 1986 p. 174). Firstly, the information to be communicated is

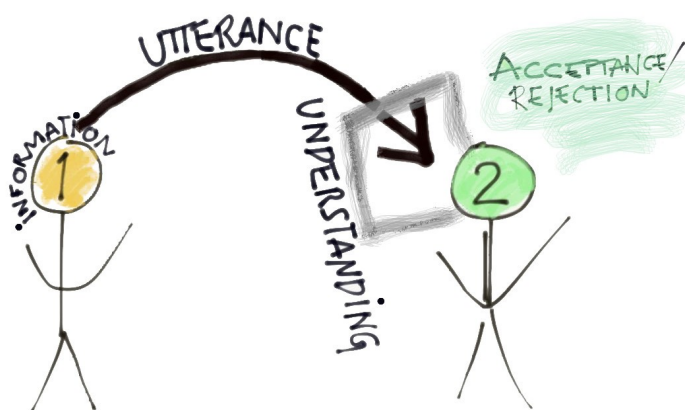


Figure 3: Communication as a three-step process. Drawn based on Luhmann, 2000 p. 183; Stichweh, 2015.

selected<sup>12</sup>. Similarly, the utterance, the 'how to say it' is chosen<sup>13</sup>. The last step of Luhmann's three-step model (Figure 3) of communication is understanding where it is crucial that another system receives the message in order to understand it. It is however not given how the other system chooses to understand it – or if it chooses to accept

or reject the utterance (Luhmann, 2000 p. 183; Stichweh, 2015). Acceptance or rejection is the fourth part of communication that brings the communication to the next round: it brings about a new choice: one can only either accept or reject and in both cases new communication will be selected (Luhmann, 1986 p. 176)

The basic components of systems, are short-lived, events<sup>14</sup> that are gone as soon as they appear. Future, present and past are defined by the irreversibility of the decay of events: expectation of an event (future) becomes present when the expectation changes irreversibly into an existing event

9 Although it is possible for the observer to know that it is not observing itself

10 Now called 1. order observation

11 Refer only to themselves, use their own distinctions as reference

12 Though not necessarily intentionally selected

13 In stead of words, a non-verbal form of communication can also be chosen.

14 Operations

(present), and again, to a past where the event no longer exists. The marker 'irreversibility' is here the definition for time. The present<sup>15</sup> exists as long as there is no irreversible change.

"Events are happenings which make a difference between a 'before' and a 'thereafter'" (Luhmann, 1986 p. 182). The very identity of events is based on this difference and therefore, in each event both sides of the difference, 'before' and 'thereafter' co-exist simultaneously: the past and the future are embedded in the present (Figure 4). There is a conscious tie-line through the time-horizons which leads to a multiplication of the duality of horizons: past and future become 'present of past' and 'present of future'<sup>16</sup> etc. (Luhmann, 1986 p. 182). The further iterations of the concepts lead to e.g. 'the future of future presents' and 'the future of past presents' (Luhmann, 1976). The concept of horizons in this context cancels out the idea of the beginning and the end of time: the horizon of the past is not the start of time, nor is the horizon of the future the end of it. In passing of time, the horizon of time is changed, and it is not possible to act in past or future (Luhmann, 2000 p. 118).

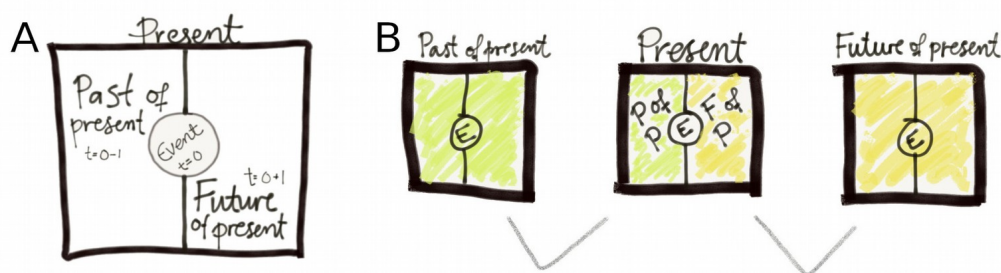


Figure 4: A) Past and future are embedded in the present. Event at time zero happens in the present. Past and future can only be perceived from time zero, that is to say from present time. B) Events of the past (and future) have also their pasts and futures, but they can only be perceived from the present at the current time. Drawn based on (Luhmann, 1986 p. 182).

15 According to Luhmann two states of presence appear simultaneously: one of the presences is finite, irreversible and the other infinite, reversible. Difference between these two presences marks the passing of time (Luhmann, 2000 p. 118-119).

16 In original text 'past present' and 'future present' (Luhmann, 1986 p.182)



## 2.4. Social, cultural and scientific capital

Some sociological thinkers have chosen to use the allegory of capital, comparable to money to represent features of societies. To give an overview of some of the capital forms<sup>17</sup>, I have summarized their main features in Table 2.

Capital	P. Bourdieu	J. S. Coleman	L. Archer & co.	
<b>Social</b>	networks of relations: family name, political party etc.	social relations; reciprocity, trust and norms of action	<b>Science capital</b>	e.g. science literacy and habits behavior; understanding scientific qualifications; science, possibilities to discuss science
<b>Cultural</b>	<i>Bildung</i> , cultural objects e.g. books; qualifications			
<b>Symbolic</b>	reputation, respectability			
<b>Human</b>		skills and knowledge		

Table 2: Different capital forms by Bourdieu, Coleman and Archer & co. (Archer, Dawson et al. 2015; Bourdieu, 1984, 1986; Coleman, 1990 p. 304; Winter, 2000). Capital forms marked with gray background color will be elaborated in the text.

### 2.4.1 Bourdieu's cultural capital

According to Bourdieu cultural capital exists in three forms: i) personal cultivation<sup>18</sup> (the embodied form); ii) physical items such as books, etc. (the objectified form) and iii) academic qualifications (the institutionalized form) (Bourdieu, 1986 p. 243). The society where the cultural capital is used defines it through its values and practices (Bourdieu, 1986 p. 245).

Bourdieu was, together with his collaborator Jean-Claude Passeron, particularly interested in the institutionalized form of cultural capital as a driving force for society power structures by the educational system. Bourdieu and Passeron claimed that schools reproduce the views of the upper class as children of the lower classes never learn to navigate in the school system and are therefore in a disadvantageous position as the official certifications of academic qualifications gives their owner a value, cultural capital, the owner can cash out (Bourdieu & Passeron, 1990 p. 210; Lamont & Lareau, 1988).

<sup>17</sup> Relevant in sociological context and the context of this work

<sup>18</sup> Bourdieu uses "Bildung" parallel to "cultivation" (Bourdieu, 1986 p. 244)

To benefit maximally, one needs both the qualifications and the knowledge on how to use them. Ranking and comparing different official academic qualifications makes it possible to establish conversion factors between qualifications and even between the qualifications and economic capital (Bourdieu, 1986 p. 246-247). Cultural capital has also in this regard a tendency to become symbolic capital due to the fact that the transfer of cultural capital from person to person is not as visible as the transfers of economic capital. Symbolic capital is unrecognized as a capital but recognized as competence or authority (Bourdieu, 1986 p. 245). Cultural capital is, similar to economic capital, a self-enforcing phenomenon: different levels of cultural<sup>19</sup> capital gives rise to different preferences of culture, moral and life choices. Through this cultural capital becomes both an indicator and a basis for class positions (Bourdieu, 1984 p. 260-317; Lamont & Lareau, 1988).

Not all cultural capital is directly coupled to the reproduction of classes through society's structures such as education, though. The embodied cultural capital, according to Bourdieu, can be described as cultivation<sup>20</sup>. In this form cultural capital is bound to each person, and acquired by investing time and effort. This self-improvement requires on the one hand personal costs such as time, but on the other hand, the wish to improve one's knowledge or skills. Through this investment into oneself, the embodied cultural capital becomes a part of the person him-/herself (Bourdieu, 1986 p. 244-245).

Cultural capital declines at the same rate as the mental capacity of its bearer and dies with him. Bourdieu argues though that transfer of cultural capital is coupled to transfer by heritage: in families with accumulated cultural capital children can start collecting their own embodied cultural capital from the early childhood without delay. By this manner the family's objectified cultural capital, such as books, musical instruments etc. is coupled to the family member's embodied cultural capital (Bourdieu, 1986 p. 244-245).

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19 And economic

20 Bourdieu uses "Bildung" parallel to "cultivation" (Bourdieu, 1986 p. 244)

#### 2.4.2 Social capital by Bourdieu and Coleman

Bourdieu defines social capital as networks of relations that can also be institutionalized. All the network's members contribute to the network with their actual or potential resources. In return, the membership provides them access to the collective capital of the whole network and allows them to profit from it in different ways (Bourdieu, 1986 p. 246). These networks are results of different conscious or unconscious investments that are made individually or collectively and with either short-term or long-term profit horizons in mind. The aim of these strategies is the formation<sup>21</sup> of social relations through necessary but voluntary exchanges of capital. This can be achieved through subjective obligations such as gratitude or friendship (Bourdieu, 1986 p. 247).

The bourdesian social capital is a complicated collection of potential resources of which the members of the network can benefit. The benefits the members can draw from the capital pool of the network are not the aim, but the underlying force of formation of the networks, even in the cases where the network is formed to concentrate social capital. The extent of social capital is determined by the amount of economic, cultural and symbolic capital of the members, and the size of the network in total (Bourdieu, 1986 p. 246).

According to James S. Coleman social capital is not one but many phenomena with two features, social structures and facilitation of actions, in common. Social capital is based on interpersonal relations and supports beneficial functions while being potentially irrelevant with respect to other individuals outside that relation (Coleman, 1990 p. 302). Composed of the social structure, or in other words organization of the social relations, social capital helps an individual to achieve something that otherwise could not be achieved, or not achieved with the same effort (Coleman, 1990 p. 304).

Coleman lists six social relations useful as capital resources. These give rise to different under categories of social capital, arising from e.g. selfless actions or trust (Coleman, 1990 p. 306-313). The different types of colemanian social capital are summarized in Table 3.

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21 Or the reproduction of existing

<b>Appropriable social organization</b>	If a social organization (e.g. charity organization) that is initiated for a purpose can help other causes than the initial goal, it is a source of social capital.
<b>Authority relations</b>	If someone transfers their right to control particular actions to another person, will that person have social capital available as those rights. This can lead to concentration of power and social capital in the hands of few.
<b>Informantion potential</b>	In all social relations lies potential for informantion, and also social relations maintained for other purposes can be used for acquiring information.
<b>Intentional organization</b>	Although a large part of social capital is a by-product of activities directed to other purposes, there are also types of social capital where direct investment of other types of capitals is directed in return in the form of social capital.
<b>Norms and sanctions</b>	Norms can be inhibitory (e.g. agains crimes), rewarding (e.g. rewarding school achievements), prescriptive norms <sup>22</sup> (e.g. selfless acts of family members). Effective norms give rise to powerful social capital. However, while facilitatating certain actions, social capital arising from norms may also limit other actions.
<b>Oblications and expectations</b>	Expectation for (good) actions to be mutually obliging gives rise to social capital with resemblance to economic capital: getting ones favor (good action) returned is like someone paying their debt to you. Trust is a central part of this type of social capital.

Table 3. Summary of social relations that are capital resources for social capital (Coleman, 1990 p. 306-313).

### 2.4.3 Science capital

The development of the Western world since Bourdieu's main works were published has resulted in need for revision and further development of the capital forms. The cultural capital in particular has been seen as outdated, and has given rise to calls for development of new types of (cultural) capitals (Archer et al., 2015; Prieur & Savage, 2013). Bourdieu was himself open for adding other forms of (cultural) capital into his existing list by introducing for example liguistic capital (Bourdieu & Passeron, 1990 p. 72-73).

Archer et al. (2015, 2012) propose a new modern type of capital: science capital that combines forms of cultural capital that are relevant for science such as understanding how formal scientific qualifications can be used to ones benefit. To this Archer et al. (2015) combines a thread of boudesian social capital related to science: parent's knowledge of science and possibilities to discuss science-related topics with others as well as science-related behavior, in particular in

<sup>22</sup> Norms concerning what is correct or good to do

freetime activities. To be able to quantify students' science capital Archer et al. (2015) has put together a number of parameters which represent the three undercategories, introduced in Table 4.

<i>Based on bourdesian cultural capital</i>	<b>Scientific literacy</b>	Understanding... ...what science is, how it works ...science in daily life and scientific concepts related to e.g. ones own health
	<b>Preferences</b>	Positive view on science in school, free time and as part of society
	<b>Using science qualifications</b>	Knowledge and understanding of how formal scientific qualifications can be used e.g. on the work market
<i>Based on behavior</i>	<b>Science-Related Media</b>	Possibility to use and interest for using of books, magazines, TV and online resources etc. related to science
	<b>Out-of-School Science</b>	Going to e.g. museums, science clubs or engaging in science-related freetime activities at home
<i>Based on bourdesian social capital</i>	<b>"Knowing Someone Who Works in a Science Job"</b>	Close family member or other significant adult who works in science <sup>23</sup>
	<b>Parents' science qualifications</b>	Formal scientific qualifications of parents
	<b>Talking about science</b>	Adults and peers to discuss scientific topics with such as parents, family members, teachers, friends etc.

Table 4. Scientific capital as defined by Archer et al. (2015) for the purpose of quantification of scientific capital. Authors' "dependent parameters" that were part of the study, but not the definition of scientific capital are excluded from the table.

Science capital, only 4-5 years after being introduced, has also been criticized. Jensen and Wright (2015) for example, have expressed their worry of an explosion of new capital forms for all imaginable purposes, taking the focus away from the original bourdesian core capital concepts, and thereby inequalities in society. Similarly, science capital has been criticized by others not to address the key bourdesian capital feature: production and preservation of inequality of e.g. classes in society. Therefore can science capital not be directly used to decrease the inequality in science education and science-related professions (Black & Hernandez-Martinez, 2016).

<sup>23</sup> Has been shown to be related to childrens aspirations for science (Archer et al., 2012; Mujtaba & Reiss, 2014)

Although the science capital concept is still under development (Edwards et al., 2018 p. 384), I will in following text use the expression 'archerian science capital'<sup>24</sup> to refer specifically to the science capital concept defined by Archer and co-workers (Archer et al., 2015, 2012).

## 2.5. In summary: the theoretical framework

Table 5 summarizes the theoretical framework presented in Chapter 2.

<b>Paradigm</b>	<b>In this study:</b> Interpretive with some features of critical social theory
<b>World-view</b>	<b>In this study:</b> Mostly, but not exclusively based on radical constructivism. Knowledge and understanding of the external world is based on constructions in a personal cognitive proces.
<b>Narrative, within-time-ness</b>	Narratives are result of integrating and disintegrating life events. In stead of following the generally accepted time (e.g. calendar), the narrative describes events happening in personal time scale based on the meaning-making coupled to the narrative construction (Bruner, 1987, 1991; Polkinghorne, 1991; Ricoeur, 1980).
<b>Self</b>	Life, the events and experiences constructed through the meaning-making processes of the mind into our autobiographical narratives form the Self (Bruner, 1997; Polkinghorne, 1991).
<b>Communication</b>	The information to be communicated and the way to express it are chosen by Person 1. Person 2 receives the information and understands the utterance. (Luhmann, 2000 p. 183).
<b>Time; past, present, future</b>	Present is in the event, and the past (before the event) defined through the present <sup>25</sup> . Both sides of time, the 'before' and the 'thereafter', co-exist simultaneously in the present: the past and the future become the 'present of past' and 'present of future'. Therefore the past only can be the 'past of present' and the future 'future of present' (Based on Luhmann, 1986 p. 182; Luhmann, 2000 p. 118-119).
<b>Social capital, bourdesian</b>	Networks of relations composed of individuals with different resources provides all of them access to the collective capital of the network and allows them to profit from it in different ways. The networks are the result of social investments and aimed at voluntary exchanges of capital through e.g. gratitude or friendship (Bourdieu, 1986 p. 246-247).
<b>Cultural capital, colemanian</b>	Social relations that in different ways facilitate beneficial functions for each individual in the social network, group (Coleman, 1990 p. 302).
<b>Scientific capital, archerian</b>	Combination of cultural capital relevant for science (science literacy, science-related behavior and understanding on how scientific qualifications can be used) and social capital related to science (parent's knowledge of science and possibilities to discuss science-related topics with others) (Archer et al., 2015).

Table 5: Short summary of the central concepts of this study.

<sup>24</sup> Nomenclature derived from use of e.g. 'bourdesian social capital'

<sup>25</sup> That is also the case for the future (after the event).

## Chapter 3: Methodology

### 3.1 Empirical design

The empirical material of this case study is composed of autobiographical narrative interviews<sup>26</sup> (referred to in the text as NIs) written into short narratives and short semi-structured interviews (referred to in the text as SSIs) used to support the analysis of the narratives. The study has no intention of generalization but focuses in stead on the individual life worlds and life stories of the informants, the reflections arising from hermeneutic analysis of the empirical data being the end-product. Considering this, purpose of the study and the research question, the NIs in the framework of a multiple case study were considered a good choice. The decision to use SSIs was taken after the NIs as they inspired for using SSIs for deeper understanding of the informants 'science autobiographies'.

The overall time frame of the multiple case study is illustrated in Figure 5. Interview 1 in the figure are the NIs performed in the beginning of September 2018. Four months later, in February 2019<sup>27</sup> the NIs were followed up with SSIs, marked as Interview 2 in Figure 5. The SSIs were performed after the first part of analysis (see section 4.1) and the questions of the interviews were based on that. It was considered to be important to form an overall view of the narratives before more information in the form of the SSIs was collected.

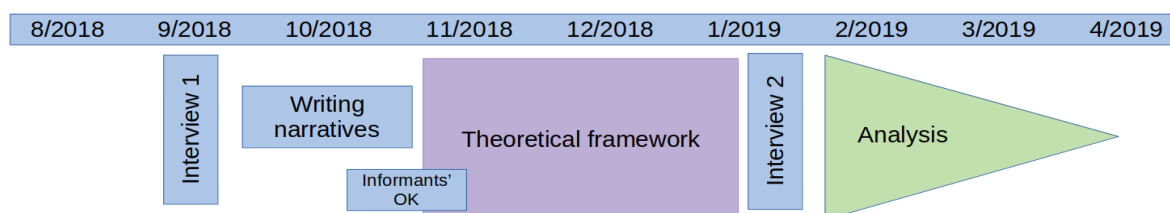


Figure 5: Collection and analysis of the empirical material during school year 2018-2019

26 With special focus on science and science studies

27 Position in Fig. 5: SSIs were originally planned to be held in January

### 3.3 The participants

All the participants (informants) were at the time of the interviews studying on the second year of their education at a technical college (in the following text in short from Danish: HTX<sup>28</sup>) in a middle-sized Danish municipality.

The informants in group 1 were of 18 years of age and signed a declaration of consent for participating in the study. They were recruited by offering all 2<sup>nd</sup> year students on study lines Mathematics/Biotechnology and Technology/Design born in year 2000 or earlier a possibility to participate in a non-anonymous questionnaire on the school intranet. The questionnaire contained 10 questions similar to those used by Archer et al. (2015). The response rate was however unfortunately low and only four students out of 38 answered the questionnaire. One of the four students who answered the questionnaire did not wish to participate in the interviews. Thereby the *de facto* selection parameter for Group 1 became voluntary participation.

Group 2 consists of informants who have during their studies at the HTX participated in an interview study<sup>29</sup> to which the informants were recruited before starting at the school. At that point it was their then-lower secondary school headmasters who, based on their knowledge of the informants’ background (‘pattern-breakers’), pointed out potential candidates. The informants were at the start of the study now parallel to the present one, under age, it was their parents who signed the declarations of consent. As the selection had happened at a considerably earlier time point, and on less transparent premises, dissimilar to the questionnaire-recruited informants’, it was decided that these informants would be placed in a separate group. One informant who originally was in Group 2 was however transferred to Group 1 before the start of the interviews. The transfer was based on following considerations: age (over 18) and a background similar to students in Group 1. The fourth informant of Group 1 signed like the three others, a declaration of consent. An overview of the informants and their organization in the two groups can be seen in Table 6 below.

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28 For nomenclature of the Danish school system, see Appendix 4

29 Four HTX students are followed throughout their 3-year education; although originally planned to be part of the master’s thesis that study is now parallel to the study presented in this master’s thesis.



<b>Caroline</b>	<b>Emil</b>	<b>Jacob</b>	<b>Laura</b>	<i>Anna</i>	<i>Ida</i>	<i>Nicolai</i>
<b>Group 1</b>				<i>Group 2</i>		

Table 6: Informants organized in groups 1 and 2. Group 2 (boldface italics) contains informants from a parallel 3-year study (light gray). Group 1 (boldface) contains three informants recruited via questionnaire (dark gray) and one informant from the 3-year study (light gray).

A very relevant question arises with the group division: why should there at all be two groups of informants? The answer is two-fold. For the first, it was methodologically valuable to conduct narrative interviews with familiar informants: to have them as good training partners for interview method, narrative interview, as they were the first ones to be interviewed. For the second, narratives of Group 2 (informants selected by others) were assumed to be fruitful in reflecting upon possible similarities or differences in narratives.

Undoubtedly, there are a few points to note: Group 2 informants (and the one transferred informant in Group 1) did quite likely communicate their narrative differently as we had met several times before. How this contributed to the actual narratives, e.g. with respect to ease in telling about ones thoughts to a known vs. unknown person, is difficult to say. I was less trained in narrative interviews with the first informants (Group 2) adds to the complex differences and similarities between Group 1 and Group 2. As the present case study has not the aim to generalize or to be quantitative, I find the selection and grouping of participants reasonable. Additionally, the transferred informant in Group 1 can be used as internal reference to check if e.g. any bias should be present.

### 3.4 Data collection

The interview sessions were organized in school hours and had a duration of 20 to 30 minutes per informant for the NIs and 10-15 min per informant for the SSIs. The NIs were recorded using a dictaphone program and the SSIs using a LiveScribe Pencast dictaphone pen. The NIs were not transcribed, but in stead written into short narratives. The SSIs were written as short bullet-formed answers in the form of citations and short summaries. As it was necessary to hide the identity of the

informants, some of the details e.g. study line or gender of present teachers were changed<sup>30</sup> or left out.

#### 3.4.1 Narrative interviews

The purpose of NIs is to record informants' life experiences. These can be focused on a specific topic or be sporadic chapters of a persons' life. In the actual interview situation the stories can come about spontaneously, or be provoked by the interviewer. Although NIs can be formed as a dialogue to organize happenings and meanings in a persons life, it is nevertheless always interviewer's role primarily to listen and with spoken and non-spoken language to create a situation where it is possible for the informant to tell the narrative, also when it may include highly personal or painful parts (Kvale & Brinkmann, 2015, p. 209-210).

Although NIs traditionally do not include an interview guide, the informants of the present case study were provided with an inspiration paper with instructions to the interview and questions for inspiration. It was made clear before the interview started, that the questions in the paper were for inspiration only and not expected to be answered. Most informants did use the inspiration paper, at least to some extent to structure their story. The inspiration paper can be found in Appendix 1. Sometimes, and especially towards the end of their interviews all informants had some or even significant difficulties in continuing their story and in those cases some indirect or even direct questions were necessary.

#### 3.4.2 Semi-structured interviews

The SSIs combine open-ended and closed questions and are well-suited to be used as second phase after the first data sets have been analyzed. The interviewer can follow up the answers independent of an interview guide that usually is the red line through the interview. Depending on the type of questions used, the collected data can be used as numerical (not necessary quantitative), especially in the case of closed-ended questions, or, in the case of open-ended questions, descriptive (Adams, 2015; Brinkmann & Tanggaard, 2015, p. 37-40).

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<sup>30</sup> referred to e.g. 'she' in stead of 'he'

The SSIs were based on the first analysis of the written narratives and the interview was loosely structured using an interview guide. The first question was based on categorization of the narratives' common themes related to choosing science education (HTX or after HTX). Question 2 was a broad question probing the background of the informants' autobiographical narratives and their view on themselves as individuals. The interview guide for the SSIs can be found in Appendix 3 together with the informants' answers to questions.

### 3.4.3 Anonymity of the informants

The gender of the informants was anonymized by randomization using the website [random.org](http://random.org). Inserted in a list form, the two genders, 'male' and 'female', were randomized and the gender at the top of the generated to-item list was used as a gender for each informant. After the randomization, the informants were given names based on the list of the most common names of newborns in the first part of the year 2000<sup>31</sup> in Denmark (Danmarks Statistik, 2001). The names of Group 2 were taken from the 11 most common name downwards whereas the names of Group 1 were from the 6th most common name downwards, gender taken into account in all cases. Names on places one to five were not used as the real names of the informants may have been on the list.

### 3.5 Writing the narratives

The written narratives<sup>32</sup> were written based on the NIs in an iterative process where sequences of the interview were listened and formulated into text. Some parts of the interviews, e.g. where the informant describes the interview situation or tells in detail about something he/she has e.g. seen or heard recently, were judged irrelevant and left out from the written narratives. Besides practicalities, the decision can be based on narrative theory. *"Not every sequence of events recounted constitutes a narrative"* (Bruner, 1991).

The narratives were written in two phases. After the first draft was finished, the informants themselves were given the possibility to read and, if necessary, comment the text, and give their approval for that they can recognize their own narrative in the written one. This step was included in

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31 The birth year of most of the interview students

32 or in short, when in context of narratives of this study: narratives

the process first of all as a part of data validation but also, as a way keeping the informants informed on how their stories were forming into cases. The narratives were considered final only if the informants did not have comments or corrections to point out. Only one informant had one single small correction on their narrative at this point and that was of course corrected for the final version.

### 3.6 The analysis

The empirical material for the work was analyzed in three phases. I have chosen to illustrate this three-phase analysis as the 'hermeneutic funnel': an allegory of a funnel – known from the chemical and biological laboratories – siphoning material into a flask (Figure 6). One can set different types of filters into the funnel, to separate the materials from each other. The traditional hermeneutic interpretation is included in the funnel-model in the phases 2 and 3. In the allegory the funnel is the three phases of analysis, filter papers my interpretations of the material, and finally, the contents of the flask the discussion and reflection of the findings of the analysis.

The first phase of the analysis is a categorization of common expressions, words etc. in the narratives in order to find possible trends. This gives a starting point for SSIs. Second part of the analysis is the actual hermeneutic analysis where I interpret the narratives, supported by the information from the SSIs. In the third part of the analysis I bind together the narratives, the case-based and overall findings relevant in a larger scale.

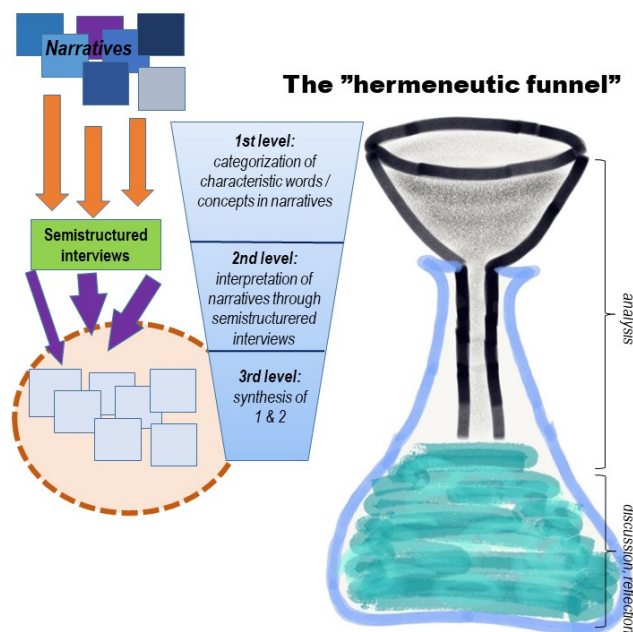


Figure 6: Analysis of the empirical material illustrated as "the hermeneutic funnel". See detailed description in text.

### 3.7 In summary: methodology

The empirical material of this case study was collected during school year 2018-2019 in a HTX located in a middle-sized Danish municipality. The informants of the study were all on the 2. year of their education. Interview material was collected first as NIs in September 2018 and then as short SSIs in January 2019. The NIs were written into short narratives by the author of this study and analyzed as written text. The SSIs were not transcribed but written as short answers to the interview questions and used to support the analysis of the individual narratives.

In the first part of the analysis, themes, topics mentioned by more than one informant were mined from the narratives to create an impression of potential common themes. These themes were used in the interviewguide of the SSIs. Secondly, the narratives were interpreted in a hermeneutic manner supported with information from the SSIs. Finally, the hermeneutic interpretations from second part are used in a synthesis of all the findings in the third phase.

## Chapter 4: Findings

In this chapter I present the findings of the analysis of the empirical material – written narratives and short SSIs – on three levels. For the first, I have categorized the common themes in the narratives that can be found in section 4.1. The common themes were used as material for the interviewguide for the SSIs. In section 4.2 I present my interpretation (hermeneutic analysis) based on the synthesis of the narratives and the SSIs. The text in section 4.3 is a synthesis of sections 4.1 and 4.2.

### 4.1 Categorizing common themes

The written narratives were analyzed first in order to find common themes, words, phrases etc. The result of this categorization is presented in Table 7. Analyzing common themes of the narratives may, due to the interview method and other limitations, have partly been inconclusive and can only be interpreted in the context of the narratives. It is, nevertheless, interesting to gather information on any trends, in particular between the two informant groups or between groupings of common themes.

There were no trends to find that would indicate differences between informants in Group 1 and Group 2. Similarly, there does not seem to be any correlation between plans of STEM-studies after finishing HTX and any of the used categories, or any apparent correlation between any trends.

	Caroline	Emil	Jacob	Laura	Anna	Ida	Nicolai
Interested in nature, mathematics							
Interested in sport							
Personal experience (or family, friends) on STEM topics e.g. medical issues							
Family-members professions influence thoughts/plans on STEM							
Not interested in STEM in primary school							
Became interested in STEM <i>after</i> primary school (level 6)							
Good STEM experience primary /secondary school							
Good primary / lower secondary STEM teacher							
Good technical college STEM teacher							
Did <i>not</i> like STEM teacher (any level)							
Parental support <sup>33</sup> on school, study plans							
<b>Clear / semi-clear plans for STEM studies</b>							
<b>Difficult to decide what to study / keeping plans open by choice</b>							

Table 7: Common themes in the written narratives and informants plans on future studies (as September 2018). Colors indicate themes and different categories different ways the topic was expressed.

Rather than using the matrix quantitatively, it was used to see which groups or themes were formed in the categorization. Personal interest in nature, sport or science as well as parental support were

33 Direct support such as help and indirect support such as encouragement, positive comments, lack of pressure

mentioned by almost all informants. Also personal experiences and/or family's professions were mentioned by many.

Teachers and experiences in STEM subjects were mentioned only by few. It is revealed by the further analysis, and in particular the SSIs, that teachers play a much more central role (sections 4.2 and 4.3) than indicated by the categorization.

It is both surprising and interesting that when looking at the overall distribution of themes, phrases and words, it is difficult to find any clear pattern or trend. The only common nominator appears to be that personal interest in nature or sport and, in particular, parental support are mentioned often.

***In a nutshell:** Almost all informants told in their narrative about interest in nature or sport, the role of personal experiences for that interest and how family's support is important for them. The categorization served as a starting point for the SSIs to deepen the understanding of the informants' view on themselves and their choice of study.*

## 4.2 Behind the narratives

In this section I dive deeper into the individual narratives<sup>34</sup>. To support the narratives' autobiographical line and, in particular the role of time, I merge in the SSIs. The concept of time, both in terms of with-in-timeness of the narratives (see p. 11) and with respect to a luhmannian understanding of time with the present as the anchor point (see p. 13-14) are referred to in the text in the form of short-hand notations that are explained in Figure 7. Quotations with normal typeset are from written narratives and those with italics direct quotes from the SSIs. The SSI quotations are translated from Danish and for readability added comments by author marked '[ed.]'. Page and section references in the text refer to this thesis. Notice that as mentioned in figure text:  $t_1$  refers consequently to the time of the NI in September 2018 and  $t_2$  to the SSI in February 2019.

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34 The written narratives can be found in their full length in Appendix 2.



Figure 7: Presentation of the short-hand notations of time based on Luhmanns systems theory (p. 11).  $t_0$  denotes a pseudo time point that only exists during the persons's cognitive process when the reality of the present time  $t_1$  is constructed.  $t_2$  and the following finite time points  $t_n$ , describe time points of reference for the person. Similarly,  $t_{1+f1}$  represents the future of the present time  $t_1$ . Whether  $t_2 = t_{1+f1}$  is case-sensitive. Notation for the past time follows the same principle, but now with a negative sign. Past of the present  $t_1$  is  $t_{1-p1}$ , whereas finite time points of the past run with a notation  $t_{-x \rightarrow n}$ . In the text  $t_1$  refers consequently to the time of the NI in September 2018 and  $t_2$  to the SSI in February 2019.

#### 4.2.1 Caroline and the developing Self

The Self, the who-am-I of a person is constructed through narratives (p. 9-10). There is an interesting development in Caroline's construction of her Self during the four months<sup>35</sup> between the two interviews. Although the SSI is not as such narrative-based, do Caroline's answers nevertheless represent her Self at that time point<sup>36</sup>.

Caroline tells in her narrative that as a child she wanted to be a veterinarian. It seems that nature and animals have played a big role in her early life, and one of her favorite free time activities was to visit a zoo. Later in her narrative she underlines that although she likes some of the new subjects at the HTX, e.g. technology, Nature, written here with a capital letter to underline the emphasis as it

35 September 2018 to February 2019

36 With the reservation that direct questions in the interview can have an effect



was in the interview, is still the core of natural sciences for her: "For me science still is, as it was when I was a child, all about Nature. It is just not about technology."

Time is a crucial component in narratives, but does not represent itself as linear (see p. 11). It does indeed seem that Caroline's early interest in nature (Nature) follows to her narrative present,  $t_1$ . She looks into her past  $t_{1-p}$  and future  $t_{1+f}$  from  $t_1$  and here appears Nature as crucially important for defining her Self and her life history so far.

In her narrative Caroline tells also how she decided to become a physical therapist after a sports injury at the age of 14. "After that, I had to go to physical therapy, and during that, I started to get interested in how the human body works..."<sup>37</sup>. Interestingly, Caroline's construction of her Self develops during the four months after the NI. Looking back from the present of  $t_2$  to her past  $t_{2-p}$  Caroline sees now her sports injury to have been The Event that had led her to start at HTX.

*"The episode or event that... you can say... what has been the most important thing for me, and maybe why I have chosen HTX, was probably when I tore my crossbone over in 2014. And then started [training, ed.] with the physical therapist. It was the [time with, ed.] physiotherapist that probably led me here. [...] I think a lot about it".*

It was now the sports accident, the "BUM", as she puts it, the split second that changed her life in a new, interesting direction. "Nothing is bad without being good for something".

Caroline's adaptation of her past from  $t_{1-p}$  to  $t_{2-p}$  has naturally consequences also for her construction of the future. Now it seems that the strong preference for physical therapy has dissipated and given space for becoming "[...] some type of an engineer or something in that direction. That I think could be interesting. A kind of combination of physics and mathematics, they are two subjects I like.". Caroline emphasizes that she now finds physics interesting, now it's something she likes. It is not the teacher nor the way physics is now thought, but the topics, the subject itself that she now experiences more interesting than before.

The narrator constructs the narrative at the moment it is told (p. 9-10). Caroline's narrative at  $t_1$  originates from time she did not have the particularly positive experiences in physics. During the

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37 This and other citations in this section are from Caroline's narrative Appendix 2, p. 66-67 or SSI Appendix 3, p. 75-76

following four months she starts to find meaning in the subject. She experiences herself this to be a consequence of closer coupling of physics with real life phenomena: "[...] a big part of the syllabus is what it [physics, ed.] is used for in everyday life. That's better somehow. It makes more sense to have physics now than in lower secondary school". At  $t_2$  she appears to have a more physics-positive Self and this seems to be closely correlated with her construction of meaning in the subject content. According to Bruner, learners in the process of learning, are constructing new world-views (Bruner, 1996). This fits well into a constructivist view on learning, where learning is seen as the process of constructing knowledge (e.g. Selvi, 2012). Here, Caroline constructs not only knowledge but also her definition of Self.

#### 4.2.2 Emil changes plans

Emil's narrative is filled with experiences at a boarding school where he, not atypical for Danish teenagers, spent the last year of the lower secondary school. He had chosen a boarding school with a good reputation but learned soon that the other young people there were not at all like him.

"It turned out to be a place especially popular among people from 'North of Copenhagen'. I mean, you know, the kind of people you connect with these stereotypes of certain lifestyle and income. Quickly I learned that it was not only that: many of the pupils there had completely different life values too."<sup>38</sup>

Emil crashed, perhaps for the first time in his life, head-on to differences between two societies, his home-society and the society of "North of Copenhagen", or seen from a bourdesian view point, differences in the social and in particular the cultural capital coupled to distinctions taste and the reproduction of the social benefits. Even though the embodied form of cultural capital is in principle available for everybody to accumulate, the heritage, or rather, transfer of capital, plays a large role (p. 15-16).

By coming into contact with young people with considerably higher bourdesian social and cultural capital<sup>39</sup>, Emil experienced how deep-going differences these give rise to with respect to everything

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38 This and other citations in this section are from Emil's narrative Appendix 2, p. 67-68 or SSI Appendix 3, p. 76

39 Acquired for the most part by familiar transfer

from life values to professional aspirations. “For most of them, it was always more about money than about people. For example at Christmas, the expensive presents were the whole point and the holidays with the family something you just needed to get over and done with.” Life choices and preferences of the person are influenced by their cultural capital (p. 15-16). The young people at the boarding school were and are, at least when it comes to taste and preferences, the product of their society<sup>40</sup>, or put in other words the capital they had collected, just like Emil’s capital assets<sup>41</sup> are connected with his background. Emil’s narrative describes vividly as if no time had passed since those experiences the year when he was caught up in a world of people with life values almost opposite to his own. Perhaps Emil’s narrative time<sup>42</sup> had in fact not moved forward at all, at least with respect to the experiences in the boarding school.

Emil reacts to the situation at the boarding school by not trying to adapt, but by trying to re-define himself.

“Before I went to the boarding school, I had had a particular general college in mind to which I wanted to go to after lower secondary school. However, after my experiences at the boarding school I started to see that school as a snobbish place.”

A rapid change in his Self in a period where Emil was challenged almost existentially, is likely to be a product of iterative re-telling and re-interpretation of his Self-constructions (see p. 10). This was, perhaps, Emil’s survival method but at the same time resulted, possibly, in that Emil turned into a more science-positive direction.

The “North of Copenhagen”ers at the boarding school, as Emil calls them, considered science as “nerdy” and as a result of that science subjects were associated with social stigma. Emil tells in her narrative her own theory on why that was the case: “I guess their [other students, ed.] parents were lawyers and they wanted follow in their footsteps.” The students from, “North of Copenhagen”, understand the rules of the social games of the society and benefits of collecting academic qualifications in particular disciplines in line with classical bourdesian capital theory (see p. 15-17).

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40 According to Bourdieu: class

41 Emil’s capital assets are not evaluated here, nor is it in the focus of this study

42 See p. 11

Emil however sees this as “snobbish” and in collision with his family-near values. For Emil, there are two worlds, two societies he compares: home with the values he knows and understands, and the “North of Copenhagen” with the values he does not accept.

Emil does not see the point in adapting into preset life values, education etc. just to be part of a social class, to gain money or influence. Very interestingly, this is underlined in Emil’s narrative by describing law studies as snobbish. In contrast, for “...people who work with science, like professors and such, it's more the finding out things rather than the career they are focused on”. In Emil’s view being a professor is not snobbish as such, it’s what you use it for that makes a difference.

Two interesting points arise from this. Firstly, such thinking suggests, what I would like to call here a ‘bourdesian blind point’: the institutionalized cultural capital, that is to say the official status of being a professor, and the conversion possibilities of this cultural capital into social and economic capital do not play a role for Emil. He possesses some cultural capital and is undoubtedly able to see at least most of the possibilities in high status professions and networks, but he chooses to ignore them or to prioritize otherwise. Secondly, this brings about a reflection on how context- and community-dependent the social status, or, institutionalized cultural capitals, of different disciplines and professions are.

Opposing “the snobs” gains importance towards the end of Emil’s narrative. After setting aside a previous plan of a school he had decided to attend, Emil chooses HTX based on the relaxed atmosphere at the school. “It was definitely not snobbish.” In future, after graduating from HTX, Emil considers studying architecture or medicine. Medical students typically come from the fair end of the socio-economic status spectrum and medical doctors have a high-status in society (Brosnan & Southgate, 2017; Johansen, 2017; Steven, Dowell, et al., 2016). Emil’s choice may seem surprising but Emil, after the eye-opening experiences of the boarding school is ready to make it. His further studies are not an investment in a future cash-out nor submit to preset external norms. In Emil’s view, medicine and architecture are interesting and therefore they are worth studying.

### 4.2.3 Jacob and the human body

Jacob's narrative has a fascinating story line: he starts by telling how he earlier didn't like biology. It was first on level 9 in a boarding school where he got "a fantastic biology teacher"<sup>43</sup> and started to learn about things he "was actually interested in, things to do with the human body like for example muscles." This suggests, although Jacob's narrative claims the opposite, that his interest in science, for human body in particular started in fact earlier than level 9. In stead of lack of interest before level 9 Jacob's narrative indicates that the school's curriculum did not resonate with his interest before level 9. How could he otherwise know what he was "interested in", if the interest was not there, also earlier? In Jacob's narrative the past where he was on level 9,  $t_{1-p(\text{level}9)}$  is a construct made in present  $t_1$  and therefore mirrors a complex mixture of contributing factors from both  $t_1$  and  $t_{1-p(\text{level}9)}$  and the years in between.

In the SSI Jacob tells indeed that he got a sports injury on level 6-7 and was treated with physical therapy. Already then, interest for science was raised.

*"It started with [the thought of, ed.] being a physical therapist. That's where I stopped thinking all kinds of other directions. [...] After that I just wanted to be something that had to do with the human body: physical therapist, nurse or medical doctor."*

Jacob looks back to his past  $t_{2-p}$  from the present of the SSI  $t_2$  and sees a time before and a time after the accident that made him interested in biology – and changed the course of his life. This clear line of thought runs from the past  $t_{2-p}$  to the future  $t_{2+f}$ . Jacob seems to have used the single event, the sport injury, to structure a strong Self. This part of his Self is so strong that it does not seem to change from 12-13 years of age until the interview time where Jacob is 18.

### 4.2.4 Laura's sustainable architecture

Laura tells about both good and unfortunate experiences with STEM-teachers in her narrative. Natural sciences was fun on level 7 and 8, even though it was actually her level 6 teacher and her parents that decided that she should take the science line in lower secondary school. At the boarding

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43 This and other citations in this section are from Jacob's narrative Appendix 2, p. 68-69 or SSI Appendix 3, p. 77

school on level 9 “[...] the physics and chemistry teacher I had took simply all the joy out of science for me. He was all too old-school in his way of teaching and he chose topics we already had had on level 7 in my old school.”<sup>44</sup> It is interesting how strong this one teacher has influenced Laura and her view on science, perhaps even her science-Self. In stead of turning science into something negative, has the negative experiences with the teacher on level 9 seemed to re-inforce the positive experiences on levels (6-)7-8.

It seems almost as if Laura has two worlds, two realities she operates in, and which of course, are united in her construction of her Self. One of the worlds in the daily Danish reality, the other, the world of non-everyday activities located in the Alps as her family has “a tradition of traveling to the German speaking area of Europe both summer and winter”. Later in life she would like to live there as “I almost feel at home there”. When she looks in to the future of the present<sup>45</sup>, it appears almost as if the story follows a premade plot. With Bruner's words: “*Narrative imitates life, life imitates narrative*” (Bruner, 1987).

Laura's choice of upper secondary was based on the fact that taking German is voluntary at HTX – unlike at the general college (STX). This is not an uncommon answer<sup>46</sup>, if you ask why someone has chosen HTX! The uncommon with Laura is, however, that she actually is fluent in German. She just does not like the kind of German (teaching) the school has to offer. German has become part of her Self, not just in this time, but also in the coming futures  $t_{1+x}$  and  $t_{2+x}$ . The narratives she has unconsciously<sup>47</sup> iterated through the many visits, undoubtedly filled with happy memories<sup>48</sup>, is for her much more significant than anything school-German could offer. It appears as if she wants to keep her German-speaking Self outside the influence of school system and teachers. Laura possesses enough cultural capital to see the power of investment in certified education, in this case an official certification of skills in German, to be able to cash-out the investment as higher income and society

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44 This and other citations in this section are from Laura's narrative Appendix 2, p. 69-71 or SSI Appendix 3, p. 77-78

45 Of the NI

46 Based on my own experiences as a HTX teacher

47 And consciously, e.g. in form of future plans

48 Of the present and of the past for each iteration of the autobiographical narrative in time ( $t=0, -1, -2...-n$ )

position later on. She has, however, a value-based 'blind point'<sup>49</sup> in her view on this as her values and choices lie elsewhere.

Laura sees her choice of education and coming work life as primarily based on interest and what one almost could call a calling.

"I am feel strongly about sustainable development and the mankind's responsibility for the nature and the climate. Therefore, for me learning science is important when it has this viewpoint. One can also see I have another interest in natural sciences: architecture, especially in the context of building more sustainable and energy effective houses than what we are building now."

It was originally her teacher in lower secondary school who got her interested in these topics, but certainly also the surrounding nature and countryside where she lives seems to have it's role. "I grew up surrounded by nature [...] It was and still is a functioning society but also a beautiful one, out in the countryside. It has always been there in my lifetime and I want to make sure that it will be there, both the nature and the functions in the future too."

#### 4.2.5 Anna's colemanian social capital

Anna tells in her narrative that she got interested in biology when she started in the lower secondary school (level 7) and that science in primary school was "quite unserious in my opinion, putting mints in Cola and things like that". However, later in the SSI she says that her interest "*started around level 3-4 where we had 'nature and technology'*<sup>50,51</sup>". It seems that the time between the interviews has changed something in Anna's view of the past: what she first (t<sub>1</sub>) looked back to (t<sub>1-1</sub>) as unserious was later (t<sub>2</sub>) seen as an interesting introduction to science. Anna's construction of Self as the Anna who almost from the start was interested in science, and biology in particular, seems to grow stronger by time. The same happens with Anna's reflection on how, and when, she is learning science.

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49 See 4.2.2

50 From original Danish "*natur og teknik*" – 'teknik' is translated here as 'technology'

51 This and other citations in this section are from Anna's narrative Appendix 2, p. 71-72 or SSI Appendix 3, p. 78-79

Anna sees HTX as a great place to learn more biology, and the good teachers she has, have generally a boosting effect in her interest in science. After finishing HTX she wants to study physical therapy. She sees the profession as a good combination of her own interest in the human body and helping others. "I want to help people and to make their life easier and less painful and make their life quality better. At the same time, I could think of being a kind of a body engineer, one who understands how the body is built up and can be used to fix itself." Education and the future<sup>52</sup> profession for Anna is not a tool for climbing up on social stairs nor securing a high salary or position in society<sup>53</sup>. "I want my job in the future to be the kind where I can enjoy going every day." As also mentioned earlier, this fits well in the context of Bourdieu's cultural capital (p. 15-16). Anna has started building up her cultural capital without a high level of transferred cultural capital. In contrast, she is determined in building up her embodied cultural capital assets in form of knowledge and has a strong background in colemanian social capital with the family-network she has close to her, both geographically and emotionally. "It is actually really nice to be close by [where grandparents are, ed.], so if they call I can be there in 5 minutes." One can interpret Anna's social capital to be indeed colemanian and not bourdesian, as bourdesian understanding of social capital is based on that social network's goal is increase in capital, while colemanian social networks have social capital as their by-product (p. 17-18) as here in case of Anna and Anna's family. This closeness to family, helping each other when needed, is something Anna sees as an important part of her future too and wants to have her family close. This suggests that Anna's colemanian capital assets are perhaps even stronger than one would at first interpret from her narrative. Anna has a background in different types of team sports since she was quite young and has a particularly close relationship to her family. She has also felt how it feels when family-ties break, and how big a benefit it is to get those relationships repaired. It is unclear from the interview material how big a role does Anna's colemanian capital play in that she wants to study physical therapy (and not e.g. medicine). Being able to study relatively close to home and having good chances of finding work in the local area may play a role.

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52 Notably: both  $t_{1+x}$  and  $t_{2+x}$  – there's no change in this view

53 Notice similarity to Emil (5.2.2) and Laura (5.2.4)



#### 4.2.6 Ida keeps her plans open

Ida started at HTX as she didn't have any particular plans and HTX seemed like a place where all options could be kept open. "I knew there are plenty of possibilities afterwards if you go to technical college and gather some knowledge there." Later, though, she tells that interest in nature has always been there: "*I am in general fond of nature and would like to help making it better in future, to make it stay as it is*"<sup>54</sup>.

Keeping plans open has often the benefit that plans are not ruined so easily. Also in Ida's case: "I actually wanted to start on another study line but in the end I am happy the way it ended up. I hope that I can use what I learn here in future." It did not seem like the four months between the two interviews had changed much in Ida's construction of her future. The picture of the future was still clouded, but now, though, one could perhaps sense a tone of frustration. "*I still don't know what I want to be. I am still a lot in doubt.*" The expression may indicate that the pasts of the past presents that she doesn't tell about contribute her construction of the narrative, now in a different way and Ida in her narrative moves in the narrative's time-scale. These pasts are different<sup>55</sup> and time-wise located further back than what may appear for the interviewer (see p. 11).

Interestingly, Ida's narrative is not as such a classical autobiographical narrative. She<sup>56</sup> composes the narrative nearly as 'plan: no plans'. Ida has a large relational network, potentially indicating a solid colemanian capital background, from which also the ideas of teaching as a potential (temporary) future plan seems to arise. There are many in her family who are teachers. It does not seem, however, that teaching is something she considers for further studies, although plans are open. "*I am still somewhere between hairdresser, architect and veterinarian.*" she tells in the SSI. Hairdresser is a vocational education, whereas veterinarian and, architect in particular, university educations often connected with high society status. Although Ida is not done with her considerations of future plans, also for her it is not the status, nor the money, it is the interest that seems to be crucial for the choice, also in Ida's case.

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54 This and other citations in this section are from Ida's narrative Appendix 2, p. 72-73 or SSI Appendix 3, p. 80

55 From each other and from the present(s)

56 The flow of story is based on her narrative, I consider the written narrative as hers, also with respect to order of events etc.

#### 4.2.7 Nicolai's rebellion against the black-and-white science

"[...] this what we understand with science, it's not so simple either. I mean we get this black and white picture of it."<sup>57</sup> Nicolai's reflected view on science has perhaps developed through his father's work where he has seen that science is much more than what you learn through formalized science education. "It is just another angle to it." Again, as mentioned in connection with many of the other cases<sup>58</sup>: for Nicolai school science and hands-on science each have a different "angle to" science. It is more about the content of the education (skills), rather than the official qualifications that are important. Nicolai is also critical on how the science education is arranged:

"The picture they give in school and other places, it's so black and white: you read A and then you become B; you go to technical college and become something in science-related. That is not at all how it is, is it?"

Nicolai implies in his narrative that combining different disciplines could be interesting for him: "I could see myself doing that in the future too"<sup>59</sup>, combining science with some more society like things." Again, there is nothing here that indicates that the "society-like things" are based on anything else than pure interest. This is in stark contrast to someone with high bourdesian cultural capital background who might see science and business/society/management skills combined to have excellent cash-out potential on the work market. Nicolai does not mention this possibility at all, yet again point to a direction of a 'bourdesian blind point' in Nicolai's narrative.

Despite of the strong focus on interest, describes Nicolai in his narrative the choice of education almost as intimidating. "It is difficult, almost scary to figure out what you will and what you should." Looking from the present  $t_1$  back towards childhood ( $t_{1-x}$ ) his life seems simple, it's easy to 'know' what happened in the past of that present: the events are there to be constructed in more or less any possible narratives. The iterations of the Self who should take the choice of education, is a demanding process as every parameter in the mental work of construction can be changed, even those of the past.

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57 This and other citations in this section are from Nicolai's narrative Appendix 2, p. 73-74 or SSI Appendix 3, p. 81

58 See 4.2.2 – 4.2.5

59 'too' refers here to his father who combines science and economy in his work

It is however Nicolai himself who takes the choice. "I have heard that the parents of some young people decide for them what they should do e.g. if they should go to college. I am so glad my parents don't do that and that they are just happy for what I will decide". He feels strongly that he can make his own decision based on his own interests and not on somebody's views on what one should read, even though this freedom comes with a penalty: responsibility of making the choice. With the much-used Bourdiesian lenses in the binoculars, this suggests that education for Nicolai is not for climbing in society or filling your pockets with money, it is for following your own interests.

*"I can't see myself studying something that's not interesting. I mean your parents can support you or influence your choice but in the end... so... I really hope nobody is studying something just because someone else said that they should."*

### 4.3 A closer look

In this section I extract the most important points from the previous sections (4.1 and 4.2) in order to synthesize them into three joint themes. I want to again emphasize that I do not do this for the purpose of generalization, but merely to shine a sharp analytical spotlight on the sociological and psychological themes underlying the narratives.

#### 4.3.1 'Bourdiesian blind point'

One of the common themes of my interpretation of the narratives, is what I have chosen to call the 'bourdiesian blind point'. By 'bourdiesian' I refer to cultural capital, and in particular the convertibility of institutionalized cultural capital (p. 15-16). The 'blind point' draws lines to Niklas Luhmann's 'blind point' in systems' inner and outer observations (p.11-13). In connection with the concept 'bourdiesian blind point', the blind point refers specifically to the informants' mindset to not to include parameters like future salary and society position, or even possibilities for employment in their consideration on further studies on science. Choosing away the obvious higher-level education of similar interest field is very likely not based on the informant's inability to see the benefits but instead, on other, stronger parameters that overrule the choice. These are typically pure interest or a combination of interest and matter(s) of conscience.

Both informant groups have examples<sup>60</sup> of 'blind points'. Laura<sup>61</sup> (Group 1) is planning on studying architecture after HTX. The average salary for a young architect in Denmark is ca. 35 000 DKK a month (*Lønstatistik 2017*, 2017), and unemployment rate for architects 2-4 years after finishing education only 6 % (*Akademikernes ledighedsstatistik*, 2017). Both facts are reasonably good reasons for studying architecture, especially if some interest in topic can be added. In Laura's<sup>62</sup> case, however, the profession of an architect is, instead of an investment in future in terms of money or workplace, nearly a calling: "I am feel strongly about sustainable development and the mankind's responsibility for the nature and the climate. Therefore, for me learning science is important when it has this viewpoint" (Laura; Appendix 2, p. 69-71).

Ida (Group 2) tells in the SSI that she is undecided between studying to be a hairdresser, a veterinarian or an architect. Interestingly, both veterinarian and architect are long university educations with applied natural science, while hairdresser is a vocational education without apparent connection to natural sciences. Nevertheless, all three have equal position in Ida's considerations. The fact that e.g. a veterinarian and a hairdresser can be seen to be placed differently in the society structure (Omar, 2012; Sabiers & Larsen, 2014), does not seem to make a difference. For Ida, what matters is her own interest and salary that makes her economically robust, also robust enough to help others. "*Open my house [to lonely, starving etc., ed.] on Christmas eve, send money to Folkekirkens Nødhjælp*<sup>63</sup> or something" (Ida, Appendix 2, p. 72-73)

Anna wants to study physical therapy instead of e.g. medicine may base her choice on family-values instead of choosing away possibilities in medical studies. In fact, she seems to have considerations of further studies in mind, but they do not have a concrete form, unlike the plans on studying physical therapy that could provide a work place in the local area close to her family, and with good possibilities of keeping the strong relational network functional. Anna is able to use and see the benefits of Colemanian social capital embedded in her relational network(s). A choice (physical

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60 Half of the cases in group 1 and all the cases in group 2. Numbers are indicative, not significant.

61 For interpretation of Laura's narrative see section 4.2.4

62 In their own way many of the other informants' cases too

63 Danish church charity organization

therapy, local area) that from a bourdesian point of view is counter-productive, is from a colemanian point of view highly beneficial.

***In a nutshell:** The concept 'bourdesian blind point' was used here to describe the informants' tendency to choose away obvious high-status careers with similar science interest based on other, stronger values which can be seen e.g. as indication of high colemanian capital.*

#### 4.3.2 Colemanian capital and relational networks

*"It is actually really nice to be close by"* (Anna, Appendix 3; p. 78-79). Anna's comment on living close to her grandparents, and family in general, gives an impression of warm family relations. Anna follows closely the world and the trends in it and she must be aware of being close to her family is being in one sense trend-resistant as today's young people have the tendency to move away from their families in rural areas and small towns and into the big towns and cities (Sørensen, Olsen et al. 2014; Vestergaard, 2016). Anna does not give any implication on seeing the physical location where she lives a disadvantage. More importantly, she experiences the support from the extended family, friends and other relational networks in the local area unconditional and non-demanding, and appreciates it. Anna is able to use the social capital stored in her family relations as a strength here and now, e.g. by accepting help to get up in the morning if she e.g. would be tempted to sleep just a bit longer. *"Sometimes in math you just think that it was so good I was here today, otherwise I'd be totally lost"* (Anna, Appendix 3; p. 78-79). She can also see the benefits it gives when she thinks of her future studies and work life.

While some forms of colemanian social capital have a bitter taste of social control and sanctions in them, is this not the case for Anna. Although is difficult to point to a clear capital form, it is most likely a combination of colemanian reward-enforced norms and obligations/expectations-type social capital (p. 17-18) that dominates the picture.

Also Laura gives an impression of being strongly influenced by the colemanian social capital she has in her network. Part the network has roots in her boarding school time indicates intentional organization. Time in boarding school has “...really given me [mental, ed.] tools, memories and experiences, good and bad, that have contributed in making me who I am” (Laura, Appendix 3; p. 77-78). Otherwise it is most likely reward-enforced norms and obligations/expectations-types that dominate.

Laura tells also how the time with her grandparents when she was a child has given her a deeper understanding of life. It is impossible based on the interviews alone to go into details on how much of the social capital influencing Laura's choices and success in life has to do with her grandfather, but it is clear from the interview material that this relation is of central importance, firstly a part of her narrative forming her Self and secondly, as a role model for her future, the continuation of her narrative.

The strength of the family network and ability to use it to one's benefit weaves together with identity and future choices also in Emil's narrative. The distressing time in boarding school where Emil was confronted with another culture and value set did not result in Emil leaving or facing a defeat. Emil's ability to utilize her strong and large support network iterate her narrative about herself, to adjust her Self to her narrative, her narrative to her Self – and to the situation at hand.

“I do not think my parents expect me to become anything particular or even to get good marks in school. They just want me to be happy.” (Emil; Appendix 2, p. 67-68)

***In a nutshell:** Relational networks are important for many informants' life and decision-making. They are able to utilize the colemanian capital embedded in their relational networks here and now and see the benefits that offers in future. The relational networks were for some so strong that they influenced future plans.*

### 4.3.3 Science capital

Although analyzing science capital was not the aim of the study, became it during the work, and analysis in particular, clear that the informants' narratives bear with them interesting insight in science capital – and therefore the topic is included here.

All the informants, both in Group 1 and Group 2, seem to have considerably high archerian science capital based on the empirical material available<sup>64</sup>. It is, however, not possible<sup>65</sup> to analyze the matter in detail. What makes the hermeneutics based analysis of archerian science capital interesting, is that based on (Archer et al., 2015, 2012) one would not expect the informants to have as high scientific capitals as they have.

For example Caroline tells in her narrative about early science-based behavior including scientific interests outside the school.

“I used to play in our garden, and was especially interested to look after the small insects and other small animals. [...] In the holidays, I used to visit with my family Randers regnskov, a tropical Zoo in Mid-Jutland.” (Caroline; Appendix 2, p. 66-67)

Many years later, at the age of 18, this has a place in her narrative and indicates that the early science experiences she has had still play a role in her Self, the way she defines her science identity through her autobiographical narrative(s).

Anna uses science literature and other media to find information beyond the limits of school curriculum. For Anna, this is coupled strongly with her ambition to truly master the science (biology) topics she is interested in and, perhaps also, to strengthen her formal performance in school, although this is not mentioned.

“It has become clear to me that I need to choose the things I read in my free time so that we have had some of the similar things in school biology as well. In that way I can better understand the scientific texts I am reading on the topics I'm interested in. Otherwise, I would just read them and not really understand or be able to explain it afterwards.” (Anna; Appendix 2, p. 71-72)

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64 Others (e.g. Black & Hernandez-Martinez, 2016) have also used narratives in evaluating science capital

65 The accurate quantification was not a goal here

Quite in line with Bourdieu's theory on embodied capital and its collection being a matter of personal investment (see p. 15-16), Anna's passion for science is a strong driving force in her collection of science cultural capital and thereby archerian science capital.

It is difficult, based on the empirical material of this case study<sup>66</sup>, to evaluate how much science literacy Caroline possesses but it appears as if<sup>67</sup> science literacy is for her an important part of her motivation for studying science (at HTX): "[...] *it [physics, ed.] was not something for me. Then I came here [HTX, ed.] and a part of the curriculum is now what it's used for in everyday life. It's better that way, somehow.*" (Caroline; Appendix 2, p. 66-67).

Science literacy is one of the key parameters of the archerian science capital model that seems to be complicated to analyze when applied to the Danish education system. It is impossible to estimate how much of the informants' science literacy<sup>68</sup> originates from e.g. their families and the informant him-/herself, and how much from the way science is taught in the Danish primary and secondary schools. Already from 1990s there has been particular focus on cross-disciplinary and project-based teaching in science. In school reform of 2014 competences such as discussion<sup>69</sup> and communication were added and the interdisciplinary science projects were anchored in the final examinations (Dalgaard, 2014; Sillasen & Linderøth, 2017). This can be assumed to have had an influence on the informants' (e.g. Caroline Appendix 2, p. 66-67; analysis in 4.2.1) science literacy already before starting upper secondary school, as well as the one and a half years of HTX, where the curriculum is "*closely linked to technological, scientific and business-oriented literacy<sup>70</sup> perspectives*" ("Lov om de gymnasiale uddannelser," 2016). Although some literacy-related topics are also included in the Key Stage 3-4 curriculum in the United Kingdom ("Key stage 3-4.," "National curriculum in England," 2014), is comparing the curricula of the two countries unproductive. This is not to say that the archerian science capital operationalized in the United Kingdom would not be usable

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66 Evaluation of scientific literacy is in general difficult as the concept is so elusive. Here, and additional challenge is the narrow empirical data that does not focus on literacy

67 Based only on my own perception of Caroline when I have met her during the interviews

68 Science literacy has many definitions, here I use consistently Archer et al. (2015, 2012)

69 In the original Danish text "*perspektivering*". It is translated here as 'discussion' as it was not possible to find an equivalent translation in English

70 In the original Danish text "*dannelse*"; translated here as literacy.



elsewhere. The example here merely show, that science literacy is one of the parameters that seems to cause divergence between the observed and expected archerian science capital in Denmark.

Based on the narratives, one of the informants, Nicolai, has a parent who works in a science-related occupation, although without formal scientific education.

“My dad works with some stuff that has to do with medicinal industry. Even though he has no education in science. He does some other things too like things to do with economics and stuff but at the end of the day it is science he is doing.”

(Nicolai; Appendix 2, p. 73-74)

In the SSI Nicolai (Appendix 3; p. 81) tells that his father talks a lot about his work at home and has even started to involve him in some of the things he is doing. Nicolai's possibilities to talk about science at home and having a close family member who works with science spill over to one of the key the boudesian cultural capital parameter of the scientific capital: how scientific qualifications can be used in the work market. Nicolai presents a strong scientific capital in all of these points:

“I find that quite interesting that one can combine different aspects [society, science, ed.] like that. I could see myself doing that in the future too, combining science with some more society like things.” (Nicolai; Appendix 2, p. 73-74)

Nicolai's father's lack of formal education in science does not have a negative effect of Nicolai's scientific capital, quite on the contrary. The fact that he works with things that “has to do with medicinal industry” (Nicolai; Appendix 2, p. 73-74), and not in the medicinal industry as such, seems even to be a strong positive contributor. One can reflect upon how this fits to the archerian science capital.

Key adults have a role in children's aspirations for science (Archer et al., 2012; Mujtaba & Reiss, 2014). All informants of this study come from backgrounds with no or few contacts<sup>71</sup> to formalized science. Interestingly, all of them point out one or more good teachers as the main reason for choosing a science and technology oriented upper secondary school (HTX) as illustrated in Table 8. This may suggest that the teacher(s)<sup>72</sup> the informants refer to are in reality their key adults with a

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71 Family-members etc.

72 Typically one science teacher on level 7-9

science education<sup>73</sup> and thus have a big influence on the (archerian) science capital of the informants, both as role models and as discussion partners. The relation between students and teachers is traditionally close and familiar in the Danish school system and this can influence way the students see their teachers: also as discussion partners and not just clear-cut authorities.

	Caroline	Emil	Jacob	Laura	Anna	Ida	Nicolai
Choice of most important parameters for choosing STEM-profile in education	B	C	A	C	A	B	B
	C	D	C	A	C	C	C
		A		D	D	A	A
							D

Table 8: Parameters chosen by informants as factors influencing their choice of education (current upper secondary and coming further education). Colors indicate the themes in Table 7 (p. 28) where common themes influencing choice of education was grouped together from informants' narratives. The answers are organized in order of significance from top to bottom (most significant / important at the top). Letters refer to interview question 1 in the SSIs of February 2019, see Appendix 2. Green/A: interest; Orange/B: own, family's or friends experiences; Purple/C: good teachers; Red/D: family support.

***In a nutshell:*** All informants of the study seem to be strong in archerian science capital. Particularly interesting is that the discrepancy between the apparent (not quantified) and expected archerian science capital which calls for revision of the concept outside the United Kingdom.

<sup>73</sup> Science teacher in the lower secondary school has typically a medium-long university college education that is not an academic education. For the children this may appear to be very "sciency".

## Chapter 5: Discussion

“The young people need to think, what the society has use for” (Korsgaard, 2018). According to the Danish Evaluation Institute (EVA) young people who are about to finish their three year college education take their consideration of future plans seriously. The trend is that many balance out their own interests and society’s expectations and choose an education leading to high-salary professions (Rathlev, 2017). Interestingly, in the present multiple case study society's expectations were not part of the informants’ autobiographical narratives on their educational path. The informants described their educational choices and the specialization towards STEM subjects to be mostly based on interest. They described how professions within medicine and science started to gain interest and became important topics to think about in lower secondary school. This is in line with e.g. EVAs investigation that shows that school children on level 8 in lower secondary school think a lot about the coming choices they face (Madsen et al., 2017).

This development coincides with the age where the adolescent brain is in speedy maturation process to allow development of consistent but flexible self-identity and is able to long-ranging life plans (Illeris, Katznelson et al., 2009, p. 32-33; Walinga & Stangor, 2014). The informants’ science identity and interest for science started indeed to find focus in adolescence, and some described how trivialities or uninteresting teaching started now to become interesting and make sense<sup>74</sup>. At the same time, this identity-forming process was supported by influence from outside, such as parents’ occupation or own experiences<sup>75</sup>. This type of influencing factors are also reported in a recent report on the influencing factors behind educational choices in Denmark (Østergaard-Thygesen, 2018).

Previous Danish studies show that the cognitive identity-forming processes continue at the transition to higher education in order to e.g. create a sense of being part of their study program (Holmegaard, Madsen et al., 2014; Ulriksen, Holmegaard et al., 2013). In the present multiple case study science identity was defined based on Archer et al. (2010) as harmonized with the rest of the person’s identity while at the same time appreciated by others. Combining the findings of the present study and the previous studies (Archer et al. 2010; Holmegaard, Madsen et al., 2014;

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<sup>74</sup> see e.g. Anna: narrativ in Appendix 2, p. 71-72; analysis in 4.2.5

<sup>75</sup> see e.g. Nicolai: narrativ in Appendix 2, p. 73-74; analysis in 4.2.7 and Jacob: narrative in Appendix 2, p. 68-69; analysis in 4.2.3

Ulriksen, Holmegaard et al., 2013) together suggests that the science identity-development described by the informants started in lower secondary school and continues as an iterative process during upper secondary school and towards the tertiary<sup>76</sup> education. This is supported by narrative theory, as development of Self (identity) through narratives is considered an iterative process (Bruner, 1987, 1991; Polkinghorne, 1991). Outcome of the iterations of science identity was in the informants' narratives a developing view on the future studies, future life and future Self. Here it is central to notice that the informants' view on future, and the building of the future Self in the narratives was unavoidably anchored in the present time, in their present Self. For the first is the time horizon of the narratives internal<sup>77</sup>, and not coupled to the external time (Ricoeur 1980) and for the second, it is not possible to act in future, not even in thought. The future is always coupled to the present (Luhmann, 2000 p. 118).

Similar to findings by Holmegaard et al. (2014), the choice of education and profession was in many cases not a question of what to become, but who to become. This was particularly visible in the narratives, both in terms of professional (science) identity, and as a reflection on 'which kind of a person I would like to be'. This was in e.g. related to a wish for close family relations in adult life<sup>78</sup> or environmental consciousness<sup>79</sup>.

Media, both the traditional and the social media have a significant role in the young people's life in creating generational cultural communities and distinctions of taste (Drotner, 2018). This has also influence in educational choices (Østergaard-Thygesen, 2018). Changes in traditional society values has lead to interpreting cultural and social relations through economic philosophy. Although disruption of the traditional classes or norms at the same time has technically emancipated the young people with respect to their social, cultural and professional ties, is the choice of future plans still not an equal choice for all (Illeris et al., 2009, p. 33-34). According to Bourdieu (Bourdieu, 1986 p. 245-247; Bourdieu & Passeron, 1990), the unequal distribution of capital is the source for added

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76 In the case of Holmegaard et al., 2014: higher education

77 within-time-ness

78 Anna: narrativ in Appendix 2, p. 71-72, analysis in 4.2.5

79 Laura: narrativ in Appendix 2 p. 69-71, analysis in 4.2.4

capital value, both economic and other types. Although Denmark<sup>80</sup> has changed since Bourdieu's days, the stratification of the society in terms of differences in socio-economical status influencing among other things education, still persists (Østergaard-Thygesen, 2018) creating a reasonable background for bourdesian analyses.

In the present study social stratification did, somewhat against expectations not play a significant role in the informants' narratives – except for one, Emil<sup>81</sup>. In luhmannian view communication in Emil's home society is different from communication in "North of Copenhagen".

Emil, who has grown up in interaction with mostly his own society, experiences a big contrast (Figure 8). Following Bourdieu's thought, is Emil's ability to purchase 'roulette chips' in the economic games

of the society (Bourdieu, 1986 p. 241) limited, mostly as he has not inherited different types of capitals from the birth – unlike the "North of Copenhagen"ers. The bourdesian view is here, however, limited by assumption on that Emil wants to buy the 'chips'. Whether or not this is the case, Emil ends up turning his back on the "snobbish", as he calls it, society and it's social games and bases his choices on his interests.

Interest is the carrying theme of all the narratives' story line without tactical considerations on where that interest will lead in life, in particular with respect to e.g. salary and society position. I have chosen in my analysis to call this 'bourdesian blind point'. Undoubtedly the informants are aware of the potential of a salary cash-out of certain professions, but this is, however, not part of their future plans: it is in the 'blind point'. We return to 'bourdesian blind point' and its implications later.

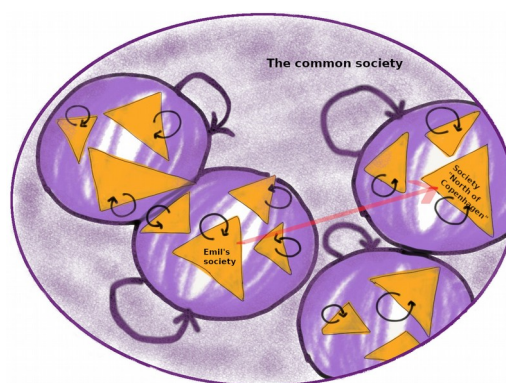


Figure 8: Emil's familiar home society is in stark contrast with the "North of Copenhagen" society. The common society is represents Denmark.

80 To some extent everywhere in Western world

81 Emil: narrative in Appendix 2 p. 67-68, analysis in 4.2.2

Although archerian science capital was not as such included in the research question, it did shine through in the narratives and analyses<sup>82</sup> in a way that justified it to have a place in the synthesis of the findings. The place is however peripheral compared to how central the topic is and further studies will be needed to investigate the matter in depth. The archerian science capital of the informants was not quantified in this study, but the narratives, and corresponding analyses were indicative of higher-than-expected capitals for all the informants suggesting that the archerian science capital model is not fully functional in Denmark.

Similar to findings of the present study, where the informants were interested in science, both now and with respect to further studies, Black and co-workers found student science identity<sup>83</sup> (Self) to correlate with interest in science for science' sake beyond its exchange value and as a safeguard against not (necessarily) knowing how to cash-out a science education (Black & Hernandez-Martinez, 2016; Black & Williams, 2013; Black et al., 2010). This is in contrast with Archer et al. (2014) who claim gender and class identities to dominate the way interest in science is created. In the present study several factors may have contributed to the difference between the expected and observed archerian science capitals. Many informants had strong assets of colemanian social capital in their large and stable relational networks, and they were clearly able to utilize that capital for their benefit, also with respect to education. Contribution of colemanian social capital is to my knowledge not taken into account in the archerian science capital.

Even more importantly, the archerian science capital was developed in the United Kingdom (UK) where not only the school system, but also the view on 'good' professions and the factual earnings are different from Denmark. In a large-scale study nearly 60% of the participating 9-year old British school children would like to have a job in business (Archer et al., 2013) giving perhaps an indication on what is seen as a 'good' profession by that age group. As seen in Table 9, in Denmark there are two groups of science-based professions in top-5 most earning professions while in the UK the best earning careers are found in trade, and there are no science professions among the top-earners. This may also have significance for the archerian science capital concept.

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82 1. and 2. phase of analyses

83 In these studies specifically in physics

<b>Positions in DK (DK definition)</b>	<b>DKK p.a.<sup>84</sup> in DK</b>	<b>DKK p.a. in UK</b>	<b>Positions in UK (DK definition)</b>
Managing directors and chief executives <sup>60</sup>	1 210 765	1 073 686	Chief executives, senior officials and legislators <sup>85</sup>
Senior government officials	1 078 612		
Aircraft pilots and related	1 105 616	1 163 098	Trade brokers
Specialist medical practitioners	1 045 578	763 623	Advertising and public relations managers
Research and development managers	946 206	755 152	Aircraft pilots and related

Table 9: Professions with highest salaries in Denmark and in the United Kingdom in 2016 (Ferguson, 2016; "LONS20" 2016). Grey background marks positions with a science-based education. Definitions for positions from ("LONS20" 2016). UK salaries converted from £ to DKK<sup>86</sup>.

The findings of the present study indicate that there is a need for further development of the science capital concept, taking the archerian science capital as a starting point and incorporating society-dependent features<sup>87</sup> or by attempting to universalize the concept.

I have in my analysis called the informants' blind points of interest-based choices of science careers bourdesian, as they indeed are profoundly in line with Bourdieus views on unevenly distributed, on the one hand possibilities, and the other hand, distinctions, in life (Bourdieu, 1984 p. 260-317. Combination of this bourdesian view in diverging archerian science capital implicated by this study underlines a need to understand the overall society-level background of the findings. To do this I use Luhmann's systems theory.

According to systems theory a get-around to reveal at least some of the inevitable invisible in all observations is a second order observation, shifting the blind point (Luhmann 2007, p. 131-135, 148). Societies, social systems based on communication, and individuals, psychic systems based on cognitive function, are able to observe each others activities and give each other irritations<sup>88</sup>,

84 A year - short from latin 'per annum'

85 The numbers may include medical leaders

86 The 2016 salaries were converted using WMR (Reuters) of April 7th 2019 at <https://danskebank.dk>. Inflation and changes in exchange rates between 2016 and 2019 are not taken into account.

87 leading to an array of science capitals in different countries

88 Do not influence the system directly, only through system's own functions

disturbances. The systems need to tackle these irritations, which leads to structural couplings between the systems and give rise to evolution in the system through provoked information processing<sup>89</sup> (Luhmann, 2007, p. 110-122).

In the model presented in Figure 9a The Individual (left side) observes different types of societies – drawn here as societies of educations and a society of medical professionals. The societies<sup>90</sup> send out irritations that influence The Individual through structural<sup>91</sup> couplings between the two systems<sup>92</sup>. Not all kind of irritations can disturb The Individual, though, only a narrow bandwidth of all possible irritations can do that, having on the other hand an enormous potential<sup>93</sup> for development in the individual through his cognitive processes. Despite of the The Individual's development<sup>94</sup>, leading possibly to different ways<sup>95</sup> to observe, there is always something outside his field of view, in the blind point. To get around this a 2. order observation (The Observer, left side) is utilized, and the direction of this observation is selected to elucidate what was not seen in the first place. Something, however, is still not seen (circle, top): drawn here, to exemplify, as a society of top hospital leaders. The individual is not able to see this, not even with the help of a 2. order observation as he does not choose the direction of the 2. order observation cunningly enough to shift the field of view into that point.

Seen with bourdesian view this is related to The Individual's capital assets. The approach of systems theory here suggests however that this is a question of The Individual's co-evolution<sup>96</sup> with the societies he observes. The Individual considered in the model did simply not develop in the direction that lead to cognitive processing where the top-leader societies are a parameter to search for in array of blind spots with the help of second order observations. To add the layer of diverging archerian science capitals into this one needs to consider different societies in Denmark (Figure 9a)

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89 E.g. reflection in psychic systems

90 All systems do this, in this case I focus on society/societis are the sender of irritations

91 And functional

92 The systems irritate each other through observations but for clarity's sake I fokus here on the Individual only

93 Through individual's own cognitive processes

94 And societies' developments, as the societies are also observing individuals

95 Or different foci

96 Development



and in the UK (Figure 9b<sup>97</sup>). The different sets of societies (both in Denmark and UK) irritate individuals differently and these different irritations lead to differences in the development of individuals.

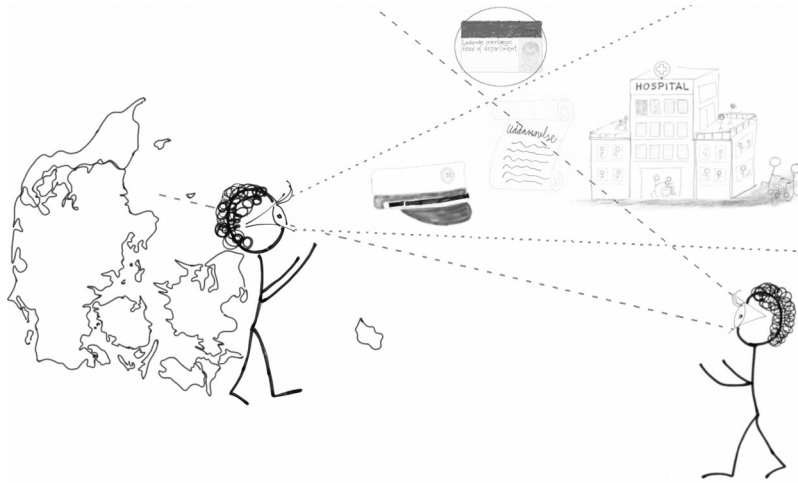


Figure 9a: The Danish observer's 1. (left) and 2. (right) order observations and their common blind point.

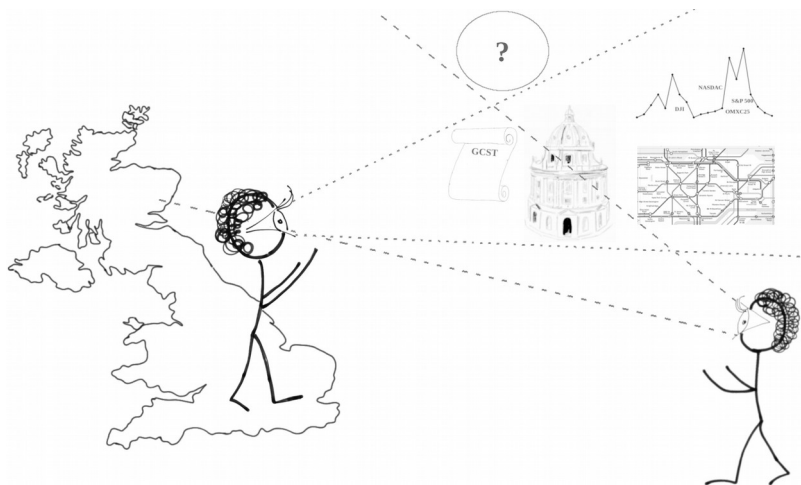


Figure 9b: Observer in the United Kingdom.

97 The Radcliffe Camera drawn with inspiration from <https://www.royce.ac.uk/partners/university-of-oxford/>; excerpt of the underground map representing the City of London from <https://tfl.gov.uk/maps/track/tube>

What was left in the blind point for The Individual in Figure 9a (DK), is different from what is left in the blind point by The UK-Individual in Figure 9b (UK). An easy critique here would be to ask, whether this would not be the case between all individuals, whether in different or same countries. However, as Denmark also is a society and irritates not only The Individual but all the societies inside Denmark disturbing The Individual, it plays a critical role in the overall sum of disturbances<sup>98</sup>. The same is the case for the UK. These influences and the development of the individuals is coupled to the development of the societies. The 'bourdesian blind point' observed in this study, as well as the observed diverging archerian science capitals can through this model be understood as a phenomenon arising from the types of small and large societies individuals co-develop<sup>99</sup> through structural couplings and therefore inherently a sociological phenomenon.

## Chapter 6: Concluding remarks

The findings of this study fall in two categories: the main findings referring to the research question and findings that were not originally in the focus of the study, but are of such significance, that they should not be ignored. The narratives mirrored the informants to have, quite surprisingly, a similar mindset regarding studying science. The title of this thesis, "I can't see myself studying something that's not interesting", a quote from one of the SSIs<sup>100</sup> is almost a one-line summary of the mindset regarding studies. It was, to larger or smaller extent, common for all informants that interest was the main reason for their orientation towards science both in the choice of secondary education, HTX, and in more or less concrete the plans of future studies. It seemed, that science careers with similar professional area (e.g. healthcare: physical therapist vs. medical doctor) were in many cases valued only by their professional content (e.g. time for patient contact) and not by parameters such as parental or society pressure, future salary or chance for future employment. Family values and values in other significant relational networks were crucial for the science-identity formation of the informants and had a central role also in influencing the decision-making background for the future

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98 Disturbances are filtered; structural coupling

99 Are in interaction with

100 Nicolai: SSI in Appendix 3, p. 81

studies within science. The findings suggest that the majority of informants of the study were able to use their relational networks and the Colemanian social capital embedded in them in their benefit.

The informants seemed to have larger-than-expected Archerian science capital assets. The Archerian science capital model, originally developed in the United Kingdom, turned out to not be fully suitable for use in Denmark possibly due to differences in society development and structure. Further work is called for to develop either a universal concept or by focusing on more fine-tuned society-dependent science capital interpretations.

## Chapter 7: Critical reflections and limitations

The search of literature was based partly on my own preceding knowledge, partly on discussions with my supervisor and for a large part cross-referencing the authors' works and using references from that. It was my goal to use as much original texts as reference material as possible and I put some effort in finding textbooks, books and classical papers by the authors. While in a way systematic, the search of information was for the most part intuitive and therefore not optimal in its width. Something, I am sure, has been left unnoticed.

Looking back to the empirical work, critique of the way the narratives were collected is in its place. I should have reserved more time per informant, as the time limit forced me to help some informants along with follow-up questions to speed up the narrative, while in other cases I had to close down a smooth-rolling narrative. More profound critical reflection is in place with respect to number, choice of informants and grouping. See section 3.3 for considerations on this.

It is worth considering how the empirical material of the interviews is put together, communicated, received and understood, and how this cognitive process on both sides of the interview table has influenced the study. In the end, the many parts of the study seem to have their own constructive position, and a development during the period of the thesis work. The experiences from the collection of the empirical material, both narrative and semi-structured, as well as reading, and writing the theoretical part<sup>101</sup> have influenced my interpretation, constructions, of the findings and implications of the study. Reflections on my constructions are drawn in Figure 10.

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101 Including all cognitive processing involved e.g. in drawings and discussions



Figure 10: Constructions. The work is a iterative cascade of my constructions starting from the constructions of the informants. (1) Informants' narratives; (2) my construct of what I hear them tell becomes (3) the written narratives that (4) I read and construct an understanding of. Based on my understandin (construction; 5) of theoretical litterature, I make the final construction of the empiral material and analysis (6).

Validity tells if one is measuring (investigating) what one should be measuring. Reliability on the other hand tells how consistent ones results are. Both concepts are used in quantitative research with logical positivism as the main paradigm. Qualitative research on the other hand does typically not have numerical data to compare and in general is not suited for analysis of validity in the same ways. The view on validity in qualitative research has developed together with the understanding of 'truth', and is subject to the diversity of perceptions on truth-concepts. Kvale defines different validity parameters in the qualitative regime and of these relevant for the present study are good craftmanship on how to check, question and theoretize ones findings; and critical dialogue (Kvale, 1995). On both accounts I claim this study to fall within the limits of acceptable validity.

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## **Appendix 1: Inspiration paper for narrative interviews**

# **Narrativt interview**

6. september 2018

Fortæl - som du ville blot fortælle en historie til en du kender - hvad du synes om naturvidenskab og om at læse naturvidenskab på HTX - og måske også senere.

Ordet er frit! Vi har 20 min! 😊

*Til inspiration:*

*Har din familiebaggrund, folkeskoletid, personlige interesser, fremtidsplaner eller andet har spillet en særlig rolle i den måde du ser på det? Hvordan?*

*Har der måske været en eller flere personer eller begivenheder i dit liv der har påvirket dig og dine tanker om naturvidenskab/om at læse naturvidenskab?*

## Appendix 2: The narratives

### Caroline

As far back in my childhood as I can remember I have been interested in nature. I used to play in our garden, and was especially interested to look after the small insects and other small animals. I could find under stones and things like that. In the holidays, I used to visit with my family Randers regnskov, a tropical Zoo in mid-Jutland. It is such a great place to visit, and especially when I was younger, I was wild with it. I was interested in all kinds of animals and wanted to be a veterinarian when I grow up.

When I was about 14 years old, I was injured in my leg while playing football in school. After that, I had to go to physical therapy, and during that, I started to get interested in how the human body works and how the physiotherapist can work with the human body. physical therapy rather combined the interest I had on the one hand interest in biology, I mean animals and now also humans, and interest in helping all the people and making their life better. On level 9 of lower secondary school, and on level 10, which I took afterwards, we could use some weeks out of school to get to know different professions. I went of course to see how it was to work as a physiotherapist. I also tried out work as prosthetist, and that was interesting too. Unfortunately, the nearest place where you could be trained to be one was somewhere up in Sweden, so I didn't think that was my thing. The time I spent with the two physiotherapist both on level 9 and on 10 confirmed my interest in that I would like to study physical therapy after college.

I chose technical college, as I like doing things myself, rather than reading stuff in a book. My sister went to the general college, and I could see that it was not really my thing. Technical college has been more less the way I imagined. There has off course also been some things I didn't know about before. I like the subject technology. That was not something I knew about before I started here. For me science still is, as if it was when I was a child, all about Nature. It is just not about technology. My parents are not college graduates and my sister and I always got a clear message that we should do our homework, and work hard, but we can choose what we want for our future. If I had chosen to be a carpenter or something instead of going to the technical college, I think my parents would have

been just as happy. They are not focused on my marks either, so whether it is tops marks I come home with or just get through the assignments (not that it happens so often!) they are just okay with that. My parents and my sister have always been there to support me no matter what I do. If I am doing well or even if I would do something stupid, their support would not waiver. That is fantastic to know.

## **Emil**

On my last year (level 9) of lower secondary school, I went to a popular boarding school. It turned out to be a place especially popular among people from "North of Copenhagen". I mean, you know, the kind of people you connect with these stereotypes of certain lifestyle and income. Quickly I learned that it was not only that: many of the pupils there had completely different life values too. For most of them, it was always more about money than about people. For example at Christmas, the expensive presents were the whole point and the holidays with the family something you just needed to get over and done with. I come from a family with close family ties and Christmas has always meant a lot to us. For us, and for me, it has always been more about the cozy atmosphere and fun with the family, then about anything we could buy with money. For the people I met at the boarding school it was completely opposite. They were showing off their presents at the school after the holidays, comparing who had got the most expensive ones.

At the boarding school science, and math, were seen as something extremely nerdy. If you wanted to be somebody, you should not be interested in those subjects. They, I mean the rich types from Copenhagen, wanted to go to law school after college. I guess their parents were lawyers and they wanted follow in their footsteps. Before I went to the boarding school, I had had a particular general college in mind to which I wanted to go to after lower secondary school. However, after my experiences at the boarding school I started to see that school as a snobbish place. I chose the technical college, I guess, mostly because the school has such a relaxed atmosphere when I was visiting here. It was definitely not snobbish. I guess it is the same with science too, that it rather seems less snobbish in a way. I mean for people who work with science, like professors and such, it's more the finding out things rather than the career they are focused on.

Apart from my mother and my aunt, everybody in my family is teachers with no background in science. I could see myself working with something science-related, though, especially as an architect or engineer. On the other hand, recently I have become interested in studying medicine. Ever since I was a child, I have been interested in building things while the thought of perhaps considering medicine must be inspired by my mother and my aunt who work in healthcare.

I do not think my parents expect me to become anything particular or even to get good marks in school. They just want me to be happy. On the other hand, though, if I need help with something, like when in primary school I boosted my math with my dad, they are always ready to help me.

## **Jacob**

When I went to lower secondary school, I didn't like biology at all. I don't think my teacher was too engaging teaching it, either. It was first when I spent my last year of lower secondary school (level 9) in a boarding school that I got interested in biology. I got a fantastic biology teacher and we started to learn about things that I was actually interested in, things to do with the human body like for example muscles. There was also some more advanced things we were reading e.g. aerobic and an anaerobic energetics, which is pretty advanced stuff for lower secondary school. It is that kind of biology I'm mostly interested in, human physiology and anatomy, and not plants. At the boarding school, we also got a really good teacher in chemistry and physics. The year at the boarding school got me interested in science and during that year the technical college became a natural choice for me. I've never been interested of the business world, so the business college was not really my thing. At the general college they have these subjects like history that really don't interest me. At the technical college more or less all the study lines and subjects seemed interesting, so that was my school.

We have a lot of math in my study line and that is just fine with me. During my year in the boarding school, I didn't like math so much but I think it was more because of my teacher than the subject. Now I have a really good math teacher, and I'm happy for mathematics again. In general, I'm motivated by the things I'm doing well with in school. Therefore, the subjects I'm good at, that motivates me to work harder.

After college, I would like to study medicine. I'm also interested in psychology so maybe something within medicine that would combine psychology and medicine, like psychiatry or pediatrics, could be something for me. I can see that my experiences with my family and friends have had an influence on the way I thinking, for example, about studying medicine. That could be for example how my grandparents are doing or when one of my friends was admitted at the hospital.

I don't have any pressure for my parents with respect to studying medicine, or anything particular, after my graduation. Actually, I don't have any pressure at all. That I'm happy for. I think they would be pleased whatever I would choose to do, even if I would become a bin man or something. My parents are not academics and have no background in science, so I guess they don't have any expectations in that direction. Sometimes, with some difficult assignments for example, they almost seem to be a bit impressed that I'm able to do them. Any pressure that there is for me with respect to school, marks, and such, is coming from myself. And, partly from the universities and politicians since the demand of having good marks to get in the end comes from them.

## **Laura**

At the level 6 of primary school we had to choose a study line for the lower secondary school. It was actually not possible just to continue without deciding, so you have to make the choice. You could choose between the international line, sports or science. I would have wanted to take sports as I thought it might get all too tough with all the physics and chemistry in the curriculum on the science line. Besides, I have always liked being physically active. However, my math teacher recommend that I should go for the science line instead. My parents also agreed. Perhaps they all could see that I had it in me, that I could much more than I believed myself I could.

The science line was a lot of fun, both what comes to learning science in more traditional ways but especially as we had access to doing science things with Legos and robots. On my last year of lower secondary school I went to a boarding school where I of course also chose the science line. That I should never have done. The physics and chemistry teacher I had took simply all the joy out of science for me. He was all too old-school in his way of teaching and he chose topics we already had had on level 7 in my old school.

I chose the technical college, to be honest, mostly because there was no German in the curriculum in contrary to what they have in the general college. I have nothing against German, and I actually speak it a lot during my holidays as my family has a tradition of traveling to the German speaking area of Europe both summer and winter. But I rather use my time in school to other things than grammar. Besides, I have always associated German with fun things in life - and like to keep it that way! At the technical college there were also some subjects I thought sounded particularly interesting, compared to some of the subjects in the general college in particular, for example design and technology.

I am feel strongly about sustainable development and the mankind's responsibility for the nature and the climate. Therefore, for me learning science is important when it has this viewpoint. One can also see I have another interest in natural sciences: architecture, especially in the context of building more sustainable and energy effective houses than what we are building now. Already on level 7 in the lower secondary school my teacher encouraged us to read a magazine called 'Science Illustrated' and that was a big eye opener for me. There were for example articles on cities that were based on sustainable values with beautiful houses built in a way that was better for the climate and the Earth. I am very impressed by the architecture I saw it when I was visiting Greenland a couple of years ago and the architecture in the northern parts of Norway I have seen in TV. I am in particular fascinated by the combination of function, materials, and sustainability in those buildings. I grew up surrounded by nature as I grew up and still live out in the countryside. I used to bike to school when I was younger, and I saw all the windmills and farms around. It was and still is a functioning society but also a beautiful one, out in the countryside. It has always been there in my lifetime and I want to make sure that it will be there, both the nature and the functions in the future too.

Sometimes I think I would like to live abroad for some years after I graduate. It could be perhaps in Austria as I almost feel at home there. I would like to experience to be surrounded by a different kind of nature than what I have had around me until now. Cities do have their benefits, but I'm not sure if a city is the right place for me. Cities are so filled with people. Especially if I have a family



one day, I would like to live close to nature. At the moment I am thinking of studying design or architecture after college, but first I want to experience the world. It is now that I have the chance to travel! I can always study later when I have been around in the world and seen places. My parents know that as soon I have graduated and have money enough I am out of the door and off traveling. We don't talk so much about what I want to study, but sometimes my parents ask about it. I do think about it a lot myself, and even though I kind of know what I want to study, I'm not tying myself up on one option for the time being. I guess I could have been inspired to go traveling, for architecture and even to experiencing the world by my grandfather, who traveled around the world, work with many different things and even build houses himself. As a child, I used to help him and ran around in the building place with a little hammer in my hand, so that too, I might have got inspiration for from him.

## **Anna**

I got interested in biology when I started the lower secondary school (level 7) and started also reading about biological topics in my free time. Before that, in the primary school, we had science, but that was quite unserious in my opinion, putting mints in Cola and things like that. It was nice to have biology in the lower secondary school but it really got exciting when I started at the Technical College. We got some good enthusiastic teachers, and that made me just more eager to learn more biology. Many things in biology have to do with one's own body and you can directly transfer the knowledge to yourself.

I am interested in sports and in how the body works, how it can be optimized. I still read a lot about topics like training and muscles in my free time. I have been training for a couple of years now and it makes good sense to read about the body and to know what happens in it when you train or when you for example eat extra protein. It has become clear to me that I need to choose the things I read in my free time so that we have had some of the similar things in school biology as well. In that way I can better understand the scientific texts I am reading on the topics I'm interested in. Otherwise, I would just read them and not really understand or be able to explain it afterwards. Knowledge of the

body, anatomy and physiology, has made me more serious with respect my training and given an insiders' view into how I train.

Biology at the college level is much more difficult than in the lower secondary school but that is okay as otherwise I think I would get a bit bored. Biology, physics, and science in general has a lot to do with my plans for future as I want to study physical therapy. I want to help people and to make their life easier and less painful and make their life quality better. At the same time, I could think of being a kind of a body engineer, one who understands how the body is built up and can be used to fix itself. I want my job in the future to be the kind where I can enjoy going every day.

Studying physical therapy would also give a possibility to study further if I had one point thing that I want to do something else. I know that I need some good marks to get a study place at the physiotherapist education. It irritates me sometimes to hear so some of the other students complain about their marks as if it was somebody else's fault. You need to take responsibility for your own marks and your own future.

## **Ida**

I have always been happy with math and found it interesting, already in the primary school. Many of my classmates found it difficult and I used to help them in the pauses or after the school. I still do that sometimes, help my classmates or someone I know with math, but not so much anymore. After the lower secondary school, I didn't know what I wanted to do. Therefore, I thought I start at the technical college and figure things out over next the three years. The humanistic subjects are easy enough for me, but somehow I don't absorb them the same natural way I absorb math and science. My cousin has graduated from the technical college and ended up studying to be a gardener in the end. Therefore, I knew there are plenty of possibilities afterwards if you go to technical college and gather some knowledge there. I actually wanted to start on another study line but in the end I am happy the way it ended up. I hope that I can use what I learn here in future.

Many people in my family have a talent for teaching. It seems to be natural for them, something they just do. I think maybe I've got some of that in me too. I have considered using a year after graduating from college to work and save up money. I have been thinking that maybe I could get a

job as a temporary teacher in a primary school somewhere nearby. There has always been many different people in my family what comes to their education and what they work with. Therefore there has also always been people to ask for advice and to use as a role model.

I don't like making too solid plans for the future. It is not the same as not making plans at all; I just don't want to limit myself to a single plan like some people do. I really hope the things I will be working with in the future will be science related but it is too early to say yet. I guess I am the type that figures out things as I go and take things as they come.

## **Nicolai**

In the primary school science lessons, we were mostly building LEGOs. It's not that it wasn't fun but it was just a lot of LEGOs during the six years. When I started at the lower secondary school we had to choose a study line. The choice was between sports, language and science. For me science had at that point just mostly been LEGOs, so I guess I thought that the science line would be more of those. More or less all my friends and sports mates went for the sports line, so I chose that too. I guess there was a lot of chance in it too. If my friends had been language nerds, had I probably chosen the language line and chose the general college or the commercial college after lower secondary school. On level 9 I got a fantastic science teacher. She really opened the world of science for me. I also went to one of those "get to know the school"-days at the technical college. It turned out to be just the place for me. There are many things you can do yourself, hands-on things you do in the lab, and a lot of the stuff you learn you can use straight away in your own life, for example about food and health. Then you can just go home and use what you have learned that day in school. Some of my friends go to the general college and some of the things they learn seem quite irrelevant to me, like "understanding of languages" (sprogforståelse) they have in their curriculum.

But this is what we understand with science, it's not so simple either. I mean we get this black and white picture of it. My dad works with some stuff that has to do with medicinal industry. Even though he has no education in science. He does some other things too like things to do with economics and stuff but at the end of the day it is science he is doing. It is just another angle to it. I

find that quite interesting that one can combine different aspects like that. I could see myself doing that in the future too, combining science with some more society like things. The picture they give in school and other places it's so black and white: you read A and then you become B, you go to technical college and become something in science-related. That is not at all how it is, is it? I mean, you can go to technical college and afterwards you can study something else than science, or even move on to something completely different at a later point of your life.

It is difficult to decide for your future. It is also something my classmates and I talk a lot about these days. Should one choose some level subjects for next year because it's good for your later education or just go for that you think is fun or interesting right now? It is difficult, almost scary to figure out what you will and what you should. I have heard that the parents of some young people decide for them what they should do e.g. if they should go to college. I am so glad my parents don't do that and that they are just happy for what I will decide even though the process of decision-making is hard for me. Nevertheless, it is great to know that they will be there for me and support me whatever it is I decide to do after college and later on.

## Appendix 3: The semi-structured interviews

**SPØRGSMÅL 1: Hvilke (hvis nogen) af nedenstående mener du at har påvirket dit valg af HTX uddannelse og evt. planer du har for videregående studier?**

- a) **Interesse** for natur, naturvidenskabelige fag eller sport
- b) Egne (evt. familiemedlemmernes, vennernes) **oplevelser** med "naturvidenskabelige ting" fx rejser, sygdom, eller familiemedlemmernes **arbejde/studier**
- c) Gode **lærere** i folkeskolen/efterskolen, gode lærere på HTX
- d) Familiens opbakning på at gå i skole (herunder indirekte opbakning som fx positive kommentarer, ikke at lægge pres på dig mm.)

**SPØRGSMÅL 2: Hvis du tænker på dit liv baglæns fra i dag og hele vejen så langt tilbage du kan huske, hvilken tidsperiode (evt. alder) eller begivenhed har været den mest afgørende mht. det du er blevet til og det du gerne vil være?**

\*\*\*\*\*

### CAROLINE

#### SVAR PÅ SPØRGSMÅL 1:

- Grunden til jeg valgte HTX var nok mest fordi jeg fulgte med på min søsters (B) gymnasietid og der kunne jeg se at hun havde en rigtig mange skriftlige ting.
- "Jeg har altid hadet at jeg skulle sidde og læse i en bog. Jeg vil gerne lave noget"
- "Først tænkte at jeg skulle starte på STX fordi jeg vidste ikke at HTX fandtes".
- Min lærer (C) fortalte at der var noget sådant og fik mig til at deltage i brobygning på HTX
- Har altid godt kunnet lide at lave forsøg
- "Der er jeg begyndt at blive rigtig glad for sådant et fag som fysik. Der er jeg begyndt at tænke over i måske nogen form af ingeniør eller i den retning. Det synes jeg også vil være meget interessant. Sådant en blanding af fysik og matematik, det er to fag jeg godt kan lide."
- I folkeskolen var fysik... jeg kunne godt finde ud af det, og jeg var god til det, men jeg kunne ikke se nogen mening ved det indtil at jeg kom her.
- Jeg har fået en bedre forståelse af hvad jeg kan blive i fremtiden.
- "Nu har vi XX. Han er en god lærer, det er slet ikke det, men det er mere interessen" der har gjort det. De ting vi har i fysik. "Det er det der mest fanger mig."
- "Stoffet er blevet mere interessant for mig. I folkeskolen var det mere sådan atomets opbygning. Alle de der plusser og minusser. Ja, selvfølgelig var det interessant, men det var ikke noget hvor jeg tænkte at det er lige det jeg vil har noget med at gøre. Så kom jeg hertil og så en del af pensum er hvad det bliver brugt i hverdag. Sådant er det bedre, på en eller anden måde. Der er mere mening at have fysik nu, i forhold til folkeskolen. "

## SVAR PÅ SPØRGSMÅL 2:

- *"Den episode eller begivenhed som... man kan sige der har betydet mest for mig, og også måske at jeg har valgt HTX'en var nok da rev mit korsben over i 2014. Og så startede det med fysioterapeut. Det med fysioterapeut er nok det der har ledt mig her."*
- *"Jeg tænker rigtig meget tilbage på det"*
- Hvis jeg ikke havde gjort det her, så ville jeg aldrig have startet her.
- *"Intet er så skidt at det ikke er godt for noget"*
- Det har betydet mest for de valg jeg har truffet.
- Det er ikke HTX det har gjort det, modnet mig. Nu spiller jeg badminton til hverdagen. Og der har vi fået en træner der har gjort det. Når han kom til vores klub, så fik vi sådant et sammenhold. Han har lige som samlet os. Det har gjort meget på hvordan jeg tænker på mig selv. Jeg er blevet meget mere flink over for andre.

## EMIL

### SVAR PÅ SPØRGSMÅL 1:

- (C) matematiklærer i folkeskolen, (D) far har hjulpet med matematik på mellemtrinnet, derefter var matematik sjovt
- (Men det er...) *"nok også interesse (A) fordi jeg godt kan lide, som i matematik, at 1 + 1 giver et facit, ikke. At det ikke bare er løst og abstrakt."*
- Eksempel fra familien viser at det er bedre at vælge de naturvidenskabelige fag til i gymnasiet fra starten af, så at man ikke ender op med at skulle opgradere nogle af fagene efter gymnasiet for at komme ind på den uddannelse man ønsker

### SVAR PÅ SPØRGSMÅL 2:

- Siden at jeg var helt lille baby har jeg altid været genert og tilbageholdende og min familie har også altid set mig som én der er genert
- Men der er sket noget, fordi jeg er en anden nu.
- Der skete noget fra slutningen af 8-klasse til omkring midten af 9-klasse, 14-15 gammel. Jeg holdte op med at være den generte pige min familie så mig som og blev mere eventyrlysten og udadvendt. Jeg fik mere selvtillid.
- Det kunne ikke alle min familie forstå, fordi de blot fortsat forestillede sig at jeg er den samme person som jeg var før.
- Jeg ved ikke hvorfor det skete, måske var det bare en lille ting, en fremlæggelse der gik godt med mindre forberedelse eller andet, og derfor kan jeg hellere ikke sige præcis hvornår det var.
- Det har givet mig tid og frihed for ikke at skulle forberede det hele.

## JACOB

### SVAR PÅ SPØRGSMÅL 1:

- *"Jeg synes jo at naturvidenskabelige fag er spændende (A) sådan som bioteknologi og kemi. Ikke så meget fysik. Jeg kan også godt lide matematik, jeg har altid godt kunne lide matematik. Jeg havde en rigtig god matematiklærer i folkeskolen, og en rigtig dårlig en i efterskolen men det er lige meget."*
- I matematikken har interessen altid været der, men ikke i de andre fag. Vi havde vildt dårlige lærer i biologi i folkeskolen
- Jeg havde valgt science til min efterskole, men jeg syntes ikke at biologi var spændende i folkeskolen
- Jeg kunne godt lide anatomi, så måske var det det der gjorde det
- Jeg havde 3 rigtig gode science-lærere i efterskolen (C)
- *"Det har altid været planen at jeg skal gå i skole, på et gymnasium, så hvis jeg ikke var gået her, så var jeg gået på STX, og hvis ikke det så på HH (X, red.), selvom jeg ikke syntes om det"*

### SVAR PÅ SPØRGSMÅL 2:

- Der er ikke sådant et tidspunkt hvor det bare slog klik.
- Jeg har haft mange sportsskader, og jeg syntes det var spændende da de behandlede mig. Det var på 6-7. klasse. Min mor arbejder også på fysioterapi (ikke som fysioterapeut, red.) så det har også påvirket.
- Efterskoletiden forstærkede interessen
- *"Det bygyndte sådan om at være fysioterapeut. Der stoppede jeg med at tænke på alle mulige andre retninger, fordi inden da ville jeg jo være lærer og alt muligt. Efter det ville jeg bare være noget der har med menneskekrop at gøre: fysioterapeut, sygeplejerske, læge"*

## LAURA

### SVAR PÅ SPØRGSMÅL 1:

- *"Jeg tror det er nogen lærer i højeste grad som er grunden til... der var en lærer (C) i hvert fald der i starten gjorde at jeg kom på den der science-linje i folkeskolen"*
- *"Da jeg skulle vælge HTX... der tror jeg det var for det første fordi jeg ikke havde lyst til at gå på STX. Så var der HH og HTX. Jeg tror bare som led i at jeg godt... der har nok været en interesse (A) for naturvidenskab, for nogle af de fag. Lige som matematik og biologi er spændende. Men var godt bevidst at det var ikke det ideelle uddannelsessted. Men der har været noget med interesser"*
- Opbakning hjemmefra (D), at det er en god ide
- *"Det er også bare meget godt at vide om naturvidenskaben, om sygdomme og sådan"*

## SVAR PÅ SPØRGSMÅL 2:

- Da min søster blev syg skete der noget i hele familien. Der var ikke nogen der fortalte os at man bliver ved med at være konstant bekymret og det påvirker stadig en.
- Rejser til alperne: den måde de lever på, deres arkitektur,
- *"Efterskoletiden har i høj grad gjort mig til den jeg sidder og er nu. Og så har virkelig givet mig nogle redskaber og nogle minder og nogle oplevelser, som på godt og ondt... som har været med til at gøre mig til den jeg er. Helt sikkert. Lært mig om livets op og ned."*
- For mig var det rart at komme væk hjemmefra og så skulle det bare være mig jeg skulle have ansvar for
- Var heldig med at komme i værelse sammen med én man kunne dele oplevelser med, åbne sig op til
- *Jeg blev passet rigtig meget som lille hos min mormor og morfar: har hørt hvad de har gjort som voksne og ikke bare dem som bare går derhjemme. Hørt hvordan morfar på trods af at ikke havde trives i folkeskolen, lykkedes at få et fungerende arbejdsliv og voksenliv*

## ANNA

### SVAR PÅ SPØRGSMÅL 1:

- "Så er det nok mest A og C"
- Interesse for naturvidenskab og sport... jeg har altid lavet sport, dyrket sport så længe jeg kan huske det. Da jeg var lille så kørte jeg den cykelsport der hedder BMX. Man kan vel kalde en form af freestyle og kapløp på en bane hvor man er 8-10 personer der kører mod hinanden der kører mod hinanden. Det var sådan en familieting, idet min onkel kørte også. Bl.a. i Frankrig til nogle mesterskaber. Så efter det var jeg springgymnast. Pga. at jeg brækkede foden, så blev jeg svømmer, for at rehabilitere, men jeg blev faktisk 3-4 år før at jeg gik tilbage til springgymnastik. Så spillede jeg meget håndbold.
- Nu går jeg så i træningscenter. Det er nemmer at passer sammen med skolearbejde, end håndboldtræning som sidder på bestemte tidspunkter. Det var til sidst op til 8 timer om ugen jeg gik til håndbold, og så skulle man også lave lektier og alt det andet. Efter at jeg så også fik en skade på et tidspunkt, så skiftede jeg til styrketræning. Det hjælper også med koncentration til skolearbejde.
- Naturvidenskabelige fag er nok fra tilbage i folkeskole. Det var bare interesse, ikke fordi jeg havde de bedste lærer i det. Det er jo en ret stor faktor i hvorfor jeg valgte det her: hvis man har dårlige lærere og alligevel er interessen der, så må der være noget at komme efter
- *"(Interessen) startede nok omkring 3-4 klasse hvor man har natur-teknik. Der er man jo en rigtig nybegynder inden for naturvidenskab, ikke, hvor man laver de klassiske forsøg at gå med et æg uden at ægget går i stykker. Og allerede der syntes jeg at det var lidt sjovt. Ikke fordi jeg forståede hvad der skete og hvordan det fungerede men man blev introduceret til noget og man syntes at det var sjovt."*



- **" ... man blev introduceret til noget og man syntes at det var sjovt. Og når man så, jeg tror at det var omkring 7-klasse blev introduceret til det igen, kan man jo huske det er noget man tidligere har haft sjovt med, så skaber det interesse."**
- **"Man kan huske at man har haft det sjovt og allerede der har du større vilje til det."**
- Efter jeg startede på gymnasiet har jeg haft mange gode lærere (C) der har øget min interesse (i naturvidenskabelige fag, red). Men desværre et par ikke-så-gode også. Især i bioteknologi og kemi har jeg haft gode lærere og fået endnu mere interesse i.
- Nu i hvert fald i bioteknologi kommer de A-niveau stof, som er lidt mere hard core lige som Krebs cyklus.
- Man (som lærer) at bruger de ting som unge mennesker synes er sjovt på en konstruktivt måde
- Rigtig stor opbakning hjemmefra (D), nogen gang til grænsen hvor man synes at det måske er lige rigeligt.
- Også hvis man er lidt træt af skolen, så få man at vide at man har ferie om lidt, eller noget.
- **"Så selv hvis... jeg godt kan synes at det er herreirriterende, så er den (opbakningen, red.) der, hele tiden."**
- **"Jeg ved det godt, man kender jo godt, det der at man står også om morgenen, Du bliver vækket mens du ligger og sover og der er ikke noget der er værre der findes. Men, når du så et stået op så synes du at: nå det var faktisk meget godt. ... Fordi nogle gange møder man op til matematiktimen så tænker man at det var da eddermame godt jeg var her i dag, fordi ellers jeg vil have været helt blæst."**

## **SVAR PÅ SPØRGSMÅL 2:**

- Har lært nogle vigtige lektier om at være ærlig. Da jeg var mindre kunne jeg godt komme med en hvid løgn hist og pist. Men så fandt jeg ud af, hvad det kan betyde for andre.
- Hvis nogen lyver over for mig nu, så bliver jeg irriteret.
- Genopbygning af forholdet til min far har betydet meget for mig. Både den tid hvor forholdet var ikke så godt og også det, at vi fik talt nogle ting igennem.
- Det tætte familiekreds vi har en kæmpe betydning, mine bedsteforældre bor tæt på og jeg hjælper dem ofte; min moster bor tæt på og jeg passer tit børn hos dem; min onkel der er faktisk ikke så meget ældre end jeg, betyder også meget; og min kæreste
- Sådan vil jeg også gerne have det som voksen: have familien tæt på
- **"Det har virket rigtig godt for mig, at have tæt forhold til bedsteforældre og resten af familie."**
- **"Det er egentligt meget rart at være tæt på, for hvis de ringer, så kan jeg være der om 5 minutter. Hvis mine forældre der boede i Aarhus, hvis de ringede, så kunne jeg være der om 5 timer. Og de kan man jo ikke bruge til så supermeget. "**
- **Familieweekend hver sommer med sammenlagte fødselsdage hvor der spises middag med det hele.**

## IDA

### SVAR PÅ SPØRGSMÅL 1:

- Har både kusine og fætter (**B**) der gik på denne skole, og sagde at det er et godt sted og at der var rigtig gode lærer (**C**) her
- I efterskolen havde jeg rigtig gode lærer, i folkeskolen måske ikke lige så gode. I efterskolen blev jeg
- *"Jeg har altid været rigtig glad for at runde rundt uden for (A). Været sådan hvad gør det her egentligt, og gør sådan noget. Har altid været meget nysgerrig."*
- *"Og så interesse... jeg er generelt meget glad for naturen, vil gerne være med til at hjælpe det med at blive bedre i fremtiden...at blive sådan det er nu".*
- Kæmpestor blanding af ting der har givet mig ideen at det skulle være HTX
- *"Jeg synes ikke at min undervisning i folkeskolen har været helt lige så god som de andre har haft det. Fordi, jeg ved ikke, indtil vi gik i... jeg startede i efterskolen i 9. klasse... så jeg gik i folkeskole til og med 8. Og der havde vi lavet fire forsøg i naturfag, og et af dem var at plukke blade og kigge på dem. Så der kan jeg godt mærke at det halter lidt og at jeg er ikke helt lige så godt med på de helt basale. Der kan jeg godt.. i hvert fald i fysik har jeg lidt svært ved på grund af de mangler".*
- Jeg havde en vildt god lærer i geografi, vildt engageret, og på efterskolen fik jeg lige så god en geografilærer (**C**).
- Jeg har været på mange rejser, mange gange fx i Tjekkiet. Og rigtig mange gange i Norge og hver gang kunne jeg se at der var bare mindre og mindre sne. Og det er bare ikke fedt.

### SVAR PÅ SPØRGSMÅL 2:

- *"Jeg ved stadig ikke hvad jeg vil være. Der er jeg stadig meget i tvivl. Jeg er stadig et eller andet sted mellem frisør, arkitekt og dyrlæge."*
- Når jeg bliver voksen vil jeg godt sørge for at give mig selv overskud både økonomisk og rent personligt at kunne hjælpe til andre.
- *"Åbne mit hus til juleaften eller sende penge til folkekirkens nødhjælp eller noget."*
- Det giver en dejlig følelse når du donerer tid eller donerer penge.
- Jagttegn. Det vil jeg faktisk stadig gerne tage på mit sabbatår. Der er meget etisk i det. Mange jæger går efter skadedyr eller svage dyr i flokken.
- Jeg har altid været meget moden for min alder, randet rundt med folk ældre end mig. Man føler sig lidt voksen. Det betyder en hel del. Jeg har også været på jagt en gang, bare for at klappe ... Men hvis noget går galt så kan det jo koste liv det der. Altså det sker jo sjældent men alligevel. Det er ikke bare for sjov. Men det er også meget hyggeligt med alle de traditioner der er.
- *Jeg er enebarn og mor har jo altid været lidt som en lillebror eller lillesøster for mig. Men jeg er god til at passe mig selv - selv om jeg bor meget af tiden alene, så har jeg altid nogen at ringe til*

## NICOLAI

### SVAR PÅ SPØRGSMÅL 1:

- Folkeskole til gymnasiet er forskelligt fra gymnasiet til videregående.
- Jeg havde en god lærer tidligere (folkeskole), virkelig vækkede interesse i mig. (C)
- Mine forældres arbejde og især min far der har snakket så meget om det
- Har altid fået opbakning (D) selvom jeg er ikke blevet skubbet i nogen retning.
- Hvis jeg skal rangere... Mine oplevelser (B) rangerer højest, at få det i hænderne og så har jeg fået interesse igennem det
- Interessen kom ret pludseligt. Indskolingen var jeg slet ikke interesseret in ny, det var først i udskolingen interessen (A) kom.
- Jeg gik på idrætsklassen på udskoling
- *"Det er megafedt at gå her (HTX, red.)"*
- Fra gymnasiet til videregående er det interessen der driver det.
- *"Jeg kan ikke se mig selv læse noget som ikke er spændende. altså så kan det være ens forældre bakker en op eller påvirker ens valg men i sidste ende... så... håber jeg ikke at der er nogen der læser noget fordi andre siger man skal."*
- Interessen skinner mere igennem efter gymnasiet

### SVAR PÅ SPØRGSMÅL 2:

- Der må have været et eller andet... jeg var jo ikke interesseret i naturvidenskab i starten. Det kom med alderen... 13-15 års alderen, der hvor jeg går i 7-9 klasse i hvert fald.
- Jeg skifter jo skole til en folkeskole der er kendt for at være naturvidenskabelig. Selvom jeg ikke valgte den naturvidenskabelig linje, så var der hele tiden nogle små ting.
- *"Jeg tror man bliver bare meget mere opmærksom på ting når man bliver ældre. Så jeg tror også at jeg begyndte at forstå det mere. Jeg kan huske at [...] der har altid været nogle science-mennesker ude og så var der noget der sprang op af en kolbe hvor man altid var bare 'aaarrh'.... men når det begynder at give mening så bliver det mere interessant for mig"*
- *Har altid været meget matematisk, men det jeg er ikke mere. Nu er der meget mere sådan biologiske ting der er spændende.*
- Matematik bliver så... jeg ved ikke hvor jeg skal hen med den. Den biologiske kan jeg virkelig perspektivere ud og det giver mening for mig.
- Min far er også begyndt at inddrage mig mere i sit arbejde
- *"Det kunne være fedt nok at sige at der var et eller andet turning point, men jeg tror bare det er kommet, altså stille og roligt."*

## Appendix 4: The Danish school system

Translation of the Danish system to English is in this work based on the Danish Ministry of Education fused with some of the nomenclature of the United Kingdom school system. This is a conscious choice for the first in order to make it easier to work with the reference material<sup>102</sup> for a large part from the United Kingdom and secondly, to be in tune with the schools (HTXs in general) own preference for English names<sup>103</sup>. The name of the fourth type of upper secondary school, Higher Preparatory Examination, has not got a 'College' name. This type of schooling is not relevant for the present study that mainly focuses on Technical college (HTX).

School type				Level	Age
Kindergarten class				0	6
Folkeskole	Primary school			1	7
				2	8
				3	9
				4	10
				5	11
				6	12
	Lower secondary school			7	13
				8	14
				9	15
	(voluntary '10th class')				10
Upper secondary school					
General college (STX)	Technical college (HTX)	Commercial college (HHX)	Higher Preparatory Examination (HF)	1.g	16-17
				2.g	17-18
				3.g	18-19

102 In particular with respect to archerian science capital

103 See e.g. <https://techcollege.dk/>; <https://www.koldcollege.dk/>; <https://aarhustech.dk/english/students>

i Citation for the front figure (Teniers the Younger, 1655)



ii The thesis is composed of 49 standard pages of text, 10 figures, 9 tables and 4 appendixes

iii I must go down to the seas again,  
to the wagrant gypsy life,  
To the gull's way and the whale's way,  
where the wind's like a whetted knife;  
And all I ask is a merry yearn  
from a laughing fellow-rower,  
And quiet sleep and a sweet dream  
when the long trick's over.

(John Masefield)