Leaving or continuing in the technical sector? Exploring crucial life experiences that contributed to the study and career choice of male STEM alumni

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Leaving or continuing in the technical sector? Exploring crucial life experiences that contributed to the career choice of male STEM alumni

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Abstract

In the Netherlands there is a growing demand for science, technology, engineering and mathematics (STEM) professionals. Although the number of STEM students in higher education is growing, still only few male alumni opt for a career in STEM. It remains unclear why such a large number of male technical professionals opt for a career outside the technical sector. Professional identity is proven to be a useful concept in trying to understand the motives for choosing for a career outside the technical sector. A professional identity is constructed by social experiences. Furthermore, the development of professional identity is a life long process. Therefore, this research aims to find out what experiences in which life phases have been crucial for STEM alumni for the choice to either leave or stay in the technical sector. In order to gain insight into their decision process, life history interviews are being conducted with eight alumni that stayed in the technical sector and five alumni that left the technical sector, all with a technical degree from a university or a university of applied sciences. In these interviews, experiences from their whole life cycle are being narrated. Based on the life histories, three patterns can be distinguished: the engineers that stayed in the technical sector, the scientists that stayed in the technical sector and the scientists that left the technical sector. The engineers are the alumni that describe having technical hobbies throughout their whole lives and describe being more practical oriented. Their experiences show that they know they want to have a technical study and career and therefore their decision process is quick and clear. These experiences have been crucial for their choice to stay in the technical sector. The scientists that stayed and left are the ones that are more theoretical and want to have a certain cognitive challenge in their study and career. Their decision process in study and career is less stable and clear than the decision process of the engineers. The patterns of the scientists that stayed and left the technical sector can be characterized as quite similar. From university period their patterns start to diverge. A lack of professional socialization activities and searching for characteristics that in their eyes cannot be found in the technical sector (i.e. wanting variety and flexibility and a fast career) could be indicated as motives for leaving the technical sector. The present study provides insights into the life experiences that contributed to the professional identity development of men in STEM.

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Problem statement

There is a continuously growing demand for technical professionals in the Netherlands. In 2019 there were on average 77.800 vacancies in the technical sector compared to 41.200 vacancies in 2016 (Monitor Techniekpact, 2019). This growing demand asks for a large number of science, technology, engineering and mathematics (STEM) professionals. Although the share of STEM students in the total number of students in higher education increased from 22% in 2009 to 29% in 2019 (Monitor Techniekpact, 2019), only few graduates opt for a career in STEM. Research shows that only 28% of the female graduates and 59% of the male graduates eventually end up working in the technical sector (Platform Bètatechniek, 2016). It remains unclear why such a large number of alumni with a technical degree opts for a career outside the technical sector.

A factor that is proven to influence the career choices of professionals is professional identity (Hong, 2010). Professional identity gives an answer to the question "who am I as a professional?". It describes one´s professional self-concept based on one's own values and beliefs (Slay & Smith, 2011) and it is shaped by the social environment and social situations (Beijaard, Verloop & Vermunt, 2000).

Previous research showed that professional identity influences a person's career choice. For instance, research among nurses showed that nurses with a strong professional identity had a lower intention to leave their profession (Sabanciogullari & Dogan, 2015). Furthermore, Möwes (2016) showed that STEM students with a strong professional identity were more likely to opt for a career in the technical sector. To conclude, Cech (2015) found that employees with a strong professional identity were more likely to stay in the technical sector. Thus, professional identity is proven to be a useful concept in trying to understand why technical alumni leave the technical sector. According to Cohen-Scali (2003), there are two determining dimensions in the construction of professional identity: social experiences taking place in family and school context and professional experiences undergone by young adults.

In previous research, the construction of professional identity is often measured at one certain point in someone's life and especially in higher education (e.g. Perez, Cromley & Kaplan, 2014), or in one's (early) career (e.g. Beijaard et al., 2000). However, professional identity is not a stable concept, rather the development of professional identity takes place across the entire lifespan (Marcia, 2002). In order to get a full understanding of the experiences that contributes to the professional identity development, research is needed that not only involves higher education and/or (early) career, but also takes the professional identity development of one's early life into account.

Furthermore, since women are underrepresented in the STEM sector, most research on why technical alumni leave the technical sector is focused on women (e.g. Smeding, 2012; van Veelen, Derks & Endedijk, 2019) or both men and women (e.g. Canrinus, Helms-Lorenz, Beijaard, Buitink & Hofman, 2012). However, in the current situation, men remain the biggest group in STEM education and the STEM working field. Furthermore, the motives for women leaving STEM are often related to the fact that the STEM sector is a male dominated sector (e.g. Allen, 1999) Therefore, it is relevant to

focus on only men as well to find out which experiences contributed to their choice for staying in or leaving the technical sector.

Since professional identity is partly shaped by experiences (Cohen-Scali, 2003), it is relevant to find out which experiences are regarded as meaningful by the alumni and herewith shaped their professional identity. Therefore, the current study aims to gain insight into this life experiences of male technical alumni that opted for a career outside the technical sector and a career inside the technical sector to find out which experiences shaped their study and career choices. The current study builds upon the study of Van Hattum - Janssen & Endedijk (2017). In their research they provided an insight into the life experiences of male technical alumni that continued in the technical sector after graduation. The life experiences of alumni that left and stayed in the technical sector are being compared in order to explore differences and similarities between the two groups. Furthermore, this research is part of the 'Bridge the Gap' project in which a tool was developed based on quantitative data to get more insight into the professional identity of technical professionals. This study aims to contextualize these findings in a qualitative manner.

Theoretical framework

Identity

At the root of professional identity lies identity. In order to understand the concept of professional identity, one first needs to understand the concept of identity. The concept of identity has been discussed for years now, but giving an unambiguous definition to identity is hard (Beijaard, Meijer & Verloop, 2004). Identity is about answering the question "Who am I" (Vignoles, Schwartz & Luyckx, 2011) and forms the basis for one's choices in what to do and why (Hong, 2010).

In literature, in general two main perspectives on identity are distinguished: the personal perspective and the social perspective. Erikson's ego identity theory lies at the basis of the personal perspective (Crocetti, Avanzi, Hawk, Fraccaroli & Meeus, 2014). According to Erikson's theory, identity is a developmental process. There are eight developmental and chronological life stages a person has to go through, starting from childhood. In each stage, the person has to overcome a conflict to proceed with development (Sokol, 2009). For instance, in the fifth stage of the ego identity theory (between 12-18 years) a person searches for a sense of self by exploring what one's personal values and beliefs are. In this perspective, personal identity is been described as the traits, believes, attitudes and motives a person holds about him or herself (Slay & Smith, 2011). In summary, identity viewed from the personal perspective is individual and developmental: a person does not have one identity, but goes through various phases of identity development. Identity is developed by integrating the existing identities with the new identity.

In contrast, according to the social perspective, identity is seen as a social concept that is present on group level instead of on individual level. This perspective, derived from Tajfel's theory

(Tajfel & Turner, 1986), focuses on identification with groups and social categories a person belongs to (Crocetti et al., 2014). Spears (2011) defined social identity as: "(…) a process of social categorization and of identification with the groups we belong to, which we then characterize as part of ourselves" (p.203). Thus, according to this idea, an individual's identity is shaped based on the characteristics of the social group a person belongs to. The more an individual attaches affective significance to the group he or she belongs to, the closer and committed the individual is (van Veelen, Otten, Cadinu & Hansen, 2016). In conclusion, whereas the personal perspective claims that one's identity develops over time and is present at individual level, the social perspective claims that one's identity is a social concept that is present at group level.

Professional identity

Professional identity is often conceptualized as a major component of one's overall sense of identity (Skorikov & Vondracek, 2007). The theories of Erikson and Tajfel and therewith the division in personal and social is also present in the concept of professional identity. Researchers focusing on the personal perspective define professional identity as one's perception of occupational interests, abilities, goals and values (Skorikov & Vondracek, 2011). They see professional identity as something that is different for every individual, it is viewed from an individual level. On the social perspective, professional identity can be described as: "the degree to which employees identify themselves with the profession that they practice and its typical characteristics" (Bartels, Peters, de Jong, Pruyn & van der Molen, 2010, p. 211). According to this perspective, professional identity is developed by comparing and adapting one's individual characteristics to one's profession. So, where the personal perspective looks at professional identity on individual level, the social perspective looks at professional identity on group level.

Professional identity consists of two components: identity content and identity strength (Ashforth, Harrison & Coley, 2008). Identity content contains characteristics, behaviours, norms and values that creates one's professional identity. For instance, the identity content of an engineer may contain that he or she "likes to solve mathematical exercises", "wants to design machines" and "can repair machines". Identity strength can be defined as the extent to which someone is committed to these aspects. According to Ashforth et al. (2008), identity strength leads to organizational membership and is the core of identification.

Professional identity is proven to have an influence on turnover intention, job satisfaction and work engagement in several work contexts. In their research in the health sector, Zhang, Meng, Yang and Liu (2018) found that when medical inspectors have a strong and stable professional identity, they are more enthusiastic, energized and satisfied in their jobs. Also, Sabanciogullari & Dogan (2014) found a positive relationship between professional identity and job satisfaction in the health sector. Furthermore, their research showed that nurses with a less stable professional identity had a greater intention to leave the profession. Also in teaching, research revealed that teachers that leave their

profession have a significantly less stable professional identity than teachers that stayed in their profession (e.g. Hong, 2010). Moreover, a positive relationship was found between professional identity and job satisfaction and work engagement in education (Canrinus et al., 2012). Although to a lesser extent, research shows the same influences of professional identity in the STEM sector. For instance, Khapova, Arthur, Wilderom and Svensson (2007) found a significant relationship between professional identity and turnover intention among IT professionals. Furthermore, Bothma and Roodt (2012) discovered that employees of an ICT company were more engaged in their work when their professional identity was stronger.

Professional identity development

In her research, Cohen-Scali (2013) describes two determining dimensions of the construction of professional identity. The first dimension is socialization for work meaning the experiences that are taking place in family and school context starting from early childhood. This dimension is important towards the study and career choices. The second dimension is socialization by work meaning the professional experiences that are undergone by young adults.

According to Erikson (as cited in Soenens & Luyckx, 2003), identity formation is a developmental process in which identity develops through the reflection of life events. He claims that in adolescence, one's identity formation can have two statuses: someone is committed to a certain identity or someone is not committed to an identity. When someone is committed, this means one's identity is integrated and stable. When there is no commitment, one is still in the phase of identity confusion. Marcia (1980) elaborated on this model and claimed that not only commitment determines one's identity status, but that it also depends on the degree of exploration*:* to what extent did a person explore what one's identity is. Based on these two dimensions, four statuses in identity development can be distinguished. These four dimensions are presented in table 1. In the status of *achievement,* individuals know what their identity is, but before this identity was obtained, they have gone through a period of exploration. In the status of *foreclosure*, individuals also know what their identity is, but in this status, they have blindly accepted their identity without further exploration. Individuals that have *moratorium* as identity status are in the process of exploration and are still searching for their identity. Finally, individuals that have the status of identity *diffusion* also do not know what their identity is, neither are they actively exploring their identity.

Table 1
Identity statuses by Marcia (1980)

		Level of commitment	
		High	*Low*
Level of exploration	*High*	Achievement	Moratorium
	Low	Foreclosure	Diffusion

Thus, in adolescence, one's identity development can have four statuses depending on the degree to which someone is committed to a certain identity and the degree to which someone explored his or her own identity.

Nowadays, the focus in literature on professional identity development predominantly lies on the development activities during high school and when one's career starts. This is because it is assumed that professional identity defines during early adulthood and adolescence (Crocetti et al., 2014). Gushue, Scanlan, Pantzer and Clarke (2006) state that: "During the high school years, students make crucial career decisions (…) that will inevitably influence their career aspirations, plans and goals" (p.20). However, professional identity development is proven to be a lifelong process. Van Tuijl and van der Molen (2015) state that career choices already have their roots in childhood. Thus, the image of how people see themselves as a professional already starts in childhood. In her research Cohen-Scali (2003) also suggests that professional identity development already starts earlier than at high school. Moreover, according to Erikson's ego-identity theory (in Marcia, 1993), which partly forms the basis of professional identity, identity development is already present in childhood. Therefore, it seems plausible to take childhood into consideration when looking at professional identity development as well. To conclude, in their research Van Hattum - Janssen & Endedijk (2017) took the entire life cycle of technical alumni into account considering their professional identity development. With their research they showed that taking childhood into consideration gains valuable insights into the concept of professional identity development.

In conclusion, although a lot of literature focuses on professional identity development during high school and the (early) career, there is evidence that the formation of professional identity already starts in earlier stages of life. This makes it worthwhile to focus on professional identity during the entire life cycle in order to obtain a clear view on professional development activities that could have been crucial for the choice to either stay or continue in the technical sector.

Life history research

A research method that is focusing on one's whole life is life history research, a form of qualitative research that can be categorized as a narrative research method. With narrative research a more in depth and detailed insight into the professional identity development can be retrieved. Narrative research has established itself as a broad research spectrum within social sciences (Hyvärinen, 2008). According to Pinnegar & Daynes (2007) narrative research is about the study of stories, narratives or descriptions of a series of events. The goal of narrative research can be different in every research. According to Sools (2012) researchers that are doing narrative research can for instance be interested in comparing stories of different groups, the development of human competence in story telling or the way identity develops in a story.

In life history research, respondents are asked to narrate life episodes of one's entire life (Scarneci-Domnisoru, 2013). The specific focus in life history interviews lies on individual stories. According to Cole and Knowles (2001) life history research is about:

> (…) gaining insights into the broader human condition by coming to know and understand the experiences of other humans. (…) It is about comprehending the complexities of a person's day-to-day decision making and the ultimate consequences that play out in that life so that insights into the broader, collective experience may be achieved (…) To understand some of the complexities, complications, and confusions within the life of just one member of a community is to gain insights into the collective. (p. 11)

The in-depth exploration of these individual stories helps understanding the complexities in the broader context where the respondent is in (Cole & Knowles, 2001). It is therefore not only about what is narrated, but also about how the story is narrated. During life history interviews the respondent is in charge and tells his or her life experiences without regularly being interrupted or pushed into a certain direction by the interviewer. The respondent therefore makes decisions himself about which experiences are relevant to tell and which are not (Rosenthal, 1993). Other experiences are present, but are considered as less relevant since they are not being told. The role of the interviewer is to ask questions that deepens and further develops the story that is being told by the respondent (Scarneci-Domnisoru, 2013). When conducting life history interviews, there is no predetermined interview structure, and beforehand it is unknown which information is going to be retrieved and which information is going to be useful. According to Haglund (2004), life history research facilitates the study of phenomena that develop over time because lifelong data is obtained.

In engineering education, most research is conducted in a quantitative or mixed-methods manner (Koro-Ljungberg & Douglas, 2008; Meyer & Marx, 2014). In order to get more in-depth insight in the sector that cannot be answered through quantitative methods, qualitative research is needed (Koro-Ljungberg & Douglas, 2008). Life history interviews have proven to contribute to the research of identity development. For instance, in the education sector, conducting life history interviews helped identifying significant questions and challenges about identity development of future teachers that would not have been identified with other research methods (Moss & Pittaway, 2013). Their study was therefore an addition to the already existing research about identity development. To our knowledge, except for the studies of Van Hattum - Janssen and Endedijk (2017) and Tegeler (2018) no further research has been conducted that explores professional identity based on life history research in the STEM sector.

This research aims to enrich the already existing findings of professional identity development in STEM through the inclusion of individual experiences. Rather than presenting conclusions at a general level, life history research helps to understand the individual experiences that contributed to the study and career choices that are being made. This research therefore aims to extend the scarce narrative research that is being used in STEM. Furthermore, this research aims to gain more insight into the concept of professional identity development as a lifelong process instead of as a process starting from early childhood. To conclude, this study aims to contribute to the literature about men and their choice for staying in or leaving the STEM sector.

Research question

The main goal of the current research is to gain insight into the life experiences of male technical alumni that shaped their study- and career choices. As professional identity is a lifelong developmental process and is shaped by experiences, it is relevant to find out what experiences from early childhood are regarded as meaningful and whether there is a difference between alumni that stayed in the technical sector and left the technical sector in these experiences.

The *main research question* is therefore:

"What experiences in which life stages have been crucial for male STEM alumni for the choice to either leave or continue in the technical sector?"

In order to answer the main research question, the following sub research questions are formulated:

1. What experiences in which life stages preceding the first job of STEM alumni shaped the study and career choices of male technical alumni that left the technical sector?
2. What experiences in which life stages preceding the first job of STEM alumni shaped the study and career choices of male technical alumni that stayed in the technical sector?
3. What are the similarities and differences between the two groups?

Research Method

Design

In the current study, life history interviews were conducted with technical alumni that left the technical sector and technical alumni that continued in the technical sector. In this study, the respondents were asked to tell life stories on four stages in their lives: “early childhood”, “12 years of age until the start of studies”, “university period” and “transition to the first job”. The interviews took about 60 to 90 minutes. The collected data was transcribed, analysed and compared in order to find out whether there are similarities and differences in life experiences that shaped their study and career choices.

Respondents

The respondents of the study are thirteen male technical alumni in total: eight alumni that are currently working in the technical sector and five alumni that left the technical sector. In this research, the following definition of the technical sector is used: energy and minerals, construction, food, chemistry, metal, ICT, architecture and food- and textile production. The eight respondents that continued in the technical sector were already interviewed in the study of van Hattum - Janssen and Endedijk (2017). In the current research, this data is being used for analysis. In order to find respondents that left the technical sector, snowball sampling has been used. This sampling method is appropriate when the needed population is hard to locate (Babbie, 2010) which was the case in this study. From the thirteen respondents in total, eight have a degree from a university and five from a university of applied sciences located in the Netherlands. They all have a degree in one of the following studies: Electrical Engineering, Industrial Engineering and Management, Mechanical Engineering and Technical Physics. They are between 24 and 29 years of age and are graduated between 1,5 and 5 years before the date of the interview.

Instrumentation

When conducting life history interviews, there is no predefined interview structure since the aim is to let the respondents select the stories that he considers as relevant without specific guiding or suggestive questions from the interviewer. However, some key questions were developed in order to give the respondents inspiration to talk about when needed. These questions are displayed in appendix A.

Procedure

The data was collected through life history interviews. These interviews took place at a location that was chosen by the respondent so that he felt comfortable to tell his story. Before the interview started, the respondents were informed that all data is being processed anonymously. Furthermore, since all interviews were audio recorded, permission of the respondent was asked and a consent form was signed by the respondent. The duration of the interviews was around 60 to 90 minutes. After the data collection, the interviews were transcribed and the data was anonymized in such a way that no data could be traced back to the respondent. This means for instance that names were changed into

pseudonyms and that company names were anonymized as well.

Because the research involves human participants and potentially sensitive data, this research proposal was assessed for ethical assessment and approved by the ethics committee of the faculty of Behavioural, Management and Social Sciences (BMS).

Data analysis

The qualitative data was collected, transcribed and analysed based on Schütze's method of conducting and analysing narrative research (as cited in Jovchelovitch & Bauer, 2000). He proposes six steps of analysing narratives (see figure 1).

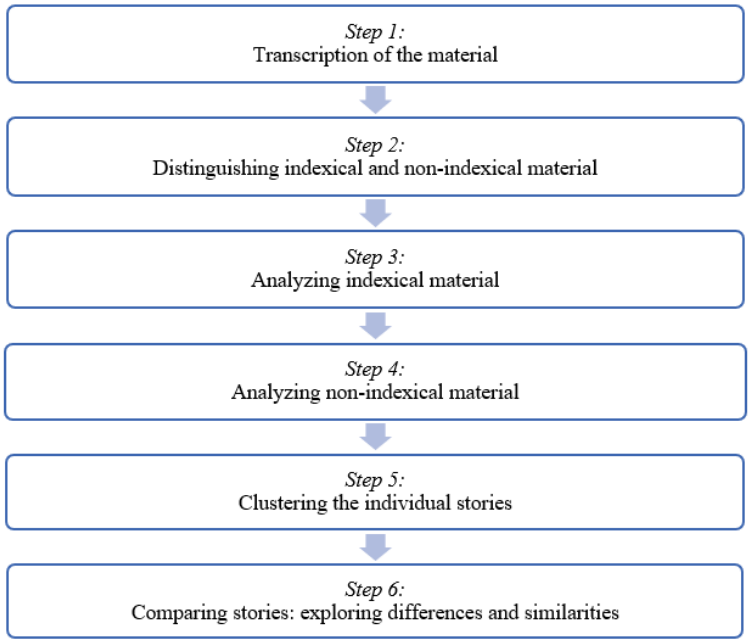

Figure 1. Steps in analysing life history research (Schütze, as cited in Jovchelovitch & Bauer, 2000)

The first step in this analysis is a detailed transcription of the material. For the transcription of the material Amberscript is partly used. This software transcribes the material automatically. After that, the material is separated into indexical and non-indexical material (step 2). Indexical material involves all factual events in the interview whereas non-indexical material goes beyond the events and involves the interpretation of these events (i.e. values, opinions, feelings, legitimizations). In step 3 all indexical material and its ordering of events is being coded and analysed. Step 4 focusses on coding and analysing the non-indexical material. All material is coded with the aid of Atlas.ti version 8. A quality check for the coding scheme is being done and a Krippendorff's alpha coefficient of 0,75 was reached. Table 2 shows the used coding scheme. For an extensive coding scheme, see appendix B. Next, in the fifth step the individual stories are being clustered again and compared. To conclude, the individual stories are being put into context and compared with other stories.

Table 2.

Coding scheme

Material	Code	Sub code	
Indexical	*Action*	Having hobbies	Doing sports
			Playing music
			Playing games
			Tinkering
			Playing outside
			Social activities
			Reading
			Watching television
			Playing with technical toys
		Following courses	Alpha courses
			Beta courses
			Higher level courses
			University courses
		Doing extracurricular activities	Associations
			Committees
			Study trips
		Redoing / skipping a grade	
		Skipping school	
		Making study- and career choices	Choice for location
			Choice for study level
			Choice for study profile
			Choice for study
			Choice for master
			Choice for first job
		Orientating on study- and career	Activities
			Options
		Making tests and assignments	Bachelor/Master thesis
			Tests and assignments
		Following a Minor	
		Doing internships	
		Having side jobs	
	Actors	Classmates	
		Friends	
		Relatives	Parents
			Siblings
		Study advisor	
		Teacher	
		Colleagues	
Non-indexical	Values & Opinions	Decision process	
	Felt & Experienced	Decision process	
	Usual & Ordinary	Decision process	
	Argumentative	Decision process	

Results

This research aimed to find out what experiences in which life stages have been crucial for STEM alumni for the choice to either stay in or to leave the technical sector. Therefore, first one needs to get to know the lives of the respondents. For an overview of the respondents, see table 3. In order to get to know the live trajectories of the respondents, the lives of each respondent that left and stayed in the technical sector are outlined. The three trajectories of the group that stayed and the three trajectories of group that show the diversity in characteristics in a most accurate way are described in-text. The other trajectories can be found in appendices C and D. Quotations from the respondents are used to illustrate the findings. The names of the respondents are replaced by pseudonyms. After the description of the respondents' lives, the similarities and differences in indexical and non-indexical material between the two groups are examined and described.

Table 3.

Overview of the respondents that left or stayed in the technical sector

Status technical sector	**Respondent (pseudonym)**	**Type of study**	**Type of university**
Left	Frank	Industrial Engineering and Management	University
	Noah	Industrial Engineering and Management	University of Applied Sciences
	Sam	Mechanical Engineering	University
	Bram	Mechanical Engineering	University
	Otis	Technical Physics	University
Stayed	Luke	Electrical Engineering	University
	Tom	Electrical Engineering	University of Applied Sciences
	Matthew	Industrial Engineering and Management	University
	Paul	Industrial Engineering and Management	University of Applied Sciences
	Robin	Mechanical Engineering	University
	Thomas	Mechanical Engineering	University of Applied Sciences
	Simon	Technical Physics	University
	Rik	Technical Physics	University of Applied Sciences

1. Experiences that shaped the study and career choices from alumni that left the technical sector

Sam, Mechanical Engineering, University

Early childhood

Sam has clear and vivid memories about his early childhood. He remembers going to primary school was first tense for him, but he that he liked it. He gets in touch with less educated kids in his class and he remembers finding that a bit hard.

Sam describes himself as curious, eager to learn and being easily bored during primary school. He remembers that he really disliked doing odd jobs such as making drawings, cutting and pasting. He liked doing math games and reading books and spends a lot of time on that.

> *"But I, yeah, learning to read and calculate, I could be very busy with that. I did a lot of counting games, mainly with my dad. I was very eager to learn"*

In his first years of primary school he describes hobbies such as playing outside, playing with Lego and reading books. When playing with Lego, he always got the Lego kits that were harder than average for his age. And when reading books, he could read books for hours.

> *"I was highly interested in animals. I had, you know, a series of books […]. I really devoured that. I studied that forever and, yeah, I do not know if obsessively is the right word, but it really was extreme"*

Sam clearly remembers moving to another place and school in third grade. He mentions missing the personal attention of his previous school. Eventually he switched to a school with more personal attention and he experienced this switch as pleasant because this personal attention meant for him that his needs for extra material could be better met.

In this period he mainly remembers everything that has to do with mathematics. He remembers having a predilection for numbers and that he gets mathematics from a higher level and that he does mathematic games on his computer.

> *"Yeah I had a game on the computer […] And then you had to do tables […], you had to finish the tables and the time was being recorded. Yeah, I could really devour that, to improve the time constantly. Yeah so I really liked doing that"*

Other hobbies in this phase were fishing, playing basketball, judo and tennis. During his later years of primary school, he remembers having two big passions: playing with marbles and with Pokémon cards. Also here, he remembers that he could totally lose himself in this to get better and better.

In grade eight he remembers doing the end test. Although the score for this test was high, the results were disappointing for him. He blames this, in his eyes, low score on the fact that he made himself crazy due to his own competitiveness.

12 years of age until start of studies

Sam goes to the higher level of education. He describes that he wanted to go to another location of the school than his parents wanted, because he thought at the location of his preference, everything was bigger and better. He remembers ending up in a class with only boys. There was a lot of competition between them and Sam describes a bet with his classmates in which the person with the best grade for every test could win candy:

> "*I also really liked doing that and to keep on pushing"*

In second grade he moves to a school with a different culture and attitude towards teachers. He describes that he had to get used to this and that he felt like he did not fit, but also in this class there was a certain competitiveness which he liked.

Sam makes the profile choice based on ratio, he mainly takes his future career into account

> *"I also really thought about what it would mean for my career choice, because I always have had the drive to try to make a good career"*

He describes actually wanting to do three profiles in one, but this was not possible because of practical problems with the timetable. He mentions finding that a pity because he would have wanted some extra challenge during high school. Eventually he chooses for the technical profile because with this profile he can choose all possible follow-up studies and the profile is known as the hardest and most challenging. He involves his parents and mentor in the decision process, but eventually makes the decision himself. He describes skipping school often because his grades were good enough. Sam especially remembers his mathematics teacher because this teacher made the courses very challenging. He had hoped that more teachers were like him.

At the end of his high school period he orients on his follow-up study, he visits open days and there he visits every study he is interested in. He orients extensively on technical as well as non-technical studies, but eventually chooses for Mechanical Engineering because it is being told that this is one of the most difficult studies and the mathematical part attracts him.

University period

During his study, Sam ends up living at the university campus and he likes partying a lot. After the first year he considers switching to Medicine studies.

> *"So even after completing my first year, I seriously doubted to switch to Medicine. But eventually I did not do that. Mainly because I was less interested in biology than mathematics"*

During his study, Sam describes that he is not the person that comes up with creative concepts in class. Rather he wants to apply theories. He likes tackling complex topics and is good in the mathematical courses. He remembers several projects but does not describe the content of these projects extensively. Which courses he likes also depends on the teachers.

"Fluid Mechanics, that was, there was a very good professor […] and that was, he was fantastic in explaining, and that was very challenging and that really grabbed me"

At the end of his bachelor, he starts doubting whether he wants to work in the technical sector after graduating.

"I, I just really had that strong ambition. So I still really wanted to move up to that top. And I, I did not know whether the technical sector would offer me the fastest track."

When choosing for a master, he doubts doing a double master. He completes a premaster in Business Administration, but he does not find that interesting enough. He eventually chooses a master of his own study track. He knows that this master is known as a good master with a good exit position for his future career. Furthermore, he is doing a board year because he knows that this is very good for his resume. This board year showed him that there is more than making sums. He starts to realize here that he does not want to work in the technical sector. He has the feeling that in a technical company making a fast career is impossible. He describes really missing the ambition in technical companies.

Transition to first job

When orienting on his first job, Sam considers doing a PhD, but he decides that he wants to work in the consultancy. He starts studying cases that are needed to be able to apply for jobs in the consultancy. Eventually he gets an offer from a consultancy company, but he rejects this offer because it was not one of the big companies he could work for. After more training he eventually gets an offer from a company he wants to work for. He did not consider applying for a job in the technical sector.

Otis, Technical Physics, University

Early childhood

Otis describes that his early childhood did not impress him much. He has good memories of a teacher that stimulates him to read much. He remembers having keyboard classes and tennis classes. He argues that he liked both, but that he only did what he had to do to keep up with his current level. Furthermore, he remembers sitting behind the computer a lot to play games. When he was not playing games, he was playing outside with friends.

"No, but.. I've been outside a lot, but I did not get really dirty. Not really building things, in the mud or something. Just wandering around"

In general, Otis did good at school, he did not pay a lot of attention on his school performance. He remembers playing draughts and being selected for a regional school competition in draughts. At the end of primary school Otis has the end test. He describes that making this test was relaxed for him. He scores the highest score of everyone in his class.

12 years of age until start of studies

Otis goes to the higher level of high school. He describes the choice for high school as logical because it was the only school nearby that offered his level. Otis describes himself as an introvert and shy boy during high school. In terms of courses Otis describes liking Greek and history because of the stories. But he outlines that he mainly liked the technical courses, he likes being at the forefront in these courses. He also remembers participating in a mathematical Olympiad.

> *"Yeah, and in the technical courses such as mathematics, I always liked being at the forefront by just figuring out what subjects are offered in the next year, so to say. Just to figure out whether I already understood that".*

In his leisure time Otis is interested in playing keyboard again. However, he spends most time playing computer games with friends. He also remembers that he figured out how the security system works on a computer at school.

> *"I was messing about with computers a lot. […]So, then you could put things like passwords on the computer very easily so that people could not use it anymore. And obviously you could not run extra programs, but you could always figure ways out to get round that. At a certain moment I was known for being very good at that."*

The profile choice was not difficult. He argues that he liked physics, mathematics and science and that is the reason for choosing this profile. He did not involve any actors in his decision process because for him there has not been another option than the technical profile. He also remembers doing a career test in which a technical job came out as the best match.

When orienting on a follow-up study Otis visits open days with a friend. He only visits technical studies and technical universities because he already knew that he wants to do something like that. He eventually chooses Technical Physics because he liked physics the most during high school and he liked the fact that he is broadly oriented with this study. He did not involve anybody in his study choice because he knew what he wanted.

University period

From his university period, Otis mainly describes the extracurricular activities. He becomes member of several committees. These memberships made him realize that there is more than his technical study and that he likes organizing and networking as well.

> *"It was just more, at a certain moment I realized, wait, this is also possible. But, I don't know, that is just something, you discover that, and that was actually really fun."*

Besides study related committees, he also becomes member of a board that had nothing to do with his study association. Furthermore, he applies for the committee of an organization that looks after students' interests. In his eyes this was the highest possible position he could apply for. Eventually he does not get the position and he is not amused about that.

Otis does not describe any courses from his bachelor. He does describe that he did his final assignment in the educational context.

In the third year of his bachelor, Otis realizes that he wants to work in consultancy after a friend from the association invites him to follow a presentation related to consultancy.

> *"So he was already following the business courses from the big consultancy companies. And people also wanted to have him. […] and at the end he could give a presentation to friends to show what he did. And he thought, I think Otis finds that interesting, so I invite him. And that is when I figured out, oh, Strategy Consultancy is actually a thing. And then I became more and more enthusiastic about that business"*

After that he follows several so called "In House days" through the whole country.

When orienting on a master, he first focuses on a non-technical master. He follows a pre-master for this, but eventually does not follow the master. In his eyes, the level was very low and there were few interested people. He eventually chooses a master from his own study track that was most interesting to him. He also does not describe any courses he followed during his master. He tries to find a final assignment in the professional context because he wants to see more than the university. When he does not find a suitable assignment, he graduates in the educational context. To conclude, Otis does an internship abroad that is focusing on Physics. He really wanted to go abroad and do something else than he did at that moment.

Transition first job

When applying for his first job, Otis doubts between doing a PhD and applying for a job in the consultancy. He considers a PhD because he thinks it is a pity to not use the knowledge that he gathered during his studies. However, he eventually applies for positions in the consultancy because he likes the short-term projects, the diversity and the personal development in these positions. He also likes the fact that he can use his analytical skills in this position. He applies for positions at the top three consultancy companies but he does not get hired. He remembers being very disappointed.

> *"It is two years later now. I am still not over it. I wonder if I will ever be over it. I think it is very unfortunate"*

Eventually he gets in contact with a friend who is recruiter. That person offers him a job at another consultancy company.

Frank, Industrial Engineering and Management, University

Early childhood

Frank mainly plays soccer or games on the PlayStation or Gameboy during his childhood. Furthermore, he plays with Duplo, Lego and Knex and he has a lot of Pokémon cards. He remembers he is able to guess words in a television program at a very young age. Frank describes himself as a very curious boy.

"I was very curious as a child. So when he [his brother] got a present, then I always brought these presents to him. He never wanted to unwrap them and then I would really prick in it so that he would unwrap them as soon as possible, because I wanted to know what was in"

Frank was not motivated during primary school, he describes going to school as not interesting and challenging enough and describes that he was mainly lazing during high school. In third grade, his teachers want him to redo a class because they think that he needs more time to learn. Frank describes that in reality he does not feel challenged enough. He does an intelligence test and it appears that he is almost highly intelligent. When his school still wants him to redo a class, he switches school and thereafter he even skips a class. When looking at courses, Frank dislikes history, but mainly talks about mathematics. He is good at it and likes spending time on it. He remembers running out of mathematics exercises and playing mathematic games on the computer. In fourth grade he gets extra higher level mathematics

"I remember that I thought [during the extra mathematics classes], all right, this is pretty hard. I did not have that with other things"

Besides that, Frank likes being challenged at school. He also wants to be the best in everything:

"I remember a topography game where you had to fly from city to city with a helicopter […] Everyone wanted to play that. […] But I, one classmate was better in that game than I was, I found that very annoying"

In seventh grade, Frank has to do a test where he scores the maximum score. On the end test in eighth grade, he scores a bit lower than expected. He blames this lower score on the fact that he wanted to be done with it as soon as possible. His teacher gives the advice to go to the intermediate level of education, but together with his parents he decides going to the higher level of education. During this phase Frank describes that he does not get stimulated by his parents.

12 years of age until start of studies

Frank eventually goes to the higher level of education. The choice for the high school was based on practical reasons and because his father went to the same school. He is playing a lot of sport games in high school and tells that becomes one of the best in his class in doing sports.

In terms of courses Frank describes that he hated history during high school and that he was not interested in the Dutch courses. He liked gymnastics and was still interested in mathematics. He remembers being fascinated by his mathematics teacher.

"He stimulated people of which he saw, okay they maybe have a higher level […]. And I liked that, I could just do my work when I did not need any explanation, or thought I did not need it. And I liked that a lot."

He also describes teachers he disliked because they obliged him to listen to their explanation although he already understood it.

During his profile choice he doubts between the health track and the technical track. He eventually chooses the technical track. His motive for choosing the technical track was that he disliked parts of the other profiles.

> *"Yes, the economical profile […] I liked that profile a lot, but there you had history. And I did not want that. That really was just a no go. So that is why the cultural and the economical profile were dropped, that was just a no go. And then the health and the technical profile were left. And then I went for the other [the technical profile] based on biology"*

Frank describes not excelling in any course, only in mathematics for some years. He is not interested in making his homework and has no motivation to do good at school because he knows he is good enough to pass school. He remembers not getting good grades because he liked doing other things than school. In fifth grade, his marks are so bad that his teachers think he is not going to make it to the next year. Eventually, when he is putting effort in it, he gets a lot of good marks in the last semester and he is going to the next grade. Also in this phase he describes that he does not get stimulated by his parents to do his best at school. Other actors are not being mentioned either.

When orienting on a follow-up study at university, Frank visits one open day and only visits the technical studies. He mentions that he is a hundred percent sure that he wants to do a technical study. After the open days, he has an orientation day at Industrial Design and decides that this is the study he wants to do.

University period

Frank initially starts the study Industrial Design because he likes that this study is technical and innovative in one. He still has motivational problems. During this study he realizes that he is not good enough in drawing and thinking out of the box, he therefore quits his study after six months. In the next six months he is doing a lot of activities for the student association. Through his student association he gets in touch with someone that is studying Industrial Engineering and Management. He joins him to the study for a day and decides that this is the study he wants to follow. He eventually chooses Industrial Engineering and Management because he knew a lot of people there, it was a good study for his future career and it was easy to combine with the activities he did for the student association.

During his study he dislikes the financial courses because it is not mathematical enough. He is very enthusiastic about the logistics courses because of the strong focus on mathematics and he is also very good at it. He describes that these courses were known for its difficulty.

"[…] These courses also gave me a lot of energy and motivation to really do something. […] That have been the first courses where I really was putting effort in and where I thought, well, this is fun, let's go!" […] Yeah, you really had some courses that were known as stumbling courses. That were the courses I passed for […] Yes, I just found that interesting courses"

Frank does his bachelor thesis in a professional context. When choosing his master, he doubts between doing a master in mathematics and the logistics track of his study. He eventually chooses for the logistics track because he does not want to have more study delay than he already has. He likes his master because there are a lot of people that are smarter than him. He does his master thesis in a professional context

Transition first job

During his study, Frank starts orienting on his first job. He therefore visits company days twice and he updates his LinkedIn profile and resume. He gets approached by several technical recruiters. He gets an offer for a traineeship at a technical company. He likes this job and the offer, but eventually does not accept it because he thinks it is too far away. After that, a recruiter approaches him for a job at a non-technical company. He doubts after the first conversation, but when the company shows that they want to have him and the offer is good, he takes the job.

2. Experiences that shaped the study and career choices from alumni that continued in the technical sector

Simon, Technical Physics, University

Early childhood

Simon describes multiple hobbies and activities during his early childhood. He watched Sesame street every night, read a lot of books and remembers that his parents stimulated him in that. He plays with Duplo, Lego and marbles. Moreover he describes playing computer games. In terms of sports he takes swimming classes, plays tennis and soccer and practices street dance. He also takes keyboard classes.

Simon describes liking tinkering a lot. He likes discovering new things and figuring out how everything works. He remembers that his father gave him technical objects from his work that were broken, such as a typewriter. His father let him to use his toolbox so that he could tinker with it. His father stimulated him in that.

"He would bring typewriters home. That was very funny, with all those tiny balls in it where you could play with. Also computers. And once an old monitor. He was fan of old stereos himself so he replaced amplifiers, speakers or an old DVD player and got me to look what is inside. It was fun to explore that a bit."

During primary school Simon is a good student. He describes himself as being fact based and being shy. He does not have any courses that cause trouble but likes mathematics most and language becomes less interesting. During his end test he scores the highest score possible. He talks with his

teacher and parents about the high school location, but these conversations did not have had an influence on his final decision.

12 years of age until the start of studies

Simon eventually goes to the higher level of education and starts at bilingual education because he thinks that is exciting. Therefore, the choice for the location of the high school was quickly made because there were few bilingual high schools in his surroundings. At first he was impressed by his new high school and has to get used to is.

During high school Simon plays tennis and had keyboard classes. However, he is still mainly very busy with tinkering. The help of his father becomes less when tinkering. When his computer does not work as it should, he starts repairing it himself by just trying things out.

> *"[…] I had bought a computer game but that did not functionate because a new graphical card had to be put in the computer and that night I was in a bad mood, had a fight with my dad. So my dad was like: I am not going to learn you something new now […] And then I tried it myself and that worked out"*

Moreover, when he and his family got a new computer, he found out himself how the computer works by pressing every possible button and analysing what the consequences were of his actions. He feels like trying and drawing conclusions during tinkering helped him a lot. During high school he picked up a new technical related hobby: 3D modelling at the computer, he describes learning a lot from that.

At high school he describes that he is putting effort in studying and that he gets good results. He realizes that the technical courses suit him most and that he follows other courses such as history because he has to. He remembers his mathematics teacher who had the rule that when he got caught by a student working out a sum incorrectly, this student gets a chocolate bar. Simon chooses the technical profile because he mainly loves physics. He likes that physics is very technical and analytical. He describes the profile choice as very easy.

At the end of high school he participated in a program in which students could follow extra beta courses at a university. He liked doing extra things and going more deeply into the material. He felt like he is on a more equal level with the students from the program than with his 'regular' classmates.

> *"And there I noticed that at normal high school, it was more like: Simon is the smartass from class and always has good grades. And there, yes, everyone had that and it was easier to have conversations with them. Like 'how does that work?', without having people that said: oh but we don't need to know that for the test. There was a very open atmosphere"*

Simon spends less time on tinkering at the end of high school and starts doing photography. For his follow-up study, Simon remembers that his high school stimulated students to go to open days and write a short paper about this. He only focusses on technical studies and technical universities.

Simons' father also has a technical degree, but Simon describes that this did not have an influence on his choice. His parents did stimulate him to choose a study he likes and supported him in that. Simon's friends influenced the choice of which city he should go to.

University period

Simon chooses Technical Physics as the follow-up study because he really likes physics and because he thinks he can find a good job when he is graduated. Moreover, the study has a practical focus which he likes. He likes being able to apply what is learnt in a practical setting in this study.

In his first year he puts a lot of time in studying. He feels like working hard at high school and keeping up with the material helped him through university. Because of that it feels like studying becomes easier as the years go by.

In his second year, he becomes part of a committee from his study association and helps organizing study trips. After that, he becomes chairman of the committee as well. Moreover, he gets a side job where he is going to primary schools and high schools promoting the beta courses by showing experiments.

> *"Yes, that was very fun. On the one hand I earned some money with it […] Yes and then there was the period of the 'Vandergraaffgenerator" that makes your hair stand up. Or the experiments where you suddenly throw a kind of liquid in the water and then it becomes hard […]Yeah, I liked doing it a lot because, yeah, most children were very enthusiastic about it and then you can convey your own enthusiasm."*

Simon did his bachelor thesis within university. He furthermore does a minor focussing on something completely different than where his study was about. He liked doing something different, but is also happy when it is over, physics is what he likes. At the end of his bachelor he chose a master focussing on Optica. He describes that he partly chose this study track because of the teachers and partly because he was most interested in the courses offered in this track. He describes that his master was more business focussed because he has to do an internship and a graduation assignment. His internship was abroad at a university, the focus of this internship was in line with his master. He looks back on his master thesis with a good feeling because he could apply what he had learned in practice during this thesis. During his master he picks up the tinkering again and finds his friends doing that as well. As a birthday present he gets a Arduino, a little computer board, from his roommates.

Transition to first job

When Simon orients on his first job, he describes only focusing on technical organization. He orients on the physics sector and institutes and does not consider business.

> *"The business, Rabobank et cetera I did not like that. I wanted the physics knowledge…*
> Why didn't you like that?
> *I think it is the atmosphere, but also yes, then you studied physics and maybe they use the methods of the approach you learned and the discipline, but with the physics itself you won't do anything I guess."*

He has thought about a PhD as well, but did not choose that because he does not want to work on the same topic for four years. During his orientation, he sees a job vacancy that attracts him. He calls with the hiring manager and has a job interview. At the same time he gets the opportunity to start working on a project at the university that he worked on during one of the courses in his master. He eventually chooses for the company because that position attracts him more.

Matthew, Industrial Engineering and Management, University

Early childhood

Matthew grows up on a farm in a little town where he goes to a small primary school. He plays outside a lot building huts. He also plays with Lego, but is mainly interested in soccer. He remembers spending most of his leisure time on soccer. This contained not only playing (online) soccer, but also making scrapbooks of his favorite club and writing letters to soccer clubs. The rest of his time he spends behind the computer, mainly for playing games.

He expresses that he finds primary school very easy. He describes being good at everything, but mainly in mathematics. He reads a lot of books and therefore has an excellent reading level. That is why he becomes a coach for schoolmates that are not that good at reading.

At the end of primary school Matthew remembers helping his father with odd jobs on the farm. He does mowing and cultivating and likes driving around on a tractor. However describes that he was not good at and not interested in tinkering.

> "But also repairing things or when a machine broke or something?
> *No, I was actually not really handy in that compared to my friends. So yes, I did not find that really interesting."*

Matthew scores the maximum score on the end test at school.

12 years of age until the start of studies

Matthew goes to the higher level of education to a high school that was the only high school nearby. He still plays soccer fanatically and trains for the selection teams. As he gets older he still plays computer games anymore and also has his own moped.

"When I was 16, when I had my own moped, I did replace the brake discs for instance and replacing the chain. A bit, bit, I could do the small and easy things, but
Yes, but not demounting a motor block that kind of stuff..
No, I never did that."

In that time he also gets a side job and spends time with his friends.

At high school he performs well. In the first years he finds the courses easy and because of that not that interesting. He describes getting caught for making a book report that he got from the internet. He also describes skipping exams with friends because school is too easy. In the fourth grade he chooses the technical study profile. Reason for this choice is mainly that he wants the profile to be as difficult as possible. He made the choice himself without exertion of his parents or other actors.

"[the technical profile] is the hardest profile. That is how it was brought to the students. Like, if you are good in learning then you can do that. […] So that was actually my biggest motive, I just have to do the technical profile because that is the hardest."

Because he wants the profile to be as hard as possible, he decides to write a letter to the head of the department with his friends in which they ask whether they could have two extra courses in the profile. He performs good during high school and even does bets with a friend who can get the highest mark on tests. At the end of high school he organizes the school parties. He gets money for every sold ticket. He also makes plans with his friends how to earn as much money as possible.

When a choice for a follow-up study has to be made, he does a study choice test. The results of this test show studies such as Industrial Management and Engineering and Mechanical

He knows that he wants to do something with business and that he wants to earn money. In fifth and sixth grade he visits open days with school and with his parents. Based on these open days he realizes that studies such as Science are too technical for him and studies as Economics too theoretical. He likes the story that is being told by a professor of Industrial Engineering and Management during an open day.

University period

Matthew eventually chooses Industrial Engineering and Management because of the fact that the study is difficult enough, it has a focus on business which he likes and because he can earn enough money with it in his future career. Of his first year he remembers the financial courses.

"One course was very fun, that was Finance & Accounting. That was just calculating and that was cool and for instance making financial statements for companies. I found that very interesting. I also had mathematics of which I really thought, wow, that was also really.. was also really difficult. But very difficult"

During his study he spends a lot of time maintaining social contacts. He becomes member of a student association and does various committees. He goes on study travel and goes backpacking after that. He

also becomes chairman of the student association. He has a study delay because of all these activities. He mainly does all this committee work because it looks good on his resume.

During the rest of his study he likes the financial and logistic courses. At first, he does not perform very well because he is not that motivated, but when he is putting effort in studying, it is easy for him. He realizes that he has made a good choice regarding his study when he gets in touch with older people from his study and sees where they are at that time.

Matthew does his bachelor thesis abroad in a professional context and chooses the financial track of the master. During his master he wants to do an internship at a consultancy company, but he does not get hired. During his master he thinks it is about time to put some more effort in the study because he did not really do that before. Eventually he does his master thesis at a technical company. However, he also oriented on doing his thesis at a consultancy company. The effort he is putting in his master is paying off: he graduates cum laude.

Transition to first job

During his bachelor thesis, he already gets approached for a job at the company where he completed his bachelor thesis. At first, he is not that interested in this job because he did not think about a job in that direction. After that, the company from his Master thesis is also offering him two jobs. He doubts about what to do, but then he realizes that the job that is offered by the company from his Bachelor thesis is so cool, that he is accepting that offer.

> *"So then I thought to myself, okay. I can go for a traineeship at Unilever or Heineken or something like that. Such a traineeship is maybe better regarded. But, then you are one out of many. […] while here, it is actually easier to excel […]".*

Rik, Technical Physics, University of Applied Sciences

Early childhood

In his early childhood Rik plays a lot with Duplo, Lego, Knex and blocks. He remembers that he built big and difficult constructions with two friends. When his father buys a new laptop, Rik plays several games on it. Later at primary school he remembers he needed to have one hobby and one sport from his parents. Because of that he tries out six different sports such as chess, ice skating and athletics. Although he liked the sports, he was quickly bored with doing new sports and hobbies

During primary school Rik gets bullied and therefore he dislikes primary school. Because of this bullying he is redoing a class so that he is not in the same class as his bullies anymore. After that, he starts liking primary school. He does good at primary school, he dislikes the Dutch language, but does not have courses he specifically excels in.

During this phase, Rik does several tests that reveal that he has a high intelligence. However, during his end test he scores lower than expected. Based on the score of the end test he should go to the lower level of education, but his teacher decides that he can go to the intermediate level of

education. Rik orients extensively on the location of his high school. Because of his dyslexia his teachers want to send him to a school that is focusing on that, but he dislikes that school. He eventually chooses the location of the high school based on his feeling.

> *"Yes, I have been dragged to several high schools during the decision process and I arrived at a school and there I thought yes, this feels like home, here I want to go."*

12 years of age until the start of studies

Rik goes to the intermediate level of education along with some friends from the Scouts and his primary school. During high school, Rik performs on average, he likes Mathematics and in general he finds the courses easy. He does not make his homework often. Only for French he has to do extra lessons to keep up and to understand the material. In his free time Rik sails, plays hockey and is part of the scouts.

Rik chooses the technical profile although he scores better on the alfa courses such as history and economics. On the beta courses he scores on average. His teachers tries to convince him to choose another profile, but eventually he chooses the technical profile because he wants to have a difficult profile and does not want to get bored.

> *"But I thought yeah, that [the technical profile] is really what I want to do. Because I don't put any effort in the other courses and I still score eights. That is just not that difficult, so I don't want to do that. And eventually I said, well I want to do the technical profile."*

Rik also chooses extra courses than needed. Some of the courses he follows are scheduled at the same time. He has to decide himself which course he wants to follow when courses overlapped in the time schedule. He likes the extra challenge he gets by doing extra courses. At the end of high school he needs some extra guidance in making his homework for a short period because his marks start to get worse. Rik describes himself as a boy that is afraid to get bored easily. He wants to do something new constantly.

After graduating on the intermediate level of high school he actually wants to go to the higher level of education. However, a conversation with his teacher makes him think differently.

> *"I got a warning from my teacher […]. He said: "Rik, you are a very smart boy and you have the level, but I doubt whether you are going to graduate easily on the higher level. And that is not because it is too difficult for you, but because you are constantly going to think: "the material I get, I also had that on the intermediate level but with a bit extra". But then you already lost attention and then you won't keep up with the material anymore." And then I thought, yes that is actually true."*

Rik does not describe any orientation activities for his follow-up study at the University of Applied Sciences.

University period

At first, Rik chooses physics as a study because he likes physics.

"And you did not consider anything else?

No, I am pretty easy at that […]. Because yeah, I like everything so in that respect it does not matter to me, I like almost everything

But, Electrical Engineering or something like that?

No, I liked Physics so I also did not look any further."

In his first year of high school Rik is mainly busy with doing several committees. He remembers liking the courses about Optics and disliking the courses about Electrics. He starts doubting whether this is the right study for him. Also, he does not get enough points to go to the next study year which means that he has to quit his study.

After quitting his study, Rik does various tests to decide on his next study. These tests show that Technical Physics suits best. Other options were as well technical as non-technical studies. He also considers Business Administration. He realizes he wants to do a study in which he can organize things, but he mainly wants to do something difficult and challenging and therefore chooses Technical Physics. Also this choice is quickly made.

"I thought, I want to do Technical Physics. That is the most difficult field compared to other fields."

In comparison with his previous study, he spends more time on studying . He studies at least two hours each day and puts the most effort in mathematics because he has most difficulties with that. However, also during this study he is busy with several committees. He does two board years, tries to set up a study association and organizes study days for people that want to study for exams in groups. Furthermore he tries to build an exam database in which study material can be shared. After that he decides to fully focus on his study and does the least social things as possible.

Rik especially likes his study because of the internships. He does his first internship at a technical organization. He considers this internships as one of the most important in his decision process because he can be creative there and has a lot of autonomy. He gets a high mark for this internship. After that he does a technical minor and another internship at a technical company. He also graduates at a technical company and remembers that he mainly likes the commercial side of this graduation assignment. When it becomes too technical he loses his attention.

Transition to first job

During his graduation presentation for the company he does several recommendations. One of his recommendations is that the company misses someone with a background in Physics. He presents himself as a potential candidate and he gets a job offered at this company that he accepts. He did not orient on or apply for other jobs.

3. Differences and similarities between technical alumni that left the technical sector and that continued in the technical sector

When looking at all life histories of the respondents, three patterns can be distinguished. First there is a pattern of the so-called engineers, the alumni belonging to this pattern all stayed in the technical sector. Second, there is a pattern of so-called scientists that stayed in the technical sector and third, there is a pattern of scientists that left the technical sector. Table 4 shows which alumnus belongs to which pattern.

Table 4.

Overview of respondents divided in the three patterns

Engineers	Scientists that stayed in the technical sector	Scientists that left the technical sector
Simon	Luke	Bram
Thomas	Matthew	Frank
Tom	Paul	Noah
	Rik	Otis
	Robin	Sam

In the following paragraphs, the similarities and differences in indexical and non-indexical material between the three patterns are being described per life phase. In appendix E, a schematic overview of the indexical and non-indexical material of each individual respondent can be found.

Early childhood

Table 5.

Indexical and non-indexical material in early childhood

		ENGINEERS	SCIENTISTS IN	SCIENTISTS OUT
INDEXICAL MATERIAL	ACTIONS	*ACTIONS* Reads books *(Simon)* Play outside Play with technical toys: Duplo, (technical) Lego, & Meccano Do sport *(Tom, Simon)* Have music classes *(Simon)* Play computer games *(Simon)* Are busy with technical projects (e.g. tinkering with technical objects, building constructs, welding)	*ACTIONS* Read books *(Matthew, Luke)* Play outside *(Matthew, Paul)* Play with technical toys: Duplo, Lego, Knex *(Matthew, Luke, Paul, Rik)* Do sports *(Robin, Matthew, Luke, Paul)* Play computer games *(Matthew, Luke, Rik)* Do higher level courses *(Robin, Matthew, Luke)*	*ACTIONS* Reads books *(Sam)* Play outside *(Sam, Otis, Noah)* Play with technical toys: Duplo, Lego, Knex *(Sam, Bram, Frank, Noah)* Do sport Have music classes *(Otis)* Play computer games *(Sam, Otis, Frank)* some also play educational games *(Sam, Frank)* Do several higher level courses *(Sam, Frank)* Describe several hobbies in which the goal is to get better (Sam, Frank)
	ACTORS	Parents and teachers are involved in choice for high school level and location Father helps with tinkering *(Simon)*	Parents are involved in choice for high school level and location	Parents are involved in choice for high school level and location. For Noah, this involvement was decisive
NON-INDEXICAL MATERIAL		Performs well at school, does not experience difficulties *(Simon)* Like mathematics, are good at it Dislike language Like doing technical and practical projects Choice for high school level is based on the results of the end test Choice for high school location is based practical reasons	Perform well at school, find it very easy *(Matthew, Luke, Paul)* Like mathematics, are good at it *(Robin, Matthew, Paul)* Dislike language *(Matthew, Paul, Rik)* Are curious, eager to learn and quickly bored *(Matthew, Luke, Rik)* Choice for high school level is based on the results of the end test Choice for high school location is based on practical reasons or because of a preference for a specific school	Perform well at school *(Sam, Bram, Otis)* Are not interested in school *(Frank, Noah)* Like mathematics, are good at it *(Sam, Otis, Frank, Noah)* Likes handicraft and being creative *(Bram)* Are curious, eager to learn, quickly bored *(Sam, Frank)* Want to be the best in everything, like being challenged *(Sam, Frank)* Choice for high school level is based on the results of the end test Choice for high school location is based on practical reasons

NOTE When no names are presented behind the material, this means that this material is being described by all alumni in that group

Indexical material

Similarities

When taking a look at the indexical material from this phase, the data shows that there is an overlap in the actions and actors that are being described by the alumni of all three patterns. The alumni from all patterns describe experiences such as reading books, playing computer games and playing outside in this phase. Also playing with technical toys such as Lego and Duplo is being described by the alumni. For instance, Paul describes: *"I played with Lego a lot, all day long, I know that I played with Lego in the morning before school started, when I came home from school, in school breaks and yes, at night before and after diner I played with Lego."*

Alumni from all patterns describe actors such as classmates and teachers. For instance, they remember classmates they played with, or teachers they liked or by whom they got stimulated: *"I had*

a nice teacher […] and he stimulated people that in his eyes had a higher level" [Frank]. Parents are being mentioned in a more specific way. For instance, Simon describes that his father helped him with tinkering. Moreover, in all patterns there are alumni that describe that their parents were involved in the decision process for the high school and high school level. However, these alumni also describe that their input was not decisive. For instance, Simon describes that his parents: *"[…] asked 'what do you like' and if there really was something wrong with that school then they would have told me that. But I feel like I really made the choice myself".* Only Noah describes that his parents had and decisive influence on the level and location.

Also a similarity becomes present between the two patterns of scientists only. Both groups of scientists describe participating in higher level courses during primary school, especially in mathematics and reading. Robin, Sam, Frank and Otis describe that they got extra material for mathematics. Matthew and Luke describe that their reading level was so high that they got extra tasks for this. Matthew says about this: "*Yeah, […] the ones that were finished with the books became a coach of a group of students that were not finished yet. So then I became a coach of students who were two grades higher than I was".*

Differences

Also, two differences can be found in the indexical material between the groups. First, the engineers describe being busy with technical projects. For instance, Simon describes tinkering with appliances that his father brings from work and Thomas describes building his own technical constructs such as gears and electric motors with technical Lego. The scientists from both patterns do not describe doing such technical projects during early childhood. Second, the engineers do not describe that they did higher level courser during primary school as is being described by the other two groups.

Non-indexical material

Similarities

Also the non-indexical material shows similarities between the patterns. In this phase, there are alumni among the patterns that describe liking going to school, whereas other argue that they did not spend much time on learning or that they were not being challenged much. In general, all alumni point out that their performance was good during this phase. In terms of courses, mathematics is being often mentioned as a course they like.

Also the motives that are being brought up for the high school level and high school location are similar among the groups. The choice for the high school location is in all groups mainly based on practical reasons (i.e. the choice for high school is based on location). Some alumni also describe that they went to the high school of their preference. The choice for the high school level is based on the results of the end test: "*The results of the end test showed pretty clearly that I should go to the intermediate level […] so it became the intermediate level"* [Paul].

Also a similarity becomes clear that is only present between the groups of scientists. Both groups describe that they were eager to learn, curious and quickly bored in this phase.

Differences

One difference becomes present in the non-indexical material in this phase. Whereas the scientists make clear that they were eager to learn, curious and quickly bored in this phase, the engineers do not describe this to such extent.

12 years of age until start of studies

Table 6.

Indexical and non-indexical material in the phase ´12 years of age until start of studies´

		ENGINEERS	SCIENTISTS IN	SCIENTISTS OUT
INDEXICAL MATERIAL	ACTIONS	Do sport *(Simon)* Play music *(Simon)* Do several technical projects (e.g. tinkering with mopeds, repairing own computer, 3D modelling) Choose the technical profile Follows extra (beta) courses *(Simon)* Visit an open day for the follow up study (Simon) Only focus on technical studies at technical universities *(Simon)* Gets a presentation from students Mechanical Engineering of a university of applied sciences *(Thomas)*	Do sport *(Robin, Matthew, Luke, Paul)* Play music *(Robin)* Play computer games *(Luke, Paul)* Choose the technical profile Choose extra courses in the profile *(Matthew, Luke, Rik)* Visit several open days. Orient on technical *(Robin, Luke)* as well as non-technical studies *(Matthew, Paul)* Some alumni do a study choice test *(Matthew, Paul)*	Do sport *(Sam, Bram, Otis, Noah)* Play music (*Otis, Noah)* Play computer games *(Otis, Noah)* Have a moped *(Sam, Bram)* Choose the technical profile *(Sam, Bram, Otis, Frank)* Chooses an economical profile *(Noah)* Choose extra courses in the profile *(Sam, Otis)* Gets extra mathematics material *(Frank)* Visit several open days. Focus on technical *(Bram, Otis, Frank)* as well as non-technical studies *(Sam, Noah)* Does a study choice test *(Otis)*
	ACTORS	Father *(Simon*) / Neighbour *(Thomas)* helps with tinkering Remember teachers because their way of teaching	Parents and teachers are involved in the decision process Remember teachers because of the way of teaching	Parents and teachers are involved in the decision process Remember teachers because of the way of teaching
NON-INDEXICAL MATERIAL		Beta courses are experienced as most easy *(Simon, Tom)* Has troubles with language courses *(Thomas)* Like being practical *(Simon, Tom)* Likes doing extra things and going more deeply into school material *(Simon)* Profile choice is based on preference and is experienced as easy (Simon, Tom) Choice for the study is based on preference Choice for study is quickly made and experienced as easy	Like the beta courses *(Robin, Matthew, Paul, Rik)* Like being analytical *(Robin, Luke)* Dislike language courses *(Robin, Luke, Paul, Rik)* Dislike the courses that are too easy because they are not being challenged enough *(Matthew, Rik, Paul)* Want to be challenged *(Matthew, Paul)* Profile choice is being experienced as easy *(Robin, Paul)* other alumni had more difficulties choosing the profile *(Luke)* Profile choice is based on preference *(Robin, Luke, Paul)* because they want to be broadly oriented *(Luke)* or because it is considered as the most difficult profile *(Matthew, Rik)* Choice for study is based on the degree of challenge in the study *(Matthew, Luke, Rik, Paul)*, the exit position for a future job *(Matthew)*, or based on preference *(Luke, Rik)*	Are the best in beta courses *(Sam, Bram, Otis, Frank)* Like being analytical *(Sam, Bram, Otis, Frank)* Likes being practical *(Bram)* Dislike languages *(Bram, Frank, Noah)* Want to be challenged *(Otis, Sam, Frank)* Like being competitive *(Sam, Frank)* Doubt between other profiles *(Sam, Frank)* Profile choice is based on preference *(Otis)* because they want to be broadly oriented *(Sam)*, because it is considered as the most difficult profile *(Sam)* or they like the other profiles less *(Bram, Noah, Frank)* Choice for study is based on the degree of challenge in the study *(Sam, Otis)*, the exit position for a future job *(Sam, Otis, Frank)* or based on their preference *(Sam, Bram, Otis, Noah)*

NOTE. When no names are presented behind the material, this means that this material is being described by all alumni in that group

Indexical material

Similarities

The indexical material from this phase tells us that in terms of doing sports, playing computer games

and playing music an overlap can be found between all three patterns. In terms of sports, playing soccer is being described often. Furthermore, among the engineers as well as the scientists that stayed and the scientists that left, there are alumni that stuck to playing one sport, whereas others tried several sports during this period. Music is being described less by the alumni, Otis, Simon and Robin are the ones playing music during this phase. For instance, Otis describes: *"I started playing music again on the keyboard or piano".*

When looking at the specialization in high school, except for Noah, all alumni choose a technical specialization in high school. Noah chooses a profile that is focussing more on economics. Another similarity is that in all groups there are alumni that are following extra or higher level courses during this period. From the engineers, Simon describes: "*I followed extra beta courses at a university"*. From the scientists that stayed in the technical sector, Paul gets extra mathematics material. Moreover, Matthew and Rik choose extra courses in their technical profile than was necessary: *"I really wanted two extra courses, because if not I would get very bored"* [Rik]. From the scientists that left the technical sector, Otis participates in a mathematics competition for high school students. Moreover, Sam and Frank are the ones that choose extra courses in their technical profile than necessary.

Although actors are being described in this phase, none of the alumni describe actors that have been of great influence on the decision process for the profile or study. Although multiple alumni talked with their parents or teachers about the profile- and study choice, this influence was not decisive. For instance, Rik remembers about his profile choice:

"At a certain moment we got an advice from the teachers. For all languages I had a negative [advice] […], for economics, history, all those courses I had a positive [advice], I was very good at that. And then I had an average for physics, science, mathematics […]. And then they say: "well, I do not know if your interested enough [in that profile]". But I thought, I really want to do that".

When looking at actors influencing the study choice, only Robin describes that without the voice of his brother, he would not have chosen this study. However, Robin also describes that without his brother's influence, he would still have chosen a technical study.

Furthermore, an overlap in the indexical material can be found between the two patterns of scientists when looking at the orientation activities for their future study. Some scientists did a study choice test to orient on their follow-up study. Matthew describes that he: *"[…] got a sort of study choice test".* Also Otis and Rik describe doing such a test. Furthermore, both the group of scientists that left and the group of scientists that stayed describe visiting several open days to orient on a follow up study. Both scientists that stayed and left orient on multiple studies. Some scientists describe focussing on only technical studies, Bram for instance says: *"I went to [university] and [university] […] and I guess I went to Civil Engineering, Engineering and Mechanical Engineering"* whereas

others also focus on non-technical universities and studies: "*I went to open days and then I scheduled a whole day […] I oriented on Law studies and even oriented on Dutch"* [Sam].

Differences

Whereas the alumni belonging to the two patterns of scientists describe having an extensive orientation on their follow-up study, the indexical material of the engineers reveal that their orientation is different. The material reveals that the engineers do not extensively orient on their follow up study. From the engineers, only Simon describes that he went to an open day. Tom does not describe any orientation activities at all and Thomas only remembers a presentation at his high school from *"[…] a group of students from university of applied sciences that held a presentation about what was possible there"*. So, there is a difference in the way of orienting between the engineers and scientists since the scientists describe a more extensive orientation.

When looking at the activities that are being done in their leisure time, also in this phase a difference can be found. The engineers are the ones that describe doing several technical projects during this phase. For instance, Simon describes that he repairs his own computer and Thomas describes tinkering with his moped a lot: *"I got my first moped and then the tinkering began"*. These technical projects are not being described by the alumni of the other groups.

Non-indexical material

Similarities

Also the non-indexical material shows similarities between the three patterns. In all groups, some alumni describe that they experienced high school as easy, others had more difficulties. In terms of courses they like, in general the alumni like the beta courses and dislike the language courses. Furthermore, alumni from both groups describe that they did not really excel in a specific course, others describe excelling in the beta courses.

Also in this phase the non-indexical material that is being described by the two groups of scientists can be characterized as similar. All scientists describe that they like being more analytical and theoretical: *"Especially the analytical courses […] mathematics, physics, science, economics I liked"* (Robin). The non-indexical material furthermore shows that the scientists want to be challenged and like to be competitive in the things they do. For example, Sam describes: *"I sat in a class with extremely competitive boys, I liked that a lot.* And Matthew remembers: *"So at a certain moment we started doing bets against each other who could get the highest marks, […] I enjoyed that".*

Moreover, a similarity can be found in the motives between the group of scientists that left and stayed in the technical sector for choosing the technical profile. Both groups describe several motives for choosing the technical profile. For instance, they mention that they have a preference for the courses of the technical profile. Robin (stayed) says about his profile choice: *"it was based on the courses I liked"*. Otis (left) describes: "*That was not a difficult choice, I liked physics, science and*

mathematics" and Noah (left) describes: *"The rest [of the profiles] did not attract me at all".* A second similar motive for the profile choice that is being described by the scientists is wanting to be broadly oriented. Sam describes: *"I realized that when I chose this profile I could do every possible follow-up study"*. The third similar motive is that some scientists describe wanting to have a certain challenge in their future profile. Matthew points out: *"I wanted it to be as difficult as possible"*

The same similarities in motives for choosing the technical profile can be found back in the motives for choosing a follow up study between the two patterns of scientists. Almost all scientists describe having a preference for the study they eventually choose. Furthermore, Matthew, Luke and Rik (stayed) and Sam and Otis (left) mention that they choose this study based on the degree of challenge that was present in their follow-up study. For instance, Rik says about this: *"I wanted to do Technical Physics, that is the most difficult field there is, when I compare it to other fields".* Matthew (stayed), Sam, Otis and Frank (left) also mention that they took the exit position for their future job into account when choosing for this study. Frank describes: *"[With this study] you had a good position to end up with a good job in the field of Business"*.

Differences

Where the scientists that left and stayed describe that they like being analytical and theoretical, the engineers describe that they like being practical during high school. For example, Tom describes: *courses such as handicraft […] being busy with technique, I liked that a lot"*.

Also there is a difference in the motives for the profile choice that are being described by the engineers and the scientists that stayed and left. Whereas the scientists describe three main motives for choosing a profile (i.e. preference, broadly oriented and challenge), the engineers only describe choosing the profile based on their preference for the courses being offered in the technical profile.

When looking at the motives for the study choice, the same difference in motives becomes clear. Whereas the scientists describe several motives for their follow-up study (i.e. preference, challenge, exit position) the engineers only choose their study based on their preference and the decision is quickly made. Tom describes: *"I quickly saw, I like this study […] I am going to do this study".* So, although also almost all scientists mention that they have a preference for this study, other motives are considered as well by the scientists. These motives are not mentioned by the engineers.

University period

Table 7.

Indexical and non-indexical material in the phase 'university period'

		ENGINEERS	SCIENTISTS IN	SCIENTISTS OUT
INDEXICAL MATERIAL	ACTIONS	Do sports and social activities Becomes active in a student association *(Simon)* Graduates in educational context *(Simon)* Graduate in professional context *(Tom, Thomas)* Do an internship Have a technical hobby (e.g. Arduino, technical projects, repairing motor cycles)	Do sports and social activities Become active in a student / study association *(Matthew, Luke, Rik)* Consider switching to another study or master *(Robin, Luke, Paul)* Do an internship Considers an internship in the non-technical sector *(Matthew)* Graduate in professional context	Do sports and social activities Become active in a student / study association *(Sam, Bram, Otis, Frank)* Consider switching to another (non-technical) study or master *(Sam, Otis, Frank)* Do an internship *(Bram, Noah)* Do a non-technical pre-master *(Sam, Otis)* Graduate in educational context *(Sam, Bram, Otis)* Graduate in professional context *(Bram, Frank, Noah)*
NON-INDEXICAL MATERIAL		Like the practical projects during university	Doubt about their study choice *(Robin, Luke)* Like being analytical *(Robin, Matthew, Luke)* Like being challenged in the study *(Matthew, Rik)* Wants to do committee work because it is good for his career *(Matthew)*	Like being analytical *(Sam, Otis, Frank, Noah)* Like being challenged *(Sam, Otis, Frank)* Do not continue with the non-technical master *(Sam, Otis)* because the level of this study is considered too low Doubts whether they want to work in the technical sector. Realize that there is more than making sums *(Sam, Bram).* Extracurricular activities played a big part in this decision *(Bram, Otis)* Want to do committee work because it is good for his career *(Sam, Otis)*

NOTE. When no names are presented behind the material, this means that this material is being described by all alumni in that group

Indexical material

Similarities

The indexical material of university period tells us that all alumni are busy with doing sports and social activities during this phase. Furthermore, most of the alumni became an active member of a student or study association and spend a lot of time on this.

When looking at the study itself, it becomes clear that all alumni describe professional socialization experiences. Several alumni did an internship at a technical organization and graduation took place in an educational or professional context. However, also a difference in terms of professional socialization experiences becomes clear concerning the context of graduation. This difference will be described in the following section.

A similarity that is only present between the two patterns of scientists can be found in the experiences related to switching to another study or master. Several scientists that stayed or left the technical sector describe orienting on another study or master. From the scientists that stayed in the technical sector, Robin describes: *"I doubted to switch to Civil Engineering"* and Luke considered switching to Mechanical Engineering: *"I thought, would another study not have been nicer? […] For instance, Mechanical Engineering […] I talked about this with teachers"*. When they find out that these studies are relatively similar to their current study, they do not switch. From the scientists that left the technical sector Sam considered switching: "*So even after completing my first year, I seriously doubted to switch to Medicine".*

Also when the choice for the master has to be made, the scientists that stayed and left are the ones that orient on (non-technical) masters. From the scientists that stayed in the technical sector Luke considered switching to a technical master and Paul considered switching to a non-technical master. From the scientists that left the technical sector, Sam and Otis considered a non-technical master (*"I thought, maybe I should do a completely other master"* [Otis]) and Frank considered a technical master: *"I considered a master in Mathematics".*

Differences

Whereas the scientists describe that they oriented on several other studies or masters, engineers do not describe these orientation activities. Furthermore, where the scientists that left and stayed described orienting on several masters that were not related to their current study, the indexical material from the engineers shows that they only focus on the masters from their current study.

When looking at the type of graduation assignment that is being completed by the alumni, a difference between the alumni that stayed and left becomes present. It becomes clear that the scientists that left the technical sector describe less internships and assignments in the professional context compared to the engineers and scientists that stayed in the technical sector. All engineers and scientists that stayed in the technical sector describe doing an internship whereas from the scientists that left, only Bram and Noah describe doing an internship in a professional context. When looking at bachelor/master theses in the group of alumni that stayed, Robin is the only alumnus that did an assignment in educational context. From the alumni that left the technical sector, Sam, Bram and Otis did an assignment in educational context. Otis describes wanting to do an assignment in the professional context, but that there was no assignment available in the professional context: *"During my graduation I tried to get an assignment outside university […] but there was no assignment available. So unfortunately I could not get an assignment outside the university".* So, the material shows that the alumni that stayed in the technical sector gained more experience in the professional context.

Another difference is that also during university, the engineers are the ones that have technical hobbies. Simon describes having a so-called Arduino, Tom describes taking several technical projects from school to home and Thomas describes spending almost all of his leisure time on tinkering with his motor cycle. The other alumni do not describe these experiences to this extend.

Non-indexical material

Similarities

Also in this phase in the non-indexical material, the scientists that stayed and left in the technical show a similarity. When talking about the things they like in their studies, they describe liking the theoretical and analytical projects. Robin for instance describes: *"I really liked the analytical part of the study"*. The scientists like working on doing difficult exercises and projects. For instance, Sam

describes: *"I liked tackling the complex topics"* and Matthew describes a course: "*That was calculating and I liked that a lot […] I really though, wow, this is difficult".*

Differences

Whereas the non-indexical material shows a similarity in the preference in type of projects between the two group of scientists, a difference becomes clear when comparing this material with the material of the engineers. Whereas the scientists describe liking the theoretical and analytical projects, the engineers describe liking the practical projects (*"I definitely liked the practical courses"* [Thomas]).

Also a difference becomes clear between the alumni that stayed in the technical sector and the scientists that left the technical sector. The material of the alumni that left the technical sector shows that in this phase some alumni have their first doubts whether they want to have a future profession in the technical sector. Bram and Otis describe that for them the activities at their student/study association played a big part in this decision. Because of these social activities, they started to realize that they also like other things than something technical. For example, Bram describes: "*there I actually figured out that I liked organizing, coordinating more than the content"* and Otis describes: *"I really liked networking, I got a lot of energy from that".* Furthermore, because of Otis' activities at the study association he gets in touch with someone that is having a job at a consultancy company: "*So I realized, well Consultancy is actually a thing, and so I became more and more enthusiastic about the business".*

<u>Transition first job</u>

Table 8.

Indexical and non-indexical material in the phase ´transition to their first job´

		ENGINEERS	SCIENTISTS IN	SCIENTISTS OUT
INDEXICAL MATERIAL	ACTIONS	Orient on a job in the technical field Considers a PHD *(Simon)* Applies for a job *(Simon)* Gets an offer from the company he graduated *(Tom)* Starts as a freelancer *(Thomas)*	Consider a PHD *(Robin)* Apply for jobs in the non-technical sector *(Robin)* Gets a job offer from a recruitment agency *(Robin, Paul)* Gets an offer from the company he graduated *(Matthew, Luke)* Applies for a job himself and gets the job *(Rik)*	Consider a PHD *(Sam, Otis)* Some deliberately apply for a job outside the technical sector *(Sam, Bram, Otis)* Get offers from and consider jobs in the technical sector *(Frank, Noah)* Accepts an offer from a recruitment agency *(Sam, Bram, Otis, Frank)* Gets an offer from the company he graduated *(Noah)*
NON-INDEXICAL MATERIAL		Choice for the technical sector is self-evident	Chooses this job because he thinks it is easier to excel and he wants to make a career *(Matthew)* Does not like the technical sector per se, likes the analytical *(Robin)*	Some did not consider a job in the technical sector *(Sam, Bram, Otis)* Want to work at a company that is one of the biggest he could work for *(Sam)* Wants to make a career, wants to get as fast as possible to the top *(Sam, Bram)* Likes the variety and the ambition in his currents job *(Sam, Bram, Otis)* Likes his current job because it is out of his comfort zone and it is good for his own development *(Frank)*

NOTE. When no names are presented behind the material, this means that this material is being described by all alumni in that group

Indexical material

Similarities.

When looking at how the engineers and scientists got their first job, similarities can be found. From the engineers, Simon applies for a job himself, Tom accepts an offer from the company he graduated and Thomas starts as a freelancers. From the scientists that stayed in the technical sector, Matthew and Luke accept an offer from their graduation company and Rik applies for a job himself, Robin and Paul accept an offer from a recruitment agency. From the scientists that left the technical sector Sam, Bram, Otis and Frank accept an offer from a recruitment agency and Noah accepts an offer from his graduation company. Before accepting their first job, some alumni (i.e. Simon, Robin, Sam and Otis) considered doing a PHD. Eventually they all did not do a PHD. When looking at the actors, none of the alumni describe actors that have influenced the decision process for their future career.

Differences

When looking at the way of orienting on their first job, a difference becomes clear between the patterns. The engineers are the ones that deliberately orient on jobs in the technical sector only. Simon and Tom are searching for vacancies that attract them and have several job interviews before accepting their first job. Tom describes: *"I really searched for a job in that direction, so I chose for that"*

In the group of scientists that left the technical sector, Sam, Bram and Otis deliberately and extensively orient on non-technical jobs only. They apply for several jobs in the consultancy sector and have several job interviews before accepting their first job. The other scientists that left the technical sector (Frank and Noah), did not specifically focus on whether their job was in the technical sector or not. They also got an offer from a technical company.

Also the scientists that stayed in the technical sector do not describe that they have that specific focus on in or out the technical sector. The results show that these scientists (i.e. the scientists that stayed in the sector, including Frank and Noah) did not extensively orient on their first job. Paul is the only one that describes that he searched for job vacancies that attracted him and that he found his first job based on this interest. This interest is not typical technical: *"I just looked on the internet a lot, so I found this job, but also some more jobs focusing on project management"*. Frank, Noah, Matthew and Robin considered accepting only one other job before accepting their actual first job. Rik and Luke did not orient at all on how their first job should look like. Their decision process can be characterized as a quick decision. So, whereas the engineers oriented on a job in the technical sector, a part of the scientists that left the technical sector deliberately oriented on a job outside the technical sector. The other scientists that left the technical sector and the scientists that stayed in the technical sector did not specifically orient on the technical or non-technical sector.

Non-indexical material

Differences

The non-indexical material shows that for the engineers the choice for the technical sector was self-evident. In line with this, the choice for a job outside the sector was self-evident for some scientists that left. Sam, Bram and Otis describe two main reasons for leaving the technical sector. The first reason is that they thought that they could make a career faster in the consultancy than in the technical sector. They have the feeling that their ambition cannot be realized in the technical sector. Sam says about this: *"I, I just really had that strong ambition. So I still really wanted to move up to that top. And I, I did not know whether the technical sector would offer me the fastest track".* The second reason is that these alumni think that they are more flexible in the consultancy than in the technical sector because of the (variety in) short-term projects. Bram says about this: *"That was an important argument for me, I wanted flexibility. And when you are a consultant you are very flexible".* Furthermore Otis describes: *"I really liked the short term projects, a lot of variety, but still analytical"* They mention that they can still be analytical and challenged in these jobs, something they liked from their technical studies. These motives are not being mentioned by the other scientists and the engineers.

To summarize, based on the analysis it becomes clear that the engineers describe experiences about having technical hobbies such as tinkering, 3D modeling and soldering in all life phases. They like the practical courses and activities in their high school and university period. Their decision process for choosing the technical profile at high school, choosing a technical study and a career in the technical sector is obvious and without extensive orientation or consideration. Their choices are mainly based on their preference for the technical field. During university they do not consider switching to other (non-technical) studies or masters. Their study- and career choices can be described as a logical process without other considerations, choices are being made based on their interests.

The scientists that stayed and left do not describe the technical projects as being mentioned by the engineers. Instead, they describe rather general hobbies. In their high school and university period they like the more theoretical and analytical courses in which they can find a certain cognitive challenge. Also, the decision process of the scientists is different than the process of the engineers. The decisions that have to be made are less obvious and the scientists express that they consider more and different options than the engineers. Also, their motives in the decision process are different. Instead of choosing the profile and study based on their preference, the stories of the scientists reveal that they also choose their profile and study because it is challenging and they are broadly oriented with this profile or study. When looking at university period, the scientists consider switching to another study or master, something that was not the case among the group of engineers. Having a cognitive challenge seems more important for the scientists during the life phases than doing something with technique. From university period, a difference in the patterns between scientists that

stayed and left becomes clearer. The scientists that left the technical sector describe less assignments and internships in the professional context. Furthermore, the scientists that left allocated being part of study related activities as something that made them doubt whether they want to leave the technical sector. To conclude, they describe certain needs in a future profession that made them want to leave the technical sector. These things are not being described by scientists that stayed in the technical sector or the engineers.

Conclusion and discussion

The aim of this study was to identify what experiences in which life stages have been crucial for the choice to either leave or to continue in the technical sector. After a short conclusion of the results, it will be indicated which indexical and non-indexical material gives more information about the study and career choices. Thereafter, the professional identity development of the three patterns will be discussed. Furthermore, practical implications and methodological limitations will be discussed. To conclude, suggestions for further research will be proposed.

Conclusion

The results indicate that three patterns in life histories become present among the respondents. The material from the patterns indicate that there are differences between the patterns of the engineers and the scientists that stayed and left the technical sector, and that especially the patterns of the two groups of scientists are quite similar. The pattern of the engineer is distinctive from the pattern of the scientists because they describe more experiences from early childhood that are related to having a technical affinity and they like being practical. Furthermore, the non-indexical material shows that their choices for study and career seem more stable compared to the decision process of the scientists. The scientists that stayed or left the technical sector do not describe experiences that show a certain technical affinity and they like being more theoretical and analytical and having a certain cognitive challenge. Furthermore, their orientation activities were more extensive and their decision process was less stable.

So, when comparing the life histories of the alumni that stayed in the technical sector with the life histories of the alumni that left the technical sector, the main difference is that the pattern of the engineer is not present in the group of alumni that left the technical sector. When looking at the life histories of the scientists that stayed and left in the technical sector, it can be concluded that their life histories are quite similar. Especially until university period, no specific material becomes present that could explain their eventual choice for staying or leaving the technical sector. From university period the patterns become slightly distinctive because indexical and non-indexical material is being described that could explain the choice for leaving the technical sector. This will be discussed further in the next paragraphs.

Indexical and non-indexical material that could have been crucial for study- and career choices to leave or stay

When looking at the indexical material, the analysis reveals that actors such as family and teachers are being mentioned by the alumni, but these actors have not been identified by the respondents that either stayed of left as being of such an influence that it shaped the study and career choices of the alumni in a strong way. It therefore seems that these actors not have been crucial for the choice to leave or stay in the technical sector.

When looking at the experiences that are mentioned by the alumni, it seems that describing technical hobbies from early childhood could be associated with a choice for a career in the technical sector. Thus, when alumni are having a certain technical affinity from early childhood, this could be an indicator for a more stable career choice towards the technical sector. This is in line with previous research. For instance, Pierrakos, Beam, Constanz, Johri & Anderson (2009) suggest that having more and an early exposure to engineering is critical in the decision process to stay in the technical sector. The results also indicate that having an analytical and theoretical preference and looking for a certain cognitive challenge could be associated with the choice for a technical study. However, when looking at the career choice, this seems to be less associated with a choice for a career in the technical sector.

The results also indicate that for some alumni participating in study related social activities contributed to the decision of leaving the technical sector. Although alumni of all three groups describe participating in social activities as indexical material, the non-indexical material of scientists that left the technical sector indicate that the insights they got from these activities (e.g. liking networking) have contributed to the decision of leaving the technical sector. It could be that these scientists are looking for some social traits in their future job that they cannot find back in the technical sector. Möwes (2016) found that STEM alumni that where more socially interested are more likely to opt for a career outside the technical sector.

Furthermore, the results show that a lack of professional socialization activities could be an indicator that influenced the choice for leaving or staying in the technical sector. The group of scientists that left the technical sector describe less experiences that contributed to their professional socialization than the other alumni. Previous research shows that professional socialization influences the career choice of an alumnus. Price (2009) showed that early professional experiences during a study strongly influences one's view on the future profession. Also, a lack of professional socialization experiences can lead to a less strong professional identity (Morelock, 2017). So, when insufficiently getting in contact with the professional context, the professional identity develops less, and this leads to a higher turnover intention (Hao, Niu, Li, Yue & Liu, 2014).

When looking at the non-indexical material, the results indicate having a certain technical affinity and preference could be associated with the choice for staying in the technical sector. It seems as if scientists do not have this particular technical affinity, but for them a certain cognitive challenge could be associated with their choice for a technical study. When looking at the characteristics for the

future job that are being mentioned by the alumni that left the technical sector, wanting to have a fast career and variety and flexibility in a future profession are being mentioned. These alumni describe that they have the perception that these characteristics cannot be found in a job in the STEM sector. Therefore, having a perception of the technical sector that does not meet the alumni's needs in their future job could be indicated as material that could lead to leaving the technical sector. Although the STEM sector is perceived as a sector where people often have better prospects on a professional and a wider choice of rewarding careers (Holman & Finegold, 2010) apparently some alumni do not share this perspective. A potential reason for this mismatch could be that how a future job in the STEM sector could look like and which skills are required, is often not presented clearly to students (Holman & Finegold, 2010).

Professional identity of development of an engineer versus a scientist

When looking back on the experiences that shaped the professional identity development of the respondents, the results show that the engineers, the scientists that stayed and the scientists that left the technical sector obtained a different status in their professional identity development as described by Marcia (1980). An overview of the obtained status can be found in table 9. The results indicate that the engineers fit into the status of Foreclosure. The engineers did not describe much orientation activities on their study and job, but still chose for a career in the technical sector without much considerations. Thus, although the engineers did not extensively searched for their identity, it seems that they are highly committed to their current identity. According to Kaplan & Flum (2010) the commitment of people that obtained the status of Foreclosure is based on childhood identifications that not have been extensively explored. When looking at the engineers, they have a technical affinity from early childhood and they did not explore anything else but something technical.

Furthermore, the results indicate that the scientists that stayed in the technical sector fit into the status of Moratorium. According to Schwartz (2001) this identity status can be seen as the precursor of the Achievement status. All scientists that stayed in the technical sector searched for their identity by exploring and considering several options concerning their study and future career, but when searching for their first job it seems as if they are not fully committed to their identity. They did not deliberately search for a specific job in the technical sector and some also considered a job in the non-technical sector.

Moreover, the scientists that left the technical sector either fit into the Moratorium status or the Achievement status. Frank and Noah fit into the Moratorium because they extensively searched for their identity and still do not seem to have a commitment to this identity. They both expressed that they could have chosen for a job in the technical sector as well. A possible explanation for the alumni being in the status of Moratorium might be that wanting a cognitive challenge is not a typical characteristic of the technical sector and therefore this challenge could be found in other sectors too. The other scientists that left the technical sector fit into the status of Achievement. They have gone

through a period of exploration, but it seems that this exploration resulted in being now committed to their current identity; the results show that they deliberately chose for a career outside the technical sector. According to Marcia (1993) the status of Achievement is considered as the most adaptive.

Table 9.

Overview of respondents distributed in identity status

Pattern	*Name*	*Identity status*
Engineers	Simon	Foreclosure
	Thomas	Foreclosure
	Tom	Foreclosure
Scientists that stayed	Luke	Moratorium
	Matthew	Moratorium
	Paul	Moratorium
	Rik	Moratorium
	Robin	Moratorium
Scientists that left	Frank	Moratorium
	Noah	Moratorium
	Bram	Achievement
	Otis	Achievement
	Sam	Achievement

Based on the life histories of the alumni, some guarded general conclusions about their identity content and strength could be drawn. It seems that for engineers being a technical professional means liking being practical and having a certain technical affinity. The results show that their path towards their future profession is stable. They describe a decision process that is obvious and without extensive orientation and considerations. Literature confirms that being technology oriented with strong interests in tinkering with electronics, is a stereotype that is being held of a STEM professional (Cheryan, Plaut, Handron & Hudson, 2013). It is therefore plausible that the engineers identify more with the stereotype and therefore their choice for the technical sector is more stable. After all, people with a strong professional identity are more likely to opt for a career in the technical sector (Möwes, 2016).

When we take a look at the life histories of the scientists, it seems that for them, being a STEM student or professional means being able to apply analytical models and having a cognitive challenge. When looking at their decision path towards the technical sector, the decisions that have to be made are less obvious and the scientists express that they consider more and different options related to their study and career than the engineers. Furthermore, the scientists that left the technical sector, are describing reasons for leaving the technical sector. They describe that they are looking for certain characteristics in their future job that they, in their eyes, cannot find in their future job in the technical sector. Price (2009) indicates that the more there is a match between the professional identity and the image of a certain profession, the higher the chance that someone will stay. It seems as if these scientists have a less strong professional identity towards a profession in the technical sector.

The current research has proven that life history research is of added value when researching professional identity development. This is in line with the findings of Marcia (2002) and van Tuijl & van der Molen (2015) who argued that a professional identity develops during the whole life span. The current research shows that the first small distinguishing characteristics of the patterns for leaving or staying already become clear in the phase of early childhood and 12 years of age. For instance, this research shows that the motives for choosing a technical profile or a technical study are different between the patterns. Something that would not become clear when looking at professional identity development starting from university period. Conducting life history research therefore enriches the already existing findings of professional identity development by including individual histories starting from the phase of early childhood.

Furthermore, focussing on only men in this research has been of added value. Compared to the results of previous research about why women are leaving STEM, the results of the current research show that for men other experiences underlie leaving or staying in the STEM sector than for women. For instance, previous research shows that women leave the STEM sector because of their lower professional role confidence in a man dominated sector (e.g. Cech et al., 2011). Men do not describe this. Therefore, the current research enriches the already existing findings of motives why men leave the technical sector

Implications

Findings from this research can be useful for educational institutions, study programs and technical organizations. With these findings, educational institutions get more insight in the diversity of the motives of students for choosing a technical study. They can use this information to see whether the study content meets the motives of the students for choosing this study.

Furthermore, based on what the alumni describe, being in a professional context or not during the study seems to contribute to their final choice for leaving or staying in the technical sector. Study programs can use this information by introducing the professional context earlier in the study program so that students get a clearer image of the technical sector. Furthermore, study programs should offer more opportunities to get in touch with the professional context. This can for instance be done by offering more internships and offering graduation projects that can be done in this professional context instead of the educational context.

Furthermore, this research is useful for organizations in the technical sector. The results give an insight in which type of technical alumni tend to apply for a job in the technical sector and what they are looking for in a job. Organizations can use this information to reflect on and adjust their current approach. The results show that it is important that the scientists are reached earlier by technical organizations since some scientists already made the decision to apply for a non-technical job in university period. Technical companies therefore should get in touch with the students already during study period by for instance giving presentations at the studies. Moreover, the results show that

scientists are looking for a certain cognitive challenge in their future job. Technical companies should adjust their recruitment strategy in such a way that they can show that a cognitive challenge is present in the jobs.

Methodological limitations

Some limitations of the current study need to be considered. First of all, three limitations about the population and its distribution needs to be considered. First, the distribution in the number of participants that left and stayed in the technical sector is unequal. Five alumni that left the technical sector compared to eight alumni that stayed in the technical sector participated in this study. This could have caused incalculable influences on the results. Moreover, of the five alumni that left the technical sector, four alumni have a degree from university and only one has a degree from university of applied sciences. This could have had an unintentional influence on the results as well. A possible explanation for this few participants of a university of applied sciences that left the sector is that a study from a university of applied sciences is more practical and applied and that therefore applying for a job in the technical sector is more likely. Third, in this research alumni from the study Industrial Engineering and Management are included. In the university program of this study, students have the choice to pick a Logistics, Financial or Health track. Since these tracks are not necessarily technical oriented it seems logical that they do not necessarily end up in a technical sector.

Furthermore, especially in the non-indexical material a consensus about which material belonged to which sub code could not always be found between the assessors. This lead to a decreased quality of the coding scheme. To conclude, some limitations of life history research need to be considered. First, there is a high level of subjectivity in life history research that needs to be addressed, in conducting the interviews as well as analyzing the data. When conducting life history interviews, respondents will automatically make hypotheses about what the interviewer wants to hear (Jovchelovitch & Bauer, 2000). In this study, respondents are informed about the reason for conducting this research. Therefore, it is plausible that the respondents have made the hypothesis that the interviewer wants to hear stories about technical related topics and that they therefore talked about these topics more often. Several respondents asked whether what they were telling was relevant during the interviews. Second, the analysis of narrative interviews has something subjective since answers often can be interpreted in multiple ways (Bold, 2012). Third, in this study, the respondents are only being interviewed once. Germeten (2012) claims that conducting life history interviews often requires multiple interviews with the same respondents in order to get as much relevant information. Despite these limitations, the quality of life history interviews is that it gives an in-depth insight into the lives of the respondents. This makes it possible to obtain individual perspectives of the alumni that not can be obtained with quantitative research (Koro-Ljungberg & Douglas, 2008). This type of research helps understanding the quantitative results of other studies about this topic. Furthermore, the current study has proven that life history research is relevant in investigating professional identity development.

Further research

Based on the current research, some suggestions for further research can be done. First, the results show that there is a diversion between the so-called scientists and engineers. Since the focus of this study initially has not specifically been on this diversion between scientists and engineers, but on staying in or leaving the technical sector, further research could focus more on the diversion between scientists and engineers, their professional identity content and strength and their motives to choose a technical study or career in order to gain more insight in this.

Another question that raises based on the findings of this study is how the structure of the curriculum of technical studies is influencing the career choices of technical alumni. For instance, the influence of internships and other professional socialization experiences in educational or professional context on career choices could be further investigated since this study shows that not getting in contact with the professional context often could have been of influence for the choice to stay in or leave the technical sector.

Finally, further research could focus on how technical organizations are attracting alumni for technical jobs. Is this in line with the wishes and needs of the technical students? For instance, which type of technical alumni are technical organization currently attracting, and is this in line with the kind of people they want to attract? In line with this question: is the vacancy text of potential STEM jobs specifically attracting engineers and is this not attractive for the scientists? To conclude, further research can focus on the question how technical organizations present themselves and is this in line with the expectations, wishes and needs of technical alumni?

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Appendices

Appendix A | Key questions

Early childhood	*12 years of age until the start of studies*	*University period*	*Transition to the first job*	*Other general questions*
What kind of experiences can you remember from your early childhood?	Which experiences can you remember at the age of 12, the transition to another type of school?	In which year did you go to the university?	When did you start with your first job?	From the studies until your current state, who have had an influence on you?
What did you like at school?	What did you like?	What can you tell me about the decision of your study and the whole process?	Where was your first job?	What have been the barriers?
With what did you play / what did you do in your free time?	Wherein did your parents stimulate you?	Can you remember what you did a lot during that time / which hobbies did you have?	Do you remember the process?	Which experiences have played a crucial role?
Which experiences can you remember that had to do with engineering and your interests for engineering?	What did you have for hobbies?	What did you do with your friends / what have been their hobbies?	What can you tell me about how you got your job?	Did you have any other jobs after that?
	At which school subjects have you been good?	Which people have been the most important for you at that time?		If so, how did you choose them?
	Which teachers do you remember?	What are the most important experiences during that time if you can choose 3 of them?		
	In which year did you go middle school?			
	Which have been the most important experiences during middle school? What did you like doing? What did you do besides school / which hobbies did you have? Which teacher impressed you the most? What can you tell me about your choice of the profile during middle school and how did it go?			

Appendix B | Coding scheme

INDEXICAL MATERIAL

Code	Definition	Sub code	Definition	Sub sub code	Example
Action	*Activities of the storyteller*	Having hobbies	*Activities done regularly in respondents' leisure time*	Doing sports	"I fanatically played volleybal at the time" *(Bram)*
				Playing music	"From grade six I started playing the keyboard" *(Simon)*
				Playing games	"I played a lot of computer games" *(Paul)*
				Tinkering	"I tinkered with my motor cycle at night" *(Thomas)*
				Playing outside	"We played a lot outside" *(Noah)*
				Social activities	"I had a busy social life" *(Sam)*
				Reading	"I started reading books a lot" *(Matthew)*
				Watching television	"I remember that I watched television a lot" *(Robin)*
				Playing with technical toys	"And yes, ofcourse, playing with lego. […] I did that a lot" *(Bram)*
		Following courses	*The courses the respondent tells about*	Alpha courses	"During history it went about hunters and collectors *(Matthew)*
				Beta courses	"I did not have to do my homework for mathematics *(Luke)*
				Higher level courses	"At a certain moment I made mathematical excercises from vocational level in grade five *(Sam)*
				University courses	"At a certain moment you had to apply the mathematics to do experiments" *(Rik)*
		Doing extra curricular activities	*Extra activities outside the regular curriculum*	Associations	"In the second year I became member of the rowing club" *(Otis)*
				Committees	"I started doing many committees at the student association" *(Frank)*
				Study trip	"We went to Paris with my class" *(Sam)*
		Redoing a skipping a grade	*Redoing or skipping a grade*		"I had to redo third grade of high school" *(Paul)*
		Skipping school	*Not going to classes*		"So we soften skipped school" *(Matthew)*
		Making study- and career choices	*Choices being made related to the respondents' study or career*	Choice for location	"I went to [Name of University] *(Sam)*
				Choice for study level	"I went to the intermediate level of high school *(Thomas)*
				Choice for study profile	"I chose the technical profile because I liked that" *(Luke)*
				Choice for study	"I chose Marketing and Communication" *(Noah)*
				Choice for master	"I did the master Production, Management and Logistics" *(Frank)*
				Choice for first job	"I got recruited by someone I knew from my study period *(Otis)*
		Orientating on study- and career	*Orientation that is done or options that are considered before making a final choice*	Activities: Open days	"I visited studies, I guess I went to Civil Engineering, Engineering and Mechanical Engineering" *(Bram)*
				Activities: Test	"That was just a test, a career test or something" *(Otis)*
				Activities: Business courses	"Since then, I did a lot of Business courses" *(Otis)*
				Options	"I looked at everything, from Law to, I even looked at Dutch […] to Astronomy *(Sam)*
					"I considered all three technical universities" *(Luke)*
					"I considered Civil Engineering, Mechanical Engineering and Maritime Engineering" *(Robin)*
		Making tests and assignments	*Tests and assignments being done related to study or career*	Bachelor/Master thesis: Educational context	"That was at the department where I eventually also graduated […] That was within university *(Simon)*
				Bachelor/Master thesis: Professional	"I graduated in [Place] at [Name of the company]" *(Rik)*
				Tests and assignments: End test	"You had the 'Cito'-test, and there I scored intermediate / higher level" *(Noah)*
				Tests and assignments	"And then they said, we are going to do an intelligence test" *(Frank)*
		Following a minor	*Following a minor*		"I had the choice to do a minor at the university or abroad […] So I went abroad *(Thomas)*
		Doing internships	*Gaining work experience in an organization*		"I did an internship" *(Tom)*
		Having side jobs	*Having a job next to the study*		"I worked as a delivery boy *(Bram)*
Actors		Classmates			"With my classmates I hung a cat in the schoolyard" *(Sam)*
		Friends			"I played a lot outside with friends" *(Paul)*
		Relatives		Parents	"My dad just bought a laptop and then I could play games on it" *(Rik)*
				Siblings	"I played with my sister often" *(Simon)*
		Study advisor			"I had a conversation with my study advisor" *(Noah)*
		Teacher			"I had a course from a Greek teacher, she was very bad" *(Matthew)*
		Colleagues			"I talked about it with a colleague" *(Noah)*

NON-INDEXICAL MATERIAL

Code	Definition	Subcode	Example
Felt & Experienced	*The feelings and experiences expressed by the respondent*	Decision process	"I arrived at that school and I thought, yes, this feels like home" *(Rik)* " Maybe that [school] impressed me more" *(Simon)*
Opinions & Values	*The opinions and values told by the respondent*	Decision process	"I thought that I always had to make choice too early" *(Noah)* "I also went to Economics, but in my opinion that was too theoretical" *(Matthew)* "I remember that i found that very difficult. That was the first time that I really had to think about what I wanted" *(Luke)*
Usual & Ordinary	*That which is experienced as normal by the respondent*	Decision process	"I actually did not think long about it" *(Robin)* "I actually did not consider anything else" *(Bram)* "It was an easy decision without a lot of discussion" *(Otis)*
Argumentative	*Explanations given by the respondent*	Choice for high school level	"The end test showed that very clear that I could go to the intermediate level" *(Paul)*
		Choice for high school location: Based on friends' choice	"[My parents] had the idea: it is better when you go to [location of high school] because there you do not get distracted by your friends" *(Noah)*
		Choice for high school location: Practical reasons	"That was a practical choice. In my home town there is one high school […] otherwise you really have to go to another place" *(Bram)*
		Choice for high school location: Preference	"I arrived at a school and thought, yes, this feels like home, I am going to that school" *(Rik)*
		Choice for profile: Best exit position for future career	"I really though about, what does the profile choice mean for my future career. Because I always had the drive to make a nice career" *(Sam)*
		Choice for profile: Broadly oriented	"I wanted to keep all my options open" *(Luke)*
		Choice for profile: Most challenging	"We wanted it as difficult as possible" *(Matthew)*
		Choice for profile: Preference for courses	"I liked physics, mathematics and science a lot, so that is why I chose the technical profile" *(Otis)*
		Choice for study: Based on interests	"I wanted to do Electrical Engineering because at home I was always busy with plugs, I liked that" *(Tom)*
		Choice for study: Best exit position for future career	"With this study you had a good exit position for the business" *(Frank)*
		Choice for study: Most challenging	"They told me that this was one of the most challenging studies […] that was a trigger for me" *(Sam)*
		Choice for university location: Close by	"We could become champion that year. So I really thought, I stay in [location]" *(Robin)*
		Choice for university location: Preference	"I went to [location] because the campus attracted me and the volleyball team played on a higher level *(Bram)*

Appendix C | Description of life experiences of alumni that left the technical sector

Bram, Mechanical Engineering, University

Early childhood

In Bram´s first years of primary school, he does not speak the language, because he moved to the Netherlands from abroad. He learns the language fast and has not experienced any troubles with not speaking Dutch at first. In grade three he has to redo a class because the teacher does not find him mature enough

In his leisure time he plays soccer and some other sports. Furthermore, he plays with Lego. He remembers a situation in which he brings a dagger to school that he got from his grandmother. He remembers that he used the dagger a lot for making wood carvings from branches. He also remembers collecting refills of fountain pens and pencil points a lot.

At school Bram's performance is on average, he does not get extremely high grades. He describes an Engineering Day where several experiments could be done, which he liked very much. He especially describes Handicraft as a course he liked. He likes making things and is very proud of the things he makes. During Handicraft he remembers the projects he made.

> "*[I do remember making] my own name with thread in between two, actually two metal tubes and in between those tubes you had to solder your name with a thread. Well, that was my trophy."*

Also at home he is busy doing odd jobs.:

> "*I do know that I was busy doing things like that, with my bike and stuff and that, you know, to clean your bike and repair the tires, I did all that, in practice at home so to say. I was always the person who did that kind of stuff with my dad."*

In his final year Bram does an end test that is not the regular test that is being used at primary schools. He scores the highest of everyone. Despite this high score, his teacher wants him to go the lowest level of education. However, together with his parents he decides that he goes to the higher level of education.

12 years of age until start of studies

The choice for his high school was an easy and logical choice because there was only one school nearby. He remembers being bullied in his first years of high school. Bram describes himself as not a very ambitious student and he has difficulties staying motivated.

> "*[…] I was not an overambitious student. […] I always focused on a seven. And what I actually always did is with making projects and papers, I scored my points with that and less with the theoretical tests. No, I was less good at that."*

He does not have a specific preference in terms of courses although he finds the language courses and mathematics the most difficult. He even gets extra classes in mathematics for a year.

Bram experiences his profile choice as a logical choice. He does not consider any other profiles than the technical profile. However, he does not choose the profile because he specifically likes the topics most, but because he had less affinity with the other profiles.

> "*Well, that [the profile choice] was actually not that hard […] I did not have affinity with economics. […] health, I also thought, that is really not for me, I never felt attracted to that […] And then you had the cultural profile. Well, if someone calls it the fun profile then I immediately think, let's not do that. No, and there were a lot of languages, I knew that that was not my favourite [..] No, so it was actually a very logical choice."*

He also chooses Handicraft in his study profile. He likes the variety in people in class and the variety between the theoretical and the practical. He remembers several projects he made during Handicraft. He describes doing these projects based on trial and error. During his high school period he also has a moped. He tinkers a lot with this moped with the help of his dad. Furthermore, Bram is busy playing volleyball at a high level. He also becomes captain of the school volleyball team and becomes national school champion.

During his exam weeks Bram remembers always making the first tests good, but as soon as the end is near, he performs bad. Also on his final exams he gets insufficient marks on two exams, one technical course and one non-technical course.

When orienting on a follow-up study he orients on technical studies only, he did not consider anything else. He visits one open day and considers three studies at universities as well as universities of applied sciences. He eventually decides to focus on studies at a university only because that is the level he studied for. The eventual choice for Mechanical Engineering was made based on a simple reason.

> *"And then I thought, yeah you know, Mechanical Engineering is, I remember [a text] saying: "Why should you go for Mechanical Engineering? Did you used to play with Lego a lot?" And then I thought, yeah, I did that"*

Furthermore, Bram thinks that his parents have had an (unconscious) influence on his study choice as well because his father studied Mechanical Engineering too.

> "[*…] I cannot remember that they consciously insisted. But, I do think that my parents, especially my father, is smart enough to influence me in a certain way. That is what I think, I know that, I would bet money on that."*

University period

During his university period, Bram remembers that his first year was hard for him. He describes himself as the person that has the coordinating role in class. During projects, he likes the designing,

coming up with solutions and out of the box brainstorming.

During his study he becomes an active member of the student volleyball association. He also does a national board for student sports. There he realizes that he likes coordinating and organizing. He also takes this with him in the choice for his master.

> *"And there [during his national board] I figured out that I liked organizing and coordinating better than the hard content. And then I started looking, all right, how can I apply this in my master within Mechanical Engineering"*

He eventually also bases his choice for the master on what he likes and where he is good at. This choice was easy and logical for him. During his master he tries to find an internship abroad, but this did not work out. He eventually gets an internship at a Dutch technical company. He does his master thesis at a technical company focusing on process optimization. Eventually he likes his master thesis better than his bachelor thesis because he was more able to develop, test and implement a new method during his master.

Transition first job

During his master thesis he gets a job offer from his graduation company, but he does not accept this job.

> *"Because I actually did not want to stay there […]. In itself it was nice, but I saw other boys working there for years who also did Mechanical Engineering or Industrial Engineering and Management, also at university and they worked there for a few years. And I thought: is this the role I want to fulfil? Is this, is this my path? And then I thought, no, this is not what I want"*

After that he gets recruited by a recruitment agency through LinkedIn. He gets several job vacancies from this agency and chooses the vacancies he likes and where he wants to have a job interview with. He chooses a vacancy that is in line with his master thesis focusing on process optimization.

> *"Yeah, that is what I like and where I am good at. And that was just the reason that I thought, I like that. And consultant gives you flexibility, you see a lot of companies […] Well, that sounded really cool to me"*

Also the growth path that was being outlined was a reason to choose for consultancy instead of the technical sector.

Noah, Industrial Engineering and Management, University of Applied Sciences

Early childhood

Noah finds it hard to recall memories from this period. He remembers having two group of friends. With one group he plays soccer, with the other group he mainly plays outside. He remembers playing with cars in the woods and climbing into trees. His mother stimulates him being outside. Furthermore he is busy playing with Lego.

He describes himself as a quiet boy with a wait-and-see attitude during his early childhood. He likes being in a familiar environment, he does not like change and dislikes being in the foreground. He has good memories of a teacher that is able to deal with who he is as a person. He looks back on primary school as a period he disliked. He was not very interested in school.

> *"I was never busy with school, I guess. I think I was mainly busy with what happened in my environment"*

He does not describe much about the offered courses during primary school. He remembers that he hated doing presentations, he also was not that good in languages. He describes liking mathematics, but he is most enthusiastic about gymnastics. Noah remembers having a national soccer tournament from school. He becomes second overall with his team.

At the end of primary school Noah does the end test. With his score he could go to the intermediate level of education, but his parents and teacher decide he should go to a level below. His parents think it is better for him that high school is rather easy than that he has to put a lot of effort in it. They also decide on the location of high school

> *"[…] but because I was not paying much attention to school, my parents and the teacher eventually decided together: we are going to send you to the lower level of education […]. They had the idea: it is better to go to [LOCATION] to school because then at least you are not constantly distracted by your friends. And then you will do focus on the right things.[…] That was fine by me"*

12 years of age until the start of studies

During this phase going to school feels like an obligation for Noah. He remembers his mother being overprotective and that she always walked the dog when Noah had to go school to check whether he really was going to school. However, high school was easy for him. He does not have to put much effort in it. That is also why he sometimes skips class.

> *"I, I guess I was a pretty difficult student […] Because I was putting a lot of attention on myself in class. And then I actually mean that I was not doing good things in class, but that was also a bit because everything was easy for me".*

Noah remembers having other hobbies than at primary school. He describes playing music with friends, he tries to play the drums. Furthermore, he is a lot with a friend that is making music himself a lot. He also plays a lot of computer games with a friend.

When Noah has to choose a study profile, he does not involve anyone in his choice. He does not know what to choose. He eventually chooses an economical profile with biology because he has to make a choice and because the other options do not attract him. He likes that mathematics and economics are courses in the profile because he is good at it. A lot of friends of him choose this profile as well. He remembers that in general making choices was difficult for him.

> *"I always thought that we had to make choices way too early anyway. So I thought, well you know, I have no clue at all"*

During high school he has no idea what he wants to become in the future.

> *"You know, some people say, I want to be a police officer or something like that. Well, I have never had that."*

When Noah gets his diploma, he remembers a teacher that advices him to get a job as soon as possible, because school is not for him. This triggers him to prove this teacher wrong. Noah does not describe the orientation process on his follow-up study.

University period and transition to first job

Noah chooses a non-technical study when going to vocational education. He thinks that this study is interesting and that it could be something for him because he likes the courses that are being offered. He finds out soon that he does not like the study, but he decides to finish it anyway. He does not have to put much effort in the study. In his leisure time he still plays soccer and hangs out with his friends.

During his study he does an internship at a commercial company. There he realizes that he gets more energy from the activities that are being done at the production department. He does his second internship at the same company. He focuses on improving processes. Even before he is graduated the company offers him a job. He accepts the offer but under the condition that he can do a part-time follow-up study at a university of applied sciences.

Noah knows he wants to do a follow-up study focusing on improving processes, but has no idea which study fits his interests. That is why he starts visiting open days with a friend. He mainly visits open days for technical studies, but also visits one non-technical study. He involves his parents and a friend in his decision process, but their advices are not decisive. He eventually gets most enthusiastic about Industrial Engineering and Management and therefore chooses this study.

It is the first time in his life that Noah gets enthusiastic about something that is study related. He likes the study and is very motivated.

> *"If I summarize my school period, then I conclude that I was always putting effort in school and always passed, but that I did not know what I wanted yet. But as soon as I knew what*

I wanted I could really put one hundred percent energy in it. And before that I think I actually never did that"

Noah does not describe much about the courses he liked during the study. However, he likes the study so much that he is able to finish the study in three instead of four years.

After graduating he stays at the company he already works. However, after a few years he applies for a job at a technical company. He gets hired there, but eventually refuses the offer because his current employer gives him a better offer.

Appendix D | Description of life experiences of alumni that stayed in the technical sector

Robin, Mechanical Engineering, University

Early childhood

Robins memories about his early childhood are scarce. He remembers spending most of his time playing football, he does not have memories about other hobbies. He does remember that he did not play with (technical) Lego at all although his brother did.

Robin also does not have clear memories about his performance at primary school. He does have memories about having mathematics on a higher level than the rest of the class

> *"I for instance know that I already was in the yellow book while the rest of the class was still in the red book. […] So I was a book further than the rest. What I liked about that? I was good at it, so then something quickly becomes fun."*

He remembers the choice for the high school was easy because it was the only school nearby.

12 years of age until the start of studies

During high school Robin plays the drums and is captain of the soccer team. At school he is mainly good at the analytical courses, especially science. He remembers that he never did homework for mathematics, he did not even prepare for the final test at the end of high school. He does not talk extensively about the courses during high school. Robin describes himself as a fact-based person.

> *"I have never been interested in nonsense. You have to be able to prove it, the things you say"*

He remembers a situation at English where he could get a sufficient mark for a test that was given on a weekly basis. He analyses what the consequences are when getting an insufficient mark and goes in discussion with his teacher about the small added value of this test.

The profile choice was an easy choice for Robin, he bases his choice on the courses he likes: mathematics, physics and science.

When orienting on follow-up studies, Robin only focuses on technical studies at technical universities. He considers studying mathematics, but does not choose this study because a relative has studied that as well and he could not find a job. Furthermore, he considers doing Civil Engineering. He actually wants to do this study, but at the end he does not have a good feeling about that. Robins brother played a major role in his decision for the study. His brother also studied Mechanical Engineering and at the end of high school his brother advices him to do Mechanical Engineering above Civil Engineering because it is easier to switch from Mechanical Engineering to Civil Engineering than the other way around.

> *"I think that his advice to study Mechanical Engineering has been decisive. Otherwise I do not think I would have chosen it"*

Besides his brother, no other actors have been of influence in this phase. He only remembers having a conversation with his mathematics teacher about his choice for Mechanical Engineering. His teacher wonders whether he is making the right choice.

> *"I think that he saw that I was good at mathematics, or at least, that I was exact and that I did not have that affinity with the very technical stuff. I have never played with technical Lego, never tinkered with cars."*

However, he still chooses for Mechanical Engineering

University period

During his university period Robin is busy doing social activities with friends and he plays the guitar and soccer. In his study he likes the analytical part of Mechanical Engineering such as the calculus and statistics courses. The practical projects attract him less.

> *"We had to develop a machine for putting an electrical bike on a bicycle carrier and next we had to build that as well. Well, I was totally not interested in that project […] I could not care less about the design […]. At the moment I had to calculate how thick the beam had to be in order to touch the wheel, then it started to be interested again. To calculate."*

He remembers always doing his projects with the people that are as analytical as he is. He does not get in touch much with the practical people and sees differences in the approaches of the practical project groups and the analytical project groups.

> *"But I guess it was funny to see. During the study you had project groups.. The one project group that approached things very practical and the other project group very..*
> Analytical?
> *Yes, yes […] our project group for instance disliked project A, because you really had to build something. Our project group for instance liked project T, because you had to put a rocket on the moon"*

As the study progresses Robin doubts switching to Civil Engineering. He eventually does not do that and chooses the study track that has most interfaces with Civil Engineering instead. He talks about his doubts with a professor and friends. He graduates abroad in a professional context. He likes his master thesis because it is very analytical.

Transition first job

After getting his degree, Robin at first wants to do a PhD at his graduation company. He eventually chooses not to do that because he does not want to stay at that company for four more years. After his decision not to do a PhD he gets recruited through LinkedIn by a recruitment agency. He fits the profile for the job the recruitment agency is searching for. He also considers other jobs focussing on investment management and asset management. However, he does not choose for a career in

investment and asset management because he does not agree with their working method. He eventually accepts the job the recruitment agency offers.

Robin makes clear that he does not like the technical sector per se, but that he likes the analytical and the calculation models. He does not care whether he has to apply this in a technical or non-technical sector.

Luke, Electrical Engineering, University

Early childhood

One of Luke´s first memories of his early childhood is that he wanted to be a construction worker because he likes building with blocks, Duplo and Lego. He also describes that he does a lot of word search games before he can actually read. Furthermore he remembers playing games on the Gameboy and playing tennis, soccer and hockey after school. Later in primary school Luke participates in chess tournaments in the neighbourhood and really enjoys that.

At school Luke performs well. He is eager to learn and spends time on his homework. He likes reading a lot of books. He is faster in reading than his classmates and therefore he has to write papers to fill the time. Furthermore he likes Mathematics at primary school, that course is easy for him.

12 years of age until the start of studies

Luke goes to the higher level of education. He chooses his high school not based on its distance, but based on the fact that it is a small and personal school that it is well regarded. His parents have had an influence on the choice for the location by thinking along about the possible options for the high school. At school Luke dislikes the languages and likes the beta courses because it is fact based.

> *"Maybe a bit classic for a technical person, but I liked all the technical courses. I liked mathematics. I liked mathematics and physics and mainly because that is just puzzling. If you understand it then you're just done. Then you don't have to put that much time in it."*

He remembers his physics teacher because he was super smart and was able to calculate sums by head. Luke describes the decision process for his profile as difficult. He discusses his study choice with his parents.

> *"Yes, I do remember that, because that was difficult for me. I really had to think about that for the first time. That I wanted to do the technical profile was clear, that is what I liked. But I actually wanted to keep all options open, so I also chose biology as an extra course.[…] so that actually meant that I could do every study in the Netherlands."*

In fourth grade Luke starts giving extra lessons in physics and mathematics to other students, something he really likes doing. In his leisure time he plays tennis and basketball fanatically. He still reads a lot and plays computer games focusing on strategy building. In his last year of high school his school is participating in a project in which the physics material was given in a faster pace than needed

so that the last three months could be spend on the modern physics. He experienced this project as fun. For his final tests Luke studies hard and graduates Cum Laude

For his orientation on a follow-up study Luke visits several open days and orientation days. He only focuses on technical studies and universities and is searching for a study in which he eventually can apply the theory. He describes wanting to do a core study such as Electrical Engineering and Mechanical Engineering. His final choice for the study was last minute because he did not know which study to choose. His parents coached him during his choice.

University period

Luke eventually chooses Electrical Engineering because the mathematics is abstract, which he likes, and because he can apply the knowledge in practice. Luke points out that it also could have been another technical study. At a certain moment Luke starts doubting about his choice for the study

> *"But I do know that at a certain moment I started doubting. Is this what I want? […] Is this the study for me? I liked it, but I don't love it..*
>
> And what made you doubt?
>
> *I think one of the programming courses that was given so badly that I thought, this is really bad. Luckily, I did not have any programming course after that [...] But I have always considered other studies that could have been interesting*
>
> What did you consider?
>
> *Mechanical Engineering, or Physics. I spoke with the teachers there […] But eventually these studies were pretty similar in my eyes […] So in the end I stayed at Electrical Engineering and I am glad with that."*

In his study he in general likes all professors, he describes he especially liked the courses from the professors he likes most. During his whole study he is been busy with several committees from the study association. He thinks that these committees have been of great influence because he learned a lot from it.

When Luke has to choose a master he considers a master in physics. He quickly decides that he does not want to do that and eventually doubts between two master options from his study. Eventually he chooses the master he likes best. He remembers that some courses were given very badly during this master. He especially likes the courses focusing on control technology. During his master he applies for an internship at an oil company. He gets an offer for this internship, but does not accept it because he wants to go abroad and this internship is not abroad. He eventually gets an internship abroad with the help of his professor. After that he travels around the world and has a small study delay because of that.

Transition first job

After Luke rejected the offer from the oil company to do his internship there, he gets invited for a recruitment day from the company. He is interested in that and has to do several exercises, case studies and presentations. After this day he gets a job offer. Although he still has to graduate first, he accepts the offer and he starts working there after completing his graduation internship.

Paul, Industrial Engineering and Management, University of Applied Sciences

Early childhood

Paul has few memories about his early childhood. He does Gymnastics and plays outside with his friends, but spend most of his time on playing with Lego. He mainly played with the regular Lego, and sometimes with the Technical Lego.

> *"I played with Lego a lot, all day long, I know that I played with Lego in the morning before school started, when I came home from school, in school breaks and yes, at night before and after diner I played with Lego."*

At the end of primary school Paul starts playing computer games with his brother. Paul does not have much difficulties with learning. He describes some courses he has to work a bit harder for, such as Geography and Biology, but overall he performs well. He finds learning the Dutch language harder than Mathematics. He goes to a speech therapist because he cannot make himself well understood.

At his end test Paul has a score that is in line with the intermediate level of education at high school. His parents and teacher agree with this level.

12 years of age until the start of studies

Paul goes to the intermediate level of high school and chooses this school out of practical reasons, this school is nearby. During high school he has a side job at his father's company. He gets is own racing bicycle and starts training fanatically. Het quits with that after a few years and starts doing fitness and running.

During high school Paul most courses are regular for him. However, he has most difficulties with French, he dislikes it as well. He is best in Mathematics, he does not have to work hard for that. Later during high school he gets to make extra, in-depth exercises for Mathematics. Paul is not motivated to do his best at school. In third year he has to redo a class because he is busy doing other things than school. Because of this, his parents have a conversation with the teacher. His parents doubt whether he has to go to the lowest level of education. However, the teacher argues that he is actually smart enough to go to the higher level of education, but that he is not motivated enough. They therefore decide that Paul stay at the intermediate level, Paul is glad with this decision.

Paul does a test for his study profile. This test shows that he scores higher on the technical profile. This choice was logical for him. He liked that profile best and therefore chooses the profile.

"There was this test where we got an advice about the profile and the technical profile scored the highest […]. And my parents agreed with that, yes and that [the profile] sounded the best to me and also the teacher thought this was the best choice. Yes, that was clear"

During high school Paul's vision of the future is clear. He wants to become a pilot, but does not get accepted.

"That was very clear at that time, but at the end it did not work out that way. But I should become a pilot, that was a foregone conclusion, for a long time. So I applied for that three times, but I got rejected."

After the third refusal, he decides to enrol for another study that is in line with becoming a pilot, but because of private reasons he does not enrol. Instead of studying, he works at his father's company fulltime for a year to figure out what he wants.

Paul does not describe how he oriented on his follow-up study. Eventually he enrols for a non-technical study, but he figures out that he does not meet all the requirements to start the study. After that he enrols for a technical study within two days.

University period

Paul chooses Industrial Engineering and Management as follow-up study. He is very satisfied with his choice .

"You have certain studies of which you have the feeling, this suits me, this does not suit me. I knew that I wanted something commercial and thought that [non-technical study] was a good choice. I think that is still an interesting study. However, now I know that I would have missed difficult things [in the non-technical study]. […] and I think that something more technical attracted me."

He describes several courses from his study, but is not specific in his anecdotes. He likes the business and the logistics courses. He remembers that he has an information evening in his first year about possible honours programs and pre-masters within the study. During his study he has to do two internships and a graduation internship. His first internship is at a technical company focusing on logistics. For his second internship, he wants to go abroad. He therefore visits an international week at a University abroad. He eventually does his second internship abroad in the automotive sector. During his minor Paul goes to University to follow a pre-master Business Administration. He remembers that he really benefited from what he learns there for the rest of his study at University of Applied Sciences. For his Bachelor thesis he does an internship at a technical company and writes an implementation plan. After getting his degree, he does a non-technical master at University. He doubts between Business Administration and Industrial Engineering and Management but chooses for the Business Administration master because he likes the offered courses of that master more.

Transition to first job

During his master he starts searching and applying for jobs. He looks for vacancies on the internet. He already figured out which kind of jobs he wants to apply for. He eventually gets recruited by recruitment agencies. He has a conversation with one such company to coordinate what he is looking for in a job. This agency searches for vacancies for him and offers him a job. He takes the job. He likes his current job because he gets his own projects and is responsible himself for that project.

Tom, Electrical Engineering, University of Applied Sciences

Early childhood

Although Tom does not remember much about his early childhood, he remembers that he was always busy with discovering how things in house work. He presses buttons from radios, lamps et cetera to see what happens after that. He also has a lot of Lego and Meccano and plays with that. He describes a memory that he plays with resistances and solders components to each other. Besides these memories, he knows that he played a lot of soccer, most of his free time is being spend on that. At primary school he likes Mathematics and dislikes the Dutch language. That is the only thing he remembers in terms of courses.

At the end of primary school it has to be decided to which level of education Tom goes. He remembers his parents having a conversation with the teacher about this. For some courses Tom has a level that is comparable to the higher level of education. For some courses he has a level that is similar to the lower level of education.

12 years of age until the start of studies

Eventually he goes to the lower level of education, how this is decided is not being told by Tom. At first Tom does not perform well at high school due to personal circumstances. In his first year Tom has to choose a study track. He chooses a specialization in Metal and Electrical Engineering.

> *"That was easy for me, doing some technical stuff. I liked that, it was easy and I was good at it".*

As the years go by, high school is very easy for him. Because he actually has a higher level on the beta courses, he does not make his homework. He has to do several practical projects and likes that, mainly the courses about Electrical Engineering

> *"I like the courses about metal and electrical engineering […]. Then you had to do things with electrics and lamps and stuff. You know, the real electrician things."*

Also of this phase, the memories are scarce, he remembers not having much friends in this phase, that he was smarter than the rest and that school was easy for him. He did not like the school that much, only the electricity parts of the study he likes.

University period

Tom goes to study Electrical Engineering on vocational level. This decision process goes very fast.

> *"Then I said, I want to do Electrical Engineering, because at home I always messed around with plugs, and I wanted to continue with that […] So, with my parents, I just said: I want to do that, I am going to do a study in Electrical Engineering so I looked up a school […] The choice was quickly made."*

At the beginning of his study he gets some Mathematics and Physics that he experienced as difficult. English was easy for him because he played a lot of online computer games and communicated in English during these games. He describes that he performs on average. He is not interested in getting high marks and does not have to put a lot of effort in it.

> *"I did not have to learn much. My marks were higher for the courses where I had to put a lot of effort in than the courses where I did not put much effort in, because I did not pay much attention to these courses."*

During his study at vocational level he has to do several internships. In his first internship he has to screw phones together. His second internship is at a technical company, a fabric. There he re realizes that he does not want to do something like that in the future. His final internship is also at a technical company where he has to make designs. He performs well during his internships.

> *"[…] I only got eights or nines for my internships. So I just did a lot of side things next to my internships. People from vocational education just have to execute things and then you finish that. But I was very fast and wanted to do more things, so I asked for that. I wanted to do extra things."*

Also at school projects he wants to do extra things. He takes technical projects from school with him to his home and goes on with this there.

During these internships Tom realizes that he wants to do a follow-up study at the University of Applied Sciences. He thinks that the students from higher education can do the nicer stuff and he wants to do that as well. He goes to an open day of Electrical Engineering at a University of Applied Sciences and talks with people there about this study. The choice for this study was made in 30 minutes because he still likes Electronics and he wants to continue this.

During his study Tom has to do a resit for a Mathematics test twice. After that, he is putting a lot of effort and extra time in Mathematics. He has the possibility to ask questions about the course to a teacher and after that the grades become better. He likes doing projects and is good at that.

> *"I always took the managerial role. I wanted to have an overview of what I do. So I exactly knew what the status was, what we had to do. That was my job, and beside that I did the technical stuff so I actually did two things. I was good at that, so the marks of my projects where not below and eight."*

He does a minor in nanotechnology. The minor is not what he expected and therefore he does another assignment. He has a study delay for six months. During his graduation internship he focusses on the fine electronics. He designed electronics, programmed it and communicated it, which he really liked. There he realizes what he wants to do in his future career.

> *"And what I liked, I assembled the whole mechanical thing, did the electronics. And after that I could program it and then it functionated. And that, that delivering, I really enjoyed that. I wanted to continue with that."*

Transition to first job

When Tom is orienting on his first job he has three to four job interviews. He gets rejected for one. Furthermore he gets an offer from the company where he did his graduation assignment. He accepts this offer and gets the job. He likes his current job because he has opportunities to grow and experiences a nice atmosphere.

Thomas, Mechanical Engineering, University of Applied Sciences

Thomas' primary and high school period was slightly different than the other respondents because he went to a German school and the school system is different than in the Netherlands.

Early childhood

Thomas played a lot with Lego and blocks during his early childhood. When he gets older he plays with the Technical Lego, he remembers that he build his own things and did not use the manual because that was too boring.

> *"It was all Lego of what I can remember. All Lego, Technical Lego and then I started building some pretty advanced stuff at a certain moment. I started building construction cranes that were a meter high and they functioned just like in reality."*

Because he lives on the countryside, he gets in touch with his neighbour who is a farmer. Thomas learns how to weld from this neighbour. He says he wants to become an inventor later.

12 years of age until the start of studies

During his high school period he performs on average. He also gets some troubles learning. He finds out that he is dyslectic and gets extra classes. He is mainly good at Mathematics and the practical courses where things had to be build. He remembers that he wants to choose a technical course, but he is not allowed to follow that course which he finds a pity. During his high school he chooses the technical profile. The technical track is mainly focused on IT which Thomas is not really interested in.

He still spends a lot of time with his neighbour that teaches him a lot about machines. Also in that time he gets his first moped. From that moment he is only busy with his moped and starts tinkering with it. Another neighbour teaches him a lot about this.

"There I learned how to weld, wire cutting, assembling, you name it."

At the end of high school he buys his first motor and starts doing more advanced tinkering.

"[…] I bought a motor cycle and after the first day the engine block broke […] And I revised that whole block and that was […] I deconstructed the whole motor block and did some intensive operations."

He also starts tinkering with the mopeds from his friends and brothers. As the years go by Thomas is able to do everything himself on his motor cycles in terms of tinkering. Thomas does not really have other hobbies than his mopeds and motor cycles during this period. His parents try to send him to a sport, but that did not work out. During his high school period, some students from the University of Applied Sciences visit his high school

"A group of students of [Name of school] gave a presentation, what was possible in terms of studies there. And I saw Mechanical Engineering on a list. I thought, that is what I am going to do. So that is what I did."

University period

Thomas chooses Mechanical Engineering and did not talk about this choice with people. His parents think he makes a good study choice

He remembers finally getting good marks in this phase. Something he did not get during high school, where he had to study hard and did not get high marks. He likes his study because he finally does something he likes and where he is good at. He remembers that a lot of students did not tinker with mopeds in their free time. He thought that it was not a good choice for them to do a technical study. During his study he mainly likes the practical courses and the theoretical courses less. He talks very enthusiastic about the projects he had to do.

"And at a certain point we had design courses, then we had to determine our own powertrain. So then you went from a chain to a v-belt, calculating things. I really liked that kind of courses. And the courses about Mathematics and Mechanics, well, I did that because we had to."

He also remembers doing a project in which he has to design a machine to move closets. Because he does not like the topic, he asks if he can design something that his dad really needs at that time, a wood splitting machine. He likes that because he knows that his design is really going to be used.

Thomas does two internships during his study, both abroad. In his first internship he mainly has to fulfil tasks to optimize the production process. He likes that he can arrange a lot by himself. His second internship is the opposite from his first internship, he does not have autonomy and feels like he is just an intern. At first he also wants to do his graduation assignment abroad at a company that builds motor cycles, but that did not work out. Eventually he ends up at a technical company and he designs a

machine that eventually is never built. He finds it frustrated that he never sees the results of the things he designed. He realizes that Mechanical Engineering is a lot of drawing of machines and he misses actually building it.

> *"That made me realize that sitting behind a computer the whole time without seeing result, that is not for me. And that destroyed Mechanical Engineering a bit for me.*

This made him decide to do a follow-up study for a year that focusses more on commercial activities after completing a technical study.

Transition to first job

During his follow up study he starts orienting on what he wants to do after his studies and he realizes that he wants to do business.

> *"At that time I realized that I liked doing business. And at that time I was already orienting on jobs, but then I had to start at the bottom of the career ladder, and I did not feel like doing that."*

He starts as a freelancer and gets hired at his graduation company where he eventually can build the machine he designed during his graduation assignment.

Appendix E | Schematic overview of indexical and non-indexical material

Sam, Mechanical Engineering
University

	EARLY CHILDHOOD	12 YEARS OF AGE UNTIL THE START OF	UNIVERSITY PERIOD	TRANSITION TO FIRST JOB
INDEXICAL MATERIAL	Gets in touch with less educated kids Remembers hanging a cat on the school yard Plays basketball, judo and tennis Reads a lot of books about nature, could read books for hours Plays with Lego, gets Lego kits that are harder than average Switches schools twice Gets extra material for mathematics Plays a lot of mathematic games on the computer, is busy improving his personal records Is busy playing with marbles and playing with Pokémon cards, he totally loses himself in this to get better Remembers the teacher that made him do extra material for Mathematics Does the end test, results are lower than expected	Goes to the highest level of education Ends up in a class with only boys. There is a lot of competition Remembers a bet with his classmates in which the person with the best grade for every test can win candy Moves to a school with a different culture and different attitude towards teachers, but with the same competitiveness When making his profile choice he at first wants three profiles in one, this is not possible out of practical reasons Chooses the technical profile. Involves his parents and teacher in the decision process Skips school often because he thinks his grades are good enough Remembers his mathematics teacher because he made the courses very challenging Visits open days for his follow-up study. Visits every study he is interested in. Orientates on as well technical (such as Technical Physics) as non-technical studies (such as Law and Dutch)	Chooses Mechanical Engineering Considers switching to Medicine after his first year, does not do that Starts doubting whether he wants to work in the technical sector Completes a premaster in Business Administration Doubts doing a double master, but eventually chooses a master from his study Does a board year. Realizes that there is more than making sums Graduates in a professional context	Considers doing a PHD, but decides he wants to work in the consultancy Starts studying cases that are needed to be able to work in the consultancy, underestimates how hared these cases are Gets an offer from a consultancy but he rejects this offer After more training he eventually gets an offer from a company he wants to work for He did not consider applying for a job in the technical sector
NON-INDEXICAL MATERIAL	Finds primary school tense at first Likes going to school Dislikes doing odd jobs such as making drawings, cutting and pasting Likes doing math and reading books Has a predilection for numbers Is a popular child that does good with classmates and teachers Is curious, eager to learn and easily bored Likes the school with personal attention more because his needs for extra material could be better met Wants to be the best in everything Blames the low score on the end test on his own competitiveness and that he made himself crazy because he wanted to be the best	Wants to go to another, bigger, school than his parents want because he thinks there everything is going to happen Likes the competitiveness in class Makes the profile choice based on ratio, mainly takes his future career into account Finds it a pity that he cannot do three profiles in one, wanted some extra challenge Chooses the technical profile because he eventually can choose all possible follow-up studies with this profile. He also likes mathematics and the profile is the hardest and the most challenging	Chooses Mechanical Engineering because it is being told that this is one of the most difficult studies and the mathematical part attracts him Does not switch studies because he is more interested in mathematics than in biology Is not the person that comes up with creative concepts Likes applying the theory and tackling complex topics Is very good in the mathematical courses Likes the courses where he is being challenged a lot Is very ambitious, does not know whether the technical sector would offer him the fastest track to the top Does not find the premaster Business Administration interesting enough Knows that the master he eventually chooses is a good master with a good exit position for his future career Chooses a board year because that is good for his resume	Rejects the first offer because it is not one of the biggest companies he could work for Wants to make career, wants to get as fast to the top Likes the variety, likes the ambition

Outside technical sector
Ecam Mechanical Engineering University

	EARLY CHILDHOOD	12 YEARS OF AGE UNTIL THE START OF	UNIVERSITY PERIOD	TRANSITION TO FIRST JOB
INDEXICAL MATERIAL	Moves to Holland, can not speak Dutch at first Brings a paper with Dutch translations to class to make himself understandable Learns the language fast Plays with Lego a lot Builds things with blocks When he has the chance to bring a present to school, he brings a dagger that he got from his grandmother. Has to turn it in Makes woodcarvings with the dagger Plays soccer and some other sports Does grade three twice because he was not mature enough Collects refills of fountain pens and pencil points, everyone that walks past his table has to turn in a refill or pencil point During Handicraft he makes a construction of his own name that had to be soldered between two metal tubes Remembers an Engineering day where he could do experiments Is at home busy doing odd jobs such as repairing tires from the bike, does that with his father Plays a prominent part in the final musical Does an end test, is not the regular test that is being used at primary schools. Scores the highest of everyone Teacher thinks he should go to the lowest level of education, parents decide that he goes to highest	Goes to the highest level of education Gets bullied in his first years of school, reports this to his teacher twice, eventually the bullying stops Makes an intelligence test. Score high on every part, but excels in the beta courses Chooses the technical profile, does not consider other profiles Gets extra classes in mathematics for a year Makes several technical projects during handicraft such as a chair made out of one part of metal. Has several mopeds, tinkers with the help of his dad Plays volleyball four to five times a week, gets selected for the higher team Is captain of the school volleyball team, becomes national champion During exam weeks he makes the first test good, but as soon as the end is near, he performs bad Gets into a discussion with his mentor about his performance Has a side job as courier At the end tests he gets two insufficient marks for Dutch and physics, but still graduates Orientates on technical studies only. Considers three studies. Visits an open day His father also studied Mechanical Engineering	Keeps on playing volleyball at the club of his hometown Is active member of the student volleyball club Does a national board of student sports. Realizes that he likes coordinating and organizing a lot Remembers making a bicycle stand Chooses Designing and Engineering as Master Tries to find an internship abroad, did not work out Gets an internship at a Dutch technical company on and Research & Development department Does his Master thesis at a technical company focussing on process optimization	His graduate company offers him a job, does not accept this job Gets recruited by a recruitment company through LinkedIn, has several interviews with potential companies Accepts the offer of the company he currently works at
NON-INDEXICAL MATERIAL	Has not experienced troubles with not speaking Dutch Does not like people that cheat Likes making things and doing odd jobs, is very proud of the things he makes Does not get very high grades, performs on average Has not a good feeling about how everything is arranged at school, thinks it is weird that little is recorded	Choice for the high school was self-evident Is not an over ambitious student, hard to stay motivated Does not have a specific preference in terms of courses Is more practical minded than theoretical Choses his study profile based on the fact that he has less affinity with the other profiles. Thinks it is a logical choice Likes the variety of the technical and the practical (of handicraft). Likes being with different people Is practical, does a lot of trial and error Is fact based	Finds his first year hard, especially the calculus courses In projects he is the one that is coordinating Likes coming up with ideas, creating solutions and out-of-the-box thinking Bases his choice for a master on what he likes and where he is good at Choice for the master was easy and logic for him Wants to follow practical courses Likes his master thesis better than his bachelor thesis because he could develop, test and implement a new method	Does not accept the job at his graduation company because he sees other classmates doing certain jobs and realizes that that is not what he wants and the location was not practical Likes the work that is being outlined, is in line with his graduation assignment. Likes the flexibility and variety of the job. Likes the growth path of the company

Outside technical sector
Otis, Technical Physics, University

	EARLY CHILDHOOD	12 YEARS OF AGE UNTIL THE START OF STUDIES	UNIVERSITY PERIOD	TRANSITION TO FIRST JOB
INDEXICAL MATERIAL	Remembers a teacher that stimulates him to read Has keyboard and tennis classes. Only does what he has to do to keep up with his current level Sits behind the computer a lot playing games When not playing games he is outside with friends, wandering around Plays draughts a lot, is being selected for a regional school competition, won more games than his classmates Has the highest score of his class on the end test	Goes to the vwo level of high school Has a small group of friends Participates in the Mathematics Olympiad Plays keyboard again, but spends most of his time playing computer games with his friends Spends a lot of time figuring out how the security system works on a computer, is being known for that at school Does a career test in which a technical job comes out as the best match Chooses the technical profile, did not consider anything else. Does not involve any actors in his decision. Visits open days with a friend and his mother. Only visits technical studies at technical universities.	Chooses Technical Physics and did not involve anybody in the decision process Does a lot of extracurricular activities, becomes member of several committees of his study Becomes member of a board that has nothing to do with his study association Applies for the committee of an organization that looks after students' interests, he does not get the position Does his final assignment in the educational context focusing on a topic that is related to the master he wants to follow Friends invites him to follow a presentation related to consultancy. Realizes that he wants to work in consultancy Follows so called 'In house days' through the whole country. Notices that he has a unique profile for consultancy Orientates on a non-technical master. Follows a non-technical pre-master Chooses a master that is in line with his study and where he is most interested in Tries to find a final assignment in the professional context, but does not find a suitable assignment Graduates in educational context	Doubts between doing a PHD and applying for a job in the consultancy Applies for positions at the top three consultancy companies, is not hired for these positions Gets in contact with a friend who is recruiter. That person offers him a job at another consultancy company
NON-INDEXICAL MATERIAL	This period did not impress him much Liked both the keyboard and tennis classes, but was not super enthusiastic Has a lot of affinity with computers Does good at school, does not pay much attention to his school performance Has a relaxed feeling about his end test	Is an introvert and shy boy Likes Greek and history because of the story Mainly liked the technical courses Likes being at the forefront in the technical courses Profile choice was a logical choice for him and therefore not difficult. Chooses the profile because he likes physics, mathematics and science	Chooses his study because he likes Physics the most during high school and he likes that fact that he is broadly oriented Likes organizing and networking Feels like the extracurricular activities make him realize that there is more than only technical things Applies for the committee because he thinks that is the highest possible position he could apply for. Is not amused that he does not get hired Becomes more and more enthusiastic about consultancy Follows the non-technical pre-master because he is interested in business and companies. Eventually thinks that the level of this pre-master is too low Does an internship abroad because he really wants to go	Likes a PHD because he can use the knowledge he gathered during his studies Is very disappointed about the fact that he does not get hired at the top three consultancy companies Goes into consultancy because he likes short-term projects, diversity and the personal development in these positions. He also likes the fact that he can use his analytical skills in this position

Outside technical sector
Frank, IE&M University

	EARLY CHILDHOOD	12 YEARS OF AGE UNTIL THE START OF STUDIES	UNIVERSITY PERIOD	TRANSITION TO FIRST JOB
INDEXICAL MATERIAL	Watches a television program with his grandmother in which words have to be guessed. Is able to guess these words at a young age Mainly plays soccer. Plays games on the PlayStation and Gameboy. Plays with Duplo, Lego and Knex and has a lot of Pokémon cards Always opens the presents of his brother during his birthday because he wants to know what is in it Switches school Does an intelligence test, it appears that he is almost highly intelligent Skips a class Is very fast in mathematics, runs out of mathematics exercises Plays mathematics games on the computer Goes to a class for extra higher level mathematics Remembers a topography game that everyone wants to play. One classmate was better than him Does a test in 7th grade where he scores the maximum score Does the end test in 8th grade, wants to be done with it as soon as possible. Scores a bit lower than expected. Gets the advice from school to go to intermediate level of education, parents think he should go to the highest Does not get stimulated by parents in this period, school was not the subject of their conversations	Goes to 'vwo', his father was on the same school Plays a lot of sport games in high school Becomes one of the best of his class in doing sports At biology everyone has to weigh and measure themselves, Frank is relatively high and heavy Goes on school trip to Paris with French Is fascinated by his mathematics teacher, he gets extra mathematics Has a teacher that obliges him to listen to his explanations, although he already understands it Visits the dean regularly because is late often During is profile choice he doubts between the biology track and the technical track. Eventually chooses the technical track Does not get good grades during high school. In fifth grade his marks are so bad that his teachers think he is not going to make it to the next year. Eventually gets a lot of good marks in the last semester, is going to the next grade Does not get stimulated by his parents to do his best at school Visits one open day and only visits the technical studies	Has an orientation day at Industrial Design, decides that this is the study he wants to do. Starts this study Becomes member of a student association Still has motivational problems, gets sent to a psychologist by his study counsellor because of this Realizes that this is not the study for him, quits study after six months Does a lot of committee activities for the study association Has an orientation day from Industrial Engineering and Management with someone he know from his association Decides that this is the study he wants to do. The logistics courses are the first courses that could motivate him to do something Gets high marks on the difficult courses Does his bachelor thesis in a professional context Plays soccer Doubts whether he wants to do a Master in mathematics, eventually chooses for the Logistics track of his study Does his Master thesis in a professional context	Starts orienting on his first jobs. Visits company days twice Updates his LinkedIn profile and resume Gets approached a lot by technical recruiters Gets an offer for a traineeship at a technical company A recruiter approaches him for a job at a non-technical company. Doubts after the first conversation, but when the company shows that they want to have him and the offer is good, he takes the job
NON-INDEXICAL MATERIAL	Does not remember a lot from this period Is very curious Does not like writing Is not interested in school Does not find primary school challenging enough Likes mathematics and playing mathematics games Thinks that he is the stupidest in class when skipping class, is a trigger for him Likes the extra challenge from the higher level mathematics class Doing (book)presentations gives him the creeps Wants to be the best	Chooses high school location out of practical reasons Hates history Dislikes the Dutch course, is not interested Likes mathematics a lot Likes gymnastics Likes being challenged and going his own way Chooses the technical track because he starts to find Biology less interesting over the years. He also dislikes the other profile options because those profiles contain history and he is very uninterested in that He does not excel in any course, only in mathematics for some years Is not interested in making homework Has no motivation at all to do good at school at all. Knows he is good enough to pass school	Chooses Industrial Design because it is something technical and innovative Is not good in drawing and thinking out of the box Chooses Industrial Engineering and Management because he knew a lot of people, it is a good for his future career in business and it was easy to combine with the activities he did for the student association Is most interested in the difficult courses Does not choose the Financial track of the master because he does not want to end up at a bank, likes the Logistics track more Does not choose the Master Mathematics because he already has a study delay and he does not want to have more delay Likes being with people that seem to be smarter than he is	Likes the offer from the technical company, but does not accept the job because it is too far away Likes the job from the non-technical company because it is out of his comfort zone, thinks that that is an interesting move for his own development

Outside technical sector
Noah (ENN University of Applied Sciences

	EARLY CHILDHOOD	12 YEARS OF AGE UNTIL THE START OF STUDIES	UNIVERSITY PERIOD	TRANSITION TO FIRST JOB
INDEXICAL MATERIAL	Plays a lot of soccer Plays outside a lot. Remembers playing with cars in the woods with a lot of sand and climbing into trees. Mother stimulates being outside Falls out of a tree because his teacher told him that when you climb high into a tree, you can see the horizon Plays with Knex with a friend Goes on holidays with the family, his little brother is the one that dares to go to the bakery. Noah is the one that walks along Eats pancakes at a friends' grandmother every Wednesday afternoon Has a national soccer tournament from school, becomes second overall with his team Remembers his gymnastics teacher Does the end test, can go to the intermediate level, but parents decide that he has to go to a level below. Parents also decide to which high school location he goes	Has a conversation with his mentor His mother is overprotective. Remembers that his mother always walked the dog when Noah had to school to check whether he really was going to school Remembers having other hobbies than at primary school. Plays music with friends, tries to play the drums. Is a lot with a friend that is making music himself a lot Plays a lot of computer games with a friend all summer long Skips school sometimes Chooses an economical study profile with biology. Does not involve anyone in this choice Visits open days to orient on his follow-up study Remembers a teacher that advices him to get a job as soon as possible, because school is not for him. Triggers him to prove this teacher wrong	First goes to vocational education. Does a non-technical study Still plays soccer, hangs out with his friends Has a side job as delivery man Does an internship at a commercial company to gain work experience. Realizes that he gets more energy from people that work at the Production department Does his second internship at the same company Graduates, but realizes that he does not want to have a job that is in line with this study Gets a job at this company during his studies, but under the condition that he can do a follow-up study at a University of Applied Sciences Realizes that he wants to do something with improving processes Orients on a follow-up study by asking around by colleagues and parents. This advice was not decisive Visits open days with a friend, visits as well technical as non-technical studies. Starts with a part-time study Industrial Management and Engineering. Realizes that this is what he wants Graduates in three instead of four years	Still works at the company from his internship Applies for a job in the technical sector, gets hired, but refuses the offer because he gets a better offer from the company he is working at that moment
NON-INDEXICAL MATERIAL	Does not remember much of this period Did not like primary school Likes being in an environment where everything is familiar, does not like change Is a quiet boy, has a wait-and-see attitude Doing presentations was a nightmare for him, dislikes being in the foreground Was not very interested in school Likes mathematics Dislikes reading and writing. Has troubles writing neatly Gets energy from gymnastics Parents make the choice for the study level because they are afraid that otherwise Noah ends up with his friends in one class which is not good for his school performance. Noah is fine by the	Does not have one specific interest School is easy for him, does not have to put a lot of effort in it Chooses his study profile based on the fact that he has to make a choice. The other options did not attract him, choses the simple way. Friends of him chose this profile as well Likes mathematics and economics and biology Thinks that the important decision moments came to early for him. Has no idea what he wants in the future	Thinks that this study is interesting and that it could be something for him because he likes the courses that are being offered. Does not like the study Likes the mathematical part of the study Does not have to put a lot of effort in the study Gets a lot of energy from improving processes Chooses his follow-up study based on the fact that in this study improving business processes is offered Is a bit insecure about the study because he has to learn a lot of new things that he have never heard of before He likes the follow-up study, he is extremely motivated, his performance is very good.	Wants to do more than he is doing at his first job. Wants to do more towards the production process

Inside technical sector
Robin, Mechanical Engineering, University

	EARLY CHILDHOOD	12 YEARS OF AGE UNTIL THE START OF STUDIES	UNIVERSITY PERIOD	TRANSITION TO FIRST JOB
INDEXICAL MATERIAL	Plays a lot of soccer Did not play with Lego or technical Lego Has mathematics on a higher level than the rest of the class	Plays drums, is captain of his soccer team Does not have to make homework for mathematics because it is so easy for him Remembers that he could get a bonus point for English when he gets a sufficient mark for a test that was given on a weekly basis, analyses what the consequences are and goes in a discussion about the small added value of it Chooses the technical profile Goes to open days, only visits technical studies and technical universities Also considers studying Mathematics, but does not choose that because a relative had studied that as well and could not find a job Has a conversation with his Mathematics teacher that asks him if Mechanical Engineering is the best choice	Chooses Mechanical Engineering Brother also studied Mechanical Engineering, has had a major impact on his choice for the study Plays the guitar and soccer Drinks a lot of beer with his friends Does his projects with people that are analytical as well, does not make contact with the more practical people Doubts switching to Civil Engineering, eventually does not do that and chooses courses in his study that have interfaces with Civil Engineering Gets interested in topics focused on Econometrics Graduates in the professional context	Considers doing a PHD at his graduation company Applies for jobs in the non-technical sector (investment management and asset management) Gets recruited through LinkedIn, he fits the profile for the job the recruitment company is searching for
NON-INDEXICAL MATERIAL	Is good a mathematics, the analytical courses	Chooses high school because it is the only option Excels in the analytical courses Experienced the choice for the study profile as easy, was clear for him. He liked the beta course most Is interested in the analytical models behind economics Is fact based Dislikes learning words for the language courses	Has not a good feeling about Civil Engineering Is analytical Likes the projects in which something has to be designed and develops, likes it when something has to be calculated Likes his Master thesis because it is very analytical	Does not choose a PHD because he thinks he is too long connected to one organization Does not choose for a career in the non-technical sector because he does not agree with their working method Does not like the technical sector per se, likes the analytical and the calculation model Likes the technical sector above the consultancy because he does not like the performance atmosphere in consultancy companies

Inside technical sector
Matthew IE&M University

	EARLY CHILDHOOD	12 YEARS OF AGE UNTIL THE START OF STUDIES	UNIVERSITY PERIOD	TRANSITION TO FIRST JOB
INDEXICAL MATERIAL	Grows up in a little town on a farm Goes to a little primary school Plays a lot outside: builds huts, drives a tractor a lot and plays with Lego Plays soccer fanatically, playing soccer on the schoolyard was not allowed Gets a computer at home. Plays a lot of games on it, is discovering a lot on the computer. Also installs computer programs by himself Remembers a boy at primary school that gets bullied Reads a lot of books, has an excellent reading level. Becomes a coach for schoolmates that are not good at reading Makes scrapbooks of his favourite soccer club. Starts writing letters to the club Plays a lot of FIFA '98 Helps his father with odd jobs on the farm such as mowing and cultivating Has the maximum score on the end test at school	Goes to the highest level of education in high school Has to make a book report. Choses the thinnest book and gets a book report from the internet. Gets caught Plays soccer fanatically, trains for the selection teams Has his own moped. Repairs only the easy things such as replacing the brake disc Builds a website for him and his friends and for a local band Has a side job at a butcher's shop Skips several classes and tests Chooses the technical study profile Submits a request to the head of the school department that he wants to do some extra classes Does bets with a friend who can get the highest mark on tests Organizes parties for school. Gets money for every sold ticket Makes plans with his friends how to earn as much money as possible Does a study choice test. The results show the studies Industrial Management and Engineering or Mechanical Engineering Visits open days with school and parents. Visits Science, IM&E and Economics	Becomes member of a student association Keeps on playing soccer in his hometown Is busy maintaining social contacts Spends a lot of time doing committees Goes on study travel and goes backpacking after that Has a study delay because of all the committee work Becomes chairman of the student association Has a side job working on a farm, gets more money for that than an average side job. Stimulates study mates to also do this job Does his Bachelor thesis abroad in a professional context Chooses a financial track of the master Wants to do an internship at a consultancy company, does not get hired Does his Master thesis in the professional context at a technical company. Also oriented on banks. Graduates Cum Laude Remembers one professor because of his charisma and his great stories Is influenced by the friends from his study association in the things he did (e.g. making a study trip).	Gets approached for a job by the company where he completed his Bachelor thesis The company from his Master thesis is offering him two jobs Chooses the job at the company from his Bachelor thesis
NON-INDEXICAL MATERIAL	Finds primary school very easy. Is good at everything, but dislikes learning the language Likes driving around on a tractor Was not good at and interested in repairing machines	Finds Physics and Science less interesting in high school, was too easy for him. He also did not like Mathematics that much because it was too easy. Finds languages very boring Chooses his study profile based on the fact that he wants his profile to be as hard as possible and he wants to be broadly oriented Realizes that Science is too technical for him. Economic is too theoretical. Chooses IM&E because of the economical impact	Likes the financial and logistic courses during his study period. Mathematics is harder form him Does not perform very well at the beginning of his study, is not very motivated. But when he is putting effort in studying it is very easy for him Realizes he made the good choice regarding his study when he gets in touch with older people from his study and sees where they are now Chooses his side job because of the money he can make Does committee work because everyone says this looks good on your resume	Chooses for this job because he thinks it is easier to excel. He wants to make a career

Inside technical sector
Simon, Technical Physics, University

	EARLY CHILDHOOD	12 YEARS OF AGE UNTIL THE START OF STUDIES	UNIVERSITY PERIOD	TRANSITION TO FIRST JOB
INDEXICAL MATERIAL	Takes part in a picture book competition in which he has to tell a story about what is happening on the pictures Watches a lot of Sesame street Reads a lot, parents stimulated him in that Plays with Duplo and later Lego Has swimming classes Plays with marbles Starts playing tennis and street dancing Plays computer games and soccer a lot with his best friend Takes keyboard classes Father gives him technical objects (such as a typewriter) from his work that are broken. Lets him to use his toolbox so that he can tinker with it. Father really stimulates him to do that Is one of the youngest in class Scores the highest possible score at the end test Talks with his teacher about bilingual education. Talks with his parents about the high school, did not have an influence on his final decision	Chooses bilingual education (English-Dutch) When his computer does not work as it should, he starts repairing it himself by just trying things out Gets a new computer at home, spends a lot of time finding out how the computer works by pressing every possible button and finding out what the consequence is of that action Has keyboard classes and plays tennis Father sometimes helps him tinkering, but he also figures out a lot by himself Studies hard, gets good marks Remembers his Mathematics teacher who had the rule that when he gets caught working out a sum incorrectly by a student, this student gets a chocolate bar Starts 3D modelling at the computer. Reads a lot about 3D modelling on different fora on the internet Chooses the technical study profile and includes Biology Has a conversation with his dean about the choice, was more a formality Does 'Junior College', a program in which students can follow extra beta courses at the university Starts doing photography, his father did the same in his younger years Visits open days. Only focusses on technical studies and technical universities	Chooses Technical Physics Father also did al technical study. Parents stimulate him to do what he likes and support him in that Friends have influence on the choice for the city of the university Puts a lot of time in studying, especially in the first year Becomes part of a committee from his study association in the second year. Helps organizing study trips Becomes chairman of the committee. Gets in contact with company to arrange company visits Has a side job going to primary schools and high school promoting the beta courses by showing experiments Does his Bachelor thesis in educational context Does a minor in Sustainable Development Chooses a master that is part of his study Gets a starters kit to make microcontrollers as a present from his housemates. Starts tinkering with that and makes for instance a laser trigger Does an internship abroad at a University with a subject that is in line with his master Does his master thesis in the same direction as his Bachelor thesis	Gets the opportunity to start working on a project that he worked on during one of the courses from his master Starts orienting on a job in the technical and physics field, considers a PHD Sees a vacancy at an institute, calls the manager of that institute and applies for the job. Gets the job
NON-INDEXICAL MATERIAL	Likes reading and gymnastics Likes swimming Likes mathematics, language becomes less interesting Is fact based Likes tinkering a lot, likes discovering new things and figuring out how everything works Performs well at school, does not experience difficulties	Chooses the high school based on the fact that he wants bilingual education. Thinks bilingual education is very nice, is excited Is impressed by his new high school and its size, has to get used at first Feels satisfied when he solves something before knowing something about the problem beforehand Feels like trying and drawing conclusions during tinkering helped him a lot Realizes that the technical courses suit him most Likes his Mathematics teacher because he is very good in explaining. Actually likes every teacher at high school Profile choice is easy for, likes Physics a lot because it is very technical and analytical Likes doing extra things and to go more deeply into school material. Feels like he is on a more similar level with his students from 'Junior College' than with his 'normal' classmates Likes learning new things	Chooses Technical Physics because he really likes Physics and because he thinks he can find a nice job with this study Likes doing practical stuff and not only theoretical. Likes being able to apply that what is learnt in a practical setting Feels like working hard at high school and keeping up with the material helped him through university. Feels like studying becomes easier as the years go by. Likes that, but also feels insecure about that Likes his side job because he can share his enthusiasm about Physics with others Likes the part of the master that holds the description and explanation of the behaviour of light, also likes the teachers of this master most Chooses an internship abroad because he wants to go far away	Does not chose a PHD because he does not want to work on one topic for four years Business does not attract him, because of the atmosphere Wants to do something with his Physics knowledge

Inside technical sector
Luke, Electrical Engineering, University

	EARLY CHILDHOOD	12 YEARS OF AGE UNTIL THE START OF STUDIES	UNIVERSITY PERIOD	TRANSITION TO FIRST JOB
INDEXICAL MATERIAL	Plays with Duplo and Lego Does word search before he actually can read Wants to be a construction worker because he likes building with blocks Plays games on the Gameboy Plays tennis Moves to another place Reads a lot of books, is faster in reading than his classmates and has to write papers to fill the time Spends a lot of time doing homework Plays street hockey or soccer in the park after school Plays chess tournaments in the neighbourhood	His parents have influence on the high school Remembers his Physics teacher because he was super smart and was able to calculate sums by head His high school is participating in a project in which the Physics material is given in a faster pace than needed so that the last three months could be spend on the modern Physics Chooses a double profile so that he is broadly oriented. Talks about his study choice with his family Gives extra lessons in Physics and Mathematics Drops German because it is extra work and he does not necessarily need it Plays basketball and tennis Reads a lot and plays computer games focusing strategy building Graduates cum laude Visits several open days and orientation days. Focuses on the technical studies and universities. Is searching for a study in which he eventually can apply the theory	Did his study choice a bit last minute. Knew that he wanted a technical study, but not what Chooses Electrical Engineering Does several committees at the study association Doubts whether this study is something for him. Starts seeking advice from teachers. Comes to the conclusion that another study wont be much better Asks for advice from the teachers Physics, Mechanical Engineering and Electrical Engineering Considers a master Physics, does not do that Considers two master options from his study. Eventually chooses the master he likes best Applies for an internship at Shell, gets an offer for this internship but does not accept it because it is not abroad Does an internship abroad in a professional and technical context. Gets this internship via a professor Travels around the world, has a small study delay	Gets invited for a recruitment day from Shell, he already applied there for an internship. Has to do several exercises, case studies and presentations Gets an offer, but first has to graduate Gets the job after his graduation
NON-INDEXICAL MATERIAL	Likes reading and mathematics Performs well at school Is eager to learn Likes playing chess	Chooses a smaller school that has the highest level of education and is well regarded Dislikes languages, likes the beta courses because it is fact based Experiences his profile choice as difficult, knows that he wants to do something with the technical profile, but also wants to be broadly oriented Likes giving extra lessons	Experienced his study choice as difficult because he did not know what he wanted Thinks that the committees have had a big influence Eventually chooses Electrical Engineering because it is a bit abstract (especially the Mathematics) and because he could apply the knowledge Reason for his doubts about the study is the fact that a course was given very badly Is glad that is did not switch studies Likes the control technology courses	

Inside technical sector
Paul (FHN University of Applied Sciences

	EARLY CHILDHOOD	12 YEARS OF AGE UNTIL THE START OF STUDIES	UNIVERSITY PERIOD	TRANSITION TO FIRST JOB
INDEXICAL MATERIAL	Plays a lot with Lego, spends all his free time on playing with it. Also plays outside with friends Plays gymnastics Goes to a speech therapist because he can not make himself well understood Remembers a teacher that could tell stories very nicely Starts playing computer games Scores a score on the end test that is in line with the intermediate level of education on high school. Parents and teacher agree with this level	Goes to the intermediate level, has a side job at his father's company Gets a racing bicycle and starts training fanatically, quits with that and starts doing fitness, after that he starts running Buys his own computer and plays computer games with friends Has to redo the third year of school because he is busy doing other things than school Parents have conversation with parents after he has to redo a year, parents doubt whether he has to go to the lowest level of education. Teacher argues that he is smart enough to go to the highest level of education, but that he is not motivated Gets to make extra exercises for Mathematics and Physics Does a test for his study profile. This test shows that he scores highest on the technical profile Applies for the study of becoming a pilot three times, does not get admitted to the study After the third refusal he decides to enrol for the Royal Netherlands Air Force, but because of private reasons he does not enrol Keeps on working at his father's company for a year to figure out what he wants Enrols for a non-technical study, figures out that does not meet all the requirements of the study Enrols for another study within two days	Chooses Industrial Engineering and Management Describes a lot of courses, not very specific anecdotes Has an information evening at school about possible honours programmes and pre masters within the study Does an internship in the second year at a technical company focusing on logistics Does not have an extensive coaching trajectory with his study coach, sends an e-mail in which he informs his study advisor that everything goes well and he does not need a conversation Goes to an international week at a University abroad Does his second internship abroad at a car factory Does a pre-master Business Administration at the University as a minor Benefits from what he learns on University for the rest of his study at University of Applied Sciences Does his graduation assignment at a technical company Chooses a non-technical master	Applies for jobs during his master, looks for vacancies on the internet Gets recruited by recruitment companies, has a conversation with one such company to coordinate what he is looking for in a job. Gets an offer, takes the job
NON-INDEXICAL MATERIAL	Does not remember much from this phase Performs well, has not much difficulties with learning Finds learning the Dutch language harder than Mathematics	Chooses high school out of practical reasons Has difficulties with French, dislikes it as well Is best in Mathematics, does not have to work hard for that Is glad that he stayed on intermediate level Choice for profile was logical, he liked that profile best Eventually chooses the study because he likes something commercial and he thinks it is challenging	Is very satisfied with his choice for the study, is glad he did not go for the study of his first choice Likes the business and logistics courses Chooses Business Administration instead of Industrial Engineering and Management because he likes the offered courses more	Know what type of job he wants Likes his job at this company because he gets his own projects and is responsible himself for that project

Inside technical sector
Tom, Electrical Engineering
University of Applied Sciences

	EARLY CHILDHOOD	12 YEARS OF AGE UNTIL THE START OF STUDIES	UNIVERSITY PERIOD	TRANSITION TO FIRST JOB
INDEXICAL MATERIAL	Plays with resistances and solders components to each other Father works at a technical company Is busy with discovering how things in house work, presses buttons from radios, lamps etcetera Plays a lot with Lego and Meccano Spends most of his time playing soccer His parents have conversation with the teacher about the level of high school. For some courses he scores higher level of education, for some courses he scores lower level of education. Eventually goes to lower level of education	Goes to the lower level of education Chooses a specialization in metal and electrical engineering Has to do a lot of practical projects Does not make his homework for the beta courses because it is too easy for him Remembers the teacher from electrical engineering because he could get along with him well and he teaches well	Chooses a study Electronics on vocational level. Decision process goes very fast Does a lot of online gaming, learns himself how to speak English Does an internship in which he has to screw phones together Does a second internship at a technical company, a fabric, realizes he does not want to do something like this in the future Takes his technical project from school with him to his home, goes on with this at home. Puts more time in this than average Realizes that he wants to do a follow-up study Does his final internship at a technical company, makes designs Considers becoming a pilot Goes to an open day of Electrical Engineering at a University of Applied Sciences, talks with people about this study. The choice for this study was made in 30 minutes Has to do a resit for a mathematics test twice, after that he is putting a lot of extra time on mathematics, has the possibility to ask questions about Mathematics to a teacher. After that his Mathematics grades become much better Gets high grades on the courses he puts a lot of effort in Has to do a resit for Physics twice. Has a conversation with his teacher that he does not want to do something with Physics in the futuer. His teacher helps him getting a sufficient mark Has a study delay of six months Does a minor in nanotechnology, is not what he expected, has to do another assignment for a technical company Does his graduation assignment focusing on the fine electrical engineering, graduates with a 9	Has three to fouw job interviews, gets rejected for one Gets an offer from the company he does his graduation assignment, accepts this and gets the job Has made most choices in his life by himself without any influence of other actors
NON-INDEXICAL MATERIAL	Does not remember much Likes Mathematics, dislikes Language	Doest not perform well at school at first because of personal circumstances. After that, everything is very easy for him Likes being practical Only likes the courses about elektrical engineering	Choice for this study was made very quickly Performs on average level, is not interested in getting high marks, but does not have to put a lot of effort in it Wants to do a follow-up study because he feels like every student from Universities of Applied Sciences can do the nice stuff Likes taking a leading role and keeping eye on the overall process	Likes his current job because he likes it, opportunities to grow, nice atmosphere

Inside Technical Sector
Rik, Technical Physics
University of Applied Sciences

	EARLY CHILDHOOD	12 YEARS OF AGE UNTIL THE START OF STUDIES	UNIVERSITY PERIOD	TRANSITION TO FIRST JOB
INDEXICAL MATERIAL	Plays a lot with Duplo and blocks builds big and difficult constructions with two friends When he has to learn how tie his shoelaces he learns some extra ties Plays with Lego and Knex His father buys a new laptop, Rik plays games on it Needs to have one hobby and one sport from his parents Tries out six different sports such as chess, ice skating and athletics. Is member of the Scouts Plays chess competitions and is member of a chess club Gets bullied, is redoing a class because he does not want to sit in the same class as his bullies Does several tests in which he has a high intelligence score, but on his end test he scores lower than expected. Based on the score he should go to the lower level of education, teacher decides he goes to the intermediate level of education Orients on different high school locations	Goes to the intermediate level of education with some friends from the Scouts and his primary school. Bikes with them to school Remembers his Mathematics teacher Has to do extra lessons for French to keep up with and to understand the material. Still scores insufficient Does not make homework for the courses Plays hockey but quits in second grade. Sails and goes to the Scouts till the end of high school Chooses the technical profile although he scores better on the alfa courses and he does not have very good marks for the beta courses. Chooses extra courses than needed Teacher tries to convince him to choose another profile Some of the courses he follows are scheduled at the same time, he has to decide himself which course he wants to follow Reads a book about a man in an egg floating through space that is very bored. That is when Rik realizes he wants to do something in the technique, because he things the he can experience something new all the time Gets extra support in making his homework because of his bad marks. Does not make homework for Economic, Dutch and English because it is easy for him Considers going to the higher level of education after graduating on the intermediate level. A conversation with his teacher makes him thinks differently. This teacher thinks he will get bored very easily because the study material will be partly the same as on intermediate level, only on a different level	Chooses Physics at the University of Applied Sciences. Is busy with several committees Does not get enough study points to go to the next study year Does various tests to decide on his study. These test show that Technical Physics suits him best. Other options were as well technical as non-technical studies Orients on different studies Enrols for Technical Physics Is busy again with several committees, but puts more effort in his study this time. Studies for at least two hours each day and puts the most effort in Mathematics Gets into a discussion with his Mathematics teacher because he does not like the way he has to enrol for exams. Also the chaotic teaching style of the teacher does not suit him Takes a break from his study for one year to do a board year Tries to set up a study association. Organizes study days for people that want to study for exams in groups. Tries to build a exam database in which study material can be shared Tries to set up a committee for tinkering focused on Physics Does another board year Focuses on his study again, does the least social things as possible Does an internship at a technical organization, considers this internship as one of the most important in his decision process. Gets a lot of freedom to decide things for himself. Gets a high mark for this internship Does a technical minor Does another board year Does another internship at a technical company Graduates at a technical company	Presents himself as a good employee for the graduation company, gets a job there
NON-INDEXICAL MATERIAL	Is quickly bored when doing new things Dislikes primary school Does not have courses he excels in Dislikes languages Is analytical and fact based	Chooses his high school based on what feels good Performs on average, finds Mathematics easy Chooses the technical profile because he does not put very effort in the other courses and still get high marks, he wants to have a difficult profile Wants to do extra courses because otherwise he gets bored Is afraid that he gets bored easily, wants to do something new constantly	Chooses the study because he likes Physics, did not consider anything else Chooses the location of the university very quickly because he likes the brochure Is a quick decision maker Does not perform well at the beginning because he likes doing other things than studying more Likes courses focusing on Optics, dislikes the Electrical Engineering courses Feels like he wants to do more with organizing than something very technical Wants to do something that is difficult Chooses Technical Physics because its the most difficult option to choose Is better in studying in a groups than individual Really likes his internships Realizes that he likes working without a tight schedule, becomes more creative	

Inside technical sector
Thomas, Mechanical Engineering
University of Applied Sciences

	EARLY CHILDHOOD	12 YEARS OF AGE UNTIL THE START OF STUDIES	UNIVERSITY PERIOD	TRANSITION TO FIRST JOB
INDEXICAL MATERIAL	Plays with Lego and blocks Builds his own constructs such as gears and electric motors Builds huts, is the only one that built a hut with a roof Goes to a local farmer a lot to ride a tractor. Also learns how to weld. Gets education in Germany where the school system is different Teachers doubt whether he should go to the lower or the intermediate level of education	Goes to the intermediate level of education The farmer teaches him a lot about machines Gets extra classes, helps him a lot Wants to follow a technical courses, but is not allowed to follow it because he has to follow another course that was given at the same time Builds very advanced things with technical Lego such as cranes that could functionate Gets his first moped, starts tinkering with it when it is broken. Gets in touch with a neighbour who is maintenance engineer and has tinkering with mopeds as a hobby. That neighbour offers him to help with the moped. Spends a lot of time with this neighbour Buys his own motor cycle. The engine block breaks, repairs it	Chooses Mechanical Engineering Starts repairing motor cycles for his friends as well Has to make a project in which a machine has to be designed that can move closets Does two internships abroad	Starts as a freelancer
NON-INDEXICAL MATERIAL	Is good at Mathematics and the practical course where one has to design and build things Performs well overall	Finds it difficult Is dyslexic, has troubles with the language courses	Likes the study because he finally does something he is good at Likes the practical courses more than the theoretical Finds it a pity that during projects a lot of designs do not get developed and he does not see any result	Realizes that he wants to have his own business