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Understanding processes of identity development and career transitions

van der Gaag, Mandy Antoinette Ena

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Understanding Processes of Identity Development and Career Transitions

A person-centered, micro-level approach

Mandy Antoinette Ena van der Gaag

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A person-centered, micro-level approach

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University of Groningen
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Rector Magnificus Prof. E. Sterken
and in accordance with
the decision by the College of Deans.

This thesis will be defended in public on

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Introduction to the Dissertation

1

Mandy A. E. van der Gaag

IDENTITY AND LIFE'S BIG DECISIONS

When I was approaching high school graduation, just like my fellow near-graduates all over the Netherlands, I was faced with making a big life decision: to choose a very specific trajectory in higher education out of thousands of options (e.g., international business administration, sociology, applied mathematics, biotechnology, tourism, etc.). To me, having to make this decision felt exciting, but also scary and slightly unfair. I did not know what all the options were, nor what I liked, nor where I wanted my life to go in the future. So how was I to make such a big, life defining decision in a good way? This dilemma is the reality of many adolescents and emerging adults who are in the transition from high school to higher education. This dissertation is an attempt to understand how people make such career decisions, how they evaluate them after they are made, and how all of this is intertwined with fundamental micro-level processes of identity development.

Making a big life decision, such as choosing a career path, is intrinsically connected to a sense of identity (e.g., Raskin, 1985; Skorikov & Vondracek, 1998). Our identity encompasses notions on what defines us, on what we like and where we want our life to go in the future. If these notions are clear, they allow us to make fitting life choices (e.g., Rottinghaus & Van Esbroeck, 2011). But importantly, the choices we make also shape our identity. Identity researchers refer to the making of big life choices, such as deciding on a particular career path, as the formation of *commitments*. The commitments are considered to be the building blocks of identity (Marcia, 1966). The best commitments are generally thought to be preceded by a period of thorough exploration (e.g., Dietrich, Lichtwarck-Aschoff, & Kracke, 2013) where multiple options are broadly investigated and a select few are investigated in more depth (Luyckx, Goossens, Soenens, & Beyers, 2006).

Identity development continues throughout the life of an individual, it does not stop after a big life decision is made. Rather, after the choice is made and the commitment is formed (the commitment formation cycle), the chosen path is now further explored in-depth (the commitment evaluation cycle; Luyckx et al., 2006). This in-depth exploration may lead the individual to obtain new information on what the commitment truly entails and whether it is as fitting as she thought it was. This information may also lead the individual to doubt her choice – such doubt is called commitment reconsideration (Crocetti, Rubini, & Meeus, 2008). As a consequence of such commitment explorations and reconsiderations, the individual may change her mind about the path she has chosen. Such a change of career path seems to

occur rather frequently in higher education: in Europe, 20% to 50% of students drop out of their chosen educational trajectory in the first year alone (Quinn, 2013).

Identity development is commonly understood as a long-term process spanning decades, years, or months at least, or in other words, it is understood on a macro-level timescale (Lichtwarck-Aschoff, van Geert, Bosma, & Kunnen, 2008). However, in recent years some researchers have started to turn their attention towards understanding identity development as it occurs in daily and weekly processes as well, or in other words, it is increasingly understood on a micro-level timescale (e.g., Klimstra et al., 2010). This exciting new direction of studying identity on a micro-level can give us new insights on how identity emerges from everyday life interactions, which has many theoretical and practical implications. But of course, as is always the case with new directions, many questions need to be answered, in particular fundamental questions on what the concept of identity is on this micro-level, what its building blocks are, and how these building blocks interact to both form and evaluate commitments.

In this thesis I aim to further fundamental theory on the processes and mechanisms of identity development on a micro-level. I aim to understand the processes of both commitment formation and commitment evaluation and demonstrate the practical relevance of such fundamental knowledge by applying these insights to understand two major career transitions that are part of these processes: choosing a specific career path and dropping out of higher education.

THE PROCESS AND CONCEPT OF IDENTITY ON A MICRO-LEVEL

Knowledge of identity processes on a micro-level can be important for both theory and practice. From a theoretical point of view, such knowledge fills a crucial gap: how identity comes to be through the actions and experiences of everyday life. From a practical point of view knowledge on micro-level processes may be more usable than knowledge on macro-level processes. Micro-level processes of identity development are closely related to actions and experiences in everyday life (Lichtwarck-Aschoff et al., 2008). As practitioners operate on a micro-level – i.e., they tend to work with the actions and experiences of an individual in the here and now – knowledge on micro-level developmental processes of individuals may just be the type of knowledge that will be informative for them.

What constitutes a micro- or macro-level process depends on the phenomenon in question. The process of identity development can span years, or even a lifetime.

Yet these macro-level processes spanning years must be rooted in smaller, everyday interactions with the context (Bosma & Kunnen, 2001). Such everyday interactions with the context can be considered a micro-level process of identity. In order to study this micro-level process, it is necessary to think about what type of identity constructs are relevant on a micro-level timescale. For those of you who are now really excited, thinking that in this thesis finally some clarity is forthcoming on the vague concept of identity – I must moderate your expectations. Although I feel I have made some important steps in conceptualizing identity and its process on a micro-level, these steps are but the beginning of a larger quest to understand the different aspects of identity on different levels of time. We are not near a complete theory, but I shall describe some of the beginning ideas and their basis below.

Identity is a notoriously ambiguous construct. Erik Erikson – commonly cited as the founder of theory on identity – has written several works (e.g., 1956; 1968) in which he attempted to clarify the concept of identity by describing it from different angles, but he avoided an explicit definition of identity. Lacking a definition of identity is of course not very convenient if one aims to study identity, thus identity researchers after Erikson have tried to distill a measurable operationalization of identity from his writings. Marcia (1966) was arguably most successful in this – his operationalization of identity still forms the basis of the main stream of identity research today. Marcia concluded that identity development is the process of forming occupational and ideological commitments at the time that the young individual is faced with adult tasks such as getting a job and becoming a citizen. He added that a period of exploration is essential for forming optimal commitments, and that both exploration and commitment can be present or absent, leading an individual to be in one of four possible identity statuses. This concrete definition of identity allowed the field of identity research to expand rapidly and various instruments were called into existence to measure exploration and commitment.

However, it turns out that the various instruments that were designed to measure identity diverge in what they measure precisely (e.g., Waterman, 2015). I reasoned that this divergence in identity measures is perhaps rooted in an implicit divergence in the ideas of researchers about what the constructs of exploration and commitment truly entail. When trying to pinpoint these possible differences in the conceptualization of identity, I noticed that researchers differ in what they consider to be the object of commitment and exploration.

Some researchers focus on the individuals' commitment to and exploration of relatively abstract ideas that the individual has about herself in relation to her context (e.g., Bosma, 1985; Bosma, Kunnen, & Van der Gaag, 2012; Marcia, Waterman,

Matteson, Archer, & Orlofsky, 1993). These abstract ideas may entail convictions, norms and values in several domains of life (for instance, what the individual finds most important in friendships). Generating such ideas requires of the individual that she integrates many views on herself. After all, in any domain an individual may have various qualitatively different views. Moreover, her current views may differ from her past views, and from her views on where she wants to go in the future. Because of the high amount of elements and the large time-span that the individual integrates in one coherent view, it is perhaps suitable to name this aspect of identity the 'macro-level' of identity. This macro-level of identity contains not only the abstract views that the individual has on herself in different domains of life but also contains the strength of the commitment that the individual feels towards these views (i.e., the extent to which the individual is certain of these views, and how guiding these views are to the life of the individual) and how much she has explored these views (i.e., the extent to which the individual has investigated a view, thought about it, talked about it with friends etcetera).

Other researchers focus on a different aspect of identity. Several instruments designed to measure identity focus on the individuals' commitment to and exploration of concrete contexts in the environment of the individual (e.g., Crocetti et al., 2008; Klimstra et al., 2010; Van der Gaag, De Ruiter, & Kunnen, 2016). Such concrete contexts may for example be a particular career path, or a particular friend. An individual can have views on how well suited this context is with her own interests and ambitions. Such a view on the fit of a context with the self can be generated relatively easily. For example, an individual who has but a single experience with another individual can already generate a view on how well this other individual is matched with her (although this may of course change over time). This feeling of fit, and how certain the individual is of this feeling, are important aspects to her overall feeling of commitment towards a certain context. Because this feeling of commitment to concrete contexts requires an integration of only a few elements over a small time-frame in order to form, it is perhaps suitable to call this the 'micro-level' of identity. This micro-level of identity contains not only the feeling of commitment towards a context, but also how much the individual has explored the context, alternative contexts, and her own interest and ambitions within this context.

It seems likely that the micro- and macro-levels of identity described in the previous two paragraphs are closely related, but conceptually it may hold some important advantages if we explicitly differentiate them. If we do, we can start to understand if and how these levels interact. We can for example start to unravel

how a lack of a clear and strong views on the self (i.e., lacking strong macro-level commitments) can affect the ability of an individual to choose a career path (i.e., form micro-level commitments; see for example chapter 5). Indeed, it seems likely that these two levels of identity continuously shape each other. A concrete commitment on the micro-level of identity, such as a strong commitment to a particular career path, shapes an abstract commitment on the macro-level of identity, such as the individuals' view of herself as an ambitious individual. But this works both ways, the way the individual views herself also affects the micro-level commitments she forms and how she evaluates these commitments.

I touch on the topic of interaction between levels of identity in chapter 5, but for the largest part of this thesis (chapters 2, 3 and 4) I have chosen to focus particularly on the micro-level concept of identity, for two reasons. First, I expect that the micro-level of identity (exploration of and commitment to concrete options in the environment) is particularly relevant for studying micro-level processes of identity (identity processes spanning days and weeks). Concrete micro-level commitments to a specific educational trajectory or a particular friend are probably more easily affected by concrete day-to-day events than abstract ideas on the self are (i.e., macro-level identity). After all, this more abstract view on the self is here conceptualized as an integration of many views over a large time-span. If the individual dismisses this view she will need to redefine herself, an activity that is probably difficult, time consuming and accompanied by psychological turmoil. But this view can remain intact by doubting the fit of the context, which may also be unpleasant, but perhaps less threatening and time-consuming than doubting self-views that are so carefully constructed over the years. If we assume that individuals will tend to choose the less threatening, less time-consuming path, then it is plausible that they will sooner doubt the fit of a context, than doubt the view on the self. This is why I expect that the micro-level concept of identity will change more frequently on a week-to-week basis than the macro-level concept of identity, and will be the more interesting aspect of identity to study on this weekly time-scale.

The second reason to focus on the micro-level of identity is because the frequent evaluation of this construct – which is needed to investigate micro-level processes of identity – is much less intrusive than assessing the macro-level of identity. Having the feeling that a certain context or person does or does not fit, or whether you are sure about your choice for such a context or person, requires little reflection. This is evidenced by the relative simplicity of the instruments used to measure these types of concrete, micro-level commitments: multiple choice questionnaires that do not

even take a minute to complete (e.g., Klimstra et al., 2010). Contrastingly, integrating and generating abstractions from the many views that an individual may have on herself over a large time-span (i.e., macro-level identity) is time consuming and difficult. This difficulty is evidenced by the necessity of deploying interviews spanning several hours (e.g., Bosma, Kunnen, & Van der Gaag, 2012) in order to assess such self-views. This makes the assessment of an individual's macro-level identity every week for a period of several months practically difficult, and such frequent and extensive reflections would have a high chance to significantly affect the identity development itself.

Throughout this dissertation I will touch on this conceptualization of identity as a micro- and macro-level construct several times, but I will note in advance that a lot of conceptual work still needs to be done in how to exactly distinguish such levels of identity, and how they may interact. This is indeed important work as it may unite two very different views on identity that have existed side-by-side while it has so far remained unclear how they are related to one another.

THIS THESIS

With this thesis, I aim to investigate processes and mechanisms of micro-level identity development in both cycles of identity development: commitment formation and commitment evaluation. To demonstrate the practical utility of such a fundamental understanding I connect the processes in these two cycles to two types of big career transitions that may result from each of these cycles: to choose a career path (particularly an educational trajectory) and to drop out of higher education.

I start this thesis by investigating the trajectories of micro-level commitment and exploration over a period of several months and study how such trajectories are related to the decision to drop out of higher education (chapter 2). I then try to uncover the mechanisms behind these trajectories by investigating how acts of micro-level exploration are related to changes in micro-level commitment within individuals (chapter 3). Next, I study what role there may be for emotional experiences in affecting the dynamics of commitment within individuals, and how this compares to the role of exploration (chapter 4). The final chapter combines these insights with theories of both developmental and cognitive psychology in one theoretical framework on the process of career choice. We use this framework to build a career choice simulation model that allows us to predict how micro-level processes of exploration and experiences shape the formation of career commit-

ments, and how individual differences may affect this process and the quality of the resulting career choice (chapter 5). Thus the chapters are so organized that they provide increasingly in-depth empirical and theoretical insight into the question: what are the basic processes and mechanisms of micro-level identity development and how are such processes related to big career transitions?

Throughout this thesis, I have placed the individual at the center. I aim to uncover mechanisms and processes within individuals, but at the same time I try to gain some insight in how individuals may differ in these processes. These aims do not automatically align well – they require some balancing. On the one hand, to uncover as much as possible of the intricacies of within-individual mechanisms and process, it may be best to perform an extensive case study on one individual or a few individuals. The obvious downside to this is that it is not clear whether the processes and mechanisms uncovered are true for other individuals (i.e., atomistic fallacy; Courgeau et al., 2016). On the other hand, large group studies that do have the capacity to generalize over many individuals often fall into the fallacy of translating group averages to processes within individuals (i.e., the ecological fallacy, Courgeau et al., 2016; or the ergodicity problem, Molenaar & Campbell, 2009; see also chapter 2). Moreover, the sheer amount of individuals in large group studies makes it tempting to only report on averages, and draw conclusions based solely on these averages while losing sight of the individuals and how they may deviate from the average. In all my chapters I have aimed to find a middle ground. I have placed the individual at the center of my analyses to preserve the richness of idiosyncratic development, while also looking at the group level to explore possible differences between individuals.

REFERENCES

- Bosma, H.A., & Kunnen, E.S. (2001). Determinants and Mechanisms in Ego Identity Development: A Review and Synthesis. *Developmental Review, 21*, 39–66. <https://doi.org/10.1006/drev.2000.0514>
- Côté, J. (2006). Identity Studies: How Close Are We to Developing a Social Science of Identity?—An Appraisal of the Field. *Identity, 6*, 3–25. https://doi.org/10.1207/s1532706xid0601_2
- Crocetti, E., Rubini, M., & Meeus, W. (2008). Capturing the dynamics of identity formation in various ethnic groups: Development and validation of a three-dimensional model. *Journal of Adolescence, 31*, 207–222. <https://doi.org/10.1016/j.adolescence.2007.09.002>
- Dietrich, J., Lichtwarck-Aschoff, A., & Kracke, B. (2013). Deciding on a college Major: Commitment trajectories, career exploration, and academic well-being. *Diskurs Kindheits- und Jugendforschung, 8*, 305–318.
- Erikson, E. H. (1956). The Problem of Ego Identity. *Journal of the American Psychoanalytic Association, 4*, 56–121. <https://doi.org/10.1177/000306515600400104>
- Erikson, E. H. (1968). *Identity: Youth and crisis*. New York: Norton.
- Klimstra, T.A., Luyckx, K., Hale, W.A., Frijns, T., van Lier, P.A.C., & Meeus, W.H.J. (2010). Short-term fluctuations in identity: Introducing a micro-level approach to identity formation. *Journal of Personality and Social Psychology, 99*, 191–202. <https://doi.org/10.1037/a0019584>
- Lichtwarck-Aschoff, A., van Geert, P., Bosma, H., & Kunnen, S. (2008). Time and identity: A framework for research and theory formation. *Developmental Review, 28*, 370–400. <https://doi.org/10.1016/j.dr.2008.04.001>
- Luyckx, K., Goossens, L., Soenens, B., & Beyers, W. (2006). Unpacking commitment and exploration: Preliminary validation of an integrative model of late adolescent identity formation. *Journal of Adolescence, 29*, 361–378. <https://doi.org/10.1016/j.adolescence.2005.03.008>
- Marcia, J.E. (1966). Development and validation of ego-identity status. *Journal of Personality and Social Psychology, 3*, 551.
- Molenaar, P.M., & Campbell, C.G. (2009). The new person-specific paradigm in psychology. *Current Directions in Psychological Science, 18*, 112–117.
- Oppenheimer, D.M., & Kelso, E. (2015). Information Processing as a Paradigm for Decision Making. *Annual Review of Psychology, 66*, 277–294. <https://doi.org/10.1146/annurev-psych-010814-015148>
- Quinn, J. (2013). Drop-out and completion in Higher Education in Europe. *European Union*. Retrieved from http://www.fh-dortmund.de/de/hs/qdl/Kooperation_auf_EU-Ebene.pdf
- Raskin, P. M. (1985). Identity and vocational development. *New Directions for Child Development, 30*, 25–42. <https://doi.org/10.1002/cd.23219853004>
- Rottinghaus, P.J., & Van Esbroeck, R. (2011). Improving person–environment fit and self-knowledge. In P. J. Hartung & L. M. Subich (Eds.), *Developing self in work and career: Concepts, cases, and contexts*. (pp. 35–52). Washington: American Psychological Association. Retrieved from <http://content.apa.org/books/12348-003>
- Skorikov, V., & Vondracek, F. W. (1998). Vocational Identity Development: Its Relationship to Other Identity Domains and to Overall Identity Development. *Journal of Career Assessment, 6*, 13–35. <https://doi.org/10.1177/106907279800600102>
- Van der Gaag, M.A.E., De Ruiter, N.M.P., & Kunnen, E.S. (2016). Micro-level processes of identity development: Intra-individual relations between commitment and exploration. *Journal of Adolescence, 47*, 38–47. <https://doi.org/10.1016/j.adolescence.2015.11.007>
- Van Geert, P. (1994). *Dynamic systems of development: Change between complexity and chaos*. Hertfordshire, England: Harvester Wheatsheaf.

Waterman, A. S. (2015). What Does It Mean to Engage in Identity Exploration and to Hold Identity Commitments? A Methodological Critique of Multidimensional Measures for the Study of Identity Processes. *Identity, 15*, 309–349. <https://doi.org/10.1080/15283488.2015.1089403>

**Developmental trajectories
leading up to student drop-out**

2

Mandy A.E. van der Gaag
E. Saskia Kunnen
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ABSTRACT

Due to governmental incentives, preventing student drop-out has become a top priority for many universities over the past few years. We aim to shed light on the processes preceding dropout so that universities may have the possibility to identify at-risk student at an early stage. In our intensive longitudinal study, we have distinguished two types of educational commitment and exploration trajectories among first year students of psychology: a trajectory that is characterized by certainty (strong commitments and little exploration, both being stable over time) and a trajectory that is characterized by high levels of doubt (weak commitments and much exploration, both fluctuate much over time). Individuals who show trajectories characterized by doubt are at an elevated risk of dropping out of higher education. These typologies are useful to detect dropout at an early stage as they are relatively easy to detect, but the prediction of dropout can be much improved by gaining insight into more sophisticated features of the individual trajectories. In our study, dropout is most accurately predicted if individuals show a decreasing trend of commitment over time combined with an increasing trend in the amount of fluctuations in exploration, or if they show an increasing trend in their level of exploration. We have shown that trajectories of exploration and commitment seem to be relevant predictors to university dropout. Influencing these processes of exploration and commitment may have high gains with relatively little costs. By showing ways to identify at risk students early, and suggesting a few avenues through which processes of exploration and commitment can be guided, we hope to have provided evidence so that universities may try new, individual and process-oriented ways to tackle dropout.

INTRODUCTION

University drop-out is a common problem, with large consequences for both the individual and society. For example in Europe 20% to 50% of all students who start higher education do not finish it (Quinn, 2013). University dropouts have a high chance to be without higher education, training and employment for a long time (European Training Foundation, 2014). This can have long term consequences: these individuals are more likely to experience personal tragedies, to come into contact with the justice system, and cause significant welfare costs for society (e.g., Coles, Godfrey, Kueng, Parrott, & Bradshaw, 2010). To prevent dropout and the long term negative consequences this may have, it is key to understand the process of student drop-out and to identify students at risk of dropping out at an early stage. In this paper we aim to contribute to this knowledge by studying within-individual trajectories of educational commitment and exploration throughout the first year of higher education and investigating how these trajectories are related to dropout.

Identifying Students At Risk For Drop-Out

Many universities have sought to reduce the chances of dropout by identifying at-risk students, but as the high attrition numbers illustrate this is by no means an easy task. A straightforward and increasingly widely adopted strategy is to prevent individuals who have a high risk of dropping out of higher education to enter the university in the first place. In practice however, this approach encounters a number of obstacles. First of all, it is not ethically sound to select students at the gate using some of the strongest predictors of academic success: socio-economic status (Jury, Smeding, & Darnon, 2015), gender, or migratory status (e.g., Stoessel, Ihme, Barbarino, Fisseler, & Stürmer, 2015). An alternative strategy is to use less controversial predictors to select students, like personality or motivational factors (e.g., Richardson, Abraham, & Bond, 2012). This strategy encounters another practical obstacle: it is difficult to assess prospective students accurately on these variables, as these students are tempted to present themselves in such a way that will improve their chances to get admitted (e.g., Niessen, Meijer, & Tendeiro, 2017). Universities are then left with what is perhaps the most common strategy of selection: selecting on past performance, usually in the form of the grades obtained during high school, as these grades are good predictors of student performance (Westrick, Le Robbins, Radunzel, & Schmidt, 2015). However, this strategy also encounters an obstacle: it may be overly restrictive, excluding potentially talented individuals, as many high

school students are notorious underachievers (e.g., 28% in a study of Vaes, Gilar, Miñano, & Castejón, 2016).

Early identification of students who have a high risk of dropping out during the first year of higher education has three advantages over selection at the gate: 1) it is not troubled by the obstacles described above, 2) predictors of dropout that are measured during the first year of higher education, as opposed to predictors measured before the start of higher education, are found to be the strongest predictors of dropout and 3) it becomes possible to design interventions to help these at risk students to obtain their degree. Many studies demonstrate the value of predictors measured during the first year of higher education, but these studies differ in the type of predictor they focus on. A recent meta-analytical study of Westrick, Le, Robbins, Radunzel, and Schmidt (2015) investigated the effect of high school grades, the scores on a standardized test for high school performance (ACT), and first year academic performance on student retention. They found that first year *academic performance* is the strongest predictor of student retention. Another meta-analytical study by Robbins et al. (2004), showed that *psychosocial characteristics* directly related to the academic context were the strongest predictors of student retention, particularly academic self-efficacy, academic goals, and academic-related skills. Other studies have found that the *fit with educational context* as experienced by the students is the best predictor of student retention. Examples of such fit factors are the commitment students feel towards their educational institution (Strom, 1985), the certainty students feel about their choice of educational trajectory (Metzner, Lauer, & Rajecki, 2003; Neuville et al., 2007), the experienced congruence between interest and the chosen major (Allen & Robbins, 2010), and perceiving an academic fit (Elffers, Oort, & Karsten, 2012; Wintre, Bowers, Gordner, & Lange, 2006). Among so many studies showing different variables that contribute to dropout it is hard to determine the most useful predictor – which variable should a university monitor in order to identify at-risk individuals? As we shall demonstrate below, this question may be answered by placing these variables in the context of theories on the individual process of dropout.

Processes of Dropout

Tinto's classic model of student attrition (1975, 2012) is perhaps the most influential longitudinal process theory on student attrition. The model combines several important predictors in one theory. In this theory, a student arrives at university with a certain set of attributes (prior schooling, family background, skills and abilities). The

student forms educational commitments (i.e., commitments towards the institution and towards her own educational goals). These commitments affect the type of experiences the student has within the academic and social system, such as peer-group interaction and academic performance. These experiences subsequently affect social and academic integration, which then feeds back into the educational commitments of the student. Ultimately, these educational commitments inform the decision to depart. This model implies that although psychosocial (Robbins et al., 2004) and academic performance factors (Westrick et al., 2015) may have an important predictive value on whether students dropout, their effect is exerted through a mediating, more proximal role of commitment. As such, the educational commitment of an individual is perhaps a useful indicator to monitor regularly in order to identify possible dropouts at an early stage.

Commitments are also of central importance in many classic and modern theories on identity (e.g., Bosma & Kunnen, 2001; Erikson, 1956; Marcia, 1966). From an identity perspective, commitments theoretically develop through active exploration – such as reconsiderations and in-depth explorations of the current commitment (Crocetti, Rubini, & Meeus, 2008; Luyckx, Goossens, Soenens, & Beyers, 2006; Marcia, 1966). Commitments can be seen as the bond that is felt with a certain context, while exploration is the behavior through which one can investigate and re-evaluate this bond. Commitment and exploration are both core factors of identity development and are tightly connected - explorations have been shown to be related to commitment dynamics on both a micro level (e.g., Klimstra et al., 2010) and on a macro level (e.g., Luyckx, Goossens, & Soenens, 2006). It is not hard to imagine how these processes may affect each other. An individual who feels only a weak connection with her chosen educational trajectory (a low commitment) may start to reconsider whether this trajectory truly fits her (an act of exploration). Such explorations may lead the individual to conclude that the educational trajectory is indeed not that fitting at all, further diminishing the commitment she feels towards her educational trajectory. The combined processes of commitment and explorations have been shown to be related to dropout (e.g., Luyckx, Goossens, & Soenens, 2006). Thus as a complementing force to commitment, theories on identity development predict that exploration could also be an important factor to monitor if we are to effectively identify individuals in processes headed for dropout.

The levels of these educational commitments and the amount of explorations are not necessarily stable throughout the academic year. If we apply Tinto's model to a micro-level process – i.e., an individual student in his day-to-day life – we can

get an idea of how fluctuations may occur. Imagine for example, that on one day a student receives a large compliment from a fellow student (i.e., positive peer group interaction). This experience fortifies the individuals' feeling of belonging with his fellow students (i.e., increases social integration) and reinforces his feeling that this is indeed the right place for him (i.e., fortifies educational commitment). However, the next week, he may receive a bad grade (i.e., negative academic performance) which undermines his feeling of belonging at university (i.e., decreases academic integration) and weakens the feeling that this educational trajectory is right for him (i.e., weakens educational commitment). Indeed, when framing Tinto's model in such a micro-level process perspective, it seems plausible that commitment levels may go up and down frequently, on a weekly or even on a daily basis, and levels of exploration may move with it. This has in fact been shown to be true for micro-level educational commitments and explorations from an identity development perspective (Klimstra et al., 2010).

In systems science, fluctuations are considered important information. They give information about the internal dynamics and stability of a system. Fluctuations can be precursors of a transition to a qualitatively different state in any kind of system (see for example Scheffer et al., 2012). This idea has been applied in psychology as well, for example therapeutic contexts, where an increase in fluctuations of emotions is an indicator of qualitative change (Lichtwarck-Aschoff, Hasselman, Cox, Pepler, & Granic, 2012). It has also been applied in the study of development, particularly in young children, where an increase in fluctuations may signal a transition to a new developmental phase (for an overview, see Van Dijk & Van Geert, 2015). If we consider dropout as a transition to a qualitatively different state, it is plausible that also this transition is preceded by fluctuations in the students' trajectories of commitment and exploration. Thus it seems important to take the amount of and changes in fluctuations in commitment and exploration into account when trying to identify individuals in processes headed for dropout.

Present study

In the previous section we have argued that if the many predictors of dropout are integrated in theories on the individual process of dropout, the investigation of trajectories of commitment and exploration seems particularly fruitful so that we may ultimately detect potential dropouts in an early stage. In the present study we explore the types of commitment and exploration trajectories that may exist among first year students and we relate these types of trajectories to the probability

that the students drop out of higher education. Moreover, we investigate which of these trajectory characteristics predict dropout the best. Thus we aim to answer three questions: 1) Which types of trajectories of exploration and commitment can be distinguished? 2) How are such trajectories related to dropout? 3) Which characteristics of the commitment and exploration trajectories are particularly important for predicting dropout?

There are many forms of commitment and exploration one could focus on. In this study we have chosen to particularly focus on the strength of the commitment that an individual feels towards her chosen, specific educational trajectory, and to what extent she explores whether this trajectory fits her. The choice for these particular forms of commitment and exploration is related to the context in which we study educational commitment processes: higher education in Europe, particularly in the Netherlands, where all bachelor programs focus on specific topics of study (e.g. psychology, history, ecology, etc.). Students have to choose this topic of study before they start the bachelor. Thus the choice process of students, the subsequent commitment they form and the explorations they may perform, is strongly focused on a specific educational trajectory. Such a conceptualization is slightly different from the concept of commitment as proposed in Tinto's model, where commitments are formed to personal goals and the educational institution, but it is in line with forms of commitment and exploration commonly studied in identity research (e.g., Klimstra et al., 2010; Van der Gaag, De Ruiter, & Kunnen, 2016).

We use a process approach in order to identify students headed for dropout at an early stage. This means that we study exploration and commitment both within individuals and as processes over time. Our micro-level longitudinal study consists of very frequent measurements over the course of the first year of higher education. This allows us to not only study the level of exploration and commitment, but also study the gradual changes in these factors over time, as well as their fluctuations and changes in these fluctuations.

METHOD

Participants

Our sample consists of 115 first year bachelor students who have chosen to pursue the educational trajectory of psychology at a university in the north of the Netherlands. The mean age of this group was 19.3 ($SD = 1.8$) at the beginning of the study.

The majority of participants is female (81%, $N = 93$; versus 19%, $N = 22$ male), this is in line with the gender distributions (predominantly female) within this particular educational trajectory (psychology). The students participated as part of their curriculum – they are required to gather credits for research participation. They can freely choose the type of research in which to participate. All participants are Dutch speaking and live in the northern part of the Netherlands. Of these 115 participants, 12 dropped out of higher education after completing their participation in this study (specifically, they stopped pursuing their chosen educational trajectory anywhere between the end of the first academic year and the start of their third academic year), and 103 persisted in their educational trajectory (specifically, they continued their specific educational trajectory at least until the start of the third academic year).

The participants filled in weekly reports throughout a large part of their first academic year. Eighteen individuals (13%) were excluded from the original sample ($N = 134$) because they completed less than 80% of the required amount of experiences reports. In addition, one participant was excluded because she misunderstood the instructions. This makes a total of 19 excluded individuals, leaving 115 individuals in our total sample.

The amount of experience reports is different for two subsamples of the total sample: a ‘long’ subsample where 30 weekly experience reports were asked of the students, and a ‘short’ subsample where only 22 experience reports were asked. The ‘short’ subsample is shorter due to practical constraints – as multiple researchers make use of the same pool of research participants, we were limited in the amount of participant time that we could use. The included participants of the long subsample ($N = 71$) completed 29 experience reports on average ($SD = 2.0$). The included participants of the short subsample ($N = 44$) completed 22 experience reports on average ($SD = 0.9$). We have no reason to expect systematic differences between the two subsamples: they differ in the amount of weeks spent in this study, but the measured variables and population are the same. We have therefore taken them together in our main analysis.

Procedure

We collected data weekly throughout three quarters of the first academic year for the long subsample, and throughout slightly more than half an academic year for the short subsample. For the long subsample the data collection started in November, and continued until June, for a total period of seven months. For the short

subsample data collection started in January and continued until June, for a total period of five months. The participants in both subsamples were asked to fill out the same online questionnaire every week. This questionnaire contained a qualitative and quantitative section; for this study we only use the quantitative measures of exploration and commitment.

To reduce the chance of attrition over this long period of data collection, participants were allowed to choose the moment in the week to fill out the questionnaire that suited them best. This did not have to be the same moment each week. They were also allowed to skip two weeks during the data collection period (but not right after each other). Because of the substantial sustained effort required of the participants, the students were rewarded accordingly, with an attractive amount of credits.

The data of the long subsample was collected in three cohorts: first year students from academic years 2011–2012 ($N = 12$), 2012–2013 ($N = 25$) and 2013–2014 ($N = 34$). The data of the short subsample was collected only in academic year 2013–2014 ($N = 44$). Data on dropout was obtained through the administrative office of the university, all individuals in this study agreed to share this information.

Measures

The participants filled out a weekly online questionnaire, the Repeated Exploration and Commitment Scale in the domain of Education (RECS-E; Van der Gaag, et al., 2016). In our analysis we included the micro-level exploration and commitment measures of the RECS-E that were administered among all cohorts: one measure of exploration (exploration of fit: “Have you asked yourself whether this educational trajectory is right for you?”) and one measure of commitment (commitment to choice: “Do you stand by your choice for this particular educational trajectory?”). Both were rated on a Likert scale of 1 (not at all) to 6 (very much).

Analysis

We have performed our analysis in three steps corresponding to our three research questions. First, we used a cluster analysis to classify the different types of commitment and exploration trajectories. Second, we compared the cluster memberships of students who drop out with those who persist – in this way we determined whether the chance to dropout is different for the different types of trajectories. Third, we have employed a simple machine learning technique – generating decision trees – to determine which of the trajectory characteristics are particularly important for predicting dropout, and which are less important.

1) Cluster analysis of individual trajectories

We have performed a cluster analysis on several characteristics of the individual trajectories of exploration and commitment. We have included a total of eight variables in the cluster analysis – four characteristics of the exploration trajectory, and four characteristics of the commitment trajectory. We used the time-serial data of each individual to determine these trajectory characteristics. Particularly, we have calculated each individuals' average level of exploration and commitment, the general trend of change in these levels, the amount of fluctuations in both variables, and the general trend of change in these fluctuations. The average level is calculated by taking the average score of commitment and of exploration using the time-serial data of each individual. The variability of the individual trajectories is the average absolute change in commitment and exploration from one week to another. For example, if an individual first scored 5 on commitment, then 3, and then 4, the change scores are -2 and 1, the absolute change scores are thus 2 and 1, and the variability in commitment is the average of these absolute change scores: 1,5. In individual time series, such a variability measure is considered superior to using standard deviation as measure of variation (Kunnen, 2012). The general linear trend is calculated by subjecting the time-serial commitment and exploration data of each individual to a linear regression analysis. This analysis results in the best fitting linear equation of which we extract the slope to represent the general trend of change (e.g., upwards, downwards, or leveled) of commitment and exploration over time. We have performed the same procedure to calculate the general linear trend of the variability - using the weekly absolute change scores as input for the linear regression.

We have standardized all eight of the variables to equate their impact on the clustering solution. Variables with larger ranges and variances may have a larger influence on the clustering solution (Henry, Tolan, & Gorman-Smith, 2005). Standardization is necessary when the theoretical 'weight' of each of the variables is considered equal (Milligan, 1996). As we indeed consider our variables of equal importance we have standardized them by transforming the variables into z-scores (i.e., $Z_x = (X - \text{Mean}_x) / \text{SD}_x$). We have used the classic and widely known K-means algorithm (Lloyd, 1982) to perform the cluster analysis.

K-means aims to minimize dissimilarity between individuals within a cluster. The k-means algorithm first chooses the cluster centers randomly, then assigns the individuals that are closest to the cluster center to the one cluster. When all individuals are assigned to clusters, the cluster centers are calculated again and the process repeats for a certain amount of iterations – we have used 100 iterations – until the cluster

centers are optimized. Because the cluster centers are initially chosen randomly, slight variations may occur in each resulting clustering solution (i.e., the initialization problem; Tan, Steinbach, & Kumar, 2006). We have employed a common solution to this (Tan et al., 2006): we have performed the cluster analysis several times (50) and from the resulting clustering solutions we have chosen the optimal one – the solution with the least variance within each cluster and the most variance between the clusters (i.e., the solution with the smallest number when subtracting the between cluster sum of squared error from the total within cluster sum of squared error).

K-means requires that the amount of clusters (k) is defined a priori. We have chosen to divide our data over two clusters: this is the simplest partitioning possible which we consider appropriate considering our modest sample size, and a two cluster solution will allow straightforward comparison with the probability of dropping out of higher education in the second step of our analysis. To perform the cluster analysis we have used the package *cluster* (Maechler, Rousseeuw, Struyf, Hubert, & Hornik, 2016) in *R* (R Core Team, 2016). Finally, we perform t-tests to compare the two clusters on the means of the 8 trajectory variables that we have included in the analysis. In this way we discover which of the 8 variables are truly important for distinguishing the groups.

2) Comparing trajectories of dropouts and persisters

In the second step of our analysis we have investigated whether students who drop out tend to have different types of commitment and exploration trajectories than students who persist. To do so, we show the distribution of cluster membership among dropouts and among persisters. We have performed a one-sided Fisher's exact test (Fisher, 1922) in *R* (R Core Team, 2016) to compare the distributions, which is particularly suitable when distributions contain conditions with small numbers (this is the case in our data, as we shall show in the results). The resulting p -value represents the total probability that the null hypothesis – that dropouts and persisters are equally likely to show a certain type of trajectory – is true if we observe distributions as extreme or more extreme than the one we found.

3) Decision trees

In the third and final step of our analysis, we 'grow' a decision tree to predict dropout as accurately as possible (without overfitting) based on our 8 trajectory variables. It is a relatively simple machine learning technique that generates easily interpretable results (for an introduction see Tan, et al., 2006). A decision tree consists of nodes and branches. The top ('root') node represents the most important variable used for

classification (i.e., the variable that separates the data the best). Each branch represents a cut-off score, for example an average commitment score higher than 5. Each individual satisfying this cut-off score is transported to the node below. This new node may be another classification variable (an 'internal node') or it may be a 'terminal' node – a final classification in the class 'dropout' or 'persist'. Many algorithms can be used to grow a tree. We have chosen to use the widely known algorithm C4.5 (Quinlan, 1998) which has been chosen as the number one algorithm in data mining by a large panel of data-mining experts (Wu et al., 2008).

In order to perform well, a decision tree needs to be provided with classification groups of approximately equal size. However, in our data we do not have equally sized classification groups (103 individuals that persist and 12 individuals that drop out). This is a common problem when predicting anomalies in a dataset. A commonly used (and well performing) solution is to create synthetic examples of the minority class in a procedure called SMOTE (Chawla, Bowyer, Hall, & Kegelmeyer, 2002). This SMOTE procedure entails that the three nearest neighbors to each data point are connected with lines, and synthetic examples of the minority class are added randomly somewhere along these lines. This synthetic data is generated solely for training purposes – these simulated individuals are removed once the tree is trained and the trees' accuracy is of course only tested on the empirical data. A downside to using simulations to train a tree is that the generated trees can vary in structure and cut-off scores – this makes sense as there is randomness in the synthetic data that is generated in the SMOTE procedure. Thus the next step was to choose a good classification tree among many possible trees.

As a general rule, highly complex trees (i.e., trees with many nodes and branches) are likely to lead to overfitting – the tree may fit the sample very well, but it may not be generalizable to the population, and it is not easy to interpret (Tan et al., 2006). Contrastingly, very simple trees are likely to lead to underfitting – even though it is easily interpretable, it may make many errors in classifying the individuals in the sample. The challenge is to find a balance between overfitting and underfitting.¹

We have employed this general rule to choose a simple tree among the trees that we have generated. In our choice process we mainly focused on preventing overfitting because overfitting endangers generalizability which is already an issue

1 Optimally, a tree is grown using a training dataset and then tested on a new dataset. This requires a large amount of data in all categories. We only have few (12) individuals in the dropout category and therefore we have decided to take an inductive approach: only train the tree but take elaborate measures to prevent overfitting.

because of the relatively small dataset. To this end, we have made sure that each node in the tree would contain at least 10 individuals in the training process – this way each node would not be too specific for only a small set of individuals. In addition, we have employed a process called ‘post-pruning’ (see also Tan et al., 2006), which is basically an algorithm that removes branches of the tree that add little to the correct classification of individuals. We generated 50 trees in this way. These trees varied with respect to their complexity, ranging from two to five branches deep. In our first selection step, we only selected the relatively simple trees - those with a maximum depth of 3 (i.e., the maximum length of the chained branches connecting the root node to a terminal node never exceed 3). This left 34 trees in our selection set. We then excluded two trees because the same variables reoccurred in different sections of the tree, and such trees are hard to interpret (Tan et al., 2006).

To create a balance between overfitting and underfitting we selected two trees from the 32 trees left in our set: a relatively complex tree with high accuracy (i.e., with a chance of overfitting) and a relatively simple tree with lower accuracy (i.e., with a chance of underfitting). The relatively complex tree was selected by picking the tree with the highest average accuracy in correctly classifying the dropouts and the persisters among the 32 trees left in our dataset. The simple tree was selected by first taking a subsample of only the most simply structured trees – containing only two variables and with a maximum depth of two. This set contained 11 simple trees and from these we selected the tree with the highest accuracy in correctly classifying the empirical data. By showing both decision trees we gain insight into the relative importance of each of the predictor variables.

RESULTS

1) Cluster Analysis of Individual Trajectories

The descriptive statistics of the two clusters solution are presented in Table 1, these numbers are illustrated in the individual time serial trajectories of commitment and exploration in Figure 1. The individual trajectories in the first cluster ($N = 64$, see Table 2 for an overview of frequencies) are characterized by certainty. The commitment trajectories of individuals in this first cluster tend to show high levels ($M = 5.4$, $SD = 0.5$), a leveled linear slope over time ($M = 0.00$, $SD = 0.02$), little variability in the level of commitment ($M = 0.3$, $SD = 0.2$) and a slightly declining linear slope of this variability ($M = -0.01$, $SD = 0.02$). The exploration trajectories in this first cluster tend

Table 1 Summary statistics of each of the trajectory variables separately for each cluster. The two clusters have been compared on each trajectory variable using a t-test. The p-value of this t-test is reported below the corresponding trajectory variable on the bottom row.

Cluster	Commitment				Exploration			
	Level	Slope of Level	Variability	Slope of Variability	Level	Slope of Level	Variability	Slope of Variability
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
Cluster 1 'Certain'	5.4(0.5)	0.00 (0.02)	0.3 (0.2)	-0.01 (0.02)	1.7 (0.6)	-0.02 (0.05)	0.6 (0.3)	0.00 (0.02)
Cluster 2 'Doubting'	4.2 (0.9)	-0.01 (0.04)	0.6 (0.2)	-0.03 (0.04)	3.0 (0.8)	-0.02 (0.07)	1.1 (0.4)	-0.01 (0.04)
P-value of difference	< 0.001	0.009	< 0.001	0.168	< 0.001	0.473	< 0.001	0.110

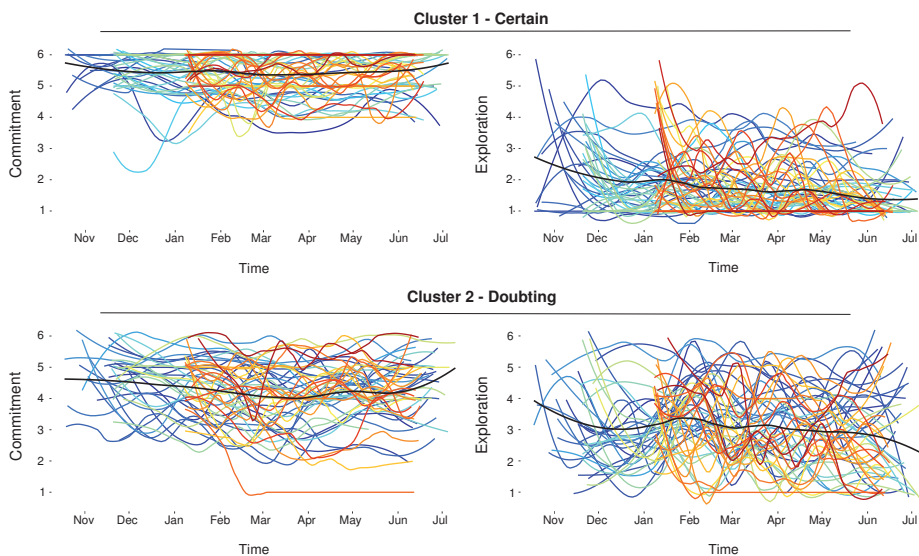


Figure 1 Illustration of the individual time-series trajectories of both commitment (left figures) and exploration (right figures) separate for cluster 1 ('certain', top figures) and cluster 2 ('doubting', bottom figures). The colored lines represent the trajectories of different individuals (these are less smoothed scores for clear illustration).

to show low levels ($M = 1.7$, $SD = 0.6$), a declining linear slope over time ($M = -0.02$, $SD = 0.05$), little variability in the level of exploration ($M = 0.6$, $SD = 0.3$) and no linear change in this this variability ($M = 0.00$, $SD = 0.02$).

The individuals in the second cluster ($N = 51$) show very different types of trajectories, characterized by frequent doubt. The commitment trajectories of individuals within this cluster tend to have relatively low levels ($M = 4.2$, $SD = 0.9$), a slightly declin-

ing linear slope over time ($M = -0.01$, $SD = 0.04$), much variability ($M = 0.6$, $SD = 0.2$), but also a linear decrease of this variability ($M = -0.03$, $SD = 0.04$). The exploration trajectories of individuals in this cluster are characterized by high levels ($M = 3.0$, $SD = 0.8$), a declining linear slope over time ($M = -0.02$, $SD = 0.07$), much variability ($M = 1.1$, $SD = 0.4$), and a slight linear decrease in this variability ($M = -0.01$, $SD = 0.04$).

Not all trajectory variables differ significantly between the clusters (see also table 1). Individuals in the two clusters show large mean differences in their level of commitment ($\Delta M = 1.2$, $p < 0.001$), their level of exploration ($\Delta M = -1.3$, $p < 0.001$), their variability in commitment ($\Delta M = -0.3$, $p < 0.001$), and their variability in exploration ($\Delta M = -0.5$, $p < 0.001$). They also show a small but significant difference in their mean slope of commitment ($\Delta M = -0.01$, $p = 0.009$). We find no significant differences between individuals in the two clusters in their slope of exploration ($\Delta M = 0.00$, $p = 0.473$), in their slope of the variability in exploration ($\Delta M = -0.01$, $p = 0.110$), nor in their slope of the variability in commitment ($\Delta M = -0.02$, $p = 0.168$).

2) Comparing Trajectories of Dropouts and Persisters

Figure 2 shows the number of students that persist ($N = 103$) versus the amount of students that drop out ($N = 12$), divided over the two clustering solutions (see also table 2). The distribution of these two groups over the two clusters is unequal: Fischer exact test demonstrates a low probability of finding a distribution such as this or more extreme ($p = 0.025$) if dropouts and persisters were equally divided over

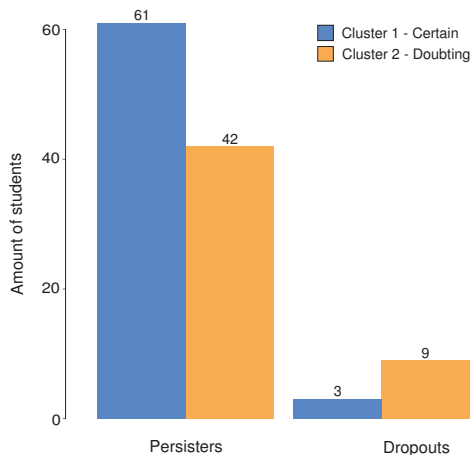


Figure 2 Distribution of individuals that persist (left two bars) and those that drop out (right two bars) over the clusters obtained from our analysis of time-serial trajectories: certain trajectory (blue) and doubting trajectory (yellow).

Table 2 Frequency table: the number of persisters and dropouts separately for each cluster, including the total number of individuals within each cluster and within each dropout category, as well as the overall total number of individuals in the study. The percentages in each category indicate the proportion of individuals relative to the total amount of individuals.

Cluster	Frequencies		
	Persisters	Dropouts	Total
	N (%)	N (%)	N (%)
Cluster 1 'Certain'	61 (53%)	3 (3%)	64 (56%)
Cluster 2 'Doubting'	42 (37%)	9 (8%)	51 (44%)
Total	103 (90%)	12 (10%)	115 (100%)

the clusters. Of the 103 students that persist, a small majority of individuals (59%) shows a trajectory characterized by certainty, while a smaller group of individuals (41%) shows a trajectory characterized by frequent doubt. This pattern is reversed for the 12 students that drop out. Most of these dropouts show a trajectory characterized by doubt (75%), while only few show a trajectory characterized by certainty (25%). Thus individuals in the doubting cluster run a higher risk of dropping out than individuals in the certain cluster. But with an overall accuracy of 61%, this prediction is far from perfect. Individuals who show commitment and exploration trajectories characterized by certainty are predicted to persist rather accurately: 95% of these individuals are correctly predicted to persist². However, individuals who show trajectories characterized certainly do not always drop out: only 18% of these individuals are correctly predicted to dropout.

3) Decision Trees

We have generated two decision trees to provide a more refined prediction of dropout. It also provides insight into the type of trajectory markers, and in the exact decision criteria, that perform best in distinguishing the dropouts from the persisting students.

Simple tree

The simplest decision tree that we have generated correctly classifies 80% (92 out of 115) of the individuals. This simple tree performs particularly well in identifying

2 But given the highly unequal distribution (90% persisters and 10% dropouts), there is already a high chance of being accurate when predicting that any given individual will persist based chance alone (i.e., 90% accuracy)

dropouts: 92% ($N = 11$) of the dropouts are correctly classified. The tree performs less well in identifying persisters: 79% ($N = 81$) of the persisters are correctly classified, thus leaving a relatively large portion of individuals (21%; $N = 22$) who are wrongly predicted to be a dropout. The tree includes only 2 predictors: the slope of commitment and the slope of exploration. This simple tree, including its predicted classes and cut-off criteria, is illustrated in Figure 3.

In this simple tree, the slope of commitment is a main predictor of dropout: 19 individuals are predicted to dropout (Figure 3, box A.) because they show a relatively strong decreasing linear trend in their commitment levels over time ($M = -0.06$; $SD = 0.02$). 37% of these individuals are accurately classified as a dropout: 7

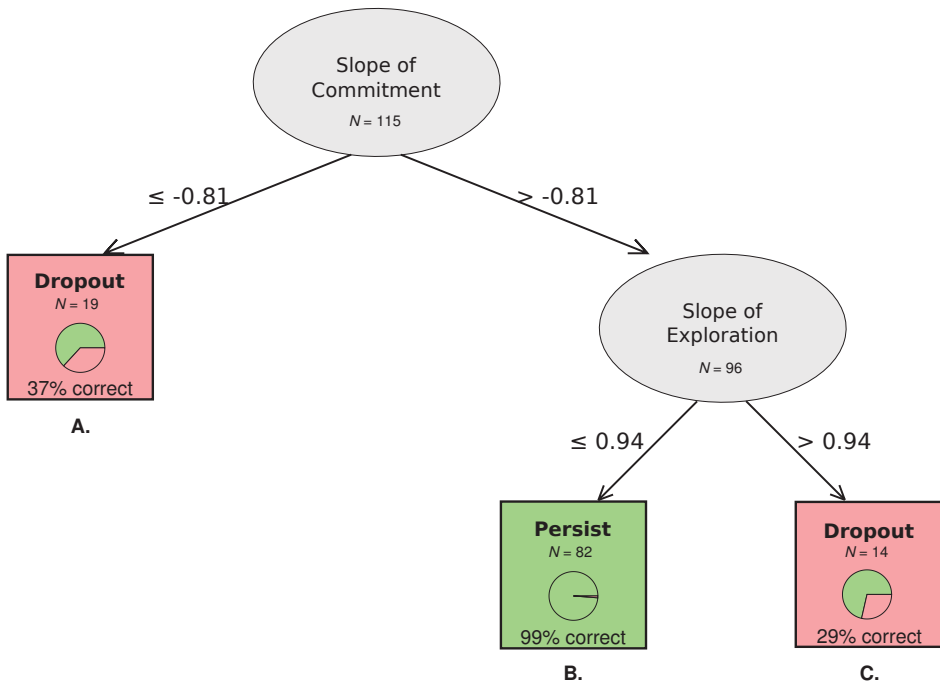


Figure 3 Simple decision tree that predicts membership of the classes 'Dropout' (boxes A. and C., in red) and 'Persist' (box B., in green). Each class contains the total amount of individuals classified in it (indicated with $N = \dots$) and the portion of correctly classified individuals. This correctly classified portion is illustrated with a miniature pie chart: the portion of the pie that corresponds to the color of the surrounding box is correctly classified, contrasting colors represent misclassification (e.g., a green pie section within a red box is the portion of persisters that are wrongly classified as dropouts). The cut-off criteria are presented next to each branch (i.e., an arrow that connects two nodes) as standardized scores – e.g., ≤ -0.81 means that an individual must score 0.81 standard deviations below the average to be classified in the class below.

of the 19 individuals who meet the criterion (standardized slope of commitment ≤ -0.81) have truly dropped out.

The slope of commitment needs to be combined with the slope of exploration to predict the large class of individuals that are likely to persist ($N = 82$, Figure 3, box B.). This class consists of individuals who tend to show a levelled or slightly increasing linear trend in their commitment scores ($M = 0.01$; $SD = 0.02$) and who also show a decreasing linear trend in their exploration scores ($M = -0.04$; $SD = 0.05$). Individuals in this class are predicted to persist with an accuracy of 99%: 81 of the 82 individuals who meet this criterion (standardized slope of commitment ≤ -0.81 and standardized slope of exploration ≤ 0.94) have truly persisted.

Finally, the combination of the slope of commitment and the slope of exploration is also needed to classify a small group of individuals as dropouts ($N = 14$, Figure 3, box C.). Similar to the persisting class, these individuals tend to show a levelled linear trend in their commitment scores over time ($M = 0.00$; $SD = 0.02$), but contrary to the persisting class they tend to show an *increasing* linear trend in their exploration levels over time ($M = 0.07$; $SD = 0.03$). 29% of the individuals in this class are correctly classified as a dropout: 4 of the 14 individuals who meet the criterion (standardized slope of commitment > -0.81 and standardized slope of exploration > 0.94) have truly dropped out.

Complex tree

The more complex tree is more accurate overall: 91% ($N = 105$) of the individuals have been classified correctly. Compared to the more simple tree described above, this more complex tree has a bit more trouble with correctly classifying dropouts: 83% ($N = 10$) of the dropouts are classified correctly (thus leaving 2 dropouts classified wrongly as a persister, compared to only 1 misclassification of this type by the simple tree). The complex tree performs markedly better in classifying persisters than the simple tree: 92% ($N = 95$) of the persisters are correctly classified (thus only a small portion of the persisters are misclassified as dropouts: 8%; $N = 8$).

The more complex tree is similar to the simple tree in two ways. First, the most important criterion for distinguishing dropouts from persisters is also in the complex tree the slope of commitment – it even predicts the exact same cut-off criteria as the simple tree does. Second, the slope of exploration also occurs as an important predictor in the complex tree as it does in the simple tree, but with slightly different cut-off criteria. The complex tree is primarily different from the simple tree because

of the addition of two new predictors: the slope of variability in commitment and the slope of variability in exploration (see also Fig. 4).

The slope of commitment is combined with the slope of variability in exploration to classify individuals as likely to persist (Figure 4, box A.). This persisting class consists of 9 individuals who tend to show a decreasing trend in their commitment levels ($M = -0.06$; $SD = 0.02$) and also tend to show a decreasing trend in the variability of their exploration ($M = -0.05$; $SD = 0.03$) – i.e., they show less or smaller ups and downs in exploration as time progresses. 89% of the individuals in this class

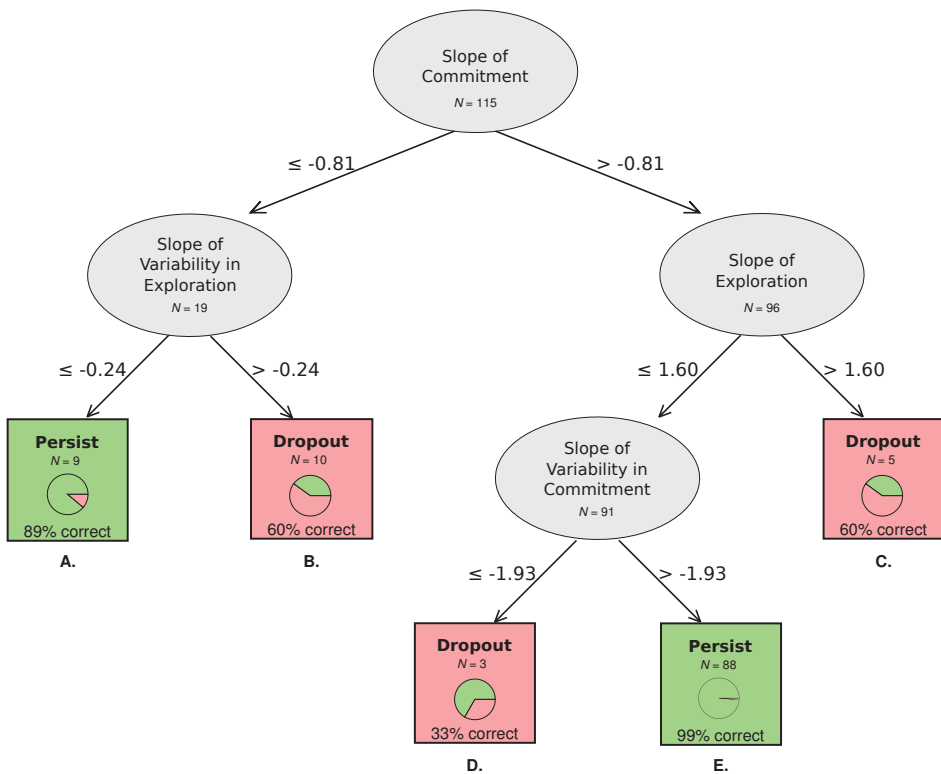


Figure 4 Complex decision tree that predicts membership of the classes ‘Dropout’ (boxes B., C., and E., in red) and ‘Persist’ (boxes A., and E., in green). Each class contains the total amount of individuals classified in it (indicated with N) and the portion of correctly classified individuals. This correctly classified portion is illustrated with a miniature pie chart: the portion of the pie that corresponds to the color of the surrounding box is correctly classified, contrasting colors represent misclassification (e.g., a green pie section within a red box is the portion of persisters that are wrongly classified as dropouts). The cut-off criteria are presented next to each branch (i.e., an arrow that connects two nodes) as standardized scores – e.g., ≤ -0.81 means that an individual must score 0.81 standard deviations below the average to be classified in the class below.

are correctly classified as persisting: 8 of the 9 individuals who meet the criterion (standardized slope of commitment ≤ -0.81 and standardized slope of the variability in exploration ≤ 0.24) have truly persisted.

These same two variables, but with different values for the slope of variability in exploration, are used to classify individuals as likely to drop out (Figure 4, box B.). This dropout class consist of 10 individuals who tend to show a decreasing trend in their commitment levels similar to the persisting class described above ($M = -0.05$; $SD = 0.02$), but contrary to this persisting class they tend to show a linear *increase* in the variability of their exploration ($M = 0.02$; $SD = 0.03$) – i.e., they show *more or stronger* ups and down in exploration as time progresses. Interesting to note is that this linear increase in fluctuations of exploration is not systematically accompanied by a linear increase in the *level* of exploration ($M = 0.00$; $SD = 0.06$). 60% of the individuals in this dropout class are correctly classified: 6 of the 10 individuals who meet the criterion (standardized slope of commitment ≤ -0.81 and standardized slope of the variability in exploration > 0.24) have truly dropped out.

Similar to the simple tree, the combination of the slope of commitment and the slope of exploration classifies a small group of individuals ($N = 5$) as dropouts (Figure 4, box C.). These individuals tend to show a levelled linear trend in their commitment scores over time ($M = 0.00$; $SD = 0.02$) and tend to show an increasing linear trend in their exploration levels over time ($M = 0.09$; $SD = 0.02$). Interesting to note is that this increase in exploration seems to be gradual – individuals in this class tend to show a levelled or decreasing amount of variability in exploration over time ($M = -0.01$; $SD = 0.01$). 60% of the individuals in this class are correctly classified as a dropout: 3 of the 5 individuals who meet the criterion (standardized slope of commitment > -0.81 and standardized slope of exploration > 1.60) have truly dropped out.

Another small dropout class ($N = 3$) is predicted by adding the slope of the variability in commitment to the slope of exploration and commitment (Figure 4, box D.). Individuals in this dropout class tend to show a slightly increasing trend in their commitment scores over time ($M = 0.02$; $SD = 0.04$), and the variability in these commitment scores decreases linearly over time ($M = -0.07$; $SD = 0.01$). There seem to be large differences in this small group in the linear trend of the exploration levels, it is levelled or slightly increasing on average ($M = 0.01$; $SD = 0.05$). 33% of the individuals in this class are correctly classified as a dropout: only 1 individual out of the 3 individuals who meet the criterion (standardized slope of commitment > -0.81 , standardized slope of exploration ≤ 1.60 , standardized slope of the variability

in commitment ≤ -1.93) has truly dropped out, thus calling into question the usefulness of this criterion.

Finally, a large class of persisters ($N = 88$) is predicted based on the same three variables as the small dropout class described above – the slope of exploration, the slope of commitment and the slope of the variability in commitment – but with different values for the slope of the variability in commitment (Figure 3, box E.). This persisting class consists of individuals who tend to show a levelled linear trend in their commitment scores ($M = 0.00$; $SD = 0.02$), the variability in these commitment scores tends to stay levelled or decreases slightly over time ($M = -0.01$; $SD = 0.02$), and their exploration scores tend to decrease ($M = -0.03$; $SD = 0.05$). Individuals in this class are predicted to persist with an accuracy of 99%: 87 of the 88 individuals who meet the criterion (standardized slope of commitment > -0.81 , standardized slope of exploration ≤ 1.60 , standardized slope of the variability in commitment > -1.93) have truly persisted.

DISCUSSION

Main Findings

The cluster analysis shows us that individuals can be distinguished from one another based on their time-serial trajectories of exploration and commitment. Five features of the individual trajectories seem to distinguish the individuals the best: the level and variability of both commitment and exploration, and to a lesser extent also the linear change in commitment over time – these features differ significantly between the two clusters. The three other trajectory markers that we included in our analysis do not distinguish well between the two clusters of individuals (the slope of exploration, and the slope of variability in exploration and the slope of variability in commitment do not differ significantly between the two clusters). In general, the difference between the individuals in the two clusters can be characterized by certainty in the one cluster, and doubt in the other. Individuals in the cluster characterized by certainty tend to show a stable, high level of commitment that shows no particular increasing or decreasing trend over time, and a low level of exploration that does not fluctuate much. Individuals in the cluster characterized by doubt tend to show a highly fluctuating, low level of commitment that decreases slightly over time and a high level of exploration that fluctuates much.

The two types of trajectories are related to the chance that students drop out of higher education: students who persist in their chosen educational trajectory more often show a trajectory characterized by certainty, while students who drop out more often show a trajectory characterized by doubt. When viewed from a different angle – an angle perhaps more useful to universities – individuals who show trajectories characterized by certainty are rather reliably predicted to persist in their studies. However, individuals who show trajectories characterized by doubt do not necessarily dropout - the large majority of students who show such a doubting trajectory do not dropout. Thus having a doubting trajectory seems to be a necessary, but not a sufficient condition for dropout.

We have refined this dropout prediction by generating two decision trees. The simplest of these two trees generates a straightforward prediction of two types of individuals who are likely to dropout: individuals who show a decreasing trend in their level of commitment over time, and individuals for whom this trend in commitment is leveled but who do show an increase in their level of exploration. Contrastingly, individuals who are likely to persist tend to show a decreasing trend in their level of exploration, and a slight increasing trend in their level of commitment. These criteria predict dropout rather well, but are still quite likely to also falsely classify students who persist as dropouts. The second, more complex decision tree that we have generated performs better in this regard than the simple tree and is more accurate overall, with the downside of having more complex decision criteria. The complex decision criteria are particularly useful to better classify individuals who show a decreasing trend in their commitment. While the simple tree predicts that all these individuals will dropout, the more complex tree predicts that whether this is true depends on changes in the variability of exploration: individuals with a decreasing commitment are only likely to drop out if their amount of exploration starts to vary more over time (i.e., exploration shows more or stronger ups and downs), but if this is not the case then they are likely to persist. The complex tree adds another prediction: individuals with a leveled or increasing trend in both commitment and exploration may drop out if their level of commitment stabilizes over time. This prediction only accurately identified one dropout, so the general usefulness of this criterion is questionable.

Types of Micro-level Educational Commitment and Exploration Processes

It indeed seems useful to monitor the level of educational commitment and exploration regularly in order to identify students at risk for dropout. Tinto's model (1975, 2012) of student attrition suggests that commitment is a proximal factor in student attrition, and that these dynamics of commitment are part of a larger process - experiences within and outside the educational setting may shape educational commitment, and this commitment may in turn affect academic and social experiences. Our study verifies that such commitment dynamics seem to exist on a micro-level and adds that exploration may also be an important part of this process, as has also been shown to be the case in studies that are focused on identity development (Crocetti et al., 2008; Klimstra et al., 2010; Luyckx et al., 2006). Indeed, we have found that micro-level dynamics in educational commitment and exploration on a week-to-week basis is common, but also that students differ in the type of dynamics they tend to show.

As is reflected in the results of our cluster analysis, both the level of and fluctuations in exploration and commitment play an important role in characterizing individual trajectories. Having a high level of commitment and a low level of exploration seems to be a comfortable, steady state for an individual. In this state, both exploration and commitment do not fluctuate much, meaning that the individual is most of the time fairly certain of her educational choice, and she experiences few periods of only mild doubt. The other state an individual may be in is much more volatile. When commitment is low, it is not stably low – it fluctuates. This fluctuation means the individual experiences frequent periods of little certainty in her educational choice, alternated with periods of relative certainty. This unstable state of commitment is accompanied by a generally elevated level of exploration, which also fluctuates much. This means that the individual experiences frequent periods of intense exploration, actively doubting and reconsidering the fit of her chosen educational trajectory, alternated with more quiet periods.

This co-occurrence of fluctuations with different levels of exploration and commitment is an interesting addition to the identity literature. In this field, fluctuations are not commonly included in typologies of individual differences in commitment and exploration: these typologies are commonly based on the level of exploration and commitment (e.g., Meeus, van de Schoot, Keijsers, Schwartz, & Branje, 2010), sometimes also including the general change trend (e.g., Luyckx, Schwartz, Goossens, Soenens, & Beyers, 2008). However, our results suggest that these levels of

commitment and exploration are intertwined with their stability: high levels of commitment tend to be stable while low levels of commitment tend to fluctuate much. Conversely, high levels of exploration tend to fluctuate much while low levels of exploration tend to be stable. Thus identity classes may not only be characterized by the levels of exploration and commitment, but also by the stability in these levels. Inclusion of these characteristics may lead to the distinction of new or other identity classes, and a new perspective on how identity develops. Thus an important step in future research on identity development is to investigate not only general individual tendencies of the level of exploration and commitment and gradual changes in these levels, but also stability characteristics.

Predicting Dropout with Trajectories of Exploration and Commitment

We have shown that it is indeed useful to investigate trajectories of exploration and commitment for the early identification of individuals at risk for dropout and that many different types of information on individual trajectories can be used for the prediction of dropout. The accuracy of the predictions depends on which of the features of the trajectory is used for the prediction. Overall, it is interesting to note that the best predictions of dropout (generated by the decision trees) make little use of the features of trajectories that come forward as the most different between individuals (generated by the cluster analysis). The trajectory features that differentiate well between individuals are the level of exploration and commitment, and the amount of variability in this level: these features differ the most between the two types of individual trajectories that we have characterized as doubting and certain. These groups of students are perhaps also relatively easy to distinguish for teachers and mentors at universities: the students' trajectories seem to be markedly different in ways that make intuitive sense. These categories also do a moderately good job at distinguishing dropouts from persisters – they work particularly well for identifying students that will persist and they filter out the large majority of dropouts, but they also tend to falsely flag many individuals as a risk for dropout while they will actually persist in their studies.

Subtler trajectory characteristics perform better at predicting dropout, but they are perhaps less visible – and may be harder to detect for teachers or mentors at universities – as they pertain to gradual change trends that cover long periods of time. All three of the best predictors of dropout that we have discovered in this study pertain to such change trends: a decreasing trend in the level of commitment, an increasing trend in the level of exploration and an increasing trend in the amount

of fluctuations in exploration. These general trends are quite difficult to identify among the many fluctuations that are also present in many individual trajectories. Such general trends can only be separated from the fluctuations within individuals (that are also abundantly present in a large group of individuals in our study) when individuals are followed with a high frequency over a long period of time.

That we find fluctuations to be a distinguishing feature of trajectories with an elevated risk for dropout makes sense from a general system science perspective (Scheffer et al., 2012; Van Dijk et al., 2015). From this perspective, we inferred that fluctuations may be a precursor of a qualitative change in a system – in our case this qualitative change is dropout. However, it is not true that all individuals showing a trajectory characterized by fluctuations (the ‘doubting’ types) also drop out of higher education: many persisters also show this type of trajectory. Thus for some individuals, having such fluctuations is apparently not a problem, at least not to such an extent that they drop out of higher education – perhaps to some individuals, frequent doubting is a common and stable state.

We also found that more frequent or more intense periods of exploration over time is an important predictor of dropout. This makes sense from a systems perspective: an increase in fluctuations in a system may precede a transition to a qualitatively different state (Van Dijk et al., 2015). Curiously, we find the opposite result for commitment: an increase in stability in commitment is identified as a predictor of dropout. However, this criterion has only accurately classified one individual as a dropout and misclassified two persisters as a dropout, thus it is highly questionable whether this criterion is truly useful to identify dropouts or if the one individual for whom this criterion worked well is somehow exceptional. Perhaps some external event or circumstance forced this individual to quit. But then again, it could also be an indicator of a more serious dilemma in using commitment as a predictor of dropout: perhaps the dropout event itself – as in, the actual unregistering from the educational trajectory - is not the transition to a qualitatively different state that we should be looking at. It may very well be that an individual has made up her mind long before she formally unregisters and that this is what we see when her level of commitment stabilizes, which points to the need to carefully consider how transitions should be defined.

Recommendations for Practice

Overall, our study shows that in order to identify university dropouts in an early stage, it is useful to look at individual trajectories of educational exploration and

commitment over time. We have shown that this can be done with obvious and easily observable criteria, such as characterizing individuals as certain or doubting. In our study – among psychology students – we find that students have a high chance of persisting in their studies if they are fairly certain of their educational choice most of the time and if they experience only few periods of mild doubt. Contrastingly, we find that students have an elevated chance of dropping out if they frequently doubt whether the educational trajectory is truly fitting and generally experience little certainty in their educational choice. This classification as ‘certain’ or ‘doubting’ will filter out many persisters and most of the dropouts, but has the disadvantage that it tends to falsely classify many doubters: the majority of doubters will actually persist in their studies. Thus using these classes as predictors has the upside that they can be identified relatively easily in practice – e.g., by taking a only a few measures among students or even by qualitative estimations of a teacher or mentor – but has the downside that many will be falsely identified as dropout-risk. This may lead to many resources being spent unnecessarily on the supervision of students who are not truly at risk of dropping out.

We have found that better predictions can be obtained by focusing the analysis of individual trajectories on more sophisticated features that require more frequent measurement in order to be estimated correctly. In our study, very useful predictors of dropout are a general decreasing trend of commitment and an increasing trend of exploration. We obtained an even more refined prediction by adding increases of fluctuation in exploration as a predictor: an increase in ups and down of exploration seems to distinguish the dropouts from the persisters among the group of individuals who all show a decreasing trend in their commitment. Using these predictors has the upside that it will lead to better predictions, but has the downside that the predictors require frequent measurement over a long period of time in order to be estimated correctly.

Thus it seems that universities need to balance their need to identify possible dropouts early with practical constraints on obtaining the detailed trajectory information that is needed to make the most accurate predictions. The choice seems to come down to this: better predictions cost more resources in measuring the trajectories, but will probably cost less resources in student guidance – as the predictions will be more accurate in identifying the students that will dropout, guidance can be deployed more efficiently. In order to use the best and most sophisticated predictors, a university needs to have a system in place that allows for refined and frequent measurement of exploration and commitment. In this is not feasible,

relatively simple measures already go a long way in identifying risk groups – i.e., the level of exploration and commitment, and the amount of fluctuations in these levels – with the downside that a rather large group of students are likely to be flagged to be at risk.

Generally, there are at least two advantages for universities when they monitor processes of exploration and commitment to try and identify individuals at risk for dropout in an early stage. First, such processes have the potential to be influenced by universities in a direct way, with relatively little cost. This contrasts other measures of early identification of possible dropouts, such as psychosocial characteristics of the students like self-esteem (Robbins et al., 2004). Such characteristics may be much harder to change for a university, requiring much more investment and expertise on the part of the teachers that is also perhaps not part of the core business of a university. Other important predictors of dropout such as academic performance (Westrick et al., 2015) are probably already monitored and heavily invested in, leaving little to be gained by investing more. This brings us to the second advantage: influencing these processes of exploration and commitment may have high gains with relatively little costs.

One can imagine relatively simple interventions that support students in their explorations and commitments. Universities can for example organize talks in mentoring groups about how students feel about their studies thus allowing doubting students to feel validated and reassured in their doubts. Or universities can for example implement structured exploration as part of assignments, allowing the students to come more quickly to an answer to the question of whether the educational trajectory truly fits them. Indeed, if universities try to help doubting students to find the answers they are looking for they may facilitate some students to pursue their studies with more confidence, while they may facilitate other students to decide in an early stage that this is not the right path for them.

Limitations

An important limitation of this study is the small and specific sample of first year students – most are female, all are from a particular University in the Netherlands, and they have all chosen psychology as the topic of their bachelor studies. Of course, the results need to be replicated in other contexts, and among a more diverse population, before we can infer the generalizability of our results. The small sample with few dropouts makes the predictions we make specific to the dropouts and persists that happen to be included in our study. This means that it is highly pos-

sible that some idiosyncrasies may be at the heart of some of the predictive criteria. Our predictions are thus very much in need of replication among other populations, because student populations can be very different depending on the major they have chosen (Slijper, 2017). Our results are thus best viewed as hypotheses that need further testing. Nevertheless, our study provides insight into which variables seem promising for detecting dropout early, and provides some innovative ways to do this, which we have demonstrated to indeed be useful in predicting dropout.

We have only few dropouts in our sample compared to European statistics (Quinn, 2013). This may be due to the specific sample and the timing of our study may also play a role. To get valid trajectory measures we have included individuals who completed at least 80% of the measurements in our study. This means that they were in this study until roughly the end of the academic year, and students that have dropped out earlier in the year were not included. Expanding the sample by replicating the study might help to catch more of these dropouts. Another solution is to start measuring earlier in the academic year, so that valid trajectory measures can still be obtained, while also including dropouts that quit earlier in the year. This also means that our predictive trajectory measures can only be used to detect dropout among individuals that persist in their educational trajectory for at least a couple of months. Students that dropout in the first couple of days or weeks can probably not be detected with this method.

Another important limitation concerns the cluster analysis. Clustering techniques are sensitive to the particular technique used and choices made. If we would have used other clustering techniques or chosen another amount of clusters to classify the individuals in, we might have arrived at a different clustering solution. Moreover, other studies of trajectories of exploration and commitment (e.g., Luyckx et al., 2008; Meeus et al., 2010) included several types of exploration and commitment, while we have limited ourselves to one type of commitment and one type of exploration in our cluster analysis. If more types of exploration and commitment are included, perhaps trajectories can be characterized differently. Thus the two cluster solution presented here should not be interpreted as the only or most accurate reflection of reality. It is best seen as a useful way to categorize reality, as it allowed us to gain insight in the types of trajectories of commitment and exploration that may be related to dropout.

Lastly, we have not cross validated the decision trees. For more generalizable predictions the best procedure is to train the tree on a small subset of data and train it on another. We felt our set was too small for this procedure and have used all data

to train the tree while taking other measures to prevent over fitting, such as pruning the tree and selecting simple trees (see also the method section).

Conclusion

Studying individual micro-level processes of educational commitment and exploration seems to be offer useful information to identify individuals at risk for dropout in an early stage, at least in this study with a quite specific sample of first year university students majoring in psychology. As we have shown, highly accurate early identification using processes of exploration and commitment is possible, but whether this is practically feasible depends on the availability of facilities to frequently measure exploration and commitment over a long period of time. If this is not present, perhaps early identification using simpler typologies as we have also presented is the more feasible option which is also rather effective in detecting dropout, but bears the cost of also identifying many false positives. By showing these ways to identify at risk students early, and suggesting a few avenues through which processes of exploration and commitment can be guided, we hope to have inspired researchers and universities to try a new, more individual and process-oriented way to detect and tackle dropout.

REFERENCES

- Allen, J., & Robbins, S. (2010). Effects of interest–major congruence, motivation, and academic performance on timely degree attainment. *Journal of Counseling Psychology, 57*, 23–35. <https://doi.org/10.1037/a0017267>
- Bosma, H. A., & Kunnen, E. S. (2001). Determinants and Mechanisms in Ego Identity Development: A Review and Synthesis. *Developmental Review, 21*, 39–66. <https://doi.org/10.1006/drev.2000.0514>
- Chawla, N. V., Bowyer, K. W., Hall, L. O., & Kegelmeyer, W. P. (2002). SMOTE: synthetic minority over-sampling technique. *Journal of Artificial Intelligence Research, 16*, 321–357.
- Coles, B., Godfrey, C., Keung, A., Parrott, S., & Bradshaw, J. (2010). *Estimating the Life-time Cost of NEET: 16–18 Year Olds Not in Education, Employment or Training*. University of York. Accessed 29 November, 2016. http://www.york.ac.uk/media/spsw/documents/research-and-publications/NEET_Final_Report_July_2010_York.pdf
- Crocetti, E., Rubini, M., & Meeus, W. (2008). Capturing the dynamics of identity formation in various ethnic groups: Development and validation of a three-dimensional model. *Journal of Adolescence, 31*, 207–222. <https://doi.org/10.1016/j.adolescence.2007.09.002>
- Elffers, L., Oort, F. J., & Karsten, S. (2012). Making the connection: The role of social and academic school experiences in students' emotional engagement with school in post-secondary vocational education. *Learning and Individual Differences, 22*, 242–250. <https://doi.org/10.1016/j.lindif.2011.08.005>
- Erikson, E. H. (1956). The Problem of Ego Identity. *Journal of the American Psychoanalytic Association, 4*, 56–121. <https://doi.org/10.1177/000306515600400104>
- European Training Foundation (2014). *Young people not in employment, education or training in the EU neighbourhood countries*. Turin, Italy: European Training foundation.
- Fisher, R. A. (1922). On the Interpretation of χ^2 from Contingency Tables, and the Calculation of P. *Journal of the Royal Statistical Society, 85*, 87–94. <https://doi.org/10.2307/2340521>
- Henry, D. B., Tolan, P. H., & Gorman-Smith, D. (2005). Cluster Analysis in Family Psychology Research. *Journal of Family Psychology, 19*, 121–132. <https://doi.org/10.1037/0893-3200.19.1.121>
- Jury, M., Smeding, A., & Darnon, C. (2015). First-generation students' underperformance at university: The impact of the function of selection. *Frontiers In Psychology, 6*.
- Kaufman, L., & Rousseeuw, P. (1987). Clustering by means of medoids. *Statistical Data Analysis Based on the L1-Norm and Related Methods*, North–Holland.
- Klimstra, T. A., Luyckx, K., Hale, W. A., Frijns, T., van Lier, P. A. C., & Meeus, W. H. J. (2010). Short-term fluctuations in identity: Introducing a micro-level approach to identity formation. *Journal of Personality and Social Psychology, 99*, 191–202. <https://doi.org/10.1037/a0019584>
- Kunnen, E. S. (2012). *A dynamic systems approach to adolescent development. A Dynamic Systems Approach to Adolescent Development*. London: Psychology Press.
- Lichtwarck-Aschoff, A., Hasselman, F., Cox, R., Pepler, D., & Granic, I. (2012). A characteristic destabilization profile in parent-child interactions associated with treatment efficacy for aggressive children. *Nonlinear Dynamics-Psychology and Life Sciences, 16*, 353.
- Lloyd, S. (1982). Least squares quantization in PCM. *IEEE Transactions on Information Theory, 28*(2), 129–137. <https://doi.org/10.1109/TIT.1982.1056489>
- Luyckx, K., Goossens, L., & Soenens, B. (2006). A developmental contextual perspective on identity construction in emerging adulthood: Change dynamics in commitment formation and commitment evaluation. *Developmental Psychology, 42*, 366–380. <https://doi.org/10.1037/0012-1649.42.2.366>

- Luyckx, K., Goossens, L., Soenens, B., & Beyers, W. (2006). Unpacking commitment and exploration: Preliminary validation of an integrative model of late adolescent identity formation. *Journal of Adolescence*, 29, 361–378. <https://doi.org/10.1016/j.adolescence.2005.03.008>
- Luyckx, K., Schwartz, S. J., Goossens, L., Soenens, B., & Beyers, W. (2008). Developmental typologies of identity formation and adjustment in female emerging adults: A latent class growth analysis approach. *Journal of Research on Adolescence*, 18, 595–619.
- Maechler, M., Rousseeuw, P., Struyf, A., Hubert, M., Hornik, K. (2016). cluster: Cluster Analysis Basics and Extensions. R package version 2.0.5.
- Marcia, J. E. (1966). Development and validation of ego-identity status. *Journal of Personality and Social Psychology*, 3(5), 551.
- Meeus, W., van de Schoot, R., Keijsers, L., Schwartz, S. J., & Branje, S. (2010). On the progression and stability of adolescent identity formation: A five-wave longitudinal study in early-to-middle and middle-to-late adolescence. *Child Development*, 81, 1565–1581. <https://doi.org/10.1111/j.1467-8624.2010.01492.x>
- Metzner, B. S., Lauer, J. B., & Rajecki, D. W. (2003). Predicting persistence among psychology majors at an urban university. *North American Journal of Psychology*, 5, 55–60.
- Milligan, G.W. (1996) Clustering validation: results and implications for applied analysis. In Arabie, P., Hubert, L.J., & De Soetie, G. (Eds.), *Clustering and classification*. New Jersey: World Scientific Publishing.
- Milligan, G. W., & Cooper, M. C. (1988). A study of standardization of variables in cluster analysis. *Journal of Classification*, 5, 181–204.
- Neuville, S., Frenay, M., Schmitz, J., Boudrenghien, G., Noël, B., & Wertz, V. (2007). Tinto's theoretical perspective and expectancy-value paradigm: A confrontation to explain freshmen's academic achievement. *Psychologica Belgica*, 47, 31–50. <https://doi.org/10.5334/pb-47-1-31>
- Niessen, A. S. M., Meijer, R. R., & Tendeiro, J. N. (2017). Measuring non-cognitive predictors in high-stakes contexts: The effect of self-presentation on self-report instruments used in admission to higher education. *Personality and Individual Differences*, 106, 183–189. <https://doi.org/10.1016/j.paid.2016.11.014>
- Quinlan, J. R. (1993). *C4.5: Programs for Machine Learning*. Morgan Kaufmann Publishers.
- Quinn, J. (2013). Drop-out and completion in Higher Education in Europe. *European Union*. Retrieved from http://www.fh-dortmund.de/de/hs/qdl/Kooperation_auf_EU-Ebene.pdf
- R Core Team (2016). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <https://www.R-project.org/>.
- Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic performance: A systematic review and meta-analysis. *Psychological Bulletin*, 138, 353–387. <https://doi.org/10.1037/a0026838>
- Robbins, S. B., Lauver, K., Le, H., Davis, D., Langley, R., & Carlstrom, A. (2004). Do Psychosocial and Study Skill Factors Predict College Outcomes? A Meta-Analysis. *Psychological Bulletin*, 130, 261–288. <https://doi.org/10.1037/0033-2909.130.2.261>
- Scheffer, M., Carpenter, S. R., Lenton, T. M., Bascompte, J., Brock, W., Dakos, V., ... Vandermeer, J. (2012). Anticipating Critical Transitions. *Science*, 338, 344–348. <https://doi.org/10.1126/science.1225244>
- Slijper, J. (2017). *En wat kan ik dan later worden?: Een onderzoek naar het studiekeuzeproces van juridische hbo-studenten*. Rijksuniversiteit Groningen.
- Stoessel, K., Ihme, T. A., Barbarino, M., Fisseler, B., & Stürmer, S. (2015). Sociodemographic diversity and distance education: Who drops out from academic programs and why?. *Research In Higher Education*, 56, 228–246. doi:10.1007/s11162-014-9343-x

- Strom, S. (1985, October). The effect of academic and social integration, goal and institutional commitment and precollege characteristics upon voluntary freshman persistence at the University of Missouri-Columbia. *Dissertation Abstracts International*, 46, 909
- Tibshirani, R., Walther, G., & Hastie, T. (2001). Estimating the number of clusters in a data set via the gap statistic. *Journal of the Royal Statistical Society: Series B (Statistical Methodology)*, 63, 411–423. <https://doi.org/10.1111/1467-9868.00293>
- Tinto, V. (1975). Dropouts from higher education: A theoretical synthesis of recent research. *Review of Educational Research*, 45, 89-125.
- Tinto, V. (2012). *Completing College, Rethinking Institutional Action*. Chicago: The University of Chicago Press.
- Veas, A., Gilar, R., Miñano, P., & Castejón, J.-L. (2016). Estimation of the Proportion of Underachieving Students in Compulsory Secondary Education in Spain: An Application of the Rasch Model. *Frontiers in Psychology*, 7. <https://doi.org/10.3389/fpsyg.2016.00303>
- Van der Gaag, M. A. E., de Ruiter, N. M. P., & Kunnen, E. S. (2016). Micro-level processes of identity development: Intra-individual relations between commitment and exploration. *Journal of Adolescence*, 47, 38–47. <https://doi.org/10.1016/j.adolescence.2015.11.007>
- Van Dijk, M., van Geert, P. (2015). The nature and meaning of intraindividual variability in development in the early life span. In M. Diehl, K. Hooker, & M.J. Sliwinski (Ed.), *Handbook of Intraindividual Variability across the Life Span*, (pp 37–58). New York, NY: Routledge/Taylor & Francis.
- Westrick, P. A., Le, H., Robbins, S. B., Radunzel, J. M. R., & Schmidt, F. L. (2015). College performance and retention: A meta-analysis of the predictive validities of ACT® scores, high school grades, and SES. *Educational Assessment*, 20, 23–45. <https://doi.org/10.1080/10627197.2015.997614>
- Wintre, M. G., Bowers, C., Gordner, N., & Lange, L. (2006). Re-Evaluating the University Attrition Statistic: A Longitudinal Follow-Up Study. *Journal Of Adolescent Research*, 21, 111-132. doi: 10.1177/0743558405285658

**Micro-level processes of
identity development: intra-
individual relations between
commitment and exploration**

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ABSTRACT

We investigate intra-individual processes of identity at the micro level. With an intensive longitudinal design in the general context of higher education, we explore associations between changes in pivotal identity concepts: commitment and exploration and elaborate on how we conceptualize these concepts on a micro level. With our within-individual empirical approach, we revealed a large amount of variation between individuals with respect to the associations between exploration and commitment processes. At the same time, similarities were found amongst individuals, which help extend and clarify existing findings regarding identity development. Our findings highlight the necessity to, firstly, distinguish between micro- and macro-level identity processes. Secondly, and in the same vein, our findings emphasize the heterogeneous nature of micro-level identity processes, and the necessity to use a within individual approach to study these processes.

INTRODUCTION

Since Erikson formulated his theory on adolescent identity development in 1968, many perspectives have been taken on what identity actually is, and how it develops over time. Because of the difficulty in translating such a complex, abstract construct as identity into something that can be measured in many ways, questions on what identity is and how it develops are still relevant. This is true even after more than half a century of both qualitative and quantitative identity research (e.g. Syed & McLean, 2015). In this article, we aim to further understanding and stimulate discussion on *micro-level* processes (which contrast macro-level processes) of identity development (Lichtwarck-Aschoff, Van Geert, Bosma & Kunnen, 2008). Building on the work of Klimstra et al. (2010) we elaborate the conceptualization and operationalization of identity on a micro-level, specifically in the domain of education/career choice. In our empirical study we explore associations between micro-level change processes of exploration and commitment within individuals.

Macro and micro approaches to identity processes

There is both a lot and little known about identity development, depending on the feature of identity that is the focus. A lot is known about what Lichtwarck-Aschoff et al. (2008) termed the 'macro-level' feature of identity development. This feature of identity is a relatively stable characteristic of identity that can be measured by reflection by research participants (e.g. interviews). For example, identity-status approaches based on the work of Marcia (1966) capture macro-level features (Lichtwarck-Aschoff et al., 2008). Marcia (1966) conceptualized identity development as consisting of two main processes: exploring different identity options, and committing to a particular identity alternative. This conceptualization of identity as commitment and exploration has inspired a lot of research and can be considered a main stream in identity research (see for example Meeus, 2011).

In contrast to macro-level features of identity, little is known about – what Lichtwarck-Aschoff et al. (2008) referred to as – the 'micro-level' feature of identity. This is the real-time expression of identity within everyday contexts in which people act and experience, where in depth reflection is much less common. This feature of identity is thus the fleeting and variable characteristic of identity, which is context dependent and can change over minutes, hours or days, and can be captured by repeated measures studies (e.g. observations, diaries). A number of identity process theorists emphasize the importance of micro-level processes of identity (e.g. Grotevant, 1987; Kerpelman,

Pittman & Lamke, 1997; Bosma & Kunnen, 2001; Korobov, 2015). The general assumption in these theories is that identity development on the macro-level is rooted in repeated interactions between person and context, in the here and now. Gaining an understanding of how identity emerges from these here-and-now interactions may be the key to developing more complete theory on identity. Furthermore, knowledge regarding micro-level processes of identity can be informative for identity interventions, which make use of micro level behavior and cognitions. Schwartz, Kurtines and Montgomery (2005) for example, devised two types of identity interventions that can both be conceptualized as micro-level interventions that are translated from macro-level concepts, specifically, 'goal strivings' and 'life choices'. For example, with regards to 'goal strivings', "going to law school was broken down to reading, studying, and memorizing" (Schwartz et al., 2005, p. 319). The participant's experiences of the activities were then linked to the emotions that they experienced, such as stressed or fearful. These micro-level experiences were then incorporated back into the participants' personal goal strivings. In their intervention, the micro-level experiences can thus be seen as vital for bringing about change on a macro level.

Although the importance of micro level identity processes has been emphasized, and theories on micro-level identity processes have become increasingly refined over the last two decades, empirical studies to support these theories are lacking. A notable exception is a study by Klimstra et al. (2010). These authors found indications that a particular form of micro-level identity processes indeed seems to operate on a day-to-day micro-level timescale. They consider commitment and reconsideration important aspects of the *identity synthesis versus role confusion* dynamic originally described by Erikson (1950) and derive their measures more specifically from the identity formation model of Crocetti, Rubini and Meeus (2008). Using one item, they measured commitment and reconsideration each day over the course of five days, and repeated this three times. Among their group of university students, they found small negative associations between day-to-day changes in commitment and reconsideration in the educational and interpersonal domain.

Expanding empirical research on micro-level identity processes.

Given that micro-level processes of identity are theorized to be fundamental to identity development, it is important that we expand this line of research. A first step in the understanding of micro-level identity processes, is gaining insight in the way in which different variables are related to each other, within individuals. A within-individual approach is necessary, as group-level associations (as presented

by Klimstra et al., 2010) are only applicable to within-individual processes if the ergodicity assumption holds (Molenaar & Campbell, 2009). This is only the case when (1) the association between components, like commitment and reconsideration, is the same for all subjects (*homogeneity*) and (2) these associations stay the same over time (*stationarity*). For the ergodicity assumption to be valid, both of these two conditions need to be met. Violation of one of the conditions for ergodicity can have large consequences for what can be said about individual processes. For example, it may be true that, on average, individuals who have a high score on reconsideration are likely to have a low score on commitment in the next time step (a *group-level* relation shown by Klimstra et al., 2010). However, this does not mean that if an individual reconsiders more, this person's commitment will subsequently become lower (an *individual-level* relation). This means that the micro-level relations found between reconsideration and commitment may only be true for a part of the individuals, and it is indeed theoretically even possible, that it is not true for any individual. It is therefore vital that we conduct our empirical analysis within individuals, as opposed to calculating group-level associations.

The present study

In this study we explore how micro-level changes in exploration can be related to micro-level changes in commitment, within individuals, in order to get a better understanding of the developmental process. This way, the ergodicity problem is taken into account while also gaining insight into possible individual differences in how concepts of exploration and commitment are related on the micro level. We use an intensive longitudinal design with weekly measurements spanning several months. We focus on one particular domain that is highly salient for adolescents; the domain of education/career choice (Bosma, 1985; Marcia, 1993; see also Goossens, 2001). In some European countries, for example in the Netherlands, students have to choose a specific topic (for example, international business, law, psychology etc.) to study for four years when entering university, a choice between more than a thousand relatively narrowly defined subjects. Especially in the first year of higher education, many students feel that they made a 'wrong' choice and quit their studies (ResearchNed, 2009), yet we know little about how educational commitments develop in this time, and how exploration plays a role in this.

Assessing identity at the micro level poses specific demands on the measurement instrument. Main requirements of such an instrument are that it should be short, minimize the amount and level of reflection needed, and that it captures

concepts that are relevant on a micro level. We have designed a measurement instrument specifically tailored to these purposes: the Repeated Exploration and Commitment Scale in the domain of Education (RECS-E). In the next section, we discuss the theoretical reasoning behind our instrument, and elaborate on how we conceptualize exploration and commitment on a micro level.

Micro-level identity measures

Our micro level measurements are similar to the measures used by Klimstra et al. (2010) in that they are tailored to the time-scale on which the concepts are measured (in this case, weekly) and one item is used to measure each of the concepts. Klimstra et al. (2010) argued that their measures of commitment and reconsideration are central to the certainty-uncertainty dynamic that lies at the heart of Erikson's (1950) original identity versus role-confusion conceptualization. However, it may be that other types of exploration and commitment also play a central role in identity processes on a micro level.

In their dual cycle model of identity development, Luyckx, Goossens, Soenens and Beyers (2006) suggest a distinction between two types of exploration and two types of commitment. In their model, a *commitment-formation* cycle is assumed, similar to Marcia's model: commitments are made based on a process of broad exploration of different alternatives. The authors extend Marcia's model by also formulating a *commitment-evaluation* cycle. In this cycle, individuals determine whether they identify with the commitment that they've made, based on in-depth exploration of the 'fit' between the person and the commitment. With the RECS-E we aim to measure the specific micro-level processes (of commitment and exploration) underlying the commitment-formation cycle and commitment-evaluation cycle described above. In addition to tailoring the Luyckx et al. commitment and exploration concepts to a micro-level, we include an additional exploration construct that has been found particularly important in the career development literature: exploration of the self (Germeijs & Verschueren, 2006). In order to avoid adding confusion to the growing "Identity Tower of Babel" (Côté, 2015, p.536), we ascribe names to our micro-level operationalizations in such a way that they literally describe what they intend to measure. Table 1 gives an overview of the concepts measured, and their relation to the literature. In the next section, we give detailed arguments on how we exactly conceptualize these concepts on a micro-level.

Based on the commitment-formation cycle (Luyckx et al., 2006), we include measures of broad exploration, and commitment making. Luyckx et al. (2006) operationalize commitment making as deciding on one's life direction, and choos-

Table 1 Overview of micro level exploration and commitment concepts and their connection to existing theory

Micro-level concept:	Theoretical connection:
'exploration of fit'	Exploration in depth (Luyckx et al., 2006)
'exploration of self'	Exploration of self (Van Esbroeck et al, 2005; Germeijs & Verschueren, 2006)
'exploration of alternatives'	Exploration in breadth (Luyckx et al., 2006) and Reconsideration (Crocetti et al., 2008; Klimstra et al., 2010)
'commitment to choice'	Commitment making (Luyckx et al., 2006)
'commitment to fit'	Identification with commitment (Luyckx et al., 2006) and Commitment (Crocetti et al., 2008; Klimstra et al., 2010)

ing particular plans for the future. In our micro-level study we applied this to the domain of education and career choice. We consider educational commitment making on a micro level as making a concrete choice for a particular context, like majoring in psychology at a particular university. We assume that the commitment felt towards this contextual choice (named '*commitment to choice*') can change both before and after making the choice. This may be influenced by broad exploration, which, applied to a micro level and the domain of education, is conceptualized as exploring alternative educational directions (named '*exploration of alternatives*'). This is actually also the essence of the 'reconsideration' concept as introduced by Crocetti et al. (2008), and measured on a micro level by Klimstra et al. (2010).

We also include measures of identification with commitment and exploration in depth from the commitment-evaluation cycle of Luyckx et al. (2006). On a micro level, and in the educational domain, identification with commitment is conceptualized as how well the chosen education is felt to fit with the self (named '*commitment to fit*'). This is also similar to the commitment construct as suggested by Crocetti et al. (2008) and studied on a micro-level by Klimstra et al. (2010). Exploration in depth on a micro level is conceptualized as the act of actively investigating the fit between the chosen (educational) context and the self (named '*exploration of fit*'). It is important to note that it possible to have a *commitment to choice* without necessarily having a *commitment to fit*, or vice versa. For example, a student may have a commitment to the choice to study law, based on the assumption that she will attain a stable and high paying job, while at the same time lacking a commitment to fit, knowing that she does not actually enjoy the related activities of law.

Finally, we added a third type of exploration to Luyckx et al.'s (2006) 'breadth' and 'depth' distinction. In career-identity literature, it is important to distinguish between exploration directed to the self, and exploration directed to the environ-

ment (e.g. Van Esbroeck, Tibos & Zaman, 2005; Germeijs & Verschueren, 2006). Van Esbroeck, Tibos and Zaman (2005), for example, describe exploration of the self as consisting of activities aimed at acquiring a better understanding of self-relevant aspects like capacities, values and interests. While exploration of the self is arguably never completely disconnected from the environment, we contend that exploration of one's own interests and ambitions has more of an emphasis on the self than forming an opinion about (the fit of) a particular career alternative. Furthermore, we suggest that exploration of the self is less context-dependent than forming an opinion regarding career alternatives, and estimating how well an option fits the self. We conceptualize exploration of the self on the micro level, as any act directed towards exploring one's own interests and ambitions (named '*exploration of self*').

The above micro-level commitment and exploration concepts form the basis for our empirical study on micro-level identity processes at the within-individual level. With our empirical study we aim to understand how changes in exploration and commitment are related to each other across the long term, and on a within-individual level. This is important as little is known about how exploration and commitment interact on the micro-level, while these concepts are theorized to be fundamental to macro-level identity processes. This information is thus necessary for gaining some first insight in micro-level identity processes, and how individuals may differ in these processes. Differences in the way these variables are related can indicate different developmental processes, and can further our thinking about what kind of mechanisms may underlie these micro level identity processes.

METHOD

Participants

Our sample consists of 31 female³ first-year psychology students from the Netherlands. From the initial sample of 36 participants, three male participants (8%) were excluded in order to eliminate the possibility that any individual differences are due to gender differences. One participant was excluded because she reported that she misunderstood some questions, and another participant was excluded because she participated for only 4 (out of the 30 required) measurement points. The 31 remaining participants participated for 29.5 measurement points on average ($SD = 1.96$, $min = 21$, $max = 34$). The mean age of this sample is 19.6 ($SD = 1.14$, $min = 17.4$,

3 A large proportion of female students is typical for this educational trajectory.

$max = 23.0$), measured at the beginning of the longitudinal study. Participation was voluntary, and was rewarded with credits for research participation, needed for the curriculum. This study was approved by the Ethical Committee Psychology of the University of Groningen, and participation followed informed consent.

Procedure

We collected weekly diary and questionnaire data throughout the last three quarters of the first academic year. Data collection started in November 2013, and continued until June 2014, for a total period of seven months⁴. The participants were asked to fill out an online questionnaire every week. Because of the substantial sustained effort required of the participants, the students were rewarded accordingly, with an attractive amount of credits. The questionnaire contained a qualitative and quantitative section. In the current study, we only use the quantitative measures of exploration and commitment.

Measures: Introducing the RECS-E

The Repeated Exploration and Commitment Scale in the domain of Education (RECS-E) consists of 5 items. These items are the operationalizations of the two commitment constructs and three exploration constructs we described above (see also Table 1). The questions are answered on a scale of 1 (not at all) to 6 (very much),

Table 2 Overview of items used in RECS-E (translated from Dutch)

Item:	Questions about the past week:
E1 - Exploration of fit	Have you been asking yourself whether this education is right for you?
E2 - Exploration of self	Have you been investigating your interests and ambitions in the domain of education and career?
E3 - Exploration of alternatives	Have you been looking for alternatives to this education?
C1 - Commitment to choice	Do you stand by your choice for this particular education?
C2 - Commitment to fit	Do you feel that this education suits you?

4 Disclosure complete data collection: the total longitudinal study is actually larger, consisting of three cohorts, the first one started in 2011 (N = 12), the second in 2012 (N = 25) and the third in 2013 (N = 36). In this study we only report on the last cohort, because the instrument measuring three types of exploration and commitment was only administered in the last cohort. In addition, identity interviews were administered for all cohorts, but for our current purpose, this data was not relevant to include.

participants are instructed to answer the questions concerning the past week. An overview of the translated items of the RECS-E can be found in Table 2 (translated from Dutch).

Validity

The convergent construct-validity of the RECS-E is investigated taking a within-individual approach. This means that if two constructs are systematically related, we expect to see within-individual correlations that go in one direction (i.e. all positive or all negative) for the vast majority of individuals. The

types of exploration and commitment included in the RECS-E are obviously meant to capture different aspects of exploration and commitment. At the same time, the core of all of the exploration constructs are acts of investigation, and the core of both of the commitment constructs are feelings of certainty. Therefore, we expect that the different commitment measures will be positively related to each other within all individuals, and that this is also the case for the relation between the different exploration measures.

Intra-individual associations

For each individual, Spearman correlations (r_s ; suitable for rank-ordered data) were calculated amongst all items from the RECS-E. Within individual correlations were calculated by correlating the time series of one variable with the time series of

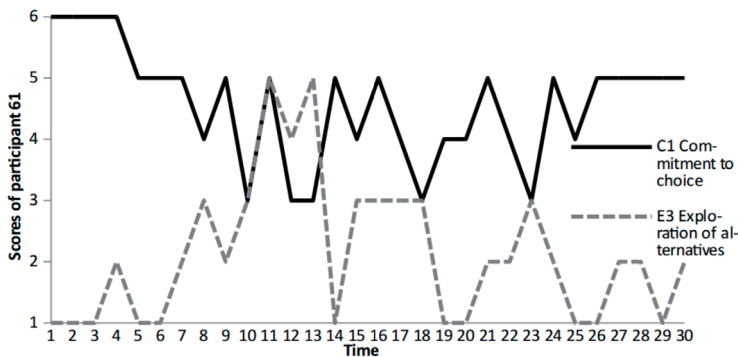


Figure 1 Time series of participant 61. Intra-individual correlations for this participant are calculated by correlating the time series of two variables; in this particular case the Spearman correlation between exploration of alternatives (E3) and commitment to choice (C1) is negative ($r_s = -0.54$). This negative correlation is visible in the graph: decreases in commitment to choice are frequently accompanied by increases in exploration of alternatives and vice versa.

another variable, both measured within the same individual (see Figure 1 for an example of the procedure).

Because the correlations are based on individual time series (rather than aggregated data), the intra-individual correlations represent a relationship in how the variables *change across time*. For example a positive intra-individual correlation means that when exploration increases within this individual, commitment is also likely to increase within this same individual (and vice versa). Because we investigate these relationships in *change*, a necessary condition is that a score has to change across time. If a score does not change across time, there can be no relation between changing scores. Therefore, no correlation can be computed if the individual shows no variation across time in either the commitment score or the exploration score. As a result of this, cases in which no variability across time was observed were excluded from the analysis. As a consequence, the N per analysis is lower than the total N and differs between the different analyses.

First, the correlations were calculated amongst time-series scores for the three exploration items, and amongst the time-series scores of the two commitment items, in order to determine convergent construct-validity, resulting in four correlation scores for each person. Second, we answered our research question regarding the relation between within-individual changes in exploration and commitment across time, by correlating the time series of the commitment items with the time series of the exploration items (within individuals), resulting in six correlation scores for each person. In Table 3, an overview of the correlations calculated within each individual is given.

When each of the correlations are calculated for each individual, we follow Cohen (1988) in categorizing correlations between -0.1 and 0.1 as negligible; correlation above 0.1 are categorized as positive, and correlations below -0.1 as nega-

Table 3 Overview of calculated intra individual correlations

	E1	E2	E3	C1	C2
E1 Exploration of fit	-				
E2 Exploration of self	V	-			
E3 Exploration of alternatives	V	V	-		
C1 Commitment to choice	A	A	A	-	
C2 Commitment to fit	A	A	A	V	-

Note. The letters indicate what the purpose is of the within individual calculation:
 V = investigate convergent construct validity of instrument
 A = explore associations between micro level exploration and commitment

tive. The proportion of occurrence for each category of correlations are reported, and summary measures are included. To gain more insight in differences in type and strength of the intra-individual correlations, we also show the distributions of the correlations using beanplots (Kampstra, 2008), generated with R (R Core Team, 2015). Beanplots are especially suitable for comparing multiple distributions. A density curve is estimated for each type of correlation, allowing for a detailed illustration of which correlation values occur frequently, and which values are rare. We determined an optimal balance between smoothness and detail in the density curves of the correlations; we have set the bandwidth parameter that regulates the smoothness (see Kampstra, 2008), to 0.8.

RESULTS

Participant exclusion

A relatively large proportion of participants had to be excluded from the calculation of within-individual calculations of correlations, the correlations can only be calculated if variation is present in both of the target variables. Of the 31 total participants, 3 (10%) did not show any variation in the commitment to choice measurement (C1), and 4 participants (13%) did not show any variation in the commitment to fit measurement (C2). With regard to exploration, all of the participants showed variation in the exploration of self measure (E2); 1 participant (3%) showed no variation in the exploration of fit measurement (E1); and 8 participants (26%) showed no change in exploration of alternatives (E3), see also Table 4.

Convergent-construct validity RECS-E

Four types of intra-individual correlations were calculated to get indications of the convergent-construct validity of the RECS-E. For each individual, the correlation is calculated between the two commitment items (C1-C2), and between the three exploration items (E1-E2, E1-E3 and E2-E3), see also Table 4 and Figure 2. Overall, the correlations among the exploration constructs, and among the commitment constructs, are positive for the large majority of participants indicating sufficient convergent construct validity.

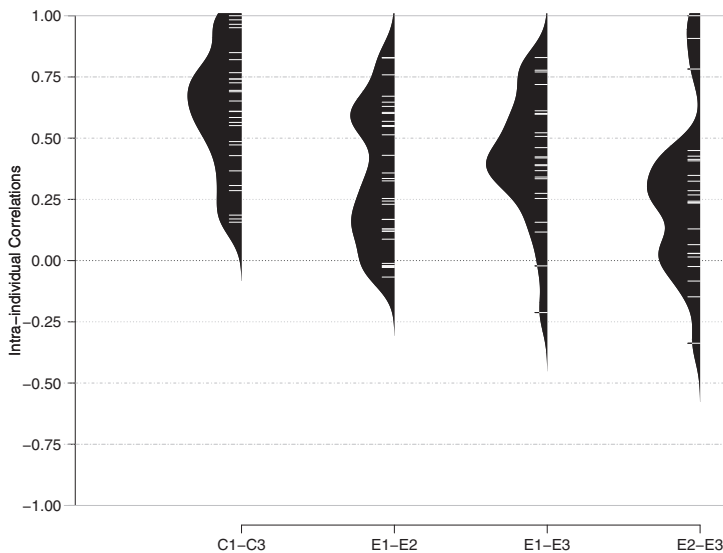


Figure 2 Density distributions of intra-individual correlations within commitment, and within exploration. Commitment to choice (C1) is correlated with commitment to fit (C2) in the left figure, and exploration of fit (E1), exploration of self (E2) and exploration of alternatives (E3) are correlated with each other in the three right figures. The white lines represent the observed individual correlations. The black areas indicate the density distributions of the correlation values. Thicker areas mean that the correlation values occur frequently, thinner areas indicate that the values occur infrequently.

Within-individual correlations between exploration and commitment

The results reveal interesting patterns of correlations between micro-level commitment and exploration at the within-individual level. Table 4 shows summary measures for the intra-individual correlations, and in Figure 3 the distributions of the intra-individual correlations are illustrated. For all types of correlations we found large individual differences; ranging from strongly negative (i.e. smaller than $r_s = -0.5$), to moderately positive (i.e. between $r_s = 0.3$ and $r_s = 0.5$).

The correlations between *exploration of fit* (E1) and the two commitment measures (commitment to choice (C1), and commitment to fit (C2)) are similar in terms of (1) the form of the distribution (i.e. resembling a Gaussian distribution, see Figure 3), (2) the exact value of the mean correlation ($r_s = -0.14$), and (3) the wide range of correlations (E1-C1: $r_{smin} = -0.58$ to $r_{smax} = 0.38$, $SD = 0.205$; E1-C2: $r_{smin} = -0.60$ to $r_{smax} = 0.31$, $SD = 0.220$). Moreover, Table 4 shows that, while some individuals show negligible or weakly to moderately positive correlations, the largest propor-

Table 4 Summary of intra-individual correlations

Type of correlation:	M	SD	Min.	Max.	n (%)	Occurrence n (%) per type of correlation: ²		
						Negative	Negligible	Positive
E1 – C1	-0.14	0.205	-0.58	0.38	3 (10%)	17 (61%)	7 (25%)	4 (14%)
E1 – C2	-0.14	0.220	-0.60	0.31	4 (13%)	15 (56%)	8 (30%)	4 (15%)
E2 – C1	0.05	0.271	-0.54	0.48	3 (10%)	9 (32%)	6 (21%)	13 (46%)
E2 – C2	0.08	0.247	-0.62	0.42	4 (13%)	5 (19%)	7 (26%)	15 (56%)
E3 – C1	-0.13	0.242	-0.54	0.38	8 (26%)	14 (61%)	4 (17%)	5 (22%)
E3 – C2	-0.12	0.253	-0.66	0.31	9 (29%)	10 (46%)	7 (32%)	5 (23%)
E1 – E2	0.35	0.277	-0.07	0.83	1 (3%)	0 (0%)	6 (20%)	24 (80%)
E1 – E3	0.42	0.257	-0.21	0.83	8 (26%)	1 (4%)	1 (4%)	21 (91%)
E2 – E3	0.26	0.324	-0.34	1.00	8 (26%)	2 (9%)	6 (26%)	15 (65%)
C1 – C2	0.61	0.251	0.16	1.00	4 (13%)	0 (0%)	0 (0%)	27 (100%)

Note. Meaning of abbreviations:

E1 – exploration of fit

E2 – exploration of self

E3 – exploration of alternatives

C1 – commitment to choice

C2 – commitment to fit

¹ A case was excluded when no variation ($t_{n+1} - t_n = 0$ for all change scores) was shown within an individual trajectory in either commitment or the exploration item of interest.

² For the occurrence per type of correlation, the calculation of the percentages is based on the total of included cases, the excluded cases are omitted (i.e. % occurrence = n occurrence / (total n [31] – excluded n) * 100).

tion of individuals demonstrate negative correlations (E1-C1: 61%, E1-C2: 56%). The two commitment measures also differ in their correlations with exploration of fit, however. Firstly, the peak of the distribution is closer to zero for commitment to fit (around $r_s = -0.1$), while the peak frequency for the correlations with commitment to choice is more strongly negative (around $r_s = -0.25$). Secondly, the distribution of the correlations with commitment to choice is more skewed (see the left distributions in Figure 3).

The individual correlations between *exploration of self* (E2) and both commitment measures (C1 and C2) resemble a highly skewed Gaussian distribution (see Figure 3). Frequency peaks for both correlations are in the positive correlation range (between $r_s = 0.05$ and $r_s = 0.25$) (see Table 5). The range of the correlations is wide, and the standard deviations are large for both associations (E2-C1 range: $r_s = -0.54$ to $r_s = 0.48$, $SD = 0.271$; E2-C2 range: $r_s = -0.62$ to $r_s = 0.42$, $SD = 0.247$). While large

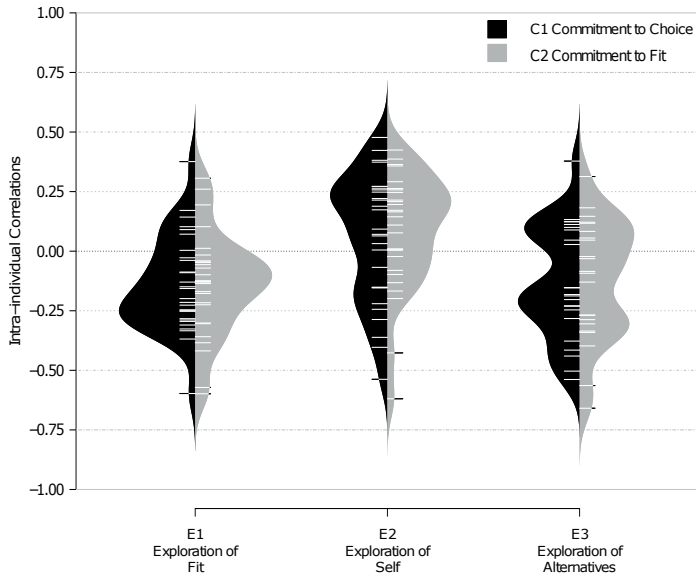


Figure 3 Density distributions of intra-individual correlations between exploration and commitment. The three exploration types (E1, E2 and E3) are correlated with commitment to choice (C1), represented by the black areas, and with commitment to fit (C2), represented by the grey areas. The white lines represent the observed individual correlations. The black and grey areas indicate the density distributions of the correlation values. Thicker areas mean that the correlation values occur frequently, thinner areas indicate that the values occur infrequently.

individual differences can be seen, Table 4 shows that about half of participants show a positive correlation between exploration of self and both commitment measures (E2-C1: 46%, E2-C2: 56%). The large amount of individual differences is also reflected in the correlation distributions (Figure 3), where besides the large peak off positive correlations around $r_s = 0.25$ there is a small second peak around $r_s = -0.20$ for the correlation between exploration of self and commitment to choice.

The distributions of the individual correlations between *exploration of alternatives* and both commitment measures, seem to resemble a bimodal distribution with two peaks, one weakly positive and one moderately negative (E3-C1: $r_s = 0.1$ and $r_s = -0.2$; E3-C2: $r_s = 0.1$ and $r_s = -0.3$) (see Figure 3). Moreover, we find wide ranges for both of these correlations (E3-C1 range: $r_s = -0.54$ to $r_s = 0.38$, $SD = 0.242$; E3-C2 range: $r_s = -0.66$ to $r_s = 0.31$, $SD = 0.253$). Table 4 shows that, amidst the large individual differences, the largest portion of participants shows a negative correlation between exploration of alternatives and both types of commitment (E3-C1: 61%, E3-C2: 46%).

DISCUSSION

In this study we explored relations between changes in micro-level explorations and commitments over time, within individuals. We distinguished two types of micro-level commitment (commitment to choice and commitment to fit) and three types of exploration (exploration of fit, exploration of self and exploration of alternatives; see Table 1) and applied these concepts to the domain of education. An instrument was developed to measure the micro-level constructs (RECS-E; the Repeated Exploration and Commitment Scale in the domain of Education). We examined the validity of our operationalizations, and explored the distributions of intra-individual correlations between time series of the different types of exploration and commitment.

We found that, firstly, the association between changes in exploration of fit and changes in both types of commitment (commitment to choice and commitment to fit) are negative for the majority of individuals. This is in contrast to Luyckx, Goosses en Soenens's (2006) macro-level finding that there is a positive correlation between slopes of exploration in depth (conceptually related to the micro-level exploration of fit) and identification with commitment (conceptually related to the micro-level commitment to fit). This may indicate that identity processes on a micro-level are qualitatively different from macro-level identity processes. At the same time, our results revealed large individual differences, such that there were a few cases showing a positive or negligible relation between exploration of fit and commitment.

Secondly, the association between changes in exploration of self and changes in both commitment measures is positive for the majority of individuals. This contrasts Germeijs and Verschueren's (2006) macro-level finding amongst high-school students, showing no correlation. Our finding of a positive association for the largest proportion of individuals could be due to the use of a different target group (i.e. high school students versus university students). Alternatively, these contrasting results may suggest – like the association between exploration of fit and commitment (above) – that micro-level processes are qualitatively distinct from macro-level processes.

Thirdly, we found that a majority of individuals show negative associations between changes in exploration of alternatives and changes in commitment. This is in line with Klimstra et al.'s (2010) micro-level study showing that, on a group level, negative associations exist between micro-level reconsideration (related to exploration of alternatives measure) and commitment in the domain of education.

Our within-individual approach extends this finding of a negative association, however, by revealing a bimodal distribution: a large proportion of individuals showed a weak to moderate negative association, while another large proportion showed a negligible to weak positive relation. This bimodality may be an explanation for the fact that Klimstra et al. (2010) only found modest negative correlations on a group level. If the population can be characterized by two distinct distributions, aggregating this as one correlation may result in a very small correlation.

In general, the shapes of the distributions indicate clear differences in the relation that each type of exploration has with commitment. The differences are less clear for the two types of commitment. For example, the shape of the distributions, and the type of correlation shown by the majority, were largely similar for the two types of commitment. Only subtle differences were found regarding the strength of the association shown by the majority. Therefore, it seems that distinguishing types of commitment on a micro-level is less useful than distinguishing different types of exploration.

Micro-level and macro-level explanations of the large heterogeneity in intra-individual relations

Below, we discuss two explanations that could account for the large variation we found in intra-individual relations between exploration and commitment: (1) a micro-level explanation, and (2) a macro-level explanation.

Regarding the micro-level explanation, the large between-individual variation may indicate that other micro-level events, such as personal experiences, may mediate the association between exploration and commitment. For example, it may be that it is not necessarily exploration that changes commitment, but the information gained from the experiences *following* exploration. This is in line with process theories regarding identity development. Grotevant (1987) for example, defined identity exploration as “problem solving behavior *aimed at eliciting information* about oneself or one’s environment in order to make a decision about an important life choice” (p. 204). Similarly, in the identity-control model from Kerpelman, Pittman and Lamke (1997), interpersonal feedback about one’s identity is emphasized as the information that can trigger identity development. Furthermore, at the core of Bosma and Kunnen’s (2001) identity-development model is the assumption that, within individuals, commitments develop across a long series of daily life-events that support or challenge the existing commitment. This was confirmed by Kunnen’s (2006) empirical finding that day to day experiences, as measured in a diary

study, are related to macro-level changes in identity. Together, the above studies emphasize that *experiences* related to the self or one's environment are key elements in identity development.

Experiences may explain the large individual variation in correlations found in our study. For example, individuals who showed a positive relation between exploration of alternatives and commitment might have experienced other alternatives as *less* attractive than the chosen alternative (such that the commitment with the current educational choice increases). On the other hand, individuals with a negative relation might have found alternatives *more* attractive than the chosen education (such that the commitment for the current education decreases). Following this reasoning, it would theoretically even be possible for commitment to change without any exploration, but solely as a consequence of an experience.

Regarding a macro-level explanation of the large between-individual variation found, relatively stable factors within individuals may mediate the association between exploration and commitment. For example, coping strategies (Luyckx, Klimstra, Duriez, Schwartz & Vanhalst, 2012) and personality (Klimstra, Luyckx, Goossens, Teppers & De Fruyt, 2013; Luyckx, Teppers, Klimstra & Rassart, 2014) – both relatively stable and context-independent macro-level factors – are found to influence identity development. On a group level, Luyckx et al. (2012) found that exploration in breadth and in depth was positively related to a problem-solving coping strategy and support seeking, but negligibly to weakly related to an avoidant strategy. Alternatively, Klimstra et al. (2013) and Luyckx et al. (2014) found that the personality trait 'openness to experiences' predicted exploration in breadth and in depth. This could mean that for an individual who uses an avoidant coping strategy, or does not have an open personality, a drop in commitment would probably not be accompanied by an increase in exploration. On the other hand, while an individual with a problem-solving or support-seeking coping strategy, or an open personality, might respond to a decline in commitment by exploring more.

The above micro-level and macro-level mediators between exploration and commitment are theoretical, and as such, need to be tested. In general, the finding that a lot of heterogeneity exists in intra-individual correlations is, in itself, an important outcome of the current study. This finding is highly relevant for the discussion regarding ergodicity raised by Molenaar and Campbell (2009). Specifically, one of the two conditions for ergodicity is homogeneity, meaning that the relations between variables should be the same for all individuals. Our heterogeneous results indicate that it is plausible that the ergodicity assumption is violated for micro-level

commitment and exploration in the domain of education. This implies that it may not be possible to generalize findings on relations between these concepts stemming from group-based analyses to intra-individual processes. It is therefore vital that for the study of micro-level identity processes, a within-individual perspective is adopted.

Limitations and directions for future research

A number of methodological characteristics and limitations of the current study should be considered for future research. Firstly, due to the correlational nature of our study, we cannot determine whether a change in exploration or commitment comes first.

Secondly, the current sample was relatively small and homogeneous (i.e. all female first year university students majoring in psychology from the Netherlands). Both of these characteristics impose limitations to the generalizability of our results to the larger population. Therefore, while our findings can be generalized to the *theory* of micro-level identity processes (see Van Geert, 2014), empirical replication is necessary to generalize to different populations. Nevertheless, it is striking that even in this very homogeneous sample, we find much heterogeneity. The homogeneity of the sample rules out the possibility that individual differences are due to gender, age, educational level or the topic that is studied. This highlights the omnipresence of between-individual variation in micro-level identity processes.

Thirdly, by calculating within-individual correlations (based on time series of relevant scores), individuals who show stationarity in their scores across time cannot be included. This raises interesting theoretical questions. We observed that a lack of temporal variation was mainly present in exploration of alternatives. This could mean that exploration of alternatives is only relevant to some individuals. From a dynamic systems perspective, lack of change on a micro level can be explained by stability on a macro level. Specifically, studies show that micro-level variability implies macro-level transitions (e.g. Granic, Hollenstein, Dishion, & Patterson, 2003). Thus a lack of micro-level variability may indicate that the individual is in a stable identity state. Future research is needed to clarify the meaning of stability at the micro level.

Fourthly, while the current study found initial support for the convergent construct-validity, it is also important to investigate other types of validity in future research (e.g., discriminant validity), and to do so in other populations. Moreover,

convergent construct-validity was investigated in the homogenous population of first-year university students, and needs to be expanded to other populations.

A final limitation is that we did not include reliability calculations of our measurement instrument. This is because all of the reliability calculations that we know of assume that variations are random fluctuations around a (slowly changing) average (e.g. Chronbach, 1951; Cranford et al., 2006). However, recently, this assumption has been challenged by research showing that intra-individual variation in similar psychological processes is in fact not random, but has a temporal structure (e.g. De Ruiter, Den Hartigh, Cox, Van Geert & Kunnen, 2015). For questions assessing the source of variation across time (as noise or as meaningful change), techniques based on random-fluctuation assumptions do not seem to be suitable. Suitable techniques, however, where temporal structure in intra-individual variability is assumed, have so far not yet been developed to the best of our knowledge. Future research is needed to explore and develop such alternatives.

Conclusion

In general, our study shows how identity can be conceptualized on a micro level, and we show how these processes can operate on a micro level. Specifically, we show how changes in micro-level educational explorations and commitments are related to each other within individuals. We find a striking amount of difference between individuals, even in the homogeneous sample that we have used. For some, increase in any type of exploration corresponds to an increase in commitment, and for others increase in exploration is related to a drop in commitment. This highlights the necessity to use a within individual approach to study micro-level identity processes. At the same time, we found that the largest proportion of individuals demonstrated similar patterns, where (1) changes in exploration of fit correlated negatively with changes in commitment, (2) changes in exploration of self correlated positively with changes in commitment and (3) exploration of alternatives is correlated with commitment in two ways (slightly positive and moderately negative), as demonstrated by a bimodal distribution. Some of these results contrast macro-level findings, indicating the necessity to distinguish between micro- and macro-level identity processes. With the current article, we hope to generate questions for future research, and to trigger discussion regarding the conceptualisation of identity on a micro level, and the possible role of individual differences in identity research.

REFERENCES

- Bosma, H. A. (1985). *Identity development in adolescence. Coping with commitments*. Groningen: University of Groningen.
- Bosma, H.A., & Kunnen, E.S. (2001). Determinants and mechanisms in ego identity development: A review and synthesis. *Developmental Review, 21*, 39-66. doi:10.1006/drev.2000.0514
- Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). New Jersey: Lawrence Erlbaum Associates.
- Côté, J. E. (2015). Identity formation research from a critical perspective: Is a social science developing? In K. C. McLean & M. Syed (Eds.), *The Oxford handbook of identity development* (pp. 562-573). New York, NY, US: Oxford University Press.
- Cranford, J. A., Shrout, P. E., Lida, M., Rafaeli, E., Yip, T., & Bolger, N. (2006). A Procedure for Evaluating Sensitivity to Within-Person Change: Can Mood Measures in Diary Studies Detect Change Reliably? *Personality & Social Psychology Bulletin, 32*, 917-929. doi:10.1177/0146167206287721
- Crocetti, E., Rubini, M., & Meeus, W. (2008). Capturing the dynamics of identity formation in various ethnic groups: Development and validation of a three-dimensional model. *Journal Of Adolescence, 31*, 207-222. doi:10.1016/j.adolescence.2007.09.002
- Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*, 297-334. doi:10.1007/bf02310555
- De Ruiter, N. P., Den Hartigh, R. R., Cox, R. A., Van Geert, P. C., & Kunnen, E. S. (2015). The temporal structure of state self-esteem variability during parent-adolescent interactions: More than random fluctuations. *Self And Identity, 14*, 314-333. doi:10.1080/15298868.2014.994026
- Erikson, E. H. (1950). *Childhood and society*. New York: Norton.
- Erikson, E. H. (1968). *Identity: Youth and crisis*. New York: Norton.
- Germeijs, V., & Verschuere, K. (2006). High School Students' Career Decision-Making Process: Development and Validation of the Study Choice Task Inventory. *Journal Of Career Assessment, 14*, 449-471.
- Goossens, L. (2001). Global versus domain-specific statuses in identity research: A comparison of two self-report measures. *Journal Of Adolescence, 24*, 681-699. doi:10.1006/jado.2001.0438
- Granic, I., Hollenstein, T., Dishion, T. J., & Patterson, G. R. (2003). Longitudinal analysis of flexibility and reorganization in early adolescence: A dynamic systems study of family interactions. *Developmental Psychology, 39*, 606-617. doi:10.1037/0012-1649.39.3.606
- Grotevant, H.D. (1987). Toward a process model of identity formation. *Journal Of Adolescent Research, 2*, 203-222.
- Kampstra, P. (2008) Beanplot: A Boxplot Alternative for Visual Comparison of Distributions. *Journal of Statistical Software, 28*, 1-9.
- Kerpelman, J. L., Pittman, J. F., & Lamke, L. K. (1997). Toward a microprocess perspective on adolescent identity development: An identity control theory approach. *Journal Of Adolescent Research, 12*, 325-346. doi:10.1177/0743554897123002
- Klimstra, T. A., Luyckx, K., Goossens, L., Teppers, E., & De Fruyt, F. (2013). Associations of identity dimensions with Big Five personality domains and facets. *European Journal Of Personality, 27*(3), 213-221. doi:10.1002/per.1853
- Klimstra, T. A., Luyckx, K., Hale, W. I., Frijns, T., van Lier, P. C., & Meeus, W. J. (2010). Short-term fluctuations in identity: Introducing a micro-level approach to identity formation. *Journal Of Personality And Social Psychology, 99*, 191-202. doi:10.1037/a0019584
- Korobov, N. (2015). Identities as an interactional process. In K. C. McLean & M. Syed (Eds.), *The Oxford handbook of identity development* (pp. 562-573). New York, NY, US: Oxford University Press.

- Kunnen, E. S. (2006). Are conflicts the motor in identity change?. *Identity: An International Journal Of Theory And Research*, 6, 169-186. doi:10.1207/s1532706xid0602_3
- Lichtwarck-Aschoff, A., Van Geert, P. L. C., Bosma, H. A., & Kunnen, E. S. (2008). Time and identity: A framework for research and theory formation. *Developmental Review*, 28, 370-400. doi:10.1016/j.dr.2008.04.001
- Luyckx, K., Goossens, L., & Soenens, B. (2006). A developmental contextual perspective on identity construction in emerging adulthood: Change dynamics in commitment formation and commitment evaluation. *Developmental Psychology*, 42, 366-380. doi:10.1037/0012-1649.42.2.366
- Luyckx, K., Goossens, L., Soenens, B., & Beyers, W. (2006). Unpacking commitment and exploration: Preliminary validation of an integrative model of late adolescent identity formation. *Journal Of Adolescence*, 29, 361-378. doi:10.1016/j.adolescence.2005.03.008
- Luyckx, K., Klimstra, T. A., Duriez, B., Schwartz, S. J., & Vanhalst, J. (2012). Identity processes and coping strategies in college students: Short-term longitudinal dynamics and the role of personality. *Journal Of Youth And Adolescence*, 41, 1226-1239. doi:10.1007/s10964-012-9753-z
- Luyckx, K., Teppers, E., Klimstra, T. A., & Rassart, J. (2014). Identity processes and personality traits and types in adolescence: Directionality of effects and developmental trajectories. *Developmental Psychology*, 50, 2144-2153. doi:10.1037/a0037256
- Marcia, J. E. (1966). Development and validation of ego-identity status. *Journal of Personality and Social Psychology*, 3, 118-133.
- Marcia, J.E. (1993). Epilogue. In J.E. Marcia, A.S. Waterman, D.R. Matteson, S.L. Archer, & J.L. Orlofsky (Eds.), *Ego Identity: a Handbook for psychosocial research* (273-281). New York, NY, US: Spinger-Verlag.
- Meeus, W. (2011). The study of adolescent identity formation 2000-2010: A review of longitudinal research. *Journal Of Research On Adolescence*, 21, 75-94. doi:10.1111/j.1532-7795.2010.00716.x
- Molenaar, P. M., & Campbell, C. G. (2009). The new person-specific paradigm in psychology. *Current Directions In Psychological Science*, 18, 112-117.
- R Core Team (2015). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <http://www.R-project.org/>.
- ResearchNed (2009). Studiekeuze en studiesucces. Nijmegen: ResearchNed.
- Schwartz, S. J., Kurtines, W. M., & Montgomery, M. J. (2005). A Comparison of Two Approaches for Facilitating Identity Exploration Processes in Emerging Adults: An Exploratory Study. *Journal Of Adolescent Research*, 20(3), 309-345. doi:10.1177/0743558404273119
- Syed, M., & McLean, K. C. (2015). The future of identity development research: Reflections, tensions, and challenges. In K. C. McLean & M. Syed (Eds.), *The Oxford handbook of identity development* (pp. 562-573). New York, NY, US: Oxford University Press.
- Van Esbroeck, R., Tibos, K., & Zaman, M. (2005). A Dynamic Model of Career Choice Development. *International Journal For Educational And Vocational Guidance*, 5, 5-18. doi:10.1007/s10775-005-2122-7
- Van Geert, P.L.C. (2014). Groups versus individual data in a dynamic systems approach to development. *Infance*, 66, 283-312. doi:10.4074/S0013754514003061

**Micro-level mechanisms of
identity development: the role
of emotional experiences in
commitment development**

4

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ABSTRACT

Based on Marcia's theory, many researchers consider exploration and commitment as the main processes in identity development. Although some identity theorists have hypothesized that emotional experiences may also be an important part of the mechanisms of identity development, empirical research to investigate this claim has been lagging behind. In this study, we shed light on the role of emotional experiences in micro-level commitment dynamics, and compare this to the role of exploration. We take a within-individual approach, and particularly focus on educational commitment. We collected weekly measurements among 103 first year university students over several months, resulting in 22 to 30 measurements for each individual. Every week, the students reported an important experience and accompanying positive and negative emotions, their level of educational exploration and commitment. We generated linear growth models for each individual separately, using Dynamic Linear Modeling. These individual models generate regression weights that indicate how strong the impact is of exploration, positive and negative emotional experiences on changes in micro-level commitment for each individual. Our main finding is that both positive and negative emotional experiences are indeed related to changes in educational commitment. Positive experiences, but surprisingly, also negative experiences, are related to increases in educational commitment for the majority of individuals. Moreover, for the large majority of individuals, the impact of emotional experiences is larger than the impact of exploration. We therefore conclude that it is highly likely that emotional experiences are an essential part of the micro-level mechanisms of identity development.

INTRODUCTION

How do individuals develop a sense of identity? A century ago, based on Erikson's (1968) identity theory, Marcia (1966) proposed that the answer to this question lies in two core processes: an individual *explores* identity alternatives and forms *commitments* towards suitable alternatives. Forming identity commitments is particularly relevant in adolescence and young adulthood (Kroger, Martinussen, & Marcia, 2010). Many individuals in this age period are driven by contextual demands to form commitments to future goals and career paths. Optimally, these commitments are formed through a process of exploration (Kroger & Marcia, 2011), where an individual investigates different life paths and experiments with various roles.

The two processes of exploration and commitment still form the core of many modern theories on how identity develops (see for example, Bosma & Kunnen, 2001a). Over the past ten years, increasingly refined subtypes of exploration and commitment have been found (e.g., Crocetti, Rubini, & Meeus, 2008; Luyckx, Goossens, Soenens, & Beyers, 2006; Skhirtladze, Javakhishvili, Schwartz, Beyers, & Luyckx, 2015; Zimmermann, Lannegrand-Willems, Safont-Mottay, & Cannard, 2015). Mostly, these different types of exploration and commitment have been used in one of three ways: 1) to describe individual differences in identity statuses, 2) to describe different pathways of identity development, and 3) to describe how both identity statuses and pathways of identity development are related to various indicators of wellbeing (for an overview, see Meeus, 2011).

This body of research that describes (individual differences in) features of identity and identity development has brought us many insights, but also leaves some important gaps in our knowledge. This is perhaps best illustrated when trying to apply our knowledge to inform identity interventions. For these interventions, it is relevant to be able to identify who is in, or headed for, suboptimal identity statuses or pathways. Our current body of knowledge provides plenty of general insight in this – we know the types and amounts of exploration and commitment that are beneficial or detrimental for the individual (e.g., a lot of ruminative exploration seems detrimental to the individuals' wellbeing; Beyers & Luyckx, 2015). And with this knowledge, and the right instruments, we could predict the chance that a specific individual heads for undesirable outcomes. But prediction alone is not enough to inform intervention. For practitioners it is also relevant to know how exactly they can steer problematic trajectories in the right direction. This is where our current knowledge on identity development comes up short. The bulk of our

current knowledge is about abstract concepts on a macro level. This may help a practitioner formulate a goal – for example, to reduce ruminative exploration and increase commitment – but this does not inform practitioners how they can contribute, which actions they can take, to achieve that goal. For this, knowledge on a different level is needed: micro-level knowledge. Micro-level knowledge connects identity development to the actions and experiences of the individual in the here and now (see also Lichtwarck-Aschoff, Van Geert, Bosma, & Kunnen, 2008). Unfortunately, it is particularly this micro-level knowledge of identity development that is currently lacking (Lichtwarck-Aschoff et al., 2008). This is not only unfortunate for practice, but also for our theory on identity formation. Indeed, after all these decades of research, we are still largely in the dark on how exactly identity commitments come to be through actions and experiences in everyday life.

In this paper we help to fill the gap in our knowledge on identity development. We will show on a micro level, and within individuals, how emotional experiences and acts of exploration are related to changes in micro-level commitment. As we shall review in the next section, identity theorists have suggested that experiences, particularly emotional experiences, may play an important role in micro-level identity development, while empirical research to test these hypotheses has been lagging behind.

The Process of Identity Development and the Role of Emotional Experiences

A number of identity theorists have developed theories and hypotheses on the process of identity development on a micro-level time scale. Grotevant (1987) for one, suggested that acts of exploration result in cognitive and affective outcomes – information that the individual subsequently uses to consolidate and evaluate her identity. Kerpelman, Pittman, and Lamke (1997) further specified this process in their identity control model. They suggested that the exploration process often occurs in the form of social interaction, which leads an individual to have a perception of herself. If this self-perception is incongruent with an internal identity standard, a control process within the individual adjusts either the self-perception or the identity standard, ensuring that congruency is eventually achieved. The idea that an individual strives to achieve a form of congruency is also a central in the view of Bosma and Kunnen (2001a). In their model of identity development, a transaction between an individual and her context may either fit or conflict with the identity commitments of the individual. A fitting experience leads the individual to con-

solidate and strengthen her existing identity commitment. However, a conflicting experience leads the individual to attempt to reconcile the experience and the identity commitment through either assimilation (by adjusting the interpretation or perception of the experience), or accommodation (by adjusting the commitment).

All the theories described above thus suggest that an interaction with the context results in an individual having an experience, and the extent to which this experience is fitting or conflicting with an identity commitment determines whether the identity commitment is affirmed or reevaluated. Such a fitting or conflicting experience may contain many aspects: an experience can be conceptualized as a higher order structure within individuals, that emerges from a loosely organized network of cognitions, emotions, perceptions and action tendencies, resulting from an interaction between the individual and her context (Kunnen, Bosma, Van der Meulen, & Van Halen, 2001; Lewis, 2000). Among these many aspects of an experience, the emotional aspect may be particularly important to understand micro-level identity development. Vleioras and Bosma (2005) state that emotions arise when experiences hold self-relevance, thus conceptualizing emotions as a signal of identity-relevant events. This is in line with Kunnen et al. (2001) who conceptualize a conflict between an experience and identity commitments as fundamentally emotional. In fact, they and others (see Bosma & Kunnen, 2001b) describe the emotional aspect of an experience as central in the micro-level processes of identity development.

Taken together, the theories described above generally propose that on a micro level, identity develops as a result of an individual interacting with her context, which leads to an emotional experience, which in turn allows the individual to affirm or reevaluate her commitments. In this chain of events, we can recognize Marcia's (1966) concepts of exploration and commitment: exploration may instigate the interaction between an individual and her context, and the commitment is ultimately affirmed or reevaluated. However, in between an act of exploration and the evaluation of the commitment, there is another essential ingredient: an emotional experience. These identity process theories imply that any interaction with the context – whether or not this interaction is instigated by exploration – results in an experience, and that it is this experience and its emotional valence that forms the basis for the individual to affirm or reevaluate her commitments. Thus an emotional experience is hypothesized to be essential in determining commitment dynamics. It perhaps even has a larger role in determining commitment dynamics than exploration has, as an emotional experience is more proximal to commitment in the proposed chain of events.

Empirical studies on the hypothesized role of emotional experiences in the development of identity commitments are rare, but a few have been done. For one, in a qualitative multiple case study, Vleioras and Bosma (2005) found some initial indications that experiences play an important role in the development of macro-level commitments. They found that the combination of content and emotional valence of an experience was more successful than exploration was in predicting both stability and change in the strength and content of identity commitments in the domain of parents. Secondly, Kunnen (2006) found that within individuals, a large amount of intense negative emotional experiences was related to a subsequent reduction in the strength of identity commitments in multiple domains. Both studies are based on pre- and post-measurements of macro-level identity commitments using identity interviews (the GIDS; Bosma, 1985), with multiple experiences taking place in between. These studies have provided us with important new insights on macro-level identity processes: a stacking of emotional experiences can be followed by changes in macro-level identity commitments. But the macro-level timescale used in these studies poses limits on the conclusions we can draw regarding the micro-level identity dynamics. We are still left with many questions: do emotional experiences have an immediate impact on commitments on a micro level, and if so, how strong is this, and does this impact differ among individuals?

Conceptualization of Micro-level Commitments

Multiple researchers have tried to conceptualize and study identity on a micro level, both based on a narrative (e.g., Kerrick & Thorne, 2014; Morgan & Korobov, 2012; Schwab, 2013) and commitment dynamics perspective (e.g., Klimstra et al., 2010; Klimstra et al., 2016; Van der Gaag, De Ruiter, & Kunnen, 2016). In this paper, we particularly focus on the dynamics of micro-level commitments. However, the conceptualization of micro-level commitments is still subject to discussion, and it is far from clearly conceptualized how micro-level identity is related to macro-level identity. Therefore, we will briefly clarify our view on this⁵.

In our conceptualization of identity commitments, macro- and micro-level commitments are intrinsically related: macro-level identity commitments emerge out of the integration of many micro-level commitments, and micro-level commitments are in turn shaped by macro-level commitments. For example, an individual

5 We will here limit ourselves to a discussion of macro- and micro-level commitment, and not exploration. For a discussion on micro-level exploration we refer to Van der Gaag et al., 2016.

may have a macro-level commitment that comes down to 'I am dedicated to helping people'. This commitment is implemented by choosing a specific context that reflects this macro-level commitment – this individual decides for example, to major in psychology. The commitment that is formed to this chosen context – in this case, a commitment to a psychology major – is what we consider the micro level of commitment. The dynamics of this micro-level commitment may in turn affect the macro-level commitment of the individual. For example, if the psychology student starts to doubt whether the psychology major fits her (i.e., reevaluating her micro-level commitment), she may eventually start to wonder whether helping people really is what defines her (i.e., reevaluating her macro-level commitment). Thus, we conceptualize micro-level commitment as the currently felt connection with a concrete context, such as a feeling of belonging in this educational trajectory or of belonging with this person, while we conceptualize a macro-level commitment as an integration of these micro-level commitments into more abstract ideas about the self, such as interests and goals in various life domains.

Such a distinction between a macro and micro level of identity has already implicitly been present in the many reliable and valid instruments to measure identity. Our concept of macro-level identity is measured in established identity interviews that investigate commitments in terms of abstract self-concepts, interest and goals in many domains of life (e.g., Bosma, 1985; Marcia, Waterman, Matteson, Archer, & Orlofsky, 1993). Our concept of micro-level identity is captured in questionnaires that investigate commitments and explorations applied to a specific context (e.g., Klimstra et al., 2010; Van der Gaag et al., 2016). As micro-level commitments are a more simple construct than macro-level commitments, these commitments can be measured using very few items, or even one item. Klimstra et al. (2010) have shown that single-item micro-level identity measures (measuring commitment to, and exploration of, a particular educational trajectory and a particular best friend) show good convergent and discriminant validity, and are related to various constructs (i.e., academic adjustment and relationship quality) in theoretically expected ways. Van der Gaag et al. (2016) demonstrate the convergent validity of similar micro-level exploration and commitment measures, particularly applied to the context of higher education.

Emotional Experiences and Micro-level Commitment Dynamics

Although emotional experiences have been shown to play a role in macro-level identity development (Kunnen, 2006; Vleioras & Bosma, 2005), their role in micro-

level commitment dynamics remains unclear. However, we can formulate some hypotheses based on the process theories of identity development, and a micro-level empirical study by Klimstra et al. (2016). This within-individual study of Klimstra et al. (2016) provides some initial clues about how negative emotional experiences may play a role in micro-level commitment dynamics. Using a large adolescent sample, they found that a negative mood on one day is on average negatively related to micro-level commitment on that same day, and found this result in both the relational (friends) and educational domains. The study of Klimstra et al. (2016) is about general mood and not about emotional experiences as the macro-level studies of Vleioras and Bosma (2005) and Kunnen (2006). However, it has been argued that general mood and emotional experiences are related – they are similar emotional phenomena, on different timescales (Kunnen et al., 2001; Lewis, 2000).

The findings of Klimstra et al. (2016) fit with process theories of identity development. Negative emotions are a prime indicator that an experience is in conflict with the identity commitments of an individual (Kunnen, 2006), and if these negative emotional experiences are accommodated, the strength of commitments may decrease (Bosma & Kunnen, 2001a). The micro-level findings of Klimstra et al. (2016) are in line with such a process. Therefore, we expect that on a micro level, negative emotional experiences will generally be related to decreases in commitment.

To our knowledge, there have not yet been empirical studies that have investigated the role of positive emotional experiences in micro-level identity development. Similar to the suggestion that negative emotions indicate that an experience is in conflict with the identity commitments of an individual (Kunnen, 2006), we suggest that positive emotions indicate that an experience is fitting with the identity commitments of an individual. As experiences of fit can affirm existing commitments (Bosma & Kunnen, 2001a), it seems plausible that positive emotional experiences are related to increases of micro-level commitment.

More generally, nothing is known about how large the impact of emotional experiences is on micro-level commitment dynamics, particularly as compared to the impact of that other classic driving force of commitment development – exploration. If emotional experiences are indeed a more proximal influence on commitment dynamics, we would expect their impact on commitment to be larger than that of exploration.

Present Study

In the present study we explore the role of emotional experiences in micro-level commitment development and investigate the merit of the expectations formulated above. Particularly, we investigate the size of the impact that emotional experiences may have on within-individual changes in commitment, and compare this to the impact of exploration. Following Kunnen (2006), we consider the intensity of negative emotions accompanying an experience to be a good indicator of the measure of conflict of an experience with an identity commitment, and we add that the intensity of positive emotions can be considered a good indicator of the measure of fit between these. Thus, we particularly focus on the positive and negative emotional valence of an experience, and investigate how this is related to changes in the strength of micro-level commitment. We study micro-level commitment dynamics in a domain particularly important for many adolescents and emerging adults: education (e.g., Bosma, 1985).

Context. Identity development in the educational domain is probably strongly affected by societal demands: young people are expected to choose an educational path right after finishing secondary school. In some countries, particularly in Europe – also in the Netherlands, which is the specific context of this study – there are no broad bachelors. Instead, all bachelor programs focus on specific topics of study (e.g., psychology, chemistry, informatics, modern languages etc.). As a consequence, prospective students already have to make a very specific choice for their educational trajectory before the transition to higher education. Moreover, in many countries, financial investments and restrictions make it difficult for an individual to switch to another educational trajectory once a trajectory has been chosen, which increases the pressure to make the right decision. This means that around age 18, youngsters need to have developed a rather clear idea about their career choice, and thus about their educational commitments. Because they are often still in the midst of their identity development, this choice causes a lot of doubt and hesitation, as is evidenced by high drop-out rates (20% - 50% in Europe; Quinn, 2013), particularly in the first year of higher education (ResearchNed, 2013). We therefore expect that educational commitment development is a highly relevant issue, particularly for first year students.

Within-Individual Approach. We take a within-individual approach by studying the micro-level commitment dynamics, and the role of emotional experiences and exploration in these dynamics, for each individual separately. Molenaar and Campbell (2009) showed that a within-individual approach is the only valid way to

make claims on individual change processes, at least until the ergodicity assumption has been proven. This ergodicity assumption entails that associations between variables as found in group data, can only be translated to individuals if these associations are similar across all individuals at the within individual level (homogeneity) and that these within-individual relations do not change over time (stationarity). Van der Gaag et al. (2016) showed large heterogeneity in the within-individual relations between micro-level exploration and commitment. This makes it likely that the ergodicity assumption is violated, and that particularly for investigating micro-level identity dynamics, a within-individual perspective is essential.

METHOD

Participants

Our sample consists of 103 first year psychology students in the Netherlands. The mean age of this group was 19.1 ($SD = 1.4$) at the beginning of the study. The majority of participants is female (81%, $N = 83$; versus 19%, $N = 20$ male), this is in line with the gender distributions (predominantly female) within this particular educational trajectory (psychology). The students participated as part of their curriculum – they are required to gather credits for research participation. They can freely choose the type of research in which to participate. All participants are Dutch speaking and live in the northern part of the Netherlands.

The participants filled in weekly reports throughout a large part of their first academic year. We have excluded individuals from the original sample ($N = 134$) if they either (1) did not show any variation in the dependent variable (commitment, measured on a six-point Likert scale) or (2) if they did not complete enough experience reports. Twelve individuals (9%) were excluded because they do not meet the first criterion – their reported level of commitment is the same for the entire measurement period. Eighteen individuals (13%) did not meet the second criterion: they completed less than 80% of the required amount of experiences reports. In addition, one participant was excluded because she misunderstood the instructions. This makes a total of 31 excluded individuals, leaving 103 individuals in our total sample.

The amount of experience reports is different for two subsamples of the total sample: a 'long' subsample where 30 weekly experience reports were asked of the students, and a 'short' subsample where only 22 experience reports were asked. The

'short' subsample is shorter due to practical constraints – as multiple researchers make use of the same pool of research participants, we were limited in the amount of participant time that we could use. The included participants of the long subsample ($N = 64$) completed 29 experience reports on average ($SD = 2.0$). The included participants of the short subsample ($N = 39$) completed 22 experience reports on average ($SD = 0.9$). We have no reason to expect systematic differences between the two subsamples: they differ in the amount of weeks spent in this study, but the measured variables and population are the same⁶. We have therefore taken them together for our main analysis.

Procedure

We collected data weekly throughout three quarters of the first academic year for the long subsample, and half an academic year for the short subsample. For the long subsample the data collection started in November, and continued until June, for a total period of seven months. For the short subsample data collection started in January and continued until June, for a total period of five months. The participants in both subsamples were asked to fill out the same online questionnaire every week. To reduce the chance of attrition over this long period of data collection, participants were allowed to choose the moment in the week to fill out the questionnaire that suited them best. This did not have to be the same moment each week. They were also allowed to skip two weeks during the data collection period (but not right after each other). Because of the substantial sustained effort required of the participants, the students were rewarded accordingly, with an attractive amount of credits. This questionnaire contained a qualitative and quantitative section; for this study we only use the quantitative measures of emotions, exploration and commitment. The data of the long subsample was collected in three cohorts: first year students from academic years 2011–2012 ($N = 12$), 2012–2013 ($N = 21$) and 2013–2014 ($N = 31$). The data of the short subsample was collected only in academic year 2013–2014 ($N = 39$).

Measures

We measured experiences through a weekly online questionnaire. This questionnaire had two parts: first they were asked to fill out an experience report, then they

⁶ As a check on this assumption, we have run our main analyses (see section 2 under the header Analysis) on both samples separately. We did not find any significant differences between the group averages.

were asked to answer a few multiple choice questions regarding the emotions that accompanied this experience, and their level micro-level educational commitment and exploration. In the experience report, participants described an experience from last week that they felt was important to them and had impacted their attitude towards their education. They indicated the emotions they had felt with this experience by rating 18 qualitatively different positive and negative emotions (following the emotion measures of Kunnen, 2006) on a six-point Likert scale. The 10 negative emotions are: anger, sadness, guilt, confusion, fear, loneliness, insecurity, shame, disappointment and frustration. The 8 positive emotions are: curiosity, happiness, relief, pride, love, freedom, enthusiasm and hope. For each experience of each individual, we calculated a positive emotion score: the average of the 8 positive emotions that accompanied the experience. We also calculated a negative emotion score for each experience: the average of the 10 negative emotions. The internal consistency of the positive and negative emotion scales is within acceptable range – the median within-individual standardized Chronbach’s alpha for positive emotions is 0.85 (*Interquartile Range* = 0.79–0.90), the median for negative emotions is 0.84 (*Interquartile Range* = 0.78–0.91).

In the same weekly measurement, we used one measure of exploration and one measure of commitment of the RECS-E (Repeated Exploration and Commitment Scale in the domain of Education; Van der Gaag et al., 2016) to assess micro-level exploration and commitment (for evidence on the validity of the RECS-E, see Van der Gaag et al., 2016). Here we only use the measures that were administered among all cohorts: one exploration measure (exploration of fit: “Have you asked yourself whether this education is right for you?”) and one commitment measure (commitment to choice: “Do you stand by your choice for this particular education?”). Both were rated on a Likert scale of 1 (not at all) to 6 (very much).

Analysis

The analysis was performed in three steps (explained in detail below). In the first step, we checked the intra-individual covariances between the three independent variables (positive emotions, negative emotions, exploration). In the second step a dynamic linear model was fitted for each individual. This generated regression weights for each individual, which indicate the impact of emotional experiences and exploration on changes in commitment. In the third step, these regression weights were compared within each individual, to investigate which variable (exploration,

positive emotions, or negative emotions) had the strongest impact on commitment changes.

1) Covariances check

As a first step we checked whether there is multicollinearity between the independent variables – that is to what extent the independent variables (positive emotions, negative emotions, exploration) covariate within individuals. We did this by creating individual linear models, using only the independent variables (thus excluding commitment), and checking how much variance is explained (R^2) by relations among these variables. If this explained variance does not exceed 0.75, the amount of multicollinearity between the independent variables is considered acceptable (cf., Miles & Shevlin, 2001, p. 130). As a follow-up, we calculated the intra-individual Spearman correlations (r_s) between the independent variables (i.e., positive emotions – negative emotions; positive emotions – exploration; negative emotions – exploration) for two reasons: (1) to reveal the types of correlation (positive or negative) between the independent variables, and (2) to discover whether any one relation is responsible for the total covariance among independent variables. We report the summary statistics of the intra-individual correlations (r_s), and total explained variance (R^2).

2) Estimating individual models

In the second step we estimated a particular type of dynamic linear model for each individual – a linear growth model including covariates. The conceptual form of the model (see Petris, Petrone, & Campagnoli, 2007, Section 2.4; West & Harrison, 1997, Section 7.3) is similar to that of a standard linear regression. However, the specific implementation of our model deviates in two ways from typical linear regression analyses. First, we take a within-individual approach to account for the ergodicity problem. We have effectuated this by estimating a model for each individual separately using the time-serial data of the individual, resulting in 103 individual linear growth models. Second, we make two deviating assumptions about the dynamics of commitment (see also below). These assumptions are meant to reflect the idea that any current level of commitment depends in part on the previous level of commitment, and that commitment has an intrinsic dynamic, which can be nonlinear.

The commitment trajectory of each individual is modeled using each individual's experience reports (n being either 22 or 30)⁷. From each experience report, we used the positive emotions score, the negative emotion score, the exploration score, and the commitment score to model the entire individual commitment trajectory. For each individual, the model estimates three regression weights: the weight of positive emotions, negative emotions, and exploration. These individual regression weights indicate the average level of impact that emotional experiences and explorations have on changes in commitment for one particular individual: the higher the regression weight, the larger the impact generally is. More specifically, the model for an individual is as follows:

$$C_t = \mu_t + \beta_1 X_{1,t} + \beta_2 X_{2,t} + \beta_3 X_{3,t} + v_t \quad (1)$$

$$\mu_t = \mu_{t-1} + \gamma + w_t \quad (2)$$

where C_t captures the commitment score at time t and $X_{1,t}$, $X_{2,t}$ and $X_{3,t}$ represent the positive emotion score, the negative emotion score and the exploration score, respectively. The regression weights β_1 , β_2 and β_3 – that we use in the third part of our analyses – determine how strongly these scores impact the level of commitment. The level of commitment is further determined by an intercept that describes intrinsic commitment dynamics (μ_t), a general trend (γ) and error variances for both the observed score (v_t) and the latent intercept (w_t).

We assume that the commitment can fluctuate nonlinearly, which is captured by the intrinsic commitment dynamics (μ_t described in (2)). The dynamics of this intrinsic, base-rate commitment – changes in commitment stripped of all effects of emotional experiences and exploration – are data driven: no underlying model of commitment dynamics is assumed. This contrasts the standard regression model, in which the base rate of the dependent variable is assumed to be static, or changing linearly over time. Instead, in our model the base rate μ_t in (1) can fluctuate nonlinearly, and includes a time dependent effect (described in (2)).

To be more specific, the extent of the time-dependency effect – how much the current level of commitment depends on the previous level – is estimated in parameter w_t . The parameter w_t is an error term, its variance determines how susceptible commitment is to changes – if this variance is close to zero, commitment is not

7 We did not correct for missing data as this is not necessary when using this technique, even on slightly irregular data (see also Krone, Albers & Timmerman, 2016).

susceptible to changes. The general trend – or slope – parameter γ measures the general trend in μ_t , after we have already used the explanatory information of $X_{1,t}$, $X_{2,t}$ and $X_{3,t}$.

The above set of equations is transformed into the framework of a Bayesian dynamic linear model (Petris et al., 2007; West & Harrison, 1997). As the model is transformed into a Bayesian model, prior distributions for the parameters need to be postulated. These distributions describe our a priori guesstimate for what the value of the parameters can be. By choosing a specific type of priors (see supplementary R code), the dynamic model is robust against misspecification: should our initial guesstimate be (very) wrong, the model corrects for it. For an accessible introduction to the dynamic linear model aimed at (clinical) psychologists, see Krone, Albers & Timmerman (2016). Computation is done using the package ‘dlm’ (Petris, 2010) in R (version 3.3.0; R Core Team, 2016).

To give an indication of the performance of our individual models, we report model-fit measures by reporting summary statistics for the explained variances (R^2) of the 103 individual models. To illustrate this more concretely, we show the observed commitment trajectories of four individuals, and compare these to their modelled commitment trajectories. We choose the four individuals randomly from three categories: two individuals showing an approximately average amount of explained variance, one individual showing relatively low explained variance, and one individual showing high explained variance.

3) Comparing individual model parameters

In the third step, we plotted the individual regression weights in distributions to compare the impact of exploration, and positive and negative emotions on commitment changes. We use customized ‘pirateplots’ for visualizing the distributions (see Phillips, 2016; and supplementary R-code for details) using the R package ‘yarr’ (Phillips, n.d.). We also provide summary statistics and confidence intervals for the means of the individual regression weights, and for the slope parameter γ . Additionally, by ranking the absolute values of the regression weights within each individual, we investigate whether either positive emotions, negative emotions or exploration has the most impact on commitment for each individual separately. In a frequency distribution we show how often each of the three regression weights is the highest ranking regression weight, and test this distribution with a chi-square test.

RESULTS

1) Covariances Check

As a first step, we checked the multicollinearity – how much variance is explained among only the independent variables (positive emotions, negative emotions, exploration; thus commitment is excluded). For most individuals, the independent variables indeed share explained variance (see Table 1). Only a small portion of individuals (7.8%) shows an explained variance larger than 0.75. The large majority of individuals (92.2%) shows an explained variance smaller than 0.75. The amount of multicollinearity between the independent variables is therefore considered acceptable, hence we included all independent variables in the analysis. Further inspection of the intra-individual correlations between the independent variables revealed that: 1) most of the shared variance can be attributed to an on average strong negative intra-individual correlation between positive and negative emotions, and 2) a smaller amount of shared variance can be attributed to an on average weak positive intra-individual correlation between exploration and negative emotions.

Table 1 Summary statistics for the 103 intra-individual covariance analyses between independent variables: spearman correlations (r_s) between each of the independent variables (positive emotions, negative emotions and exploration) and the total explained variance (R^2) shared by the independent variables

	95% CI			
	Mean	SD	Lower	Upper
R^2	.40	.23	.35	.44
r_s Positive – Negative	-.59	.22	-.63	-.55
r_s Positive – Exploration	-.04	.24	-.08	.01
r_s Negative – Exploration	.17	.25	.12	.22

2) Estimating Individual Models

The estimated individual linear growth models fit well with the individual empirical data: the average explained variance of the 103 models is $R^2 = 0.73$ ($SD = 0.10$, $95\% CI = 0.71 - 0.75$, $Min = 0.38$, $Max = 0.94$). In Figure 1 we illustrate the model performance in relation to the empirical data of four individuals: two individuals with an average amount of explained variance, one individual with low explained variance, and one individual with high explained variance.

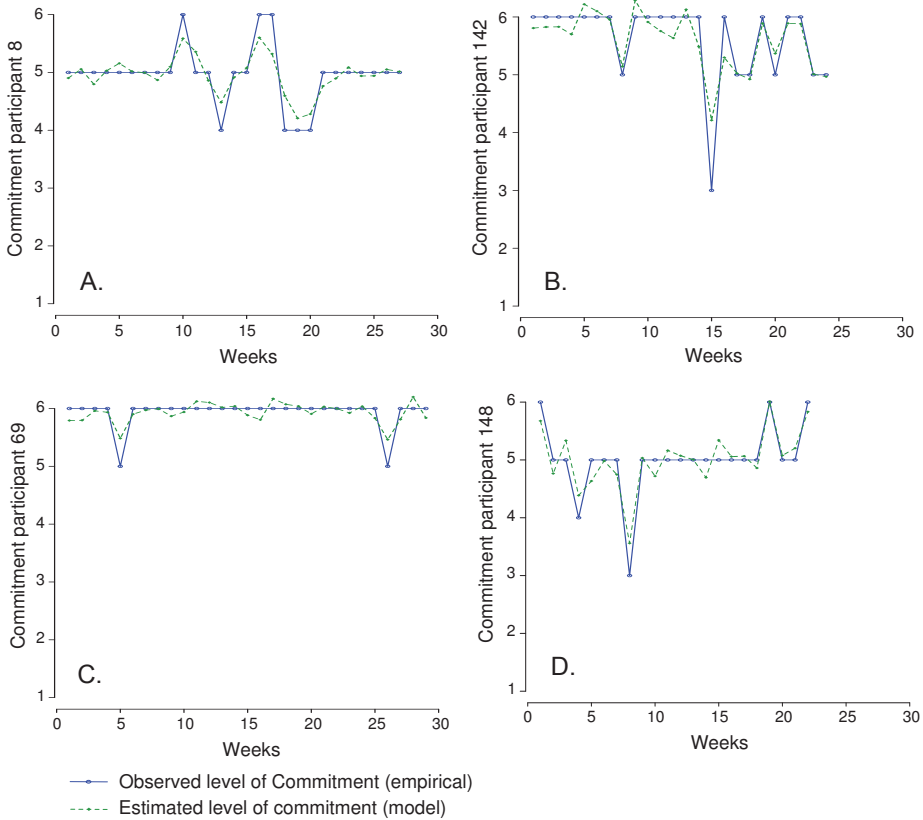


Fig. 1. Demonstration of the commitment values predicted by the dynamic linear model and the observed commitment values for four individuals. On the top, we show two participants for whom the model explains an approximately average amount of variance: participant 8 in the top-left (**A**: $R^2 = 0.73$) and participant 142 in the top-right (**B**: $R^2 = 0.74$). On the bottom, we show two participants for whom the model explains a relatively low and a relatively high amount of variance: the model of participant 69 on the bottom-left exhibits a low amount of explained variance (**C**: $R^2 = 0.55$) and the model of participant 148 on the bottom-right exhibits a high amount of explained variance (**D**: $R^2 = 0.87$).

3) Comparing Individual Model Parameters

When comparing the distributions of the regression weights of exploration, positive and negative emotions (see Figure 2) we see that positive emotions are usually related to increases in commitment for most individuals: 94% of participants show positive regression weights (see also Table 2 for summary statistics). The impact of negative emotions on commitment is more varied, although these are also mostly related to increases in commitment: 68% of individuals show positive regression

Table 2 Summary statistics of individual model parameters: regression weights of positive emotions, negative emotions, exploration and the general trend (slope) of commitment

Type of Regression weight:	Mean	SD	95% CI		N (%)			
			Lower	Upper	Positive		Negative	
Positive emotions	.16	.13	.14	.19	97	(94%)	6	(6%)
Negative emotions	.05	.18	.02	.09	70	(68%)	33	(32%)
Exploration	-.01	.15	-.04	.02	53	(51%)	50	(49%)
Commitment trend	.00	.03	.00	.01	61	(59%)	42	(41%)

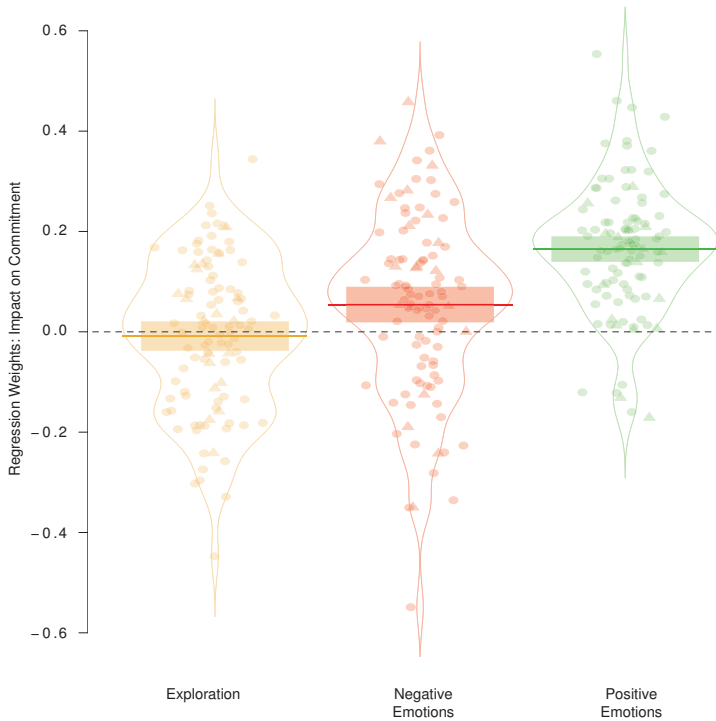


Figure 2 Smoothed empirical distributions of the regression weights of each individual. In the left pane (yellow) the exploration regression weights are shown, these are widely dispersed around zero. The middle pane (red) shows the regression weights for negative emotions which are also widely dispersed, but more often positive than negative. In the pane on the right (green) the regression weights for positive emotions are shown, these have smaller variation, and are mostly positive. The rectangle area's represent the 95% confidence intervals around the mean, the horizontal line represents this mean. The circles represent the regression weights of female participants, the triangles represent those of male participants.

weights. The impact of exploration seems to be most varied, with 51% of the individuals showing that exploration is related to increases in commitment, while for 49% exploration is related to decreases in commitment. On average, the general slope of commitment is zero, with more people having an increasing (59%) than a decreasing (41%) trend in commitment.

The regression weights are similar for males and females. Males and females do not differ significantly in the regression weights of exploration ($M_{male} = 0.02$, $M_{female} = -0.01$; $t = 0.89$, $df = 101$, $p = 0.38$) and negative emotional experiences ($M_{male} = 0.10$, $M_{female} = 0.04$; $t = 1.24$, $df = 101$, $p = 0.22$). They do differ significantly in the regression weights of positive emotions ($M_{male} = 0.11$, $M_{female} = 0.18$; $t = -2.15$, $df = 101$, $p = 0.04$): males show a smaller increase in commitment when having a positive emotional experience. However, the average of this increasing impact of positive emotions is also for males significantly larger than zero (95% CI = 0.05 – 0.17).

When comparing the highest ranking regression weights within each individual (i.e., the variable that impacts commitment the strongest), it turns out that for most individuals either positive (43%) or negative (36%) emotions accompanying an experience have the largest impact on commitment change (see also Figure 3). Therefore, for the majority of individuals (a total of 79%) emotional experiences (either positive or negative) are more impactful than exploration. For a small portion of individuals (21%) exploration is most impactful. This unbalanced distribution of highest ranking regression weights over the three categories, is significant ($\chi^2 = 7.36$, $df = 2$, $p = 0.03$).

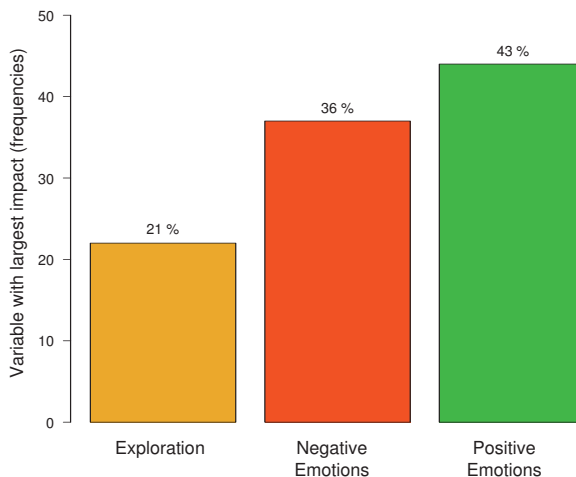


Figure 3 Distribution of the variables (exploration, negative emotions, positive emotions) that, within an individual, show the strongest relation to commitment changes.

DISCUSSION

The individual dynamic linear models that we have created – in particular intra-individual linear growth models based on exploration and emotional experiences – seem to explain micro-level commitment dynamics well (mean explained variance = 0.73). Our results show that both positive and negative emotional experiences seem to play a prominent role in micro-level mechanisms of commitment development. In fact, for most individuals, emotional experiences are more strongly related to subsequent changes in commitment than exploration is.

Experiences as a part of the Mechanisms of Commitment Change

For the large majority of individuals, we found that positive emotional experiences have a substantial impact on the level of educational commitment: commitment usually increases after a positive experience. Intuitively this seems to make sense. When an individual has a positive emotional experience – like feeling relieved to pass an exam, or feeling enthused by an engaging class – it seems logical that the commitment towards the education may increase. Moreover, this finding is in line with the theory of Bosma and Kunnen (2001a), who state that a feeling of ‘fit’ between an experience of an individual and her commitment may affirm the commitment. However, we also found large differences between individuals in the dynamic linear models that explain commitment change. Indeed, for a handful of participants, the results for positive experiences are opposite: they are followed by decreases in educational commitment. Perhaps this variation can be explained by the content of the experiences: possibly positive experiences in a domain other than education – like a series of ‘awesome’ parties or an intense romance – compete with the commitment towards the education and may cause educational commitment to decrease⁸. This is in line with the argument of Vleioras and Bosma (2005): commitment may increase if the positive emotional experience is in support of the current commitment (e.g., good educational performance), but not if this positive experience supports a competing commitment (e.g., hanging out with friends).

We find that individuals vary greatly in the way that their negative emotional experiences are related to changes in their educational commitment. For a substantial minority of individuals, negative experiences are related to a decrease in commitment, as is in line with previous research (Klimstra et al., 2016; Kunnen, 2006).

8 Our data allows for testing such a hypothesis. However, as this requires rigorous coding of all our qualitative data, this is beyond the scope of the current paper.

Indeed, it does not seem hard to imagine that negative experiences like getting bad grades, or having to attend boring classes, may decrease educational commitment. In this light, our finding that the majority of participants actually increases in commitment after a negative emotional experience is surprising. It is possible that this finding is related to the content of the experience (similar to what may be the case for positive emotions): if an individual has a negative experience in a domain other than education, like a fierce fight with a partner, this may motivate the individual to immerse herself in her studies, increasing her educational commitment. However, the content of experiences is probably not a complete explanation for the large amount of individuals showing an increase in commitment after a negative experience. In a recent master thesis study conducted on a part (67%) of the data we used here, it was found that 77% of the total of reported experiences take place in the domain of education, while experiences in other domains (e.g., friends, family) occurred in 23% of the total amount of experience reports (Zwaneveld, 2016). Thus, only a small part of the total amount of experiences takes place in domains other than education. This means that our explanation – that educational commitment increases are a result of negative emotional experiences in domains other than education – can only be true for a small part of the data, a minority of individuals, but we find this result for the majority of individuals. Therefore, other mechanism must also be at play.

Assimilation mechanisms can also explain our finding that negative emotional experiences are usually related to increases in commitment on a micro level. The assimilation-accommodation perspective of Bosma and Kunnen (2001a) entails that a single negative experience (i.e., a micro-level event) can be assimilated (changing the interpretation of the experience so the commitment remains intact), but a stacking of many negative experiences (i.e., a macro-level process) may lead to accommodation (in the form of commitment decrease). This latter macro-level process is also what Kunnen (2006) found: many negative experiences are related to a decrease in macro-level identity commitments, indicative of an accommodation process. On a micro-level we found a different result: a single negative experience is usually followed by an increase in micro-level commitment, which is in line with an assimilation process. Thus on a micro-level, assimilation is perhaps the most common way of dealing with negative experiences, at least for these students. However, our study does not provide insight into whether accommodation may also be present, as we have only focused on the average impact that a negative emotional experience may have on the commitment of an individual.: It would be very interesting

for future research to investigate how much conflicting information is necessary for a student to decrease her educational commitment. If many negative educational experiences take place but still the educational commitment is maintained, this may indicate a form of rigidity, reminiscent of a foreclosed identity status, or the rigidity present in ruminative exploration. Questions on the existence of such rigid commitment trajectories and what it takes before accommodation does take place can only be answered by taking a more dynamic perspective, for example by investigating intra-individual turning points in the relation between negative emotional experiences and changes in commitment.

Understanding how negative emotional experiences are processed on a micro level may help us to more fully understand the assimilation process, and may further explain why we find negative emotional experiences to generally be related to increases in micro-level commitment. Assimilation is not the same as maintenance of the status quo, but an active process in which the individual adjusts her interpretation of an experience that conflicts with a concern important to her, such as identity commitments (Bosma & Kunnen, 2001a). Negative emotional experiences (such as a bad grade, or a negative evaluation) may signal a conflict with identity commitments (Kunnen, 2006), and threaten the identity commitment. According to the emotion theory of Frijda (1986), a threat to a concern triggers feelings, thoughts and action tendencies which motivate the individual to protect the concern. The content of these feelings, thoughts, and action tendencies could strengthen micro-level commitments. For example, an important concern of a student may be the commitment to their self-chosen educational trajectory (e.g., psychology) as it is a reflection of her macro-level identity (e.g., "I am dedicated to helping people") that she wishes to maintain. Receiving a bad grade may be experienced as a threat to this concern, and this may trigger negative emotions. The student is now motivated to assimilate the experience in such a way that the concern is protected. To do so, she may have a concern protecting thought (e.g., "but this is really what I want to do"), resulting in an action tendency (e.g., "Next time I will read the book"), which becomes accompanied by feelings of determination. This process of assimilation, of protecting her concern, may make her dedication to this particular educational trajectory salient and stronger, resulting in a stronger educational commitment despite the initially negative experience.

This micro-level processing of negative emotional experiences can also explain why our findings are different from those of Klimstra et al. (2016). In contrast to our study, they found a negative intra-individual relation between commitment and

negative mood on average. A difference in construct used (mood versus emotional experience) is perhaps responsible for the difference in findings. However, because of the difference in the age and the educational position of the participants, it is also likely that negative emotional experiences are processed differently. The participants in our study were 19 year old university students who have made a deliberate choice for a specific educational trajectory, while the participants in the Klimstra et al. (2016) study were 13 years old secondary school students who are obligated to follow a standard curriculum. This difference in whether individuals can influence their educational circumstances (i.e., whether it is an open or closed domain; Meeus, ledema, Helsen, & Vollebergh, 1999) may lead them to have different concerns, perceive different levels of threat as a result of a negative emotional experience, and thus respond differently to negative emotional experiences. Young adolescents have not formed commitments to self-chosen contexts – a context is forced upon them. This may mean that the commitment to the educational context is not a reflection of their macro-level identity commitments (which are probably also not yet fully formed at this age). Their macro-level identity commitments are thus not really threatened as a negative emotional experience occurs, and an elaborate assimilation process is not needed. Instead they may simply decrease their micro-level educational commitment as a consequence of a negative emotional experience, without consequences to their macro-level identity commitments. This also means that the findings in our study are to some extent context dependent: not necessarily the same in closed domains or other populations. This, of course, needs to be explored in future research.

Experiences versus Exploration

We found that for the large majority of individuals, emotional experiences have a larger impact on changes in commitment than acts of exploration have, where positive experiences seem to have the largest impact for the largest portion of individuals. This supports the hypothesis that experiences are an important part of the mechanisms of micro-level identity development, as has been proposed by many researchers (e.g., Bosma & Kunnen, 2001a; Grotevant, 1987; Kerpelman et al., 1997; Van der Gaag et al., 2016; Vleioras & Bosma, 2005). Indeed, our results support the notion that emotional experiences are more proximal in the mechanisms of identity development, while exploration is more distal.

This central and proximal role of experiences could be an alternative explanation for some recent findings regarding different types of exploration. Zimmerman

et al. (2015) and Skhirtladze et al. (2015) have independently found that in-depth exploration can be both positively and negatively related to commitment. They therefore proposed to subdivide in-depth exploration in two subcategories: commitment reconsideration, which is related to decreases in commitment; and reflective in depth exploration, which is related to increases in commitment. Based on our findings we propose an alternative explanation: perhaps the differential relation between exploration and commitment is not indicative of two qualitatively different ways of exploring in depth, but a result of a mediating influence of experiences that follow in-depth exploration. As we have shown that emotional experiences seem to have a larger impact on commitment change than exploration alone, it could be a factor that has been invisible so far in many studies of identity development, but can mediate the relation between exploration and commitment.

Perhaps then, future empirical studies that attempt to explain the process of micro-level identity development should include measures of (emotional) experience, rather than only including measures of commitment and exploration. It is indeed surprising that although experiences are theorized to play a role in identity development as an outcome of the exploration process (e.g., Grotevant, 1986), that this outcome has so far usually not been included in measurements of the identity development process. In various operationalizations of exploration that we know of (e.g., Bosma, 1985; Crocetti et al., 2008; Klimstra et al., 2010; Luyckx et al., 2006; Van der Gaag et al., 2016), exploration is measured solely as various types of exploratory behavior, and does not include the experiences resulting from that behavior. Perhaps this is a result of the focus on structure rather than content (Kroger, 2003) or a result of a research tradition that focuses mainly on macro-level identity (Lichtwarck-Aschoff et al., 2008). But our results indicate that emotional experiences can be considered an important factor in commitment dynamics in their own right, separate from the act of exploration. Indeed, we follow Vleioras & Bosma (2005) in challenging the supremacy of exploration as a driving force of identity development – we might even go a step further. Perhaps, at least on a micro level, identity development is better conceptualized as consisting not of two, but of three core processes: the development of *commitments* is affected by emotional *experiences*, and these in turn may or may not result from deliberate acts of *exploration*.

Our findings allow us to interpret emotional experiences as having a more proximal impact on commitment dynamics than acts of exploration have, but the particular chain we postulate above should be viewed as merely one step towards building a more complete process theory on micro-level identity dynamics – it is

not meant to be a complete picture. Indeed, it needs to be noted that we investigated one type of impact – the impact of emotional experiences and explorations on commitment – but many other complex and mutually influencing relations are likely to exist. For example, it is completely possible, even likely, that a micro-level commitment has an impact on changing levels of micro-level exploration. This has in fact been shown longitudinally in the interpersonal domain (Klimstra et al., 2010). Moreover, it seems quite plausible that commitment can also influence emotional experiences. For instance, a person with a very high level of commitment towards his education may interpret the failure of an exam as a fluke and may experience little negative emotions. In contrast, someone with a low commitment might take this same experience as a cue that his choice of education was wrong after all, reinforcing the doubts that were already there, and this individuals might consequently experience a lot of negative emotions. It is also possible that a relation exists between exploration and emotional experiences. Even though we did not find a consistent relation between positive emotional experiences and exploration, we did find on average a weak positive intra-individual relation between negative emotional experiences and exploration. This means that an act of exploration could usually be followed by a negative experience, or perhaps more likely, the other way around: a negative emotional experience (e.g., receiving a bad grade) could elicit a form of exploration (e.g., reconsidering whether this education is actually fitting). Indeed, it seems highly likely that exploration, emotional experiences and commitment all interact in a complex way, and that many individual differences exist in how they interact precisely.

Implications for Practice

The potential for practical application of a micro-level approach is demonstrated by this study: the insight that educational commitment is susceptible to influence of emotional experiences may be of value for practitioners working with students in higher education. This can be used, for example, to prevent young individuals from dropping out of the educational system before they have attained a degree that gives them a decent opportunity on the job market. We have seen that positive, but surprisingly, also negative emotional experiences increased the educational commitment of first year students. This implies that stimulating positive experiences would probably strengthen the educational commitment of many students. However, as negative experiences also usually strengthen commitment, what seems to matter most for commitment building is whether the emotional experience is

intense or not, regardless of the valence (i.e., positive or negative). Vleioras & Bosma (2005) argued that emotions particularly emerge among experiences with personal relevance. Perhaps universities could investigate what is personally relevant to their students, and try to facilitate such experiences.

Our finding that negative experiences are usually related to increases in educational commitment may also have practical relevance in a different way. Educational experiences that are negative, frustrating or stressful may act as a motivator. Students who react to negative experiences by enhancing their efforts and increasing their commitments can be seen as resilient. However, continuing this reaction for too long may have an adverse effect: it may indicate that the individuals are rigidly clinging to their commitments, in denial of the possibility that the educational trajectory is not well suited. For supervisors or mentors it is important but difficult to distinguish between resilient and rigid reactions to negative experiences. One way to do this is to ask first year students regularly about their experiences and how they feel about their chosen educational path. If students demonstrate an imbalance between frequent negative emotional experiences on the one hand and an enduring strong educational commitment on the other hand, perhaps a conversation can be started to critically examine whether this educational trajectory is indeed the right the choice for that student.

Limitations

Of course, our study is limited in its scope and there are several methodological issues that we shall address here. First, it is important to note that we found some multicollinearity for our independent variables. For many individuals we found a strong negative correlation between positive and negative emotions. This is perhaps not so surprising: although some individuals may occasionally have multifaceted emotional experiences – experiences accompanied by both positive and negative emotions – for the majority of individuals a lot of positive emotions are usually accompanied by little negative emotions and vice versa (which would result in a negative correlation, as we have found). Moreover, some multicollinearity exists between exploration and negative emotional experiences: most intra-individual correlations between these two variables are negative⁹. However, our modeling technique ac-

9 Being negative, this relation between negative emotional experiences and exploration cannot be an alternative explanation for the relation between negative emotional experiences and commitment, which is positive.

counts for multicollinearity: the overlapping explained variance is distributed over the variables, proportional to how much variance the variables uniquely explain.

Second, the technique we have used is promising and innovative, but of course also limited in explaining all the complexities of individual development. The dynamic linear model we have used – the individual linear growth model – is still relatively static: each individual gets one parameter that represents the impact of positive and negative emotional experiences. This may not be realistic, in fact it seems plausible that also within individuals the impact of experiences may vary. Moreover, the categorization of emotional experiences and exploration as ‘independent’ variables impacting the ‘dependent’ variable commitment is in a sense artificial. In this first investigation of the role of experiences, the likely complex nature of the relationship between experiences, exploration and commitment has not been taken into account. Analyzing nonlinear and mutually influencing processes in intensive longitudinal data is just in its infancy (for a recent overview of state-of-the-art techniques see Hamaker, Ceulemans, Grasman, & Tuerlinckx, 2015). However, the relatively static nature of our individual models does not seem to be a great hindrance with regards to the amount of variance that the models are able to explain. In fact, the average amount of explained variance (0.73) is high, which underscores the promising nature of using dynamic linear models to understand individual development.

Third, the high explained variances do not mean that we now have a nearly complete explanation of commitment development. For one, we still have little understanding on the role of stability and variability, particularly in intrinsic commitment dynamics. Individuals seem to differ strongly in these commitment dynamics, with some being very stable (a few individuals had to be excluded from our analysis because of this stability – they showed the same score at each time point, perhaps also due to the use of a limited six-point Likert scale) while others showed a lot of variability in educational commitment. Moreover, differences in variability of emotional experiences and exploration may also exist: exploration referred to something general (this education, which is perhaps more stable) and experience referred to something specific (a particular event, which is perhaps more variable). Future research needs to explain these differences in variability and stability, and address the consequences of this.

Fourth, it should be noted that the linear growth model, just as a standard regression model, does not immediately lend itself for causal inference but purely for correlational inferences. We interpret our findings in relation to theory, allowing

us to hypothesize on certain sequences. However, as indicated, many other relations and sequences are definitely not excluded by this interpretation. Moreover, other factors may play a role in the relations we find. For example, we have only included one type of micro-level exploration, while others may also play a role in commitment dynamics (e.g., Van der Gaag et al., 2016). Moreover, in our design not all experiences are measured – we only ask about one important experience of the preceding week. Other, not reported emotional experiences may also play a role.

Fifth and last, our study is very specific with regard to the population and the identity domain: our sample is homogeneous (first year psychology majors from a particular part of the Netherlands) and we study only one domain of micro-level identity (educational identity) among the many domains that could be relevant for identity development (e.g., Bosma, 1985). As discussed, future research needs to explore the role of emotional experiences in identity dynamics in other populations and domains.

Conclusion

We conclude that emotional experiences seem to play a major role in the micro-level mechanisms of identity development – at least in the domain of education, within our specific student population. Our results show that emotional experiences deserve more attention: they are strongly related to changes in commitment. In fact, for most individuals, emotional experiences seem to have a stronger impact on commitment than exploration does, indicating emotional experiences are perhaps more proximal to commitment than exploration is. Indeed, emotional experiences may have to be included in our thinking about, and research on, the mechanisms of identity development.

REFERENCES

- Beyers, W., & Luyckx, K. (2015). Ruminative exploration and reconsideration of commitment as risk factors for suboptimal identity development in adolescence and emerging adulthood. *Journal of Adolescence*, *47*, 169-178. doi:10.1016/j.adolescence.2015.10.018
- Bosma, H.A. (1985). *Identity development in adolescence. Coping with commitments*. Groningen: University of Groningen.
- Bosma, H.A., & Kunnen, E.S. (2001a). Determinants and mechanisms in ego identity development: A review and synthesis. *Developmental Review*, *21*, 39-66. doi:10.1006/drev.2000.0514
- Bosma, H.A., & Kunnen, E.S. (Eds.). (2001b). *Identity and emotion: A self-organisational process*. Cambridge, UK: Cambridge University Press.
- Crocetti, E., Rubini, M., & Meeus, W. (2008). Capturing the dynamics of identity formation in various ethnic groups: Development and validation of a three-dimensional model. *Journal of Adolescence*, *31*, 207-222. doi:10.1016/j.adolescence.2007.09.002
- Erikson, E. H. (1968). *Identity: youth and crisis*. New York: Norton.
- Frijda, N. H. (1986). *The Emotions*. Cambridge: Cambridge University Press.
- Grotevant, H.D. (1987). Toward a process model of identity formation. *Journal of Adolescent Research*, *2*, 203-222. doi:10.1177/074355488723003
- Hamaker, E.L., Ceulemans, E., Grasman, R.P., & Tuerlinckx, F. (2015). Modeling affect dynamics: State of the art and future challenges. *Emotion Review*, *7*, 316-322. doi:10.1177/1754073915590619
- Kerpelman, J.L., Pittman, J.F., & Lamke, L.K. (1997). Toward a microprocess perspective on adolescent identity development: An identity control theory approach. *Journal of Adolescent Research*, *12*, 325-346. doi:10.1177/0743554897123002
- Kerrick, M.R., & Thorne, A. (2014). 'So it's like, do you like Jeff a lot or, I mean...': How women friends interactionally position personal identity while conversing about desire. *Emerging Adulthood*, *2*, 294-303. doi:10.1177/2167696814549803
- Klimstra, T. A., Kuppens, P., Luyckx, K., Branje, S., Hale, W.W., Oosterwegel, A., Koot, H.M., & Meeus, W.H.J. (2016). Daily Dynamics of Adolescent Mood and Identity. *Journal of Research on Adolescence*, *26*, 459-473. doi:10.1111/jora.12205
- Klimstra, T.A., Luyckx, K., Hale, W.I., Frijns, T., Van Lier, P.C., & Meeus, W.J. (2010). Short-term fluctuations in identity: Introducing a micro-level approach to identity formation. *Journal of Personality and Social Psychology*, *99*, 191-202. doi:10.1037/a0019584
- Kroger, J. (2003). What Transits in an Identity Status Transition? *Identity: An International Journal of Theory and Research*, *3*, 197-220. doi:10.1207/S1532706XID0303_02
- Kroger, J., & Marcia, J.E. (2011). The identity statuses: Origins, meanings, and interpretations. In S.J. Schwartz, K. Luyckx, V.L. Vignoles (Eds.), *Handbook of identity theory and research, Vols. 1 and 2* (pp. 31-53). New York, NY, US: Springer Science + Business Media. Doi: 10.1007/978-1-4419-7988-9_2
- Kroger, J., Martinussen, M., & Marcia, J. E. (2010). Identity status change during adolescence and young adulthood: a meta-analysis. *Journal of Adolescence*, *33*, 683-698. doi:10.1016/j.adolescence.2009.11.002
- Krone, T., Albers, C.J., & Timmerman, M.E. (2016). Bayesian dynamic modelling to assess differential treatment effects on panic attack frequencies. *Statistical Modelling*, *16*, 343-359. doi: 10.1177/1471082X16650777.
- Kunnen, E. S. (2006). Are conflicts the motor in identity change? *Identity: an International Journal of Theory and Research*, *6*, 169-186. doi:10.1207/s1532706xid0602_3

- Kunnen, E.S., Bosma, H.A., van der Meulen, M. & van Halen, C. (2001). A dynamic systems approach to identity and emotions: An overview and implications. In H.A. Bosma, E.S. Kunnen (Eds). *Identity and emotion: a self-organisational process*. pp. 202-230, Cambridge University Press.
- Lewis, M.D. (2000). Emotional self-organization at three time scales. In M.D. Lewis, I. Granic (Eds). *Emotion, Development and Self-organization*. pp 37-69. Cambridge University Press, Cambridge.
- Lichtwarck-Aschoff, A., Van Geert, P.L.C., Bosma, H.A., & Kunnen, E.S. (2008). Time and identity: A framework for research and theory formation. *Developmental Review*, 28, 370–400. doi:10.1016/j.dr.2008.04.001
- Luyckx, K., Goossens, L., Soenens, B., & Beyers, W. (2006). Unpacking commitment and exploration: Preliminary validation of an integrative model of late adolescent identity formation. *Journal of Adolescence*, 29, 361-378. doi:10.1016/j.adolescence.2005.03.008
- Marcia, J.E. (1966). Development and validation of ego-identity status. *Journal of Personality and Social Psychology*, 3, 118–133.
- Marcia, J.E., Waterman, A.S., Matteson, D.R., Archer, S.L., & Orlofsky, J.L. (1993). *Ego Identity: A handbook for psychosocial research*. New York: Springer verlag.
- Meeus, W.H.J. (2011). The study of adolescent identity formation 2000–2010: A review of longitudinal research. *Journal of Research on Adolescence*, 21, 75-94. doi:10.1111/j.1532-7795.2010.00716.x
- Meeus, W.H.J., ledema, J., Helsen, M., & Vollebergh, W. (1999). Patterns of adolescent identity development: Review of literature and longitudinal analysis. *Developmental Review*, 19, 419-461. doi:10.1006/drev.1999.0483
- Miles J., & Shevlin, M. (2001). *Applying regression & correlation. A guide for students and researchers*. London, UK: Sage.
- Molenaar, P.M., & Campbell, C.G. (2009). The new person-specific paradigm in psychology. *Current Directions in Psychological Science*, 18, 112-117.
- Morgan, E.M., & Korobov, N. (2012). Interpersonal identity formation in conversations with close friends about dating relationships. *Journal of Adolescence*, 35, 1471-1483. doi:10.1016/j.adolescence.2011.09.005
- Petris, G. (2010). An R Package for Dynamic Linear Models. *Journal of Statistical Software*, 36, 1-16. URL: <http://www.jstatsoft.org/v36/i12/>.
- Petris, G., Petrone, S., & Campagnoli, P. (2007). *Dynamic Linear models with R*. Springer: New York.
- Phillips, N. (2016, april 5th). The Pirate Plot (2.0) – The RDI plotting choice of R pirates [Blogpost]. Retrieved from: <http://nathaniieldphillips.com/2016/04/pirateplot-2-0-the-rdi-plotting-choice-of-r-pirates/>
- Phillips, N. (n.d.). *Yarr: A companion to the e-book YaRrr!: The Pirate's Guide to R*. R package version 0.1. URL: www.thepiratesguidetor.com
- Quinn, J. (2013). *Drop-out and completion in Higher education in Europe*. European Union: Naset. From: www.nasetweb.edu.
- R Core Team (2016). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL: <http://www.R-project.org/>.
- ResearchNed (2013). *Monitor policy measures*. Nijmegen: ResearchNed.
- Schwab, J.R. (2013). Religious meaning making: Positioning identities through stories. *Psychology of Religion and Spirituality*, 5, 219-226. doi:10.1037/a0031557
- Skhirtladze, N., Javakhishvili, N., Schwartz, S.J., Beyers, W., & Luyckx, K. (2015). Identity processes and statuses in post-soviet Georgia: Exploration processes operate differently. *Journal of Adolescence*, 47, 197-209. doi: 10.1016/j.adolescence.2015.08.006.
- Van der Gaag, M.A.E., De Ruiter, N.M.P., & Kunnen, E.S. (2016). Micro-level processes of identity development: Intra-individual relations between commitment and exploration. *Journal of Adolescence*, 47, 38-47. doi:10.1016/j.adolescence.2015.11.007

- Vleioras, G., & Bosma, H.A. (2005). Predicting Change in Relational Identity Commitments: Exploration and Emotions. *Identity: an International Journal of Theory and Research*, 5, 35-56. doi:10.1207/s1532706xid0501_3
- West, M., & Harrison, J. (1997). *Bayesian Forecasting and Dynamic Models* (2nd ed.). New York: Springer.
- Zimmermann, G., Lannegrand-Willems, L., Safont-Mottay, C., & Cannard, C. (2015). Testing new identity models and processes in French-speaking adolescents and emerging adult students. *Journal of Youth and Adolescence*, 44, 127-141. doi:10.1007/s10964-013-0005-7
- Zwaneveld, J.W. (2016). *Micro level Self-Determination Processes as Predictor of School Dropout*. University of Groningen: Unpublished master thesis.

A process-oriented approach to understanding career choice

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5

ABSTRACT

Adolescents often struggle to make a suitable career choice out of the large range of available options. As a consequence, many drop out of higher education prematurely, resulting in significant costs to both themselves and society. Here, we introduce a novel process-oriented framework aimed at understanding how adolescents make such choices. We conceptualize career choice as a process built up out of many experiences that result from broad and in-depth exploration of career options. These experiences lead individuals to adjust their assessment of career options over time, eventually resulting in a decision. Based on this conceptual framework, we constructed a computational model to simulate a large number of career choice trajectories. We present an extensive analysis of how the career choice process unfolds in this model, depending on three individual characteristics: 1) the balance between broad and in-depth exploration, 2) the accuracy in assessing how well career options will fit, and 3) the degree of selectiveness. We also identify the conditions that lead to the emergence of ruminative exploration and rash decision making, and conclude that these features do not always affect the choice process negatively. Our model generates a number of concrete predictions that can be tested empirically, and, if supported by empirical evidence, can result in individually tailored tools to help adolescents make the right career choice. More generally, our study shows how explicitly considering the dynamic aspects of complex developmental processes can lead to counterintuitive insights that one would not have arrived at by verbal reasoning alone.

INTRODUCTION

In many modern societies, adolescents are expected to make crucial choices for their future career path at a relatively young age. This is often a daunting task for these individuals; they are typically still in the midst of the process of identity development, and many are not yet capable of successfully integrating their interests and talents with the career options offered by the environment (Kroger, Martinussen, & Marcia, 2010). Moreover, it has been suggested that imbalances in adolescent brain development (i.e., rapid development of limbic structures relative to prefrontal structures) lead adolescents to make decisions that are likely to be driven by impulsive emotional motivations, rather than careful weighing of available options (e.g., Casey, Jones, & Somerville, 2011). As a result, adolescents often struggle to make a fitting choice out of the overwhelming range of available career options.

The difficulties that young individuals have with choosing a career often lead them to drop out of higher education, feeling that they did not make a fitting choice (ResearchNed, 2013). A recent study shows that drop-out levels are very high across European countries, ranging from about one in five (Denmark) to more than half (Italy; Quinn, 2013). This high incidence of poor career choices can come at a significant cost: young individuals who do not finish higher education are more likely to spend long periods without any employment, education, or training ("NEET"; European Training Foundation, 2014). Prolonged unemployment is associated with various adverse outcomes later in life, such as an elevated risk of being involved in crime and a higher vulnerability to physical and mental health issues (Coles, Godfrey, Kueng, Parrott, & Bradshaw, 2010). These issues are costly for the individual, but also for society, which bears the financial burden of the welfare system.

To be able to prevent young individuals from dropping out of career trajectories because of poor career decisions, it is important to have a sound comprehension of how these career choices are made. Research aimed at understanding career choice is mostly based on theories of career development and identity formation, and is typically considered to be long-term process. Apart from this, there is also a large body of literature aimed at understanding human decision making in general, which is mostly rooted in cognitive science, and tends to focus on (short-term) choices between simultaneously available options. In this study, we bring the developmental and cognitive approaches together in a process-oriented framework for understanding career choice. This framework is based on conceptualizing the macro-pattern of long-term choice as a series of many short-term experiences that

affect commitment to different options. This means that we consider career choice to be a complex dynamic process, which makes its outcomes hard to predict using verbal reasoning alone (Courgeau, Bijak, Franck, & Silverman, 2017). Therefore, we develop a simulation model based on our framework, and extensively discuss its outcomes across a wide range of conditions. Apart from clarifying the dynamics of complex processes, such models have an important function in the generation of hypotheses, counteracting the (recently increasingly emphasized, e.g., Gonzales & Cunningham, 2015) problem of 'HARKing' (after-the-fact generation of hypotheses to fit the data; Kerr, 1998).

The aim of this paper is to introduce a new way of thinking about the process of career choice, and about long-term decision making processes in general. To provide a clear demonstration of the basic principles our framework, we focus on a small number of core parameters. Hence, our aim is not to be comprehensive or all-encompassing, but rather to illustrate the basic principles of a dynamic approach to long-term decision making. Nonetheless, our simulation model generates a number of qualitative hypotheses which can be tested through empirical research.

Developmental approach to career choice

Within the developmental framework, career choice is typically conceptualized as a developmental task intertwined with self-concept (Super, 1957) and identity development (Erikson, 1968), and is often considered to consist of a number of distinct phases (e.g., Gati & Asher, 2001; Germeijs & Verschueren, 2006; Savickas, 1997; Skorikov, 2007; Wallace-Broschious, Serafica, & Osipow, 1994). Developmental theories of career choice generally assume that individuals engage in one or more phases of exploration, in which they explore their own interests and capabilities as well as the options to choose from, and finally a stage in which they decide on and commit to a career path (see Dietrich, Parker, & Salmela-Aro, 2012, for a review). Negative outcomes can result from imbalances in this process: individuals may arrive at suboptimal decisions if they do not develop a strong commitment towards their choice, or if they do not explore enough (Germeijs, Luyckx, Note-laers, Goossens, & Verschueren, 2012). Conversely, it has also been shown that too much exploration may lead individuals to get stuck in the exploration process and ruminate on options without coming to a decision (Luyckx et al., 2008). Research within the developmental framework has primarily focused on coming to more comprehensive and refined descriptions of the various phases of career choice (Gati & Asher, 2001; Germeijs & Verschueren, 2006; Savickas, 1997; Skorikov, 2007), types

of exploration and commitment (Crocetti, Rubini, & Meeus, 2008; Luyckx, Goossens, Soenens, & Beyers, 2006; Porfeli & Skorikov, 2010), taxonomies of career decision-making difficulties (Gati, Krausz, & Osipow, 1996) and typologies of career identity development (Germeijs, et al., 2012; Hirschi & Läge, 2007).

The developmental perspective has provided a useful overall characterization of the career choice process, leading to important advances in our capability to identify individuals that may be at risk of making poor choices. However, it is difficult to use the insights obtained with this approach to determine when and how to intervene in specific individual career choice trajectories, because they are typically arrived at by population-level analysis. The statistical relationships that emerge from population-level analyses (e.g., correlations between variables) need not reflect associations within individuals over time (the 'ergodicity problem'; Kievit, Frankenhuis, Waldorp, & Borsboom, 2013; Molenaar & Campbell, 2009). Because of this, effective measures to intervene into problematic individual career choice processes have to be based on an explicit understanding of career choice on the individual level. This means that we need more insight in how the micro-scale day-to-day interactions of individuals with their environment eventually result in the macro-scale patterns of the career choice process. Indeed, the need for a more dynamic, process oriented approach to career choice is increasingly recognized (Gati, 2013; Rottinghaus & Van Esbroeck, 2011; Savickas et al., 2009).

Cognitive approach to career choice

Decision science is a branch of cognitive science that has traditionally been dominated by rational choice theories, although dynamic approaches to modeling decision making have rapidly been gaining ground in recent years (Oppenheimer & Kelso, 2015). Although rational choice theories have been very influential across disciplines, including economics (Expected Utility Theory and game theory: Von Neumann & Morgenstern, 1947) and psychology (e.g., vocational matching theories: Dawis & Lofquist, 1984; Holland, 1959, 1997; Parsons, 1909), there has been an increasing realization that there are many choice problems for which this rational approach is not feasible. For one, evidence is accumulating that emotions are major drivers of decision making (Lerner et al., 2015). Moreover, some authors have argued that rational choice strategies are not suitable for complex decisions like career decision making, as they are characterized by an abundance of options and inherent uncertainties (Pryor & Bright, 2011; Rottinghaus & Van Esbroeck, 2011).

The limitations of the rational approach to decision making has led to a growing movement in decision science of modeling decision making as a dynamic sequence of basic nonlinear cognitive and emotional processes, rather than assuming a 'black box' psychology that is an optimization machine. For example, several dynamic models of decision making assume that individuals are under time and energy constraints when making decisions, and that individuals are not perfect in evaluating information (e.g., Busemeyer & Townsend, 1993; Johnson, Häubl, & Keinan, 2007). For the study of career choice, explicit micro-dynamical models that are grounded in these more realistic, nonlinear cognitive processes are currently still lacking.

Present study

Here, we introduce a novel dynamic framework for understanding career choice, which is firmly rooted in the developmental perspective, while making use of recent developments in cognitive science concerning the micro-dynamics of decision making. Within this framework, the micro-scale experiences that result from the individuals' exploration of career options are considered the building blocks of the career choice process. Individual characteristics and environmental factors, such as the selectiveness of the individual and the reliability of information about different career options, affect these day-to-day experiences. Eventually, these experiences all together lead to a decision. The aim of our framework is to allow the development of explicit process-oriented models of career choice that are based on these principles, which allows the investigation of how the macro-properties of the career choice process emerge (e.g., the quality of the choice that is made, how fast a decision is reached).

As the centerpiece of this paper, we introduce a computational career choice simulation model based on our framework, and present an analysis of its dynamics and outcomes across a wide range of parameters. With this model, we explore how individual characteristics (how individuals explore options, their capability of assessing how well options fit them, and their selectiveness) together shape the career choice process. In analyzing the results of this model, our main focus is on the outcome of this process: how well does the option that is eventually chosen fit the interests and capabilities of the individual? In addition, we pay specific attention to the emergence two features of the process itself: (1) the tendency of the decision process to get stuck into *ruminative exploration*, and (2) the tendency to arrive at *rash decisions* based on very little exploration. Understanding how these imbalances in the career choice process might arise can help in developing tools to

prevent them. Also, our focus on the emergence of these specific subtypes of the career choice process allows us to showcase the value of using a process-oriented modeling approach. We will show how our framework can illuminate under which conditions these phenomena are likely to arise, and if they are indeed associated with poor career choices.

CONCEPTUAL FRAMEWORK

The functional structure of our conceptual framework is presented in Figure 1. We conceptualize career choice as an iterative process of both broad exploration (sampling potential career options) and in-depth exploration (further investigating promising options in depth). Both types of exploration result in an experience with a potential career option, which may contain many aspects – e.g., cognitions, emotions, perceptions and action tendencies (Kunnen, Bosma, van der Meulen, & van Halen, 2001; Lewis, 2000). This experience informs the individual on how well a career option fits with her preferences and capacities. Depending on how good she perceives this fit to be, the individual may choose the option she has just explored, thereby ending the choice process. Alternatively, the individual may keep the option under consideration or discard it, and then engage in a new act of broad or in-depth exploration. This process repeats until a choice is made.

There are three factors (indicated in red in Figure 1) that are central to shaping the career choice process in our framework: 1) the **exploration tendency**, which determines how the individual divides her time between broad exploration and in-depth exploration, 2) the **accuracy** with which the individual is able to estimate how well options fit her, and 3) the degree of **selectiveness**, which determines how good the fit of an option must be for the individual to take it under consideration, or to choose it. Below, we discuss each of these factors and their relevance for shaping the career choice process.

Exploration tendency

In our framework, individuals can explore potential career options either broadly or in depth. This distinction between these two types of exploration is abundantly supported by many studies on career choice and identity development (e.g., Gati & Ascher, 2001; Luyckx, Goossens, Soenens, & Beyers, 2006; Porfeli & Skorikov, 2010). Broad exploration entails the investigation of new options, to get a sense of which

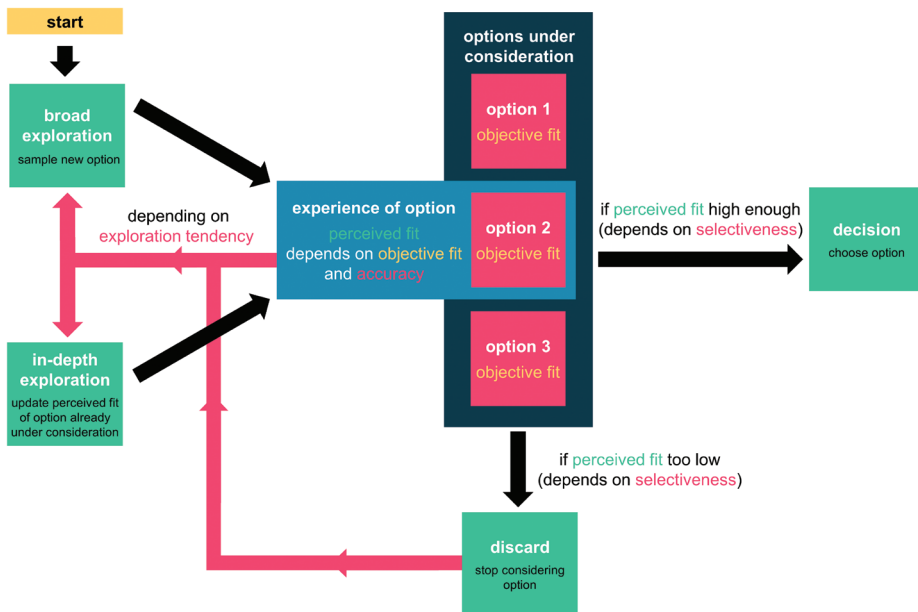


Figure 1 The functional structure of the career choice framework. We model career choice as a sequence of exploration events, encompassing both broad exploration (in which a new career option is investigated) and in-depth exploration (in which individuals gain more experience with a career option they are already considering). The individual property of *exploration tendency* determines how likely an individual is to engage in either type of exploration at any given point in time. Both types of exploration result in an experience with an option, which leads to a perception of how well the explored option fits with the individual's interests and capabilities. This 'perceived fit' is partly dependent on the inherent 'objective fit' of an option, but it is also affected by the individual's *accuracy* in assessing the fit of career options. Repeated in-depth exploration tends to lead to a more accurate perception of an option. If the perceived fit of a recently explored option does not meet the standards of the individual - this depends on the individual's *selectiveness* - the option is discarded from the set of options under consideration, and the individual again engages in exploration. Conversely, if the perceived fit of an option is high enough (also depending on the individual's selectiveness), the individual chooses that option and the career choice process ends.

options are available and which seem promising. In-depth exploration entails gaining further experience with an option that is already under consideration, likely improving the perception about how well the option fits the individual's interests and capabilities. Broad and in-depth exploration thus form the core process of career decision making.

We assume that individuals may display varying tendencies for engaging in broad exploration and in-depth exploration. This is supported by the fact that an individual's tendency to engage in these activities is associated with different personality dimensions. The tendency for broad exploration is mainly associated with openness to experience (Luyckx, Teppers, Klimstra & Rassart, 2014), whereas the tendency to explore in depth is associated with conscientiousness (Klimstra, Luyckx, Germeijs, Meeus & Goossens, 2012), and negatively associated with emotional stability/neuroticism (Luyckx, et al., 2014). Because we assume that the career choice process is time-limited (see also section 'selectiveness'), engaging in more broad exploration automatically means engaging in less in-depth exploration, and *vice versa*. In our framework, exploration tendency determines how individuals divide their time between both types of exploration.

Accuracy

We assume that broad or in-depth exploration of a career option always results in an experience with that option. All experiences that an individual has had with any particular career option together determine how the individual evaluates it. This is in line with earlier work in identity theory, which posits that information derived from experiences is essential in shaping (career) commitments (e.g., Bosma & Kunnen, 2001; Grotevant, 1987; Kerpelman, Pittman & Lamke, 1997; Van der Gaag, Albers, & Kunnen, in press; Vleioras & Bosma, 2005). However, any single experience with a career option is unlikely to result in a perfect evaluation of how well this option will turn out to fit the individual.

Information about the suitability of career options is inherently incomplete; the suitability of career options only becomes fully clear once individuals pursue them. In addition to this, there are at least three factors that may affect the accuracy with which individuals are able to evaluate the fit of career options. First, individuals differ in their level of self-concept clarity, which is vital for individuals to accurately assess how well career options will fit their interests and capabilities (e.g., Rottinghaus & Van Esbroeck, 2011). Self-concept clarity is generally lower in adolescence than in adulthood (e.g., Crocetti, Rubini, Branje, Koot & Meeus, 2016). Second, various types of cognitive biases may distort rational evaluation (Tversky & Kahneman, 1974; De Martino et al., 2006), and individuals vary in the extent to which their choice processes are affected by these biases (e.g., Stanovich & West, 2000; Teovanović, Knežević & Stankov, 2015). For example, the 'Halo effect' (e.g., Cook, Marsh, & Hicks, 2003) may cause some individuals to favor a career option only because it was

presented to them by a likable, enthusiastic speaker. Third, information obtained from the environment may be misleading. For example, educational institutions may supply misinformation about educational trajectories and prospects on the labor market, because it is in their interest to obtain many students (Bradley, 2013).

Selectiveness

In our framework, we assume that individuals will only explore an option in depth if they perceive the option to at least have a minimum fit with their interests and capabilities and will only decide on an option if it meets an even higher aspiration level. The use of two distinct aspiration levels directly follows from the idea that individuals engage in two types of exploration: broad and in-depth exploration. This implies that individuals have some criterion to make a preselection of options that they are willing to explore in-depth, and another to make their final choice. We also assume that individuals do not have an infinite amount of time and resources to find an option that meets their criteria. Rather, their choice process is time-constrained, potentially forcing them to choose an option that does not meet their aspiration levels.

By assuming that selectiveness in choosing career options is determined by aspiration levels and time constraints, we broadly follow existing cognitive information processing models, such as Decision Field Theory (Busemeyer & Townsend, 1993). Such theories assume that preferences for various options change over time, and must exceed a threshold to be chosen. Our assumptions also fit with the proposal that individuals differ in what they aspire to when making decisions: while maximizers desire the best possible result, satisficers desire a result that is good enough (Schwartz et al., 2002). In our framework, we suppose that both aspiration thresholds can differ between individuals: some individuals may have relatively low standards, readily considering options as good enough even if they do not fit very well with their interests and capabilities, whereas others may be very picky.

Features and outcomes of the career choice process

Our framework allows the study of both the outcome of the career choice process (the decision) and features of the process itself (e.g., how fast decisions are reached). In our framework, the quality of the decision resulting from the career choice process is expressed as the fit between the chosen career option and the capacities and interests of the individual making that choice. This rests on an important assumption: we assume that some career options objectively fit better with the interests and

capabilities of the individual than others. Although similar assumptions have been commonly made before (e.g., in vocational matching theories: Parson 1909; Dawis & Lofquist, 1984; Holland, 1959, 1997), it has proven difficult to clearly define or measure such an 'objective fit' between individual and career path (see for example Halaby, 1994). In our framework, we do not assume that objective fit is a perfectly measurable quantity nor that it is completely predetermined, but we do consider it to be *at least partly* inherent. For example, a young individual may be a very talented football player, but not at all musically gifted. Although this individual could invest energy in becoming a violin player, and would almost certainly become better at this through time, it is unlikely that this person will ever be as good at playing the violin as he could have been at playing football.

In this study, we pay special attention to two features that may emerge from the career choice process: ruminative exploration, and rash decision making. These features are considered to be phase-inadequate for the post-secondary school transition (Dietrich et al., 2012), during which time adolescents typically make their career choices. Ruminative exploration is a state of repetitive exploration or brooding, where individuals continuously ask themselves the same questions (Luyckx et al., 2008). In the case of career choice, ruminative exploration can be considered repetitive exploration of the same career option. Rash decision making can be considered as the opposite of ruminative exploration: this happens when individuals decide on a career option based on very little exploration. Both phenomena have been associated with negative outcomes: individuals who show a high degree of ruminative exploration are likely to show stronger symptoms of depression and lower self-esteem (Beyers & Luyckx, 2015). Similarly, individuals who make rash decisions show a low level of academic commitment, academic adjustment and social adjustment a year after they have implemented their choice (Germeijs, et al., 2012).

It is not at all obvious how the three factors that we have verbally discussed above (exploration tendency, accuracy, and selectiveness) act in concert to produce the outcomes and features of the career choice process that we are interested in (decision quality, phase-inadequate exploration). The dynamic nature of the process causes it to be complex, and the outcomes are therefore hard to predict without modeling the process explicitly (e.g., Courgeau, Bijak, Franck, & Silverman, 2017). To face this challenge, the next step is to use our conceptual framework to construct a computational simulation model.

SIMULATION MODEL

The computational model we present in this paper essentially simulates a large number of individual career choice trajectories. A trajectory consists of T time steps ($T = 100$ for all results shown), in each of which the individual has some kind of experience with a potential career option brought about by either broad- or in-depth exploration. The time steps are not directly translatable to real time; they represent consecutive exploration actions, but these may be separated by large (e.g., a week) or smaller segments of real time (e.g., an hour). We assume that individuals will only take options under consideration if they perceive them to fit well with their interests and capabilities. However, we also assume that they are not perfect in assessing this; options may objectively fit better or worse than they think. Through in-depth exploration, the perceived fit of an option can change over time, typically approaching the option's objective fit more closely as it is explored more. In the model, individuals can only have a limited number of N options under consideration at any given time (the set of options under consideration is denoted S ; $N = 3$ for all results shown). A final decision is made when the perceived fit of an option is high enough, or if time runs out.

At the start of a simulation, the individual does not yet have any options under consideration, and can therefore only engage in broad exploration. As soon as an individual is considering at least one option, the probability that she will engage in either broad or in-depth exploration in the next time step, depends on her **exploration tendency** (m). With probability m , she will engage in broad exploration, and with complementary probability $(1 - m)$, she will explore one of the options already under consideration in depth. Table 1 shows an overview of all parameters of the model.

Broad exploration

If the individual engages in broad exploration, she samples a new career option from a pool of potential options. The newly sampled option is characterized by an objective fit (x_o). The objective fit is drawn from a standard normal distribution (i.e., options that fit very well or very poorly are relatively rare, whereas options that have an intermediate objective fit are most common). Individuals cannot directly perceive the objective fit of an option; their perceived fit (x_p) is subject to some error, such that

$$x_p = x_o + \varepsilon \tag{1}$$

Table 1 Parameters and variables of the career choice simulation model

Parameter	Description
m	exploration tendency. The fraction of time that the individual dedicates to broad exploration. The individual dedicates the complementary fraction $(1-m)$ of time to in-depth exploration of options that are already under consideration.
α	accuracy. The accuracy with which the individual assesses the objective fit of career options. The accuracy is directly related to the standard deviation σ of the uncertainty term that is added to the objective fit to obtain the perceived fit ($\alpha = 1 - \sigma$; see eq. 1).
θ_1	selectiveness – consideration threshold. If the perceived fit of a newly explored option exceeds this number, the individual takes this option under consideration.
θ_2	selectiveness – decision threshold. If the perceived fit of an option exceeds this number, the individual enters the mode of final decision making for this option.
T	time limit. The number of time steps available for exploring options before a decision has to be made.
N	maximum size of consideration set. The maximum number of options the individual can have under consideration at any point in time.
r	recency factor. The relative weight of past experiences when determining the perceived fit of an option. If the recency factor is smaller than one, individuals discount the past.
c	confidence factor. The confidence the individual has in their final choice. Determines the probability that the individual chooses the option exceeding θ_2 while in the mode of final decision making. With complementary probability $(1 - c)$, the individual explores this option in-depth.
Variable	Description
S	The set of options under consideration.
x_o	The objective fit of an option.
x_p	The perceived fit of an option.
k	Number of times an option has been explored in depth.

where ε is drawn from a normal distribution with mean 0 and standard deviation σ . The **accuracy** (α) with which an individual is able to assess the fit of career options decreases with increasing σ . For the purposes of this study, we define accuracy as $\alpha = 1 - \sigma$ (we only consider values of σ that are between 0 and 1, thereby ensuring that α is also always between 0 and 1).

To determine whether the individual will take the newly sampled option under consideration, the perceived fit x_p of the option is compared with the individual's 'consideration threshold' (θ_1), which is an aspect of the individual's **selectiveness** (the other aspect being the 'decision threshold' (θ_2), see below). If there are currently fewer than N options under consideration, the newly sampled option will be added to consideration set S if $x_p > \theta_1$. If there are N options under consideration, the newly sampled option replaces the option in S with the lowest perceived fit, if it

has a higher perceived fit. If neither of these conditions are met, the newly observed option is discarded.

In-depth exploration

If the individual engages in in-depth exploration, one of the options in S is selected at random. The perceived fit of this option is then updated. The updated perceived fit (x_p') depends on the previous perceived fit (x_p) as follows:

$$x_p' = \frac{x_p kr + x_o + \varepsilon}{kr + 1} \quad (2)$$

where k denotes the number of times the option has already been explored in the past, r represents a recency factor, determining the relative importance of past experiences ($r = 0.5$ for all simulations shown), and ε is an uncertainty component associated with the current experience, drawn from a normal distribution with mean 0 and standard deviation σ (reflecting the individual's accuracy, see above). In this function, the perceived fit that resulted from all past experiences (x_p) is multiplied with a factor k , ensuring that the relative impact of the current experience (represented by $x_o + \varepsilon$) decreases with the number of times the option has already been explored before. In addition, x_p is multiplied with r , ensuring that more recent experiences are weighed more heavily than experiences further in the past. If $x_p' < \theta_1$, the option is discarded from S . Otherwise, x_p is updated to x_p' , and the option is retained in S .

Decision

At the end of each time step (after broad- or in-depth exploration has taken place), the perceived value of the option that was just explored is compared to the individual's 'decision threshold' (θ_2). If $x_p > \theta_2$ (and for as long as this remains the case), the individual will enter the mode of final decision making. When in this mode, the individual has a probability c (the confidence factor; for all results shown, $c = 0.5$) to make the final decision for the option exceeding θ_2 . However, with the complementary probability $(1 - c)$, the individual will explore this option in depth. This continues until either the final decision is made (in which case the simulation ends), or the perceived fit (x_p) of the option has decreased to a value below θ_2 , in which case the individual enters back into the regular mode of career choice. The implementation of a mode of final decision making reflects the possibility that individuals desire to accumulate more evidence to increase their confidence before making the final

decision (i.e., post-decisional processing of confidence judgments as proposed in the two-stage dynamic signal detection theory; Pleskac & Busemeyer, 2010).

If the career choice process reaches time step N without having reached a decision, the individual simply chooses the option in S with the best perceived fit. If there are no options in S at this point (for example, because of a very large value of θ_2), the individual chooses a randomly sampled option.

Simulation set-up and analysis

We systematically investigated the impact of individuals' exploration tendency (m), their accuracy in assessing the fit of career options (α), and their selectiveness (determined by θ_1 and θ_2) on the career choice process. To do this, we ran a large number of simulations across a broad range of parameter combinations. Specifically, we varied m from 0.001 to 0.2 (in increments of 0.001), α between 0.0 and 1.0 (in increments of 0.005), θ_1 between 0.0 and 1.0, and θ_2 between 1.5 and 2.5. For each of the 160,000 parameter combinations investigated, we ran 25,000 replicate simulations. For each parameter combination, we kept track of the average objective fit of the option that was eventually chosen, and the average number of time steps that each of the options were evaluated for. The other parameters of the model were kept constant throughout this study (see Table 1 for an overview). The simulation model was written in C++ (code available upon request).

In addition, we partnered with Umanise to develop an interactive web application that the reader can use to generate animated career choice trajectories based on our model (<http://www.umanise.nl/careerchoicemodel>; Blijlevens, 2016). The application allows users to enter custom parameter values, and thereby gain first-hand experience with how the different factors affect the career choice process in our model.

RESULTS

Figure 2 shows three illustrative examples of individual career choice trajectories produced by our model, for three different values of exploration tendency m (the parameter values were chosen for purely illustrative reasons). Although these examples by no means encompass the full range of decision making patterns observed in our model, they do give some insight in the model workings by exhibiting a number of typical features. Most importantly, it is visible how the perceived

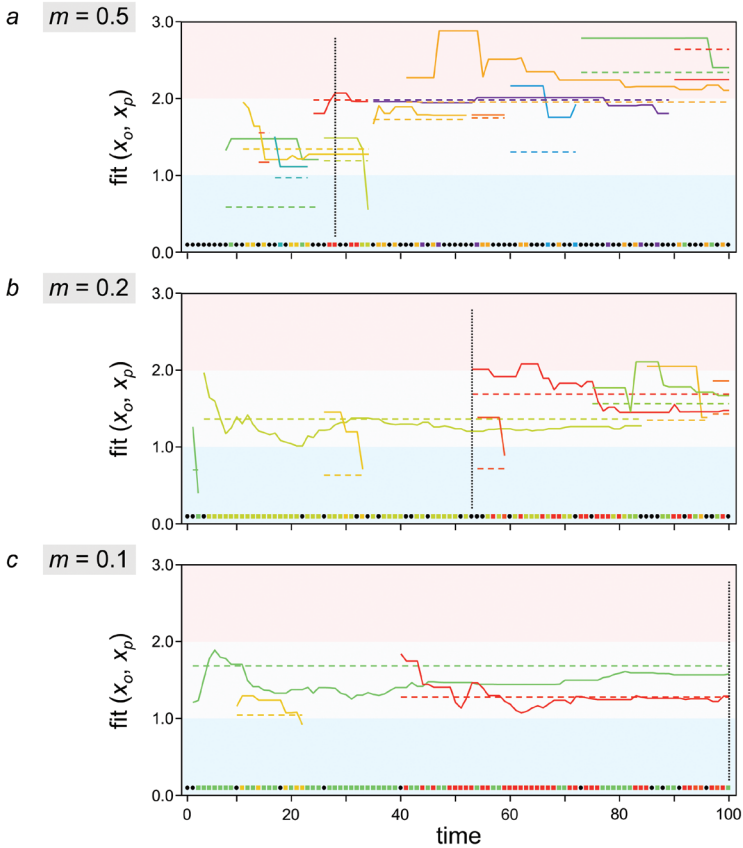


Figure 2 The career choice trajectories of three simulated individuals (**a**, **b**, and **c**). The objective and perceived fit of career options are represented by pairs of lines of matching colors. Stable, dashed lines represent the objective fit (x_o) of an option (which is always constant). The (color-matched) fluctuating, solid lines represent the perceived fit of that same option (x_p , which changes as a result of in-depth exploration of that option). When the perceived fit of an option enters the red area ($x_p > \theta_2$) the individual enters the mode of final decision making for that option (see Simulation Model section). A decision is indicated with a vertical, dotted line (for example in **a** at $t = 28$ – for illustrative purposes, we have continued these simulations even when a decision was already made). An option is discarded when its perceived fit enters the blue area ($x_p < \theta_1$; for example the yellow option in **c** at $t = 22$). The symbols at the bottom of each graph indicate the event that occurred in each time step. Black circles represent broad exploration events; a new pair of colored lines start at that time point if the newly explored option has a high enough perceived fit. Colored squares represent events of in-depth exploration (the color of the square indicates which option was explored in depth). The exploration tendency is different for each of the three simulated career trajectories: $m = 0.5$ (**a**), $m = 0.2$ (**b**), and $m = 0.1$ (**c**). The other parameters are constant for these simulations (accuracy $a = 0.5$, selectiveness $\theta_1 = 1.0$, $\theta_2 = 2.0$).

fit of options (solid lines) changes over time because of the experiences resulting from in-depth exploration. Generally speaking, the perceived fit tends to improve: it usually converges on the objective fit (corresponding dashed lines of the same color) over time, although this is not always the case. It is also visible how imperfect accuracy ($\alpha = 0.5$ in all three simulations) can lead to 'wrong' decisions: it can occur that individuals discard options even if their objective fit exceeds the consideration threshold (θ_1). For example, the yellow option in Figure 2c is discarded, even though its objective fit is not in the blue zone (i.e., it is not below θ_1). Conversely, it can also happen that individuals make their final decision (indicated by a vertical dotted line) for an option even though its objective fit is below the decision threshold (θ_2). This happens in Figures 2a and 2b, where the objective fits chosen options are not in the red area (i.e., they do not exceed θ_2). The simulation runs also show examples of ruminative exploration (notably in Fig 2c), where the individual gets stuck evaluating the same option many times over without arriving at a decision before time runs out.

General Overview of Model Outcomes

Figure 3 gives a complete overview of simulation outcomes for a large range of parameter combinations. The figure shows how exploration tendency (m), accuracy (α) and selectiveness (θ_1 and θ_2) affect the quality of the choice (Fig. 3a), the total time it takes to make a decision (Fig. 3b), and the average time spent exploring each option under consideration (Fig. 3c). Figure 3a reveals that the relationship between the objective fit of the career choice and the parameters that determine the choice process is not always straightforward. Generally speaking, more selective individuals (high consideration [θ_1] or decision threshold [θ_2]) tend to make better decisions, as do individuals with a stronger tendency to explore broadly (high m), and individuals with a higher degree of accuracy (high α). However, whether these overall effects of the parameters hold true often depends on the values of the other parameters. For example, the effect of accuracy is reversed when individuals have a strong tendency to explore in depth ($m < 0.05$); if this is the case, higher accuracy tends to lead to worse choices. It is also clear that no single exploration strategy can ensure an individual to make the best possible choice. This is indicated by the red line within each subplot in Figure 3a, which shows the optimal exploration strategy (value of m), depending on accuracy. For example, the bottom left panel of Figure 3a (low overall selectiveness; $\theta_1 = 0.0$, $\theta_2 = 1.5$) shows that relatively inaccurate individuals ($\alpha < 0.25$) make the best choices if they explore mainly in depth (the red line shows an

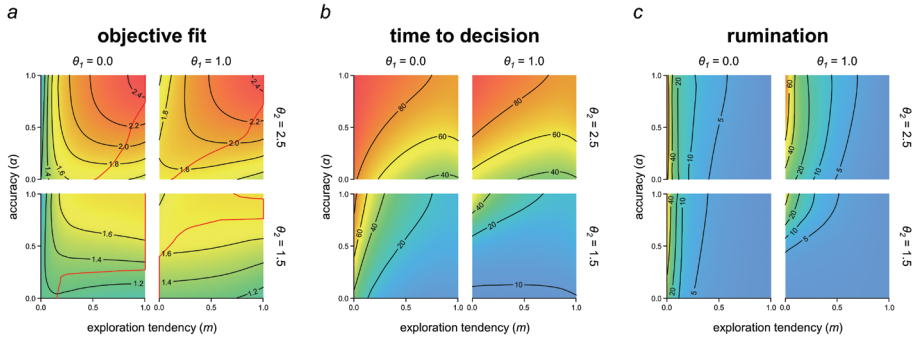


Figure 3 An overview of (a) the objective fit of the career choice, (b) the time it takes before a decision is made and (c) the time individuals spend on ruminating, depending on a broad range of parameter combinations. The four panels within each of these subplots show a combination of two consideration thresholds (θ_1) and two decision thresholds (θ_2). Within each of these four panels, the exploration tendency (m , on the x-axis) and accuracy (a , on the y-axis) vary (between 0 and 1 in steps of 0.01). In figure a, colors (and black contour lines) indicate the objective fit of the chosen option for each parameter combination. The red lines indicate the exploration tendency that leads to the highest objective fit, depending on the accuracy. In figure b, the colors and contour lines indicate the number of time steps that have passed before the decision is made. In figure c, they indicate the average number of time steps any one option is explored in-depth. The graphs show averages over 25,000 replicate simulation runs for each parameter combination.

optimal exploration strategy of $m \approx 0.2$). However, for more accurate individuals, the red line quickly goes to $m = 1.0$, indicating that they make the best career choices if they only engage in broad exploration. Generally speaking, this pattern holds for the other three panels, although there are also differences; selectiveness also affects what the optimal exploration strategy is given the individual's accuracy level.

Figure 3b shows how the model parameters affect the time it takes individuals to make their decision. Generally speaking, more accurate individuals take longer to decide, while less accurate individuals decide more quickly. This happens because less accurate individuals perceive more variation in the fit of options, and are therefore more likely to perceive any given option as fitting either very poorly or very well. Hence, they will tend to encounter options that cross their decision threshold (θ_2) sooner than individuals that are more accurate, and therefore make decisions faster. The relationship between time to decide and exploration tendency (m) is more complicated. In case of a high decision threshold ($\theta_2 = 2.5$), the quickest decisions are often taken for intermediate exploration tendencies. Interestingly, although a relatively low decision threshold ($\theta_2 = 1.5$) tends to lead to quicker decisions than a relatively high decision threshold ($\theta_2 = 2.5$), the relationship seems to be reversed for the consider-

ation threshold (θ_1): a lower consideration threshold ($\theta_1 = 0.0$) leads to a longer decision process than a higher threshold ($\theta_1 = 1.0$). Rash decision making (i.e., coming to a decision in under ~20 time steps) only occurs for low decision thresholds ($\theta_2 = 1.5$).

Perhaps not surprisingly, Figure 3c shows that rumination only occurs when individuals have a strong tendency to engage in in-depth exploration ($m < 0.1$). However, the extent to which this is true strongly depends on selectiveness. For example, rumination (i.e., exploring one option for at least 10 time steps) hardly occurs at all in individuals that have a high consideration threshold ($\theta_1 = 1.0$) and a low decision threshold ($\theta_2 = 1.5$), but occur relatively frequently for individuals that are generally selective (i.e., both thresholds are high; $\theta_1 = 1.0$ and $\theta_2 = 2.5$). For individuals with a low consideration threshold ($\theta_1 = 0.0$), rumination is weakly affected by accuracy; more accurate individuals are somewhat more likely to engage in rumination, but the differences are small. However, this relation is much stronger for individuals with a high consideration threshold ($\theta_1 = 1.0$); for them, higher accuracy is strongly related to more rumination.

Are Rash Decision Making and Rumination Maladaptive?

Figure 3 shows that rash decision making generally leads to poorer outcomes than taking more time to make a decision. Extremely short decision times – decision times shorter than 10 time steps – hardly occur, but when they do, the objective fit of the chosen option tends to be below the decision threshold ($x_o < \theta_2$). Decision times between 10 and 20 time steps occur more frequently, and, although they also tend to be associated with relatively low-quality decisions, they do not always lead to bad outcomes. For relatively accurate individuals ($\alpha > 0.5$) that are not very selective ($\theta_2 = 1.5$), these quick decisions can actually lead to satisfactory choices (i.e., $x_o > \theta_2$; compare figures 3a and 3b).

Like rash decision making, ruminative exploration does not always lead to bad choices. Although high levels of rumination (on average exploring options in depth at least 10 times) are associated with very poor decisions in case of a low consideration threshold ($\theta_1 = 0.0$), this relationship is not as clear for a high consideration threshold ($\theta_1 = 1.0$), in which case the effect of ruminative exploration on decision quality depends on accuracy. For example, in individuals that are generally selective ($\theta_1 = 1.0$ and $\theta_2 = 2.5$) and have low accuracy ($\alpha < 0.5$), rumination hardly affects the quality of the career choice that is eventually made (compare figures 3a and 3c).

Figure 4 shows in detail how rumination affects decision quality for different values of accuracy ($\alpha = 0.5$ and $\alpha = 0.0$), under conditions where rumination occurs relatively frequently: if individuals mostly explore in depth, and are generally selec-

tive ($m = 0.1$; $\theta_1 = 1.0$; $\theta_2 = 2.0$). The graph shows how the objective fit of the chosen option is distributed, separately for trajectories that had high levels of rumination (i.e., that explored options in depth 10 times or more on average) and trajectories with low rumination (on average fewer than 10 in-depth explorations per option). Two patterns emerge from this figure. First, rumination is detrimental to the average decision quality for individuals that are relatively accurate ($\alpha = 0.5$), but this is not the case for inaccurate individuals ($\alpha = 0.0$; decision quality even increases somewhat for these individuals if they ruminate). Second, and perhaps more importantly, rumination greatly reduces the variance in choice quality of inaccurate individuals, but not of accurate individuals. If individuals are poor at judging the fit of career options, but make relatively quick decisions, they run a great risk of making very bad choices. In this case, 23.1% of the decisions were for a career option with an objective fit below θ_1 (i.e., for options that these individuals should in principle not even be willing to consider). When such individuals have ruminated more, the fraction of such very bad decisions is much reduced, to 2.9%.

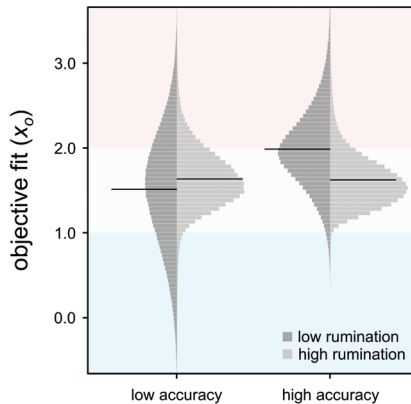


Figure 4 Vertical histograms showing the distribution of the objective fit (x_o) of career choices, for low accuracy ($\alpha = 0.0$ ¹) and high accuracy ($\alpha = 0.5$). For both levels of accuracy, separate histograms are shown for simulation runs that had a low degree of rumination (where options were explored in-depth less than 10 times on average; in dark grey) and simulation runs that had a high degree of rumination (an average of at least 10 in-depth exploration events per option; in light grey). Black lines show the average objective fit associated with each histogram. The red-shaded area shows the region that is above the decision threshold ($\theta_2 = 2.0$); the blue-shaded area shows the region that is below the consideration threshold ($\theta_1 = 1.0$). All histograms are based on an exploration tendency of $m = 0.1$ (i.e., a tendency to explore mainly in depth). The graph is based on 1,000,000 replicate simulation runs for both values of accuracy.

¹ Note that this is the lowest value of accuracy we consider, but that accuracy can in principle be negative – see ‘The Model’ section.

DISCUSSION

In this paper, we have introduced a novel, process-oriented framework for studying career choice, which combines theory on career exploration and identity formation from developmental psychology with the emerging process-oriented approach to understanding decision making from cognitive science. In this framework, the process of career choice is ultimately composed of a large number of experiences that result from acts of broad and in-depth exploration. Individuals broadly explore to gain experiences with available career options, may take various options into consideration, and explore promising options in-depth to investigate how well these options fit their interests and capabilities. The result is a dynamic framework, in which a combination of individual characteristics (tendency to explore new options, selectiveness, and accuracy in assessing the fit of career options) and the experiences that individuals have with possible career options determine the outcome and shape of the career choice process.

In addition to outlining the conceptual foundations of this framework, we have used it to construct a simulation model of career choice, of which we have presented a detailed description and extensive analysis. We have provided an overview of the outcomes of this simulation model, discussing how combinations of individual characteristics eventually shape the process of career choice, and determine whether career choices fit well to the interests and capabilities of the individual. It is clear that the relationships between individual characteristics (exploration tendency, accuracy and selectiveness) and the quality of the career choice are rarely straightforward. This shows that presuming linear relationships between individual traits and decision outcomes is likely to be misleading, and emphasizes the value of taking a process-oriented approach to understanding decision making.

Although the outcomes of our model often depend on the parameters in complex ways, a number of general patterns have also emerged. Specifically, our simulation model predicts that the best career decisions are generally made by individuals that are highly accurate in evaluating how well an option will fit them, who have high standards for making their final decision, and who tend to broadly explore many options to acquaint themselves with possible alternatives. The worst decisions are made if individuals have low standards for deeming an option worthy of considering, and tend to explore options mostly in-depth. Having said that, it is not true that broad exploration is always better than in-depth exploration, that it is always good to have high standards, or even that it is best to be as accurate as pos-

sible when estimating the fit of an option. Our model generally predicts complex relations between these factors: less accurate individuals should explore more in depth to reach the best decisions, but the extent to which this is true depends on selectiveness. Specifically, we should expect individuals who are more selective in the options they are willing to consider to profit more from in-depth exploration than their less selective counterparts.

As an illustration of the utility of our framework for understanding how career choice can go wrong, we have zoomed in on the emergence of two features that are considered phase-inadequate for adolescence: rash decision making and ruminative exploration. We observe that some individual characteristics are particularly likely to lead to the emergence of either of these patterns in our model: ruminative exploration emerges predominantly among individuals with a strong tendency to explore in depth, while rash decision making predominantly emerges among individuals who are not very selective in deciding on an option. However, although these patterns are indeed associated with poor decisions in most cases, they are not always harmful, and they can even lead to better choices under some circumstances. For example, individuals that are quite selective, but not very accurate in evaluating options, are at risk of making decisions that do not meet their aspirations at all. Rumination can greatly reduce this risk for such individuals, and can even help them making somewhat better choices on average. Similarly, individuals that are relatively accurate in evaluating the fit of career options and mostly explore broadly tend to make very quick decisions, but these decisions are of acceptable quality. These observations demonstrate how our framework, by explicitly considering the micro-dynamics of the decision making process, can generate counterintuitive insights that one would not necessarily arrive at through verbal reasoning alone.

Implications

We contend that formal modeling approaches have a vital role to play in the study of career choice, and in developmental transitions in general. Developmental scientists almost invariably study processes that are complex and dynamic (Van Geert, 1994). Such processes are very difficult to understand using verbal reasoning alone, and mistakes are easily made when the assumptions of such verbal theories are not explicitly delineated (Courgeau et al., 2017). The construction of a model requires that assumptions are stated unambiguously, thereby facilitating the precise formulation of hypotheses, and ultimately helping to design succinct empirical studies that can test these hypotheses. The use of explicitly dynamic models is particularly

valuable for gaining insight in individual processes of development, providing a valuable alternative to the more common approach of basing developmental theory on population-level analyses.

Our study provides a concrete demonstration of how a formal modeling approach can clarify assumptions and definitions that were previously implicit or unclear. For example, our assumption that individuals cannot explore options indefinitely implies that they have to decide how much of their time they invest in broad exploration vs. in-depth exploration. Our results show that this balance between both types of exploration is not trivial – it has considerable implications for the outcome of the choice process. However, this trade-off has not yet received attention in empirical studies on career and identity exploration. Our model also provides a new perspective on ruminative exploration. Whereas ruminative exploration has previously been considered as a qualitatively distinct type of exploration (e.g., Luyckx et al., 2008), our model shows that it can also emerge as an outcome of the career choice process without a priori assuming it to be a distinct type of exploration. We do not claim that our view of these forms of exploration is necessarily better than others, but our approach does take a step closer to making verbal definitions more clear, thus combating the ‘tower of babel’ that threatens to emerge in fields like identity development (Côte, 2015).

Our simulation model has generated novel and precise predictions that can be tested empirically. For example, the potential costs associated with phase-inadequate features of career choice, such as ruminative exploration and rash decision making, have thus far remained elusive (Dietrich et al., 2012). We predict that these features are in most cases associated with a cost in terms of the quality of the career choice that is made, but we also predict that these processes can be beneficial in some cases. For some people, ruminative exploration can reduce the risk of making very bad decisions. For others, rash decision making can under some circumstances be an efficient way to make a fast but satisfactory choice. Empirical studies can be designed to test these predictions.

If our model predictions turn out to have empirical merit, many practical applications can be envisioned. Our model could be used to aid career counselors to develop individually tailored career choice strategies that are based on the characteristics of the individual in question. For example, our results suggest that individuals who are not very sure at what they like or are good at may reach better decisions if they are stimulated to explore a limited number of options in depth. Since adolescents tend to have lower self-concept clarity than adults (Crocetti et al.,

2016), this may be particularly useful advice for individuals at the relatively young age at which the most important career choices are typically made. Conversely, individuals that are more certain about their preferences and capabilities may benefit from the advice to mainly focus on broad exploration. Another possible strategy could be to encourage individuals who have a strong tendency to explore many different options to improve their accuracy in evaluating available options. How this is best achieved is an interesting area for further research.

Scope and Limitations

A model is an abstraction, rather than a reconstruction, of reality – it is a tool to come to a clearer understanding of a phenomenon by boiling it down to its essence. Therefore, any model will always fail to include parameters that may affect the phenomenon of interest. In this study, we have chosen to limit ourselves to three factors (exploration tendency, accuracy and selectiveness), which we consider to be of proximal influence on the career choice process. However, this does not mean that we consider the influence of other (more distal) factors to be unimportant. For example, as we have argued, exploration tendency may be affected by personality. Similarly, a high amount of social support or self-efficacy can perhaps enhance the accuracy with which individuals can estimate the fit of career options. Extensions of the model that include more factors may be valuable, provided that they do not complicate the model to such an extent that the results become uninterpretable.

In the overview of model outcomes that we provided, we chose to investigate the effect of some parameters by varying them across many different levels (exploration tendency, accuracy), whereas we only considered a few levels of other parameters (both selectiveness thresholds), and held other factors entirely constant. For example, we only considered one value for the amount of time individuals have to make their decision (100 time steps), always allowed individuals to hold a maximum of three options into consideration simultaneously, and considered a single value for the relative weight of past experiences (controlled by the recency factor). We did not hold these values constant because we think they will not significantly affect the career choice process – we simply chose to focus our study on the effects of exploration tendency, accuracy and selectiveness. Depending on the question at hand (or simply to further explore model behavior), it may make sense to run simulations in which some other parameters are varied, or in which the same parameters are varied over a different range of values.

Broad and in-depth exploration together form the core processes of decision making in our model. Both types of exploration lead individuals to make an assessment of the fit of an option through a random experience with that option. Because we assume that an individual's accuracy does not change over time, there is an implicit assumption that individuals assess the fit of options by comparing them to some kind of constant picture of their own interests and capabilities. In reality, it is likely that exploration also entails learning about own interests and capabilities. One promising direction to extend our model is to explicitly incorporate this in the exploration process. This could be done by allowing accuracy to improve over time, potentially in reaction to the specific career options that individuals have explored.

Our implementation of 'objective fit' as a unidimensional, constant number that is drawn from a normal distribution is a choice that is convenient for modeling purposes. It reflects the assumption that the fit between individual and career option is at least partly inherent (see the Conceptual Framework section). However, in reality, it is likely that the degree to which options fit with individuals depends on more than one factor, and that some of those aspects may change over time. Other, more refined assumptions on this are conceivable, and may be worth exploring. Finally, we have assumed that the way individuals perceive the fit of options is absolute (i.e., it only depends on that option itself). However, there are reasons to suppose that individuals perceive the fit of an option as relative, dependent of the fit of other options they are considering (Steward, Chater, & Brown, 2006). Empirical work can help us to gain more insight in how individuals perceive the fit of options, and can serve to refine our model.

Conclusion

Career choice is a complex and dynamic process. The explicitly dynamic framework we have introduced can help sharpen theory on how the career choice process unfolds, and can serve to generate hypotheses that can be empirically tested. A number of predictions can be derived from the concrete model implementation that we have presented, including on how we should expect individual characteristics (exploration tendency, accuracy and selectiveness) to affect the quality of career choice, and on under what circumstances we should expect the phase-inadequate phenomena of rash decision making and ruminative exploration to actually be beneficial to the quality of the career choices that are made.

Our framework should be considered as a first step in a new direction. We have thus far only considered some factors that may affect the career choice process

and its outcomes. As is necessary (and essential) to designing models, we have highly simplified facets of career choice. Specifically, our implementations of the exploration process and the representation of the fit between individuals and career options leave plenty of room for refinement, ideally informed by empirical studies. Formalizing career choice theory in a simulation model, empirically testing model predictions, and subsequently improving the model can lead us to a better understanding of how career choice works, and can help us in the future to design individually tailored strategies to help young individuals navigate the career choice process.

REFERENCES

- Baron, J. (2007). *Thinking and deciding (4th ed.)*. New York, NY: Cambridge University Press.
- Beyers, W., & Luyckx, K. (2015). Ruminative exploration and reconsideration of commitment as risk factors for suboptimal identity development in adolescence and emerging adulthood. *Journal Of Adolescence*, doi:10.1016/j.adolescence.2015.10.018
- Blijlevens, T. (2016). *Adaptive animation career choice model* [JavaScript application]. Available on <http://www.umanise.nl/careerchoicemodel>
- Bosma, H.A., & Kunnen, E.S. (2001). Determinants and mechanisms in ego identity development: A review and synthesis. *Developmental Review*, 21, 39-66. doi:10.1006/drev.2000.0514
- Bradley, J. (2013). Integrity in higher education marketing? A typology of misleading data-based claims in the university prospectus. *International Journal for Educational Integrity*, 9, 74-88.
- Busemeyer, J. R., & Townsend, J. T. (1993). Decision field theory: A dynamic-cognitive approach to decision making in an uncertain environment. *Psychological Review*, 100, 432-459. <https://doi.org/10.1037/0033-295X.100.3.432>
- Casey, B. J., Jones, R. M., & Somerville, L. H. (2011). Braking and Accelerating of the Adolescent Brain. *Journal of Research on Adolescence*, 21, 21-33. <https://doi.org/10.1111/j.1532-7795.2010.00712.x>
- Coles, B., Godfrey, C., Keung, A., Parrott, S., & Bradshaw, J. (2010). *Estimating the Life-time Cost of NEET: 16-18 Year Olds Not in Education, Employment or Training*. University of York. Accessed 29 November, 2016. http://www.york.ac.uk/media/spsw/documents/research-and-publications/NEET_Final_Report_July_2010_York.pdf
- Cook, G. I., Marsh, R. L., & Hicks, J. L. (2003). Halo and devil effects demonstrate valenced-based influences on source-monitoring decisions. *Consciousness And Cognition: An International Journal*, 12, 257-278. doi:10.1016/S1053-8100(02)00073-9
- Côte, J. E. (2015). *Identity formation research from a critical perspective: Is a social science developing?* In K. C. McLean, & M. Syed (Eds.), *The Oxford handbook of identity development* (pp. 562-573). New York, NY, US: Oxford University Press.
- Courgeau, D., Bijak, J., Franck, R., & Silverman, E. (2017). *Model-based demography: towards a research agenda*. In van Bavel, J. and Grow, A. (eds.) *Agent-Based Modelling in Population Studies - Concepts, Methods, and Applications*. Dordrecht, NL, Springer. (Springer Series on Demographic Methods and Population Analysis).
- Crocetti, E., Rubini, M., & Meeus, W. (2008). Capturing the dynamics of identity formation in various ethnic groups: Development and validation of a three-dimensional model. *Journal Of Adolescence*, 31, 207-222. doi:10.1016/j.adolescence.2007.09.002
- Crocetti, E., Rubini, M., Branje, S., Koot, H. M., & Meeus, W. (2016). Self-Concept Clarity in Adolescents and Parents: A Six-Wave Longitudinal and Multi-Informant Study on Development and Intergenerational Transmission: Development and Transmission of Self-Concept Clarity. *Journal of Personality*, 84, 580-593. doi:10.1111/jopy.12181
- Dawes, R.V., & Lofquist, L.H. (1984). *A Psychological Theory of Work Adjustment*. Minneapolis: University of Minnesota Press.
- De Martino, B., Kumaran, O., Seymour, B., & Dolan, R. J. (2006). Frames, Biases, and Rational Decision-Making in the Human Brain. *Science*, 313, 684-687. <https://doi.org/10.1126/science.1128356>
- Dietrich, J., Parker, P., & Salmela-Aro, K. (2012). Phase-adequate engagement at the post-school transition. *Developmental Psychology*, 48, 1575-1593. doi:10.1037/a0030188
- Erikson, E. H. (1968). *Identity: Youth and crisis*. New York: Norton.

- European Training Foundation (2014). *Young people not in employment, education or training in the EU neighbourhood countries*. Turin, Italy: European Training foundation.
- Gati, I. (2013). Advances in career decision making. In W. B. Walsh, M. L. Savickas, P. J. Hartung, W. B. Walsh (Ed), M. L. Savickas (Ed), & P. J. Hartung (Ed) (Eds.), *Handbook of vocational psychology: Theory, research, and practice*. (pp. 183–215). New York, NY, US: Routledge/Taylor & Francis Group.
- Gati, I., & Asher, I. (2001). The PIC model for career decision making: Prescreening, in-depth exploration, and choice. In F. L. Leong, A. Barak, F. L. Leong, A. Barak (Eds.), *Contemporary models in vocational psychology: A volume in honor of Samuel H. Osipow* (pp. 7-54). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers.
- Gati, I., Krausz, M., & Osipow, S. H. (1996). A taxonomy of difficulties in career decision making. *Journal Of Counseling Psychology, 43*, 510-526. doi:10.1037/0022-0167.43.4.510
- Germeijs, V., Luyckx, K., Notelaers, G., Goossens, L., & Verschuere, K. (2012). Choosing a major in higher education: Profiles of students' decision-making process. *Contemporary Educational Psychology, 37*, 229-239. doi:10.1016/j.cedpsych.2011.12.002
- Germeijs, V., & Verschuere, K. (2006). High school students' career decision-making process: A longitudinal study of one choice. *Journal of Vocational Behavior, 68*, 189–204. <https://doi.org/10.1016/j.jvb.2005.08.004>
- Gonzales, J.E., Cunningham, C.A. (2015, August). *The promise of pre-registration in psychological research*. Retrieved September 22, 2017, from <http://www.apa.org/science/about/psa/2015/08/pre-registration.aspx>
- Grotevant, H.D. (1987). Toward a process model of identity formation. *Journal Of Adolescent Research, 2*, 203-222.
- Halaby, C. N. (1994). Overeducation and skill mismatch. *Sociology Of Education, 67*, 47-59. doi:10.2307/2112749
- Hirschi, A., & Läge, D. (2007). The relation of secondary students' career-choice readiness to a six-phase model of career decision making. *Journal Of Career Development, 34*, 164-191. doi:10.1177/0894845307307473
- Holland, J. L. (1959). A theory of vocational choice. *Journal of Counseling Psychology, 6*, 35–45. <https://doi.org/10.1037/h0040767>
- Holland, J. L. (1997). *Making vocational choices: A theory of vocational personalities and work environments, 3rd ed.* Odessa, FL, US: Psychological Assessment Resources.
- Johnson, E. J., Häubl, G., & Keinan, A. (2007). Aspects of endowment: A query theory of value construction. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 33*, 461–474. <https://doi.org/10.1037/0278-7393.33.3.461>
- Kievit, R. A., Frankenhuis, W. E., Waldorp, L. J., & Borsboom, D. (2013). Simpson's paradox in psychological science: A practical guide. *Frontiers In Psychology, 4*. <https://doi.org/10.3389/fpsyg.2013.00513>
- Kerpelman, J. L., Pittman, J. F., & Lamke, L. K. (1997). Toward a microprocess perspective on adolescent identity development: An identity control theory approach. *Journal Of Adolescent Research, 12*, 325-346. doi:10.1177/0743554897123002
- Kerr, N. L. (1998). HARKing: Hypothesizing after the results are known. *Personality and Social Psychology Review, 2*, 196–217. https://doi.org/10.1207/s15327957pspr0203_4
- Kievit, R. A., Frankenhuis, W. E., Waldorp, L. J., & Borsboom, D. (2013). Simpson's paradox in psychological science: A practical guide. *Frontiers In Psychology, 4*. <https://doi.org/10.3389/fpsyg.2013.00513>
- Kroger, J., Martinussen, M., & Marcia, J. E. (2010). Identity status change during adolescence and young adulthood: A meta-analysis. *Journal of Adolescence, 33*, 683–698. <https://doi.org/10.1016/j.adolescence.2009.11.002>

- Kunnen, E.S., Bosma, H.A., van der Meulen, M. & van Halen, C. (2001). *A dynamic systems approach to identity and emotions: an overview and implications*. In Bosma, H.A. & E.S. Kunnen (Eds). *Identity and emotion: a self-organisational process*. pp. 202-230, Cambridge University Press.
- Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of Vocational Behavior*, *45*, 79–122. <https://doi.org/10.1006/jvbe.1994.1027>
- Lerner, J. S., Li, Y., Valdesolo, P., & Kassam, K. S. (2015). Emotion and Decision Making. *Annual Review of Psychology*, *66*, 799–823. <https://doi.org/10.1146/annurev-psych-010213-115043>
- Lewis, M. D. (2000). Emotional self-organization at three time scales. In M. D. Lewis and I. Granic (Eds) *Emotion, Development and Self-organization*. pp 37-69. Cambridge University Press, Cambridge.
- Luyckx, K., Goossens, L., Soenens, B., & Beyers, W. (2006). Unpacking commitment and exploration: Preliminary validation of an integrative model of late adolescent identity formation. *Journal Of Adolescence*, *29*, 361-378. doi:10.1016/j.adolescence.2005.03.008
- Luyckx, K., Schwartz, S. J., Berzonsky, M. D., Soenens, B., Vansteenkiste, M., Smits, I., & Goossens, L. (2008). Capturing ruminative exploration: Extending the four-dimensional model of identity formation in late adolescence. *Journal Of Research In Personality*, *42*, 58-82. doi:10.1016/j.jrp.2007.04.004
- Luyckx, K., Teppers, E., Klimstra, T. A., & Rassart, J. (2014). Identity processes and personality traits and types in adolescence: Directionality of effects and developmental trajectories. *Developmental Psychology*, *50*, 2144–2153. <https://doi.org/10.1037/a0037256>
- Molenaar, P. C., & Campbell, C. G. (2009). The New Person-Specific Paradigm. *Current Directions in Psychological Science*, *18*, 112-117.
- Oppenheimer, D. M., & Kelso, E. (2015). Information Processing as a Paradigm for Decision Making. *Annual Review of Psychology*, *66*, 277–294. <https://doi.org/10.1146/annurev-psych-010814-015148>
- Parsons, F. (1909). *Choosing a vocation*. Boston, MA, US: Houghton, Mifflin and Company.
- Pleskac, T. J., & Busemeyer, J. R. (2010). Two-stage dynamic signal detection: A theory of choice, decision time, and confidence. *Psychological Review*, *117*, 864–901. <https://doi.org/10.1037/a0019737>
- Porfeli, E. J., & Skorikov, V. B. (2010). Specific and diversive career exploration during late adolescence. *Journal Of Career Assessment*, *18*, 46-58. doi:10.1177/1069072709340528
- Pryor, R., & Bright, J. (2011). *The chaos theory of careers: A new perspective on working in the twenty-first century*. New York, NY, US: Routledge/Taylor & Francis Group.
- Quinn, J. (2013). Drop-out and completion in Higher Education in Europe. *European Union*. Retrieved from http://www.fh-dortmund.de/de/hs/qdl/Kooperation_auf_EU-Ebene.pdf
- Rottinghaus, P. J., & Van Esbroeck, R. (2011). Improving person-environment fit and self-knowledge. In P. J. Hartung & L. M. Subich (Eds.), *Developing self in work and career: Concepts, cases, and contexts* (pp. 35-52). Washington, DC: American Psychological Association.
- Savickas, M. L. (1997). Career adaptability: An integrative construct for life-span, life-space theory. *The Career Development Quarterly*, *45*(3), 247-259. doi:10.1002/j.2161-0045.1997.tb00469.x
- Savickas, M. L., Nota, L., Rossier, J., Dauwalder, J., Duarte, M. E., Guichard, J., & ... van Vianen, A. M. (2009). Life designing: A paradigm for career construction in the 21st century. *Journal Of Vocational Behavior*, *75*, 239-250. doi:10.1016/j.jvb.2009.04.004
- Skorikov, V. B. (2007). Continuity in adolescent career preparation and its effects on adjustment. *Journal of Vocational Behavior*, *70*, 8–24.
- Stanovich, K.E., & West, R.F. (2000). Individual differences in reasoning: Implications for the rationality debate? *Behavioral and Brain Sciences*, *23*, 645-665.

- Schwartz, B., Ward, A., Monterosso, J., Lyubomirsky, S., White, K., & Lehman, D. R. (2002). Maximizing versus satisficing: Happiness is a matter of choice. *Journal of Personality and Social Psychology, 83*, 1178–1197. <https://doi.org/10.1037/0022-3514.83.5.1178>
- Super, D. E. (1957). *The psychology of careers; an introduction to vocational development*. Oxford, England: Harper & Bros.
- Teovanović, P., Knežević, G., & Stankov, L. (2015). Individual differences in cognitive biases: Evidence against one-factor theory of rationality. *Intelligence, 50*, 75–86. doi:10.1016/j.intell.2015.02.008
- Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science, 185*, 1124–1131. doi:10.1126/science.185.4157.1124
- Van der Gaag, M.A.E., Albers, C.J., & Kunnen, E.S. (in press). Micro-level mechanisms of identity development: the role of emotional experiences in commitment development. *Developmental Psychology*.
- Van Esbroeck, R., Tibos, K., & Zaman, M. (2005). A Dynamic Model of Career Choice Development. *International Journal for Educational and Vocational Guidance, 5*, 5–18. <https://doi.org/10.1007/s10775-005-2122-7>
- Van Geert, P. (1994). *Dynamic systems of development: Change between complexity and chaos*. London: Harvester Wheatsheaf.
- Vleioras, G., & Bosma, H. A. (2005). Predicting Change in Relational Identity Commitments: Exploration and Emotions. *Identity: An International Journal Of Theory And Research, 5*, 35–56. doi:10.1207/s1532706xid0501_3
- Von Neumann, J., & Morgenstern, O. (1947). *Theory of games and economic behavior., 2nd rev. ed.* Princeton, NJ, US: Princeton University Press.
- Wallace-Broschous, A., Serafica, F. C., & Osipow, S. H. (1994). Adolescent career development: Relationships to self-concept and identity status. *Journal Of Research On Adolescence, 4*, 127–149. doi:10.1207/s15327795jra0401_7

Discussion

6

OVERVIEW

My initial aim with this thesis was a practical one. I aimed to understand the processes underlying two commonly occurring career transitions: choosing a career path and dropping out of university. Such knowledge may have important practical value, for example to identify and support individuals who struggle with the successful navigation of these transitions. With this practical utility in mind, I aimed to generate a type of knowledge useful to practice: knowledge on processes within individuals, on a 'micro-level' timescale. After all, practitioners tend to work with individuals (as opposed to group averages) in day-to-day and week-to-week processes.

As I investigated these within-individual, micro-level processes, the aim of this thesis became more fundamental: to understand the nature of identity development. As explained in the introduction of this thesis, forming and evaluating big career decisions is intertwined with identity development. Thus in order to fully understand the processes underlying career transitions, it is important to understand the processes underlying identity development. However, currently, not much is known about processes of identity development on a micro-level timescale. Therefore another, and perhaps more prominent, aim of this thesis was to understand how we can conceptualize micro-level identity in the first place, which processes and mechanisms are essential to micro-level identity development, and how these processes and mechanisms may differ between individuals.

Taking both the practical and fundamental aims into consideration, the overarching research question that has been addressed in this thesis is: what are the basic processes and mechanisms of micro-level identity development and how are such processes related to big career transitions?

The short answer is that the person-centered, micro-level perspective used in this thesis has given us important new insights into the processes underlying both career transitions and identity development. In particular, it turns out that individuals differ strongly in the relation that they show between the two core processes of identity development: exploration and commitment (chapter 3). Moreover, these two processes seem to be only part of the mechanisms of micro-level identity development: emotional experiences seem to play an even more pivotal role in shaping identity commitments than exploration does (chapter 4). These processes of micro-level identity development are indeed related to career transitions. Specifically, the shape of identity development trajectories can be predictive of university dropout (chapter 2). Furthermore, in our theoretical model we show how we expect

the basic mechanisms of exploration and subsequent experiences to interact with relatively stable individual differences to shape the career choice process (chapter 5).

SUMMARY OF THE CHAPTERS

The Process of Commitment Evaluation

In the first three empirical chapters of this thesis I have tried to understand the micro-level processes and mechanisms relevant to commitment evaluation, specifically in the domain of higher education. In all of these empirical studies we make use of intensive longitudinal data collected among first year psychology students of the University of Groningen in the Netherlands. Every week, for 5 to 8 months, the students were asked to describe an important experience and the emotions that had accompanied it. In addition, they answered questions on the strength of their educational commitment and on the amount that they had explored during that week.

Chapter 2

In the first study we have shown that processes of exploration and commitment seem to be relevant predictors of university dropout among first year psychology students. We have categorized trajectories of micro-level educational commitment and exploration into two types of trajectories using cluster analysis. We found a type of trajectory that is characterized by certainty, and another that is characterized by doubt. The individuals with trajectories characterized by certainty tend to show relatively high levels of commitment and low levels of exploration, and tend to be stable over time. Contrastingly, individuals with trajectories characterized by doubt show relatively low levels of commitment and high levels of exploration, and both tend to fluctuate much over time. Perhaps not surprisingly, individuals who show trajectories characterized by doubt are at an elevated risk of dropping out of higher education.

These typologies are useful to detect dropout in an early stage. The typologies of certain and doubting students should be relatively easy to detect, and this categorization performs reasonably well in filtering out possible dropouts: the vast majority of dropouts are likely to be in the doubting category. However, this prediction is far from perfect, because the majority of doubting individuals does not drop

out but instead persists in the chosen educational path. We therefore used decision trees to optimize our prediction, and distinguish the features of the individual trajectories that predict dropout the best. It turns out that the prediction of dropout can be much improved by gaining insight into more sophisticated features of the individual trajectories. In our study, dropout is most accurately predicted if individuals show a decreasing trend of commitment over time combined with an increasing trend in the amount of fluctuations in exploration, or if they show an increasing trend in their level of exploration.

Chapter 3

In the second study we have investigated whether micro-level commitment and exploration are indeed as closely related as they appeared to be in the typologies that we distinguished in chapter 2, and whether these relations differ between individuals. We zoomed in on the relations between week-to-week changes in exploration and changes in commitment, within each individual. We presented a detailed picture by including multiple types of micro-level exploration and commitment¹⁰. Because the study of identity on a micro-level is relatively new (Klimstra et al., 2010) this meant we had to advance the conceptualization of these different forms of exploration and commitment on a micro-level. We thus translated three main forms of exploration that have been used in studies on macro-level identity (i.e., broad exploration, in-depth exploration, and self-exploration) and two forms of commitment (i.e., commitment making, and identification with commitment) into concrete micro-level concepts measurable from week-to-week. We showed that our micro-level measures of exploration and commitment show good convergent construct validity. However, we found that the differentiation between two types of micro-level commitment is perhaps less useful as they are strongly related to each other within most individuals, and they show similar relations with the three forms of exploration.

We found that changes in micro-level commitment are indeed usually related to changes in micro-level exploration within individuals. However, the extent to which this is true and the direction of the relation varies greatly between individuals. For example, it turns out that an increase in exploration of alternative career paths is related to a simultaneous increase in commitment for half of the individuals, while

¹⁰ In the other two empirical chapters (2 and 4) we only used one type of exploration and one type of commitment: exploration of the fit between the individual and chosen educational trajectory, and the commitment to the choice of educational trajectory

it is related to a decrease in commitment for the other half. This emphasizes the importance of taking a person-centered approach. Indeed, this pattern would not have become clear if we had only used the average (which is close to zero), which could have led to the false conclusion that no relation exists (while in fact individuals who showed a relation close to zero were very rare). This large heterogeneity also aroused the suspicion that we were missing some essential piece of the puzzle. Why would it be so that exploration is related to increases in commitment for one individual while it is related to decrease in commitment for the next individual?

Chapter 4

In the third empirical study we investigated whether other mechanisms might be at play besides the dynamics of exploration and commitment and looked into the role of emotional experiences. Taking several theories on the micro-level processes of identity development as a starting point, it became obvious that an experience resulting from an act of exploration could be of major influence on how commitment is impacted by exploration. Indeed, an experience alone could hypothetically alter the educational commitment that an individual feels, without any act of exploration preceding it. We investigated this potential role of experiences using the emotions that accompany experiences¹¹.

We indeed found that for most individuals an emotional experience tended to be accompanied by changes in commitment. Moreover, we found that these changes in commitment were more strongly related to emotional experiences than to acts of exploration. But similar to chapter 2, we found that individuals differ strongly in the strength, and sometimes also the direction of these intra-individual relations. The results for positive emotional experiences were most consistent: for almost all individuals (94%), positive emotional experiences were usually related to increases in educational commitment. Surprisingly, we found that negative experiences were also usually related to increases in commitment for the majority of individuals (68%). I say 'usually' because these are average relations within an individual. This means that a single positive experience is not necessarily always accompanied by an increase in commitment – they tend to go together, but the individual may respond differently each time.

That our study only shows general tendencies in how an individual responds to emotional experiences is important to note for at least two reasons. First, it is very

¹¹ Emotions are considered a good indicator of the personal relevance of an experience (Vleioras & Bosma, 2005)

likely that an individual will not respond the same to different types of experiences. For example, it may matter whether a positive experience was in the domain of education, such as receiving a good grade, or in some other domain, such as getting a puppy. While both experiences are positive, the first is probably more likely to increase educational commitment than the second (getting a puppy seems more likely to distract and perhaps decrease educational commitment). Second, according to an important theory on identity development (Bosma & Kunnen, 2001) responding to a negative experience with an increase in commitment is a process that the individual cannot maintain indefinitely. Such a process is called assimilation: the individual compensates a negative experience (e.g., a bad evaluation) with reassuring thoughts and plans for the future (e.g., study more next time) which may temporarily increase commitment. But if many negative experiences keep stacking over time, a different process called accommodation is likely to emerge: the commitment decreases in order to achieve congruency with the reality that the individual is faced with. Obviously, future research has much to explore with regard to the exact role of experiences, particularly in relation to these processes of assimilation and accommodation. Our current study has at the least shown that such an avenue is a worthy pursuit as emotional experiences seem to play an important role in the mechanisms of identity development.

The Process of Commitment Formation

Chapter 5

The foundation for the last theoretical study on the process of career choice is formed by the insights from the previous chapters: the shape of the developmental process affects big career decisions, individuals differ a lot in these processes and the dynamics that shape them, and experiences play a large role in these processes. Building on this foundation, we merged several streams of literature from both developmental psychology and cognitive science to inform one conceptual framework on the process of career choice. Because the conceptual framework is centered around a within-individual, dynamic and iterative process over time, it is hard to predict its outcomes using verbal reasoning alone. Therefore, to truly understand our conceptual framework and to be able to generate concrete predictions with it, we translated it into a simulation model and analyzed its outcomes.

In our framework, we assume that the process of career choice essentially consists of many micro-level experiences with career options that result from acts

of broad exploration (briefly scanning an option) and in-depth exploration (further investigating promising options). Each experience informs the individual on how well a career option may fit her. However, we also assume that the individual is not fully accurate in estimating this fit – this is where macro-level identity is likely to play an important role. For the individual with well-developed ideas on what she likes and where she wants to go in life (i.e., well-developed macro-level identity commitments) it is easier to accurately estimate whether a particular career path suits her, than for an individual who does not have such clear and well-developed self-views. We also assume that individuals can differ in the way that they tend to divide their time over broad versus in-depth exploration, and how selective they are in both considering an option promising and in deciding on an option.

The results of our simulations indicate that having a higher accuracy in estimating the fit of a potential career path (presumably affected by a clearer sense of self) also leads to better career choices. However, the extent to which this is true depends on the two other individual characteristics that we distinguished: the tendency to explore broadly versus in-depth, and how selective individuals are. Indeed, our simulations show that all three individual tendencies (i.e., accuracy, exploration tendency, and selectivity) contribute to determining the shape and outcome of the career choice process. For example, individuals who have a tendency to spend most of their time exploring in depth and who are very selective are likely to explore the same options over and over again, without coming to a decision. This resembles ruminative exploration, a type of exploration that is commonly considered maladaptive (e.g., Beyers & Luyckx, 2016). In our simulations, individuals who have ruminated a lot commonly make decisions far below their aspiration levels. However, our simulations also point to exceptions: individuals who are relatively inaccurate in evaluating the fit of options can actually benefit from ruminative exploration as it reduces the risk of making a very bad decision. Thus our theoretical simulation study has generated novel hypotheses on the mechanisms behind the emergence of ruminative exploration processes, and specifies conditions in which ruminative exploration is predicted to be detrimental or beneficial. This is just one example of the novel predictions generated with the simulation study and demonstrates the importance of thoroughly developing theory and hypotheses on individual processes using simulation studies.

THEORETICAL IMPLICATIONS

Person Centered Approach is Essential when Examining Micro-level Dynamics

This thesis presents a number of theoretical implications, one of the most important ones is that a person centered perspective is essential when studying micro-level processes of identity development and career transitions. We have shown that individuals differ in the types of commitment and exploration trajectories that they show (chapter 2), that individuals differ strongly in how changes in commitment are related to exploration and emotional experiences (chapters 3 and 4), and our simulations predict that individual differences have a vital impact on the process and outcomes of career choice (chapter 5). In these chapters (particularly in chapter 2), we have thus demonstrated that an important aspect of the ergodicity assumption – homogeneity, which means that relations among variables must be similar for all individuals (Molenaar & Campbell, 2009) – is clearly violated for the study of micro-level processes of identity development and decision making. Thus knowledge on such processes simply cannot be informed by group-based analyses of the relations between variables. This implies that it is essential for future research on micro-level processes of identity development and decision making to take a person-centered approach.

Fluctuations as a Distinguishing Feature of Identity Development

A person-centered approach, combined with the study of intensive longitudinal trajectories, has also brought to light new distinguishing features of the identity development process: fluctuations and stability. Individual differences in fluctuations are not commonly included in typologies of identity: these typologies are commonly based on the level of exploration and commitment (e.g., Meeus, van de Schoot, Keijsers, Schwartz, & Branje, 2010), sometimes also including the general change trend (e.g., Luyckx, Schwartz, Goossens, Soenens, & Beyers, 2008). However, the results from chapter 2 suggest that the levels of commitment and exploration are intertwined with their stability: high levels of commitment tend to be stable while low levels of commitment tend to fluctuate much. Conversely, high levels of exploration tend to fluctuate much while low levels of exploration tend to be stable. Thus identity typologies may not only be characterized by the levels of exploration and commitment, but also by the stability in these levels. For future research it may be interesting to include such stability characteristics as it may lead to the

distinction of new or other identity classes, and a new perspective on how identity develops.

Experiences are an Essential Part of the Mechanisms of Identity Development

Our results in chapter 4 support the hypothesis that experiences are an important part of the mechanisms of micro-level identity development. Emotional experiences in fact seem to impact commitment dynamics more strongly than exploration does, which supports the notion that emotional experiences are more proximal in the mechanisms of identity development while exploration is more distal. Emotional experiences could thus be a factor that has been overlooked in many studies of identity development while it could have substantially affected many of the empirical findings on the relation between exploration and commitment. Even though experiences that result from exploration have indeed been described as an important part of the mechanisms of micro-level identity development (e.g., Bosma & Kunnen, 2001; Grotevant, 1987; Kerpelman, Pittman, & Lamke, 1997; Vleioras & Bosma, 2005), experiences have so far usually not been included in measurements of the identity development process. Indeed, in various operationalizations of exploration that we know of (e.g., Bosma, 1985; Crocetti, Rubini, & Meeus, 2008; Klimstra et al., 2010; Luyckx, Goossens, Soenens, & Beyers, 2006; Van der Gaag, De Ruiter, & Kunnen, 2016), exploration is measured solely as various types of exploratory behavior, and does not include the experiences resulting from that behavior. Thus it is recommended that future empirical studies that aim to explain the process of identity development include measures of (emotional) experiences, rather than only including measures of commitment and exploration.

A More Parsimonious View on Exploration

Separating the experiences resulting from exploration from the act of exploration itself gives a more parsimonious view on the various forms of exploration that have been suggested. For example, recently researchers have found two distinct types of correlations between commitment and exploration (Zimmermann, Lannegrand-Willems, Safont-Mottay, & Cannard, 2015). And in an effort to combine competing models of identity development (i.e., Luyckx et al., 2006; Crocetti et al., 2008) they propose to interpret this result as the existence of two different forms of exploration: a form of in-depth exploration that results in an increase in commitment (more closely related to the concept of in-depth exploration of Luyckx et al., 2006),

and a form that results in a decrease in commitment (more closely related to the concept of commitment reconsideration of Crocetti et al., 2008). Based on the findings in chapter 4, I suggest that perhaps the experiences resulting from these acts of exploration have mediated this relation between exploration and commitment. Separating the acts of exploration from their resulting experiences could thus mean that we do not need to distinguish these 'in-depth exploration' and 'reconsideration' concepts as two qualitatively different ways of exploring, but could just do with one 'in-depth exploration' concept that may have two different types of outcomes (positive or negative experiences), which in turn determine how commitment is affected.

The micro-level focus of this thesis also provides a different view on another qualitatively different type of exploration that has been proposed in identity literature: ruminative exploration (Luyckx et al., 2008). Ruminative exploration refers to a repetitive form of exploration accompanied by feelings of worry, where an individual explores the same options over and over again without coming to any different conclusions. On a macro-level time-scale it seems useful to distinguish such a ruminative process because it characterizes a type of trajectory. However, on a micro-level time-scale it does not make sense to define ruminative exploration as a qualitatively different type of exploration: as a single act, it is hard to distinguish from in-depth exploration, with the possible exception that it should be accompanied by a particular set of emotions (i.e., feelings of worry). Indeed, we have shown in chapter 5 that ruminative exploration can emerge from a career choice process as a natural consequence of picky individuals with a tendency to explore in-depth. Thus, ruminative exploration may be best conceptualized a macro-level phenomenon, a type of trajectory that emerges over multiples weeks or months, but we do not need to assume that it is a qualitatively different type of exploration on a micro-level.

Thus in writing this thesis I have come to believe that we could do with fewer concepts of exploration, at least in theories on the micro-level building blocks of identity development processes. However, I do not mean to dismiss the many concepts of exploration, they may very well be useful to characterize a type of trajectory on a macro-level time-scale, and different types of exploration may also emerge on a micro-level even after filtering out the resulting experiences. Rather, I mean to say that which types exist on a micro-level, and how to distinguish them, is an important theoretical question to answer if we want to gain more clarity in the many concepts that exist in the identity 'tower of Babel' (Côte, 2015).

Complex Interactions between Exploration, Experiences and Commitment

From this thesis we can conclude that exploration, experiences and commitment all seem to be important factors in the process of micro-level identity development, and they are likely to interact in a complex way. In chapter 5 we have demonstrated that such complex interactions and their resulting processes can be made explicit in a simulation study. Such a simulation study can generate concrete predictions, testable with common population-based statistics, while taking an iterative and dynamic individual process as a starting point. It has the added advantage of making theory much more concrete because it forces the researcher to be explicit about the wide range of theoretical assumptions that underlie a theory, such as the essential building blocks of an individual developmental process, how these building blocks interact over time, and how individual differences are likely to play a role in shaping this process. Moreover, as our simulation study shows, explicitly modeling the dynamic aspects of complex developmental processes can lead to counterintuitive insights that one would not have arrived at by verbal reasoning alone. These insights of course need to be tested empirically, which may then lead to adaptations of the model. Such an empirical cycle, that includes simulations of a process theory on the level of the individual, is seen as a necessary next step (for example by Courgeau, Bijak, Franck, & Silverman, 2017) to combine theory on individual processes with population level statistics that are so commonly used in psychology (for an example see Steenbeek & Van Geert, 2008).

Making the Aspects of Identity Explicit: Micro- and Macro-level Identity

In the spirit of my mission to make sense of the many concepts in the field of identity studies, I have proposed a differentiation between two aspects of identity that both have been studied in identity research: the micro-level aspect of identity and the macro-level aspect of identity¹². In the introduction, but also chapters 3 and 4, I have explained that micro-level commitments can be seen as concrete and contextualized commitments that require an integration of relatively few elements over a small time-frame in order to form – a commitment towards a specific educational trajectory, place of work, or person. By contrast, macro-level commitments can be conceptualized as the more abstract ideas on own interests, values, ambitions, or strivings for the future in several areas of life that require an integration of many

¹² note that here the micro level vs macro level of identity does not refer to a distinction in timescales, but refers to a distinction in type of concept.

elements covering a large time-span in order to form – a commitment to helping people, saving the world, or being a family man.

Such a distinction of identity in a micro- and a macro-level has the advantage that it has the potential to integrate two main streams in the field of identity research that differ in how they measure identity: with an identity interview (e.g., Bosma, 1985; Bosma, Kunnen, & Van der Gaag, 2012; Marcia, Waterman, Matteson, Archer, & Orlofsky, 1993), or with identity questionnaires (e.g., Crocetti et al., 2008; Klimstra et al., 2010; Van der Gaag, De Ruiter, & Kunnen, 2016). These different measures implicitly conceptualize identity differently: while the interviews focus on the commitment to and exploration of abstract views of the self (i.e., the macro level of identity), the questionnaires focus on the commitment to and exploration of concrete contexts in the environment of the individual (i.e., the micro level of identity). They can be united and better understood in relation to one another if we frame them as two aspects of identity that are related, but distinct.

Uniting the studies on these different aspects of identity implies that we should gain some understanding of how these aspects of identity interact. Some beginning ideas on this interaction have emerged throughout this thesis, but as I also indicated in the introduction, much theoretical development is still needed. With that in mind, I will describe an example of how I think such interactions may occur. An abstract macro-level identity commitment of an individual may come down to “I want to help people”. This abstract view on the self then determines which of the possible career paths (i.e., micro-level commitments) are experienced as suitable and which are not. For example, for the individual that wants to help people, it may seem perfectly fitting to study psychology, but it may not seem so fitting to study engineering. Thus the abstract macro-level of identity constrains the concrete micro-level commitments that an individual is likely to form. In turn, the development of these micro-level commitments may also affect the view that the individual has of herself. For example, perhaps a stacking of many negative experiences makes the individual who wanted to help people doubt the suitability of her micro-level commitment to study psychology. She may solve this conflict a various ways that result in either maintenance or change of her macro-level commitments. She may maintain her macro-level commitments for example by forming micro-level commitments that are more congruent with it (i.e., assimilation): our example individual may still want to help people, but will look for other contexts to pursue this (e.g., social work, volunteering at refugee camps). Or the individual may change, redefine or nuance her self-view (i.e., accommodation) for example the individual may now

commit to a self-view such as “I want to help people close to me, but I do not want to do it as my day job”.

This conceptualization of identity in different levels brings up several theoretical questions that need to be addressed in future research. For one, are these levels of identity all the relevant levels of identity? I have distinguished these micro-level and macro-level aspects of identity based on what is commonly studied in identity literature. However, we can imagine the existence of commitments that are even ‘more micro’. For example, a commitment such as “I will invest considerable effort in studying for this particular psychology exam”, can be considered more micro than “I want to study psychology” because it integrates even fewer elements on a smaller timescale. Indeed, we can imagine even smaller levels of commitment, all the way down to fleeting a commitment to a decision to perform a particular momentary action, such as “I am going to get up from the couch now and study at the desk”.

We need a much more elaborate theory that can account for all the levels of identity, perhaps using a dynamic systems approach as for example De Ruiter, Van Geert, and Kunnen (2017) have done for behavioral patterns of self-development. Such a framework may allow for the systematic integration of the many aspects of identity on different timescales. Moreover, it would seem particularly fruitful to integrate such a dynamic systems theory on identity development, which can be seen as the more reflective side of self-development, with theories on the more behavioral side of self-development, such as the one by De Ruiter et al. (2017). By integrating such theories we will have a much clearer understanding of how all the different aspects of identity emerge, how they relate to each other, and how they affect and are affected by experiences and behavior.

Finally, we should critically examine whether the terms ‘micro-level’ and ‘macro-level’ identity are indeed suitable terms to refer to the distinction that I have made between the different aspects of identity. The terms ‘micro’ and ‘macro’ can also refer to distinction in processes over time (e.g., De Ruiter, Van Geert, & Kunnen, 2017), or in social contexts (Bronfenbrenner, 1992), so it can become confusing to also use it as I do here, as a distinction in abstraction of concepts. Although the distinction in concepts is loosely based on their time characteristics (i.e., views that are generated by integrating small or large time-frames) they are also well distinguished by their level of abstraction, thus a terminology such as ‘concrete’ and ‘abstract’ levels of identity also seems suitable. I will leave the question of which terms are the more suitable to use to future research, the more important point here is that however

we should decide to name this distinction, the distinction itself should be made in order to help clarify the many conceptualizations of what identity is.

PRACTICAL IMPLICATIONS

Dealing with Dropout

Universities in the Netherlands have been stimulated to decrease the amount of students that drop out through various financial incentives. The results in chapter 2 show that it is possible to flag students at risk for dropout by monitoring their educational commitment and exploration levels. We have shown that this can be done with easily observable criteria, such as characterizing individuals as certain or doubting. Students have a high chance of persisting in their studies if they are fairly certain of their educational choice and experience only few periods of mild doubt. By contrast, students have an elevated chance of dropping out if they frequently doubt whether the educational trajectory is truly fitting and generally experience little certainty in their educational choice. This classification as 'certain' or 'doubting' can be achieved relatively easily, for example by taking only a few measures among students or even by qualitative estimations of a teacher or mentor. The two classes do differ in how accurately they predict persistence and dropout. While classifying students as 'certain' can predict persistence with a high degree of accuracy, classifying students as doubters is less precise. Although the vast majority of dropout is indeed in the doubting class, most of the individuals in the doubting class will persist in their studies.

Better predictions can be obtained by focusing the analysis of individual trajectories on more sophisticated features that require more frequent measurement in order to be estimated correctly. We found two types of individuals that are likely to dropout. The first group showed a general decreasing trend in their commitment, combined with an increase in the fluctuation in the amount that they explored. A second group of likely dropouts showed a leveled or even slightly increasing trend of commitment, but at the same time a decreasing trend of exploration.

Universities can use a two-step approach to optimally predict dropout while also taking the practical restraint of limited resources into account: first classify students as doubting or certain to catch a large group with a possible risk of dropout, then follow the doubting student intensively to also be able to catch the more subtle change trends that may precede dropout.

The results of chapter 4 give some clues on what we could do for students at risk for dropout. In this chapter we have shown that students usually do not easily give up their educational commitment: most students tend to increase their commitment after negative experiences. We have argued that students' own ideas on who they are and where they want to go and perhaps also their emotional and financial investments in their educational trajectory will prevent them from just letting go of their educational commitment whenever it is threatened. And this is probably a good thing. If students would give up whenever something happens that they do not like, there would probably not be many students left after the first statistics course. It is a resilient reaction. But if they keep this reaction up for too long, it may become less resilient and more of a rigid clinging to the educational commitment (e.g., Kunnen & Bosma, 2000).

For supervisors and mentors it is important but difficult to distinguish between resilient and rigid reactions to negative experiences. One way to do this is to ask first year students regularly about their experiences and how they feel about their chosen educational path. If students demonstrate an imbalance between frequent negative experiences in their educational trajectory on the one hand and an enduring strong educational commitment on the other hand, perhaps a conversation can be started to critically examine whether this educational trajectory is indeed the right the choice for that student.

In chapter 4 we have shown that for educational commitment building it seems to matter most whether emotional experiences are intense or not, regardless of the valence (i.e., positive or negative). This implies that emotional experiences hold important informational value for the student – they use it to evaluate and adjust their educational commitment. Intense emotional experiences are thought to arise when experiences hold personal relevance (e.g., Vleioras & Bosma, 2005). Universities could try to facilitate such personally relevant experiences. One way to do this, is to design activities in the first year of higher education that allow the students to explore connections between themselves – their own interests and ambitions (i.e., their macro-level identity) – and activities or topics that are important aspects of the curriculum or the professional field. Such explorations may first be broad to allow students to select topics or future activities that seem fitting. Then students can explore a selected few options in depth, to check whether it is truly fitting. For example, the student may write a paper on a self-chosen topic important to the curriculum and most interesting to them, or gain hands-on experience with future activities that seem very enjoyable to them. If such topics or activities are indeed

congruent with the personal goals strivings of the student, the student is likely to experience a feeling of flow (e.g., Schwartz, Kurtines, & Montgomery, 2005) but if they are incongruent, the student will likely struggle with the activity. Such an experience creates an opportunity for the student to reflect on whether she truly wants to pursue this commitment, and this reflection could be stimulated by a teacher or mentor. Ultimately, this allows the student to be more informed on the fit of her current commitment: she can continue more committed with the knowledge that this is truly what she wants, perhaps combined with the knowledge that it is not going to be easy, or she can decide that other avenues are better suited for her.

Career Choice

If our career choice model turns out to have empirical merit, many implications can be imagined for both practice and policy. For example, over the past years the Dutch government has been increasing the pressure on students to make the 'right' choice for an educational trajectory: various measures have been implemented to make switching hard once an educational trajectory has been started (e.g., high fees for following a second bachelor or masters degree, replacing basic scholarships with loans). These measures seem to assume that students *can* make the right choice, if they would only make enough of an effort. Our understanding of the process of career choice as presented in our framework in chapter 5 is not in line with such an assumption: in our framework we assume that all career choices are to some extent a gamble. The extent to which a career choice is a gamble can be reduced by exploring more, but too much in-depth exploration also has a risk of resulting in rumination and bad decisions. Another way to reduce the extent of the gamble is to have a clear view on ones' own interests and ambitions. Such a clear self-view is particularly difficult to achieve for adolescents, who typically have to make these choices, as they are in the midst of developing their identity. To expect of this young group in particular to be able to make the right decision may simply not be realistic, at least not for many of them. As we have seen in chapter 4 and 5, individuals need experiences in order to develop their educational commitments and to arrive at good career decisions, and this is probably even more important when they lack clear self-views. Thus it may be necessary for some individuals, particularly for those who lack clear self-views, to try multiple educational trajectories before they know what truly is the right path for them. It would be good if policy would be shaped in such a way that gives them this space.

Other government incentives have stimulated universities in the Netherlands to implement measures to help students avoid making bad career choices in the form of various ‘matching activities’. Such matching activities entail that the prospective student participates in various activities at the university before she enrolls in the educational trajectory. For example, the student may have to follow a sample course, meet with a dean to discuss her career choice, or fill out some questionnaires which lead to personalized advice on whether the right choice was made. When framed in our career choice framework, this constitutes an extra in-depth exploration effort. Our simulations predict that in most cases this should help the prospective student to come to a more accurate estimation of how well the educational trajectory may fit her. Recent empirical studies have highlighted a few conditions that make such an in-depth exploration effort most effective: when the resulting experience is as close to the actual first year experiences as possible (e.g., ‘trial-studying’, which results are a good predictor of academic success; Niessen, Meijer, & Tendeiro, 2016) and when it is an elaborate matching activity (such as a summerschool) as opposed to a superficial activity (such as a single assignment; Slijper, 2017). The students can use such an experience to adjust their expectations to a more realistic level, and this would lead to the filtering out of those students who had a distorted idea of the trajectory they had selected, allowing them to change their mind. Thus theoretically, the introduction of matching activities seem to be a good development.

A promising way to help the exploration process is through more elaborate career choice guidance trajectories. Our theoretical framework of career choice in chapter 4 can explain why career choice interventions that use a holistic approach are particularly effective (Kunnen, 2013; Kunnen, 2014). Such career choice guidance trajectories (e.g., Orientatietraject Noord, n.d.; Saxion StudiekeuzeLab, n.d.) combine two approaches: they help young individuals explore themselves and the world around them. Guided exploration of the self means that the young individual explores her own interests and ambitions which is likely to improve the clarity of the self-views of the individual (i.e., macro-level identity concepts). Such clearer self-views are indeed predicted to lead to better career choices in our theoretical model. Guided exploration of the world means that different career paths are investigated broadly and in-depth. The model indeed predicts that more elaborate exploration of career alternatives tends to be beneficial for making good career choices. However, our model also cautions for the emergence of ruminative exploration among picky individuals who tend to explore a few options in-depth over and over again. These individuals do explore elaborately, but are not predicted to make very good

choices. It may be beneficial to stimulate such individuals to explore more broadly instead of in-depth.

The model also provides inspiration on what could be the focus of the guidance given a certain set of characteristics of the individual that has to make the career choice. For example, individuals who have clear self-views are predicted to be better off spending a large portion of their time broadly exploring many options, while individuals who do not have such clear self-views might be better off spending a large portion of their time exploring a few options in-depth. Thus the model gives ideas on the type of guidance that could be given to steer the exploration process in such a way that the individual has the highest chance of making a good career choice.

Questions for Future Research

I think this thesis has generated more questions than it has solved, which is probably the rule rather than the exception. The role of experiences in micro-level mechanisms of identity development has just been lightly touched. I have shown that the emotional valence of experiences matters for educational commitment dynamics, and it seems to matter more than exploration does. But many questions remain: does the educational commitment of an individual always respond the same way to particular types of experiences? How long can an individual assimilate negative experiences before she must accommodate? How does the content of the experience play a role? What is the role of experiences in commitment development in other domains?¹³ Can and should we begin to define 'identity experiences', a typology of experiences that are particularly relevant to identity development?¹⁴

Moreover, it may very well be that experiences play a different role when forming commitments, than when evaluating commitments. For evaluating existing commitments we saw that experiences are not immediately related to decreases in the commitment of the individual – commitment commonly increases after a negative experience (chapter 4). Thus once the individual has invested emotionally and financially in a particular career path, she is motivated to protect her concern and seems not so likely to be swayed by negative experiences. She will firstly try

13 Thanks to Moin Syed who recently pointed out this possibility during his discussion (Syed, 2017) of this paper in the symposium 'Integrating Identity Perspectives and Methods to Highlight New Research Directions'.

14 Thanks to Harke Bosma who brought forward this notion during his discussion (Bosma, 2017) in the symposium 'Identity Theory and Foundational Educational Processes'.

to assimilate negative experiences: maintain and even increase her commitment. But this process is likely to be different when the individual is still deciding on a career commitments. In this case there is not yet a concern that needs protecting, few investments have been made, thus a negative experience may not require assimilation but can inform the evaluation of the option without being distorted by the need to protect a concern. Indeed, for forming commitments, we have assumed that experiences inform the individual on the fit of a career option meaning that in this phase, a negative experience decreases the evaluation of the fit (chapter 5). The hypothesized different meaning of experience when forming and evaluating commitments seems to be an interesting question for future research.

Our findings have only made a start in explaining the dynamics of commitment evaluation. In chapter 2 we showed that much fluctuation and low levels of commitment go together with much fluctuation and high levels of exploration, and that such trajectories are related to the chance to drop out of higher education. Of course, fluctuations consist of ups and downs. We can explain the 'ups' of commitment with our results in chapter 4 – where positive experience but often also negative experiences are related to increases in commitment. Then where do the downs come from? Here I feel we are still missing another important piece of the puzzle – the dynamics intrinsic to commitment and exploration. Perhaps some individuals are just more variable in how committed they are and how much they explore from one week to the next, while others are more stable. It would be very interesting if future research would investigate more on the conditions of variability and stability in commitment and exploration, and their shape over time (e.g., Valacher, Van Geert, & Nowak, 2015).

CONCLUDING REMARKS

There is one important generic message woven into this dissertation: a focus on micro-level processes within individuals can give many new insights into how and why individuals change and stay the same. Such a focus can generate new typologies of developmental processes, can give insight into the basic building blocks and mechanisms that determine the shape of these processes, and can lead us to translate abstract psychological concepts to concrete concepts more relevant to the everyday life of individuals. And currently, almost all of such insights into micro-level processes within individuals are novel, and tend to be relevant for practice.

Indeed, this focus on processes and mechanisms within individuals points to a way to move forward specifically in research on identity, but also in research on psychological change in general. For a long time the field of identity research, just as many other fields in psychology, has invested considerable effort to distinguish typologies and correlate these typologies with practically every variable imaginable. But what use do we have for this knowledge? As the Chair of the International Society for Research on Identity, Marilyn Montgomery (2017), recently pointed out: the field seems to be saturated with this generic type of knowledge, we need knowledge that can be applied, knowledge that can bridge the gap with interventions. And as I have argued throughout the thesis, I believe that the type of knowledge that can bridge this gap is knowledge about micro-level processes and mechanisms within individuals. After all, practitioners work with individuals in day-to-day and week-to-week processes, and not with group averages. In fact I have come to believe that the famous 'gap' between theory and practice in psychology is not because there truly exist some kind of fundamental difference between theory and practice, but rather because science and practice tend to look at different things: averages versus individual processes. And while it may indeed be necessary for practitioners to concern themselves with individual processes, it is definitely not necessary for psychological science to limit itself to group averages, as I hope to have demonstrated in this thesis.

Besides, the many questions regarding micro-level processes within individuals that remain to be answered basically makes for a scientific 'smörgåsbord' for any researcher of psychology: you can just pick and choose the phenomenon you are interested in, try to find out how it works as a fundamental micro-level process within individuals and you will probably be the first one to do so. With the technology being ready for creating simulation models, for collecting intensive longitudinal data, and for analyzing this data, such endeavors are now truly feasible. This is not only exciting for researchers at the start of their career such as myself, but I believe this also means we are at the brink of some major changes in the field of psychology in general.

REFERENCES

- Bosma, H.A. (1985). *Identity development in adolescence. Coping with commitments*. Groningen: University of Groningen.
- Bosma, H.A. (2017, May). Discussion of the symposium. In E.P. Schachter (Chair), *Identity Theory and Foundational Educational Processes*. Symposium conducted at the 24th annual conference of the International Society for Research on Identity, Groningen, the Netherlands.
- Bosma, H.A., & Kunnen, E.S. (2001). Determinants and Mechanisms in Ego Identity Development: A Review and Synthesis. *Developmental Review, 21*, 39–66. <https://doi.org/10.1006/drev.2000.0514>
- Bronfenbrenner, U. (1992). Ecological systems theory. In R. Vasta & R. Vasta (Ed) (Eds.), *Six theories of child development: Revised formulations and current issues*. (pp. 187–249). London, England: Jessica Kingsley Publishers.
- Côte, J.E. (2015). *Identity formation research from a critical perspective: Is a social science developing?* In K. C. McLean, & M. Syed (Eds.), *The Oxford handbook of identity development* (pp. 562-573). New York, NY, US: Oxford University Press.
- Courseau, D., Bijak, J., Franck, R., Silverman, E. (2017). *Model-based demography: towards a research agenda*. In, van Bavel, J. and Grow, A. (eds.) *Agent-Based Modelling in Population Studies - Concepts, Methods, and Applications*. Dordrecht, NL, Springer.
- Crocetti, E., Rubini, M., & Meeus, W. (2008). Capturing the dynamics of identity formation in various ethnic groups: Development and validation of a three-dimensional model. *Journal of Adolescence, 31*, 207–222. <https://doi.org/10.1016/j.adolescence.2007.09.002>
- De Ruiter, N.M.P., Van Geert, P.L.C., & Kunnen, E.S. (2017). Explaining the “how” of self-esteem development: The self-organizing self-esteem model. *Review of General Psychology, 21*, 49–68. <https://doi.org/10.1037/gpr0000099>
- Grotevant, H.D. (1987). Toward a process model of identity formation. *Journal of Adolescent Research, 2*, 203–222. <https://doi.org/10.1177/074355488723003>
- Kerpelman, J.L., Pittman, J.F., & Lamke, L.K. (1997). Toward a Microprocess Perspective on Adolescent Identity Development: An Identity Control Theory Approach. *Journal of Adolescent Research, 12*, 325–346. <https://doi.org/10.1177/0743554897123002>
- Klimstra, T.A., Luyckx, K., Hale, W.A., Frijns, T., van Lier, P.A.C., & Meeus, W.H.J. (2010). Short-term fluctuations in identity: Introducing a micro-level approach to identity formation. *Journal of Personality and Social Psychology, 99*, 191–202. <https://doi.org/10.1037/a0019584>
- Kunnen, E.S. (2013). The Effects of Career Choice Guidance on Identity Development. *Education Research International, 2013*, 1–9. <https://doi.org/10.1155/2013/901718>
- Kunnen, E.S. (2014). The effect of a career choice guidance on self-reported psychological problems. *Frontiers in Psychology, 5*. <https://doi.org/10.3389/fpsyg.2014.00547>
- Kunnen, E.S., & Bosma, H.A. (2000). Development of meaning making: A dynamic systems approach. *New Ideas in Psychology, 18*, 57–82.
- Lichtwarck-Aschoff, A., van Geert, P., Bosma, H., & Kunnen, S. (2008). Time and identity: A framework for research and theory formation. *Developmental Review, 28*, 370–400. <https://doi.org/10.1016/j.dr.2008.04.001>
- Luyckx, K., Goossens, L., Soenens, B., & Beyers, W. (2006). Unpacking commitment and exploration: Preliminary validation of an integrative model of late adolescent identity formation. *Journal of Adolescence, 29*, 361–378. <https://doi.org/10.1016/j.adolescence.2005.03.008>

- Luyckx, K., Schwartz, S.J., Berzonsky, M.D., Soenens, B., Vansteenkiste, M., Smits, I., & Goossens, L. (2008). Capturing ruminative exploration: Extending the four-dimensional model of identity formation in late adolescence. *Journal of Research in Personality, 42*, 58–82. <https://doi.org/10.1016/j.jrp.2007.04.004>
- Luyckx, K., Schwartz, S.J., Goossens, L., Soenens, B., & Beyers, W. (2008). Developmental typologies of identity formation and adjustment in female emerging adults: A latent class growth analysis approach. *Journal of Research on Adolescence, 18*, 595–619.
- Marcia, J.E. (1966). Development and validation of ego-identity status. *Journal of Personality and Social Psychology, 3*, 551.
- Meeus, W., van de Schoot, R., Keijsers, L., Schwartz, S.J., & Branje, S. (2010). On the progression and stability of adolescent identity formation: A five-wave longitudinal study in early-to-middle and middle-to-late adolescence. *Child Development, 81*, 1565–1581. <https://doi.org/10.1111/j.1467-8624.2010.01492.x>
- Molenaar, P.C., & Campbell, C.G. (2009). The New Person-Specific Paradigm. *Current Directions in Psychological Science, 18*, 112–117.
- Montgomery, M. (2017, May). *Identity Theory and Research: What's Our Identity Horizon?* Presidential address conducted at the 24th annual conference of the International Society for Research on Identity, Groningen, the Netherlands.
- Niessen, A.S.M., Meijer, R.R., & Tendeiro, J.N. (2016). Predicting Performance in Higher Education Using Proximal Predictors. *PLOS ONE, 11*, e0153663. <https://doi.org/10.1371/journal.pone.0153663>
- Orientatietraject Noord. (n.d.). Retrieved June 19, 2017, from <http://www.orientatietrajectnoord.nl/site/>
- Raskin, P. M. (1985). Identity and vocational development. *New Directions for Child Development, 30*, 25–42. <https://doi.org/10.1002/cd.23219853004>
- Saxion Studiekeuzelab. (n.d.). Retrieved June 19, 2017, from https://www.saxion.nl/studeren/kiezen_en_kennismaken/Studiekiezer/dos/studiekeuzelab/studiekeuzelab/
- Slijper, J. (2017). *En wat kan ik dan later worden?: Een onderzoek naar het studiekeuzeproces van juridische hbo-studenten* (dissertation). Groningen: Rijksuniversiteit Groningen.
- Skorikov, V., & Vondracek, F.W. (1998). Vocational Identity Development: Its Relationship to Other Identity Domains and to Overall Identity Development. *Journal of Career Assessment, 6*, 13–35. <https://doi.org/10.1177/106907279800600102>
- Steenbeek, H., & van Geert, P. (2008). An empirical validation of a dynamic systems model of interaction: do children of different sociometric statuses differ in their dyadic play? *Developmental Science, 11*, 253–281. <https://doi.org/10.1111/j.1467-7687.2007.00655.x>
- Syed, M. (2017, May). Discussion of the symposium. In F. Gyberg (Chair), *Integrating Identity Perspectives and Methods to Highlight New Research Directions*. Symposium conducted at the 24th annual conference of the International Society for Research on Identity, Groningen, the Netherlands.
- Vallacher, R.R., Van Geert, P., & Nowak, A. (2015). The intrinsic dynamics of psychological process. *Current Directions in Psychological Science, 24*, 58–64.
- van der Gaag, M.A.E., de Ruiter, N.M.P., & Kunnen, E.S. (2016). Micro-level processes of identity development: Intra-individual relations between commitment and exploration. *Journal of Adolescence, 47*, 38–47. <https://doi.org/10.1016/j.adolescence.2015.11.007>
- Vleioras, G., & Bosma, H.A. (2005). Predicting Change in Relational Identity Commitments: Exploration and Emotions. *Identity, 5*, 35–56. https://doi.org/10.1207/s1532706xid0501_3
- Zimmermann, G., Lannegrand-Willems, L., Safont-Mottay, C., & Cannard, C. (2015). Testing New Identity Models and Processes in French-speaking Adolescents and Emerging Adults Students. *Journal of Youth and Adolescence, 44*, 127–141. <https://doi.org/10.1007/s10964-013-0005-7>

Appendix 1

Nederlandse samenvatting

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ACHTERGROND VAN HET ONDERZOEK

De keuze om een specifieke studierichting te gaan volgen of om te stoppen met een studie zijn belangrijke loopbaantransities die nauw verbonden zijn aan identiteitsprocessen: dergelijke grote beslissingen vormen de identiteit, maar andersom zijn processen van identiteitsontwikkeling ook bepalend voor welke beslissingen gemaakt worden. Maar eigenlijk zijn onderzoekers helemaal niet zo eensgezind over wat identiteit eigenlijk is, is er nauwelijks kennis over hoe identiteit precies ontwikkelt bij individuen in alledaagse interactie met hun omgeving, en hoe dit alles een rol speelt bij belangrijke levenskeuzes.

De eerste ver uitgewerkte ideeën over identiteit zijn geïntroduceerd door Erikson (1956), maar hij wees ook op de ongrijpbaarheid van het begrip en omschreef het van meerdere kanten in plaats van een definitie te geven. Misschien is deze ongrijpbaarheid de reden dat ook onderzoekers vandaag de dag verschillende ideeën hebben over wat identiteit precies is, ondanks dat Marcia (1966) er al lang geleden in geslaagd is identiteit concreet en meetbaar te maken. In de onderzoekstraditie van Marcia zijn onderzoekers het erover eens dat de begrippen *commitment* en *exploratie* de belangrijkste onderdelen zijn van identiteit en identiteitsontwikkeling. Een *commitment*, een binding aan een bepaalde keuze of overtuiging, wordt ideaal gezien gevormd als een resultaat van een exploratieproces waarbij het individu verschillende *commitment* opties globaal onderzoekt (breedte exploratie) als enkele opties diepgaander onderzoek (diepte exploratie).

Maar onderzoekers lijken ook van mening te verschillen op een belangrijk punt: waaraan mensen *commitments* vormen, en wat ze exploreren. Sommige onderzoekers focussen (meestal met lange interviews) op de exploratie van en *commitments* aan overtuigingen en keuzes over het zelf, dus het zoeken naar antwoorden op vragen van het type 'wie ben ik' waar vervolgens bindingen aan gevormd worden. Maar andere onderzoekers focussen (meestal met korte vragenlijsten) op de exploratie van en *commitments* aan opties in de omgeving, zoals een specifieke studierichting of een bepaald persoon. Een belangrijk voorstel dat voortkomt uit dit proefschrift is om deze aspecten van identiteit expliciet te onderscheiden, zodat meer duidelijkheid komt in het veelomvattende begrip dat identiteit is geworden. Voor nu heb ik dat onderscheid geduid als een verschil tussen 'macro' en 'micro' aspecten van identiteit, maar zoals ik ook aangeef in de discussie, er is zeker grond om verder te discussiëren over de meest passende terminologie.

In dit onderzoek heb ik me voornamelijk gericht op het 'micro' aspect van identiteit, dus exploratie van en commitments aan opties in de omgeving, specifiek in het domein van studie. Ik heb de ontwikkeling van dit aspect van identiteit ook onderzocht op een 'micro' tijdschaal: ik heb in kaart gebracht hoe de exploratie van en de commitment aan een studierichting zich van week-tot-week ontwikkelen gedurende het eerste jaar aan de universiteit. Ik heb onderzocht hoe deze trajecten gerelateerd zijn aan studie-uitval, en ik heb ingezoomd op de processen en mechanismen die ten grondslag liggen aan deze trajecten. Maar ik heb ook onderzocht hoe een commitment aan een studie in eerste instantie gevormd wordt door een theoretisch simulatiemodel te maken van het proces van studiekeuze. Met dit alles heb ik geprobeerd een antwoord te geven op de vraag: wat zijn de fundamentele processen en mechanismen van identiteitsontwikkeling op een microniveau, en hoe zijn zulke processen gerelateerd aan belangrijke transitieën in de loopbaan?

SAMENVATTING VAN DE STUDIES

In de drie empirische studies (hoofdstuk 2, 3 en 4) hebben we eerstejaars studenten van de opleiding psychologie aan de Rijksuniversiteit Groningen gevolgd met een dagboekstudie. Elke week, gedurende 5 tot 8 maanden, schreven zij over een belangrijke ervaring die ze hadden meegemaakt, beantwoordden ze vragen over de emoties die ze daarbij hadden ervaren, hoeveel ze hadden geëxploreerd en hoe sterk hun studiecommitment was.

In de eerste studie (hoofdstuk 2) hebben we gevonden dat de trajecten van eerstejaars studenten zijn in te delen in twee duidelijk herkenbare typen: zekere studenten en twijfelaars. De zekere studenten laten stabiele trajecten zien van sterke studiecommitments en weinig exploratie van de passendheid van de studie. De twijfelende studenten laten juist erg fluctuerende trajecten zien van zwakkere commitments en relatief veel exploratie. Het blijkt dat de zekere studenten bijna altijd hun studie blijven volhouden, terwijl twijfelende studenten vaker uitvallen. Maar twijfelende studenten vallen zeker niet altijd uit: het grootste deel van de twijfelaars houdt hun studie gewoon vol. Om de meest nauwkeurige voorspelling te doen van wie uitvalt lijkt het belangrijk om naar proceskenmerken te kijken die misschien moeilijker te ontdekken zijn. Wij konden uitval het nauwkeurigste voorspellen bij individuen die een dalende trend laten zien in de sterke van commitment terwijl

hun hoeveelheid fluctuatie in exploratie toeneemt over tijd, maar ook bij individuen van wie de commitment stabiel blijft of stijgt terwijl hun niveau van exploratie stijgt.

In de tweede studie (hoofdstuk 3) hebben we onderzocht of en hoe veranderingen in commitment en exploratie elkaar beïnvloeden van week-tot-week. Het blijkt dat veranderingen in commitment inderdaad over het algemeen samengaan met veranderingen in exploratie, maar in hoeverre dat waar is en hoe die relatie er precies uitziet verschilt sterk per individu. Bijvoorbeeld, voor de helft van de individuen ging meer exploratie van alternatieve studierichtingen gepaard met minder commitment aan de huidige commitment, maar voor de andere helft was deze relatie precies andersom. Dat onderstreept het belang om naar verschillende individuen te kijken en niet alleen naar gemiddelden, want de gemiddelde relatie tussen commitment en exploratie lag hier rond nul, terwijl deze relatie rond nul door bijna geen enkel individu getoond werd. Deze grote variatie tussen individuen in de relatie tussen exploratie en commitment deed ook vermoeden dat niet alle relevante mechanismen van identiteitsontwikkeling worden gevangen door alleen exploratie en commitment te bestuderen.

In de derde studie (hoofdstuk 4) hebben we gekeken of er nog andere mechanismen belangrijk zijn in het proces van identiteitsontwikkeling van week tot week. In het bestuderen van verschillende theorieën over het proces van identiteitsontwikkeling werd al snel duidelijk dat ervaringen, en dan met name emotionele ervaringen, een belangrijke rol zouden kunnen spelen. Uit onze studie bleek inderdaad dat emotionele ervaringen sterk gerelateerd zijn aan daarop volgende veranderingen in studiecommitment. Sterker nog, het bleek dat commitment veranderingen sterker gerelateerd zijn aan emotionele ervaringen dan aan exploratie. Deze bevinding kan veel gevolgen hebben voor hoe we de ontwikkeling van identiteit zien: er werd altijd gedacht dat exploratie de belangrijke drijfveer van identiteitsontwikkeling was, maar daarbij zijn de ervaringen die volgen op exploratie, of die zomaar voorkomen, uit beeld verdwenen. Onze resultaten laten zien dat het belangrijk is deze ervaringen misschien wel eens cruciaal kunnen zijn voor hoe wij identiteitsontwikkeling begrijpen. Een andere interessante bevinding in dit hoofdstuk was dat niet alleen positieve emotionele ervaringen, maar ook negatieve emotionele ervaringen voor veel individuen gerelateerd zijn aan een stijging in de sterkte van de studiecommitment. Dit suggereert dat veel studenten niet zomaar hun studie opgeven na een negatieve ervaring, maar eerder proberen negatieve ervaringen te 'assimileren' zoals de theorie van Bosma en Kunnen (2001) ook voorspelt. Dit houdt in dat studenten een negatieve ervaring op zo'n manier interpreteren dat hun com-

mitment intact blijft of zelfs sterker wordt (bijv. een slecht cijfer ombuigen naar een voornemen om harder te gaan studeren).

De vierde studie (hoofdstuk 5) is een theoretisch hoofdstuk geïnspireerd op de bevindingen uit de hoofdstukken ervoor en is gericht op het begrijpen van het proces van studiekeuze. In deze studie hebben wij inzichten uit ontwikkelingspsychologie en cognitieve psychologie verenigd in een theoretisch kader van het studiekeuzeproces. Dit theoretische kader hebben wij vertaald naar een simulatiemodel. Dit simulatiemodel stelt ons in staat om de logica te toetsen van de processen die we veronderstellen in het theoretische kader, en stelt ons in staat om te voorspellen hoe deze theoretische processen de studiekeuze uitkomsten zullen beïnvloeden. De simulatie liet zien dat de vorm van het studiekeuzeproces en de uitkomsten op een complexe manier wordt beïnvloed door de drie individuele verschillen die we veronderstellen: hoe selectief het individu is, hoe goed het individu kan inschatten of een optie bij haar past, en de neiging om voornamelijk in de breedte of in de diepte te exploreren. Een interessante uitkomst is bijvoorbeeld dat individuen die heel selectief zijn vaak goede keuzes maken, maar niet als ze geneigd zijn om vooral in de diepte exploreren. In dat geval blijven ze vaak 'hangen' in telkens dezelfde optie verkennen, een proces dat lijkt op ruminatieve exploratie (Luyckx et al., 2008). Dit soort ruminatieve trajecten leiden vooral tot slechte keuzes als een individu wel heel accuraat is in inschatten of een optie bij haar past, maar kunnen juist slechte keuzes voorkomen als het individu niet zo accuraat is. Dit model levert niet alleen dit soort voorspellingen op over wie een hoge of lage kans heeft om een goede studiekeuze te maken en waarom, maar levert ook een nieuwe kijk op hoe micro-niveau processen van studiekeuze en identiteit zich kunnen voltrekken.

GEVOLGEN VOOR THEORIE OVER IDENTITEIT

Dit proefschrift heeft verschillende gevolgen voor de manier waarop we identiteitsontwikkeling begrijpen. Ten eerste komt uit alle studies naar voren het essentieel is om naar processen binnen individuen te kijken als we identiteitsontwikkeling willen begrijpen. In identiteitsonderzoek, maar ook in psychologisch onderzoek in het algemeen, wordt vaak gekeken naar gemiddelden. Dat zou wel eens een behoorlijk vertekend beeld kunnen geven van de realiteit van het individu. We vinden immers dat individuen sterk verschillen in het type ontwikkeling dat ze doormaken na het maken van een studiekeuze, in de manier waarop ervaringen en (veranderingen in)

exploratie gerelateerd zijn aan veranderingen in studietoelating, en met ons simulatiemodel voorspellen we dat individuen ook sterk verschillen in hun studiekeuzetrajecten.

Daarnaast hebben we door deze focus op individuele processen ontdekt dat trajecten van identiteitsontwikkeling niet alleen worden gekarakteriseerd door de sterkte van commitments en de hoeveelheid exploratie zoals tot nu toe vaak werd aangenomen, maar ook door fluctuaties en stabiliteit. Zo vinden we dat sterke commitments vaak stabiel zijn, terwijl zwakke commitment veel fluctueren over tijd. Het omgekeerde geldt voor exploratie: weinig exploratie is vaak stabiel, maar hogere niveaus van exploratie fluctueren veel over tijd. Daarom lijkt het goed als toekomstig onderzoek maten van stabiliteit en fluctuatie meeneemt. Dat zou wel eens nieuw licht kunnen werpen op de typen identiteitsontwikkeling die tot nu toe zijn gevonden.

Dit proefschrift werpt ook nieuw licht op de mechanismen van identiteitsontwikkeling: ervaringen lijken een vergeten maar essentieel onderdeel van de mechanismen van identiteitsontwikkeling. We vinden immers dat emotionele ervaringen een sterke impact hebben op identiteitsontwikkeling, zelfs sterker dan de impact van exploratie is. Daarom lijkt het belangrijk om in toekomstig onderzoek de rol van ervaringen verder te onderzoeken.

De rol van ervaringen maar ook het micro-niveau perspectief leidt tot de suggestie dat we misschien minder verschillende typen exploratie hoeven te onderscheiden. Bijvoorbeeld, eerder onderzoek vond dat exploratie zowel gerelateerd kan zijn aan een toename in commitment als aan een afname in commitment (Zimmermann, Lannegrand-Willems, Safont-Mottay, & Cannard, 2015). De onderzoekers stellen daarom voor om twee typen exploratie te onderscheiden. Echter, het zou ook kunnen dat de ervaringen die volgen op exploratie bepalen hoe de relatie met commitment is. En dat zou weer kunnen betekenen dat het niet nodig om twee kwalitatief verschillende vormen van exploratie te onderscheiden. Daarnaast zien we in het studiekeuzemodel dat ruminatieve exploratie emergeert op een macro-niveau tijdschaal als gevolg van kieskeurige individuen die geneigd zijn in de diepte te exploreren. Dat betekent dat ruminatieve exploratie op micro-niveau niet een kwalitatief andere soort exploratie is, maar dat het een patroon van exploratie is dat zich voordoet op grotere tijdschaal.

In dit proefschrift is gedemonstreerd dat exploratie, ervaringen en commitment allemaal op een complexe manier interacteren met elkaar over tijd en dat de manier waarop ze interacteren verschillend is voor elk individu. We hebben laten zien dat

een simulatiemodel uitermate geschikt is om deze complexe individuele interacties op micro-niveau expliciet te maken. Dat heeft als bijkomend voordeel dat onze theorie over processen binnen individuen veel scherper en concreter wordt. Zoals we hebben laten zien kan dit tot onverwachte voorspellingen leiden die niet zouden zijn geformuleerd op basis van alleen verbale argumenten. Maar het belangrijkste voordeel is misschien wel dat kan worden aangetoond welke gevolgen microniveau mechanismen binnen individuen hebben voor patronen op een langere tijdschaal en uitkomsten op groepsniveau. Dit maakt het mogelijk om theorie over individuele processen te koppelen aan simpele populatiestatistieken zoals gemiddelden, zonder voorbij te gaan aan het ergodiciteitsprincipe¹⁵. Simulatiemodellen vormen daarmee een krachtige toevoeging aan de empirische cyclus binnen psychologie.

Het onderscheid tussen identiteit op een micro- en macro-niveau heeft als voordeel dat het duidelijkheid schept in de verschillende conceptualisaties van identiteit die tot nu toe vooral impliciet lijken te bestaan. Met een dergelijk onderscheid wordt het dan ook mogelijk om twee stromen van literatuur verenigen die deze verschillende aspecten van identiteit hebben onderzocht. Dat vereist wel dat we enig zicht hebben op hoe deze niveaus van identiteit met elkaar interacteren. Dat is iets dat nog verder uitgezocht moet worden in vervolgonderzoek, maar waar ik ook al wel enkele basis ideeën over geformuleerd heb. Simpel gezegd komt het erop neer dat ideeën over wie je bent en waar je heen wilt (macro-niveau aspect van identiteit) beperkt welke carrière opties je zal najagen (micro-niveau aspect van identiteit) en omgekeerd vormt de carrière richting die je kiest ook weer welke ideeën je vormt over jezelf en waar je heen wilt.

Met dit proefschrift zijn er verschillende nieuwe theoretische vragen opgeroepen die toekomstig onderzoek moet oplossen. Het onderscheid tussen aspecten van identiteit dat ik hier heb geduid met micro en macro komt voort uit wat tot nu toe is bestudeerd in de literatuur, maar dat wil niet zeggen dat dit de enige aspecten van identiteit zijn die theoretisch van belang zijn. Zo is het bijvoorbeeld voor te stellen dat andere commitments heel erg van belang zijn voor het sturen van dagelijks gedrag die nog veel meer 'micro' zijn, bijvoorbeeld de commitment om goed te leren voor de tentamens die eraan komen, of zelfs de commitment om zo van de bank op te staan om aan het bureau te gaan studeren. Er is een veel uitgebreidere theorie nodig om alle tijdschalen die van belang zijn voor identiteitsontwikkeling met elkaar te integreren. Een veelbelovende weg lijkt om een dynamisch systeem

15 Dat relaties tussen variabelen in groepen niks zeggen over relaties tussen deze zelfde variabelen binnen individuen (Molenaar & Campbell, 2009)

benadering toe te passen op identiteitsontwikkeling op een soortgelijke manier als de Ruiters, van Geert en Kunnen (2017) hebben gedaan voor gedragsmatige patronen van zelfontwikkeling. Wanneer een dergelijke dynamische theorie van identiteitsontwikkeling ook nog geïntegreerd zou worden met theorieën over de gedragsmatige patronen van zelfontwikkeling zijn we een heel stuk dichterbij het begrijpen hoe alle aspecten van identiteit ontstaan, hoe ze aan elkaar gerelateerd zijn en welke rol dagelijkse ervaringen en gedrag hierin spelen.

GEVOLGEN VOOR PRAKTIJK EN BELEID

Omgaan met Studie-uitval op de Universiteit

De resultaten uit hoofdstuk twee laten zien hoe potentiële uitvallers mogelijk te herkennen zijn¹⁶. De meest simpele aanpak is misschien wel om studenten te onderscheiden als 'twijfelaars' en 'zekeren'. Twijfelaars hebben een relatief zwakke, fluctuerende studiecommitment en vertonen een hoge, fluctuerende hoeveelheid exploratie. Aan de andere kant laten de zekere studenten juist een relatief sterke, stabiele studiecommitment zien en vertonen een lage, stabiele hoeveelheid exploratie. Met deze categorisatie is het mogelijk om de meeste uitvallers er al uit te filteren, die zitten dan in de categorie twijfelaars. Het probleem is dat er best veel twijfelaars zijn, en dat veel van hen de studie gewoon blijven volhouden. Deze twijfelaars zouden in meer detail gevolgd kunnen worden gedurende het eerste jaar, waarbij er wordt gelet op moeilijker te detecteren maar goed voorspellende maten van uitval. Wij vonden dat de grootste kans op uitval bestaat onder jongeren die een dalende trend laten zien in de sterke van commitment terwijl hun hoeveelheid fluctuatie in exploratie toeneemt over tijd, maar ook bij jongeren van wie de commitment stabiel blijft of zelfs stijgt terwijl hun niveau van exploratie stijgt.

De resultaten uit hoofdstuk 4 geven ideeën over wat er mis kan gaan in het ontwikkelingsproces van studenten in het eerste jaar. We hebben gezien dat studenten hun studiecommitment niet zomaar verzwakken na negatieve ervaringen. En dat is tot op zekere hoogte natuurlijk een gezonde, veerkrachtige reactie: als studenten bij de eerste de beste tegenslag zouden opgeven komen ze nooit door de studie heen. Maar de vraag is wel waar de grens ligt. Hoe lang is het een kwestie

16 Onze resultaten zijn wel gebaseerd op een specifiek type student, de psychologie student. Het voorspellen van uitval zoals hier gedaan werkt goed voor deze populatie, maar kan anders zijn in andere populaties.

van gezonde veerkracht, wanneer wordt het een kwestie van ongezonde rigiditeit? Daar zijn vooralsnog geen eenduidige antwoorden op. Desondanks zouden mentoren of anderen die regelmatig persoonlijk contact hebben met eerstejaars wel in de gaten kunnen houden in hoeverre de ervaringen van de studenten nog wel stroken met hun studietoelating. Als het eruit begint te zien dat de student het nog maar moeilijk kan halen en eigenlijk ook niet zo goed op haar plek is, maar de student nog altijd een sterke commitment heeft, dan wordt het misschien tijd voor de mentor om in een gesprek met de student kritisch te onderzoeken of deze studie wel de juiste plek is voor haar.

Studiekeuze Begeleiding en Beleid

Als ons studiekeuzemodel ook empirisch zijn waarde aantoont, dan zijn er veel praktische toepassingen te bedenken. Bijvoorbeeld, verschillende maatregelen die door de Nederlandse overheid zijn ingevoerd in de afgelopen jaren hebben tot gevolg gehad dat studenten minder makkelijk kunnen switchen, en er meer druk is voor jongeren om direct de juiste keuze te maken (bijv. de basisbeurs is veranderd naar een lening, en extra hoog collegegeld voor een tweede bachelor of master). Een belangrijke aanname die achter deze maatregelen lijkt te zitten is dat het inderdaad mogelijk is voor studenten om de juiste studiekeuze te maken. Ons theoretisch kader van studiekeuze ondersteunt deze aanname niet. Wij nemen op basis van theorie juist aan dat een studiekeuze maken voor vele tot op zekere hoogte een gok is, met name voor jongeren die zichzelf niet zo goed kennen – als je niet goed weet wie je bent en wat je wilt, hoe kom je er dan achter welke studie bij je past? Op basis van dit proefschrift is het antwoord volgens mij: dat lukt niet zomaar, daar hebben jongeren veel ervaringen voor nodig. En goede ervaringen opdoen kost tijd, misschien betekent dit voor sommigen zelfs het uitproberen van een paar studies voordat ze voldoende hebben ondervonden wat ze leuk vinden en wat niet. Het zou goed zijn als beleid deze ruimte kan bieden. Andere beleidsmaatregelen zoals het aanbieden van matchingsactiviteiten lijken een goede ontwikkeling. Dit biedt jongeren immers de kans om extra diepte exploratie te ondernemen zodat jongeren meer informatie krijgen over de passendheid van hun keuze, en ons studiekeuzemodel voorspelt dat dit de kans op een verkeerde keuze meestal verkleint.

Er bestaan in Nederland inmiddels verschillende studiekeuze begeleidingstrajecten die jongeren op een intensieve manier helpen een studiekeuze te maken in een paar maanden tijd (bijv. Oriëntatietraject Noord, n.d.; Saxion StudiekeuzeLab, n.d.). Ons theoretische model van studiekeuze kan verklaren waarom dit soort

intensieve trajecten met een holistische aanpak effectief zijn gebleken (Kunnen, 2013; 2014). In deze trajecten worden jongeren geholpen om zichzelf en de wereld om hen heen te exploreren. Jongeren ontwikkelen daardoor duidelijkere, sterkere ideeën over zichzelf (Kunnen, 2013) wat volgens ons theoretische model inderdaad bijdraagt aan het maken van een goede studiekeuze. Daarnaast worden ze geholpen met exploreren en gestimuleerd om dit veel te doen, en het studiekeuzemodel voorspelt inderdaad dat de langere exploratietrajecten vaak leiden tot betere keuzes. Maar hier is wel een punt van aandacht: ons model voorspelt dat meer exploratie niet altijd beter is. Als er vooral in de diepte geëxploreerd wordt, dus een paar opties worden telkens opnieuw verkend, dan lijken de langere trajecten een vorm van ruminatieve exploratie te zijn en dit is in ons model juist vaak gerelateerd aan slechte keuzes. Dit kan gesignaleerd en tijdig ondervangen worden door het veelvuldige persoonlijke contact in de intensievere studiekeuzetrajecten. Een andere interessante voorspelling dat volgt uit het studiekeuzemodel is dat diepte exploratie vooral voordelen lijkt te hebben voor individuen met weinig zicht op hun eigen interesses en ambities, terwijl breedte exploratie juist voordelen lijkt te hebben voor individuen met wel een duidelijk beeld over zichzelf. Deze voorspellingen komen nu alleen voort uit theorie, en moeten natuurlijk nog wel getoetst worden in empirische studies.

CONCLUSIE

In dit proefschrift heb ik gekeken naar processen van identiteitsontwikkeling binnen individuen op een micro-niveau (week-tot-week) tijdschaal. Vanuit dit perspectief heb ik een begin gemaakt met in kaart brengen hoe trajecten van exploratie en commitment eruit kunnen zien vlak voor en vlak na de transitie naar de universiteit en hoe processen van exploratie en commitment binnen individuen interacteren. Daarnaast heb ik laten zien dat ervaringen een essentieel element blijken te zijn in deze microniveau processen van identiteitsontwikkeling terwijl dat tot nu onderbelicht is geweest in studies over identiteitsontwikkeling. Deze focus op wekelijkse processen binnen individuen heeft meerdere inzichten gebracht die nuttig zijn voor het ontwikkelen van fundamentele theorie over identiteit. Maar onderzoek vanuit een dergelijk intra-individueel microniveau perspectief brengt ook voor de praktijk kansen met zich mee. Sterker nog, ik denk dat een dergelijk perspectief de potentie heeft om het beroemde gat tussen wetenschap en praktijk te overbruggen. In de

praktijk werkt men immers met individuele processen en niet met groepsgemiddelden.

Voor onderzoekers is een intra-individueel, microniveau perspectief niet alleen praktisch relevant en theoretisch interessant, het is ook heel vernieuwend. Er is nog zo veel te bekijken vanuit een intra-individueel, micro-niveau perspectief, je kan een psychologisch onderwerp kiezen dat je interessant vind en je bent waarschijnlijk de eerste die het op deze manier bekijkt. Met de technologie die klaar is voor het verzamelen en analyseren van intensief longitudinale data en het maken van simulatiemodellen, is het nu ook nog eens praktisch haalbaar geworden. Dat is niet alleen leuk voor de onderzoekers in psychologie. Het betekent naar mijn idee ook dat we aan het begin staan van grote vernieuwingen in de psychologische wetenschap, wat tevens zijn weerklink zal hebben in de praktijk.

REFERENTIES

- Bosma, H. A., & Kunnen, E. S. (2001). Determinants and Mechanisms in Ego Identity Development: A Review and Synthesis. *Developmental Review, 21*, 39–66. <https://doi.org/10.1006/drev.2000.0514>
- De Ruiter, N. M. P., Van Geert, P. L. C., & Kunnen, E. S. (2017). Explaining the “how” of self-esteem development: The self-organizing self-esteem model. *Review of General Psychology, 21*, 49–68. <https://doi.org/10.1037/gpr0000099>
- Erikson, E. H. (1956). The Problem of Ego Identity. *Journal of the American Psychoanalytic Association, 4*, 56–121. <https://doi.org/10.1177/000306515600400104>
- Kunnen, E. S. (2013). The Effects of Career Choice Guidance on Identity Development. *Education Research International, 2013*, 1–9. <https://doi.org/10.1155/2013/901718>
- Kunnen, E. S. (2014). The effect of a career choice guidance on self-reported psychological problems. *Frontiers in Psychology, 5*. <https://doi.org/10.3389/fpsyg.2014.00547>
- Luyckx, K., Schwartz, S. J., Berzonsky, M. D., Soenens, B., Vansteenkiste, M., Smits, I., & Goossens, L. (2008). Capturing ruminative exploration: Extending the four-dimensional model of identity formation in late adolescence. *Journal of Research in Personality, 42*, 58–82. <https://doi.org/10.1016/j.jrp.2007.04.004>
- Marcia, J. E. (1966). Development and validation of ego-identity status. *Journal of Personality and Social Psychology, 3*(5), 551.
- Orientatietraject Noord. (n.d.). Retrieved June 19, 2017, from <http://www.orientatietrajectnoord.nl/site/>
- Saxion StudiekeuzeLab - Studiekeizer - Kom verder. Saxion. (n.d.). Retrieved June 19, 2017, from https://www.saxion.nl/studeren/kiezen_en_kennismaken/Studiekeizer/dos/studiekeuzelab/studiekeuzelab/
- Skhirtladze, N., Javakhishvili, N., Schwartz, S. J., Beyers, W., & Luyckx, K. (2016). Identity processes and statuses in post-Soviet Georgia: Exploration processes operate differently. *Journal of Adolescence, 47*, 197–209. <https://doi.org/10.1016/j.adolescence.2015.08.006>
- Zimmermann, G., Lannegrand-Willems, L., Safont-Mottay, C., & Cannard, C. (2015). Testing New Identity Models and Processes in French-speaking Adolescents and Emerging Adults Students. *Journal of Youth and Adolescence, 44*, 127–141. <https://doi.org/10.1007/s10964-013-0005-7>

Appendix 2

Dankwoord

Mandy A. E. van der Gaag

DANKWOORD

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