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Micro-level Mechanisms of Identity Development: The Role of Emotional Experiences in Commitment Development

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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 experience 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. Therefore, we conclude that it is highly likely that emotional experiences are an essential part of the micro-level mechanisms of identity development.

Keywords: identity development, emotional experiences, exploration, commitment, micro level

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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 toward 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 e.g.,

Bosma & Kunnen, 2001a). Over the past 10 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, 2016; Zimmermann, Lannegrand-Willems, Safont-Mottay, & Cannard, 2015). Mostly, these different types of exploration and commitment have been used in one of three ways: (a) to describe individual differences in identity statuses, (b) to describe different pathways of identity development, and (c) 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, 2016). And with this knowledge, and the right instruments, we could predict the chance that a specific individual heads for undesirable outcomes. However, prediction alone is not enough to

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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 article 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 consolidate and strengthen her existing identity commitment. Contrastingly, a conflicting experiencing 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 re-evaluated. 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 re-evaluate 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 re-evaluated. 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 re-evaluate 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, Vleioras and Bosma (2005) found some initial indications that experiences play an important role in the development of macro-level commitments in a qualitative multiple case study. 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. Second, 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 postmeasurements 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. However, 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 im-

mediate 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., 2016, 2010; Van der Gaag, De Ruiter, & Kunnen, 2016). In this article, 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 this.¹

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 may have a macro-level commitment that comes down to “I am dedicated to helping people.” This commitment may be 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., re-evaluating her micro-level commitment), she may eventually start to wonder whether helping people really is what defines her (i.e., re-evaluating 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 with 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

¹ 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).

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, young individuals 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 ([Research-Ned, 2013](#)). Therefore, we 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 a within individual perspective is essential particularly for investigating micro-level identity dynamics.

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 were female (81%, $N = 83$; vs. 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 (a) did not show any variation in the dependent variable (commitment, measured on a 6-point Likert scale) or (b) 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 because of 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 same.² 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 7 months. For the short subsample data collection started in January and continued until June, for a total period of 5 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 that suited them best to fill out

² 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.

the questionnaire. 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 three parts: first they were asked to fill out an experience report, secondly they were asked to answer a few multiple choice questions regarding the emotions that accompanied this experience, and thirdly they were asked to indicate their level of 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 that had impacted their attitude toward 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 6-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 Cronbach's α 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 intraindividual covariances between the three independent variables (positive emotions,

negative emotions, and 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.

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, and 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 intraindividual Spearman correlations (r_s) between the independent variables (i.e., positive emotions—negative emotions; positive emotions—exploration; negative emotions—exploration) for two reasons: (a) to reveal the types of correlation (positive or negative) between the independent variables, and (b) to discover whether any one relation is responsible for the total covariance among independent variables. We report the summary statistics of the intraindividual correlations (r_s), and total explained variance (R^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-series 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).³ 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

³ 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](#)).

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 Equation 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 Equation 1 can fluctuate nonlinearly, and includes a time dependent effect (described in Equation 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 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, and 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 modeled 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.

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 “pirate-plots” 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 (CIs) 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 squared (χ^2) test.

Results

Covariances Check

As a first step, we checked the multicollinearity—how much variance is explained among only the independent variables (positive emotions, negative emotions, and 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 intraindividual correlations between the independent variables revealed that: (a) most of the shared variance can be attributed to an on average strong negative intraindividual correlation between positive and negative emotions, and (b) a smaller amount of shared variance can be attributed to an on average weak positive intraindividual correlation between exploration and negative emotions.

Table 1

Summary Statistics for the 103 Intraindividual 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

Covariance type	Mean	SD	95% CI	
			Lower	Upper
R^2 independent variables	.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

Note. CI = confidence interval.

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.

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

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 men and women. Men and women do not differ significantly in the regression weights of exploration ($M_{male} = 0.02$, $M_{female} = -0.01$; $t = 0.89$, $df = 101$, $p = .38$) and negative emotional experiences ($M_{male} = 0.10$, $M_{female} = 0.04$; $t = 1.24$, $df = 101$, $p = .22$). They do differ significantly in the regression weights of positive emotions ($M_{male} = 0.11$, $M_{female} = 0.18$; $t = -2.15$, $df = 101$, $p = .04$): men 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 men 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

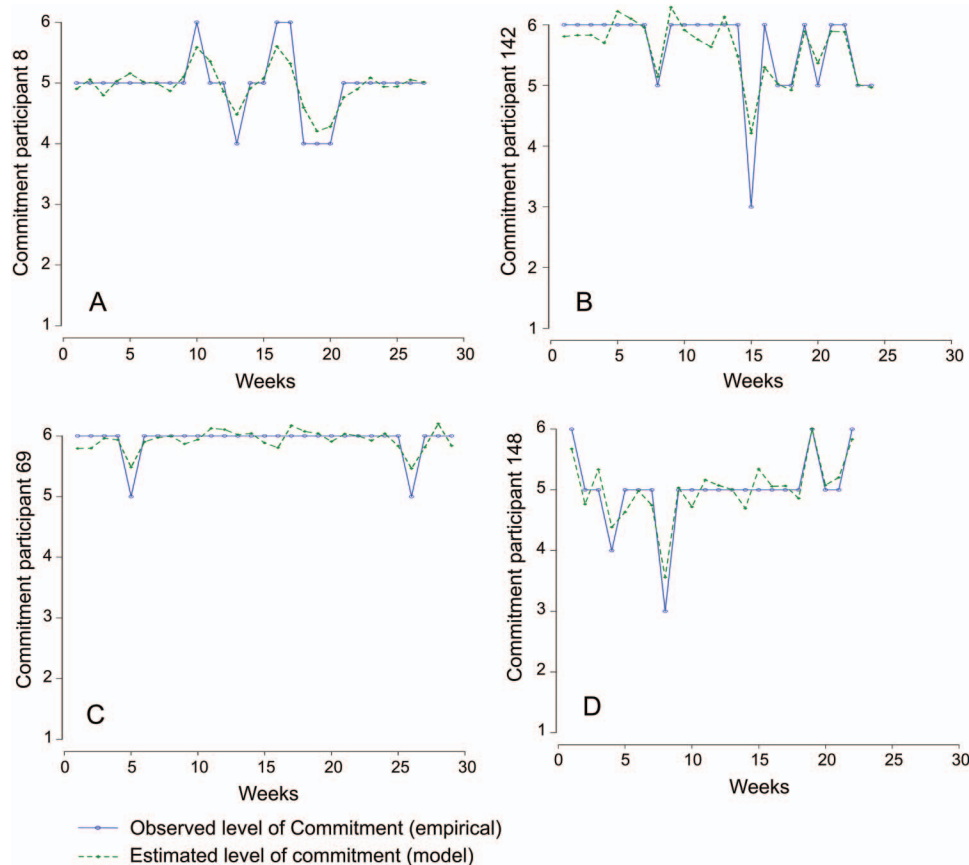


Figure 1. Demonstration of the commitment values predicted by the dynamic linear model and the observed commitment values for four individuals. On the top, we show two participants for whom the model explains an approximately average amount of variance: Participant 8 in the top-left (A: $R^2 = 0.73$) 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: $R^2 = 0.87$). See the online article for the color version of this figure.

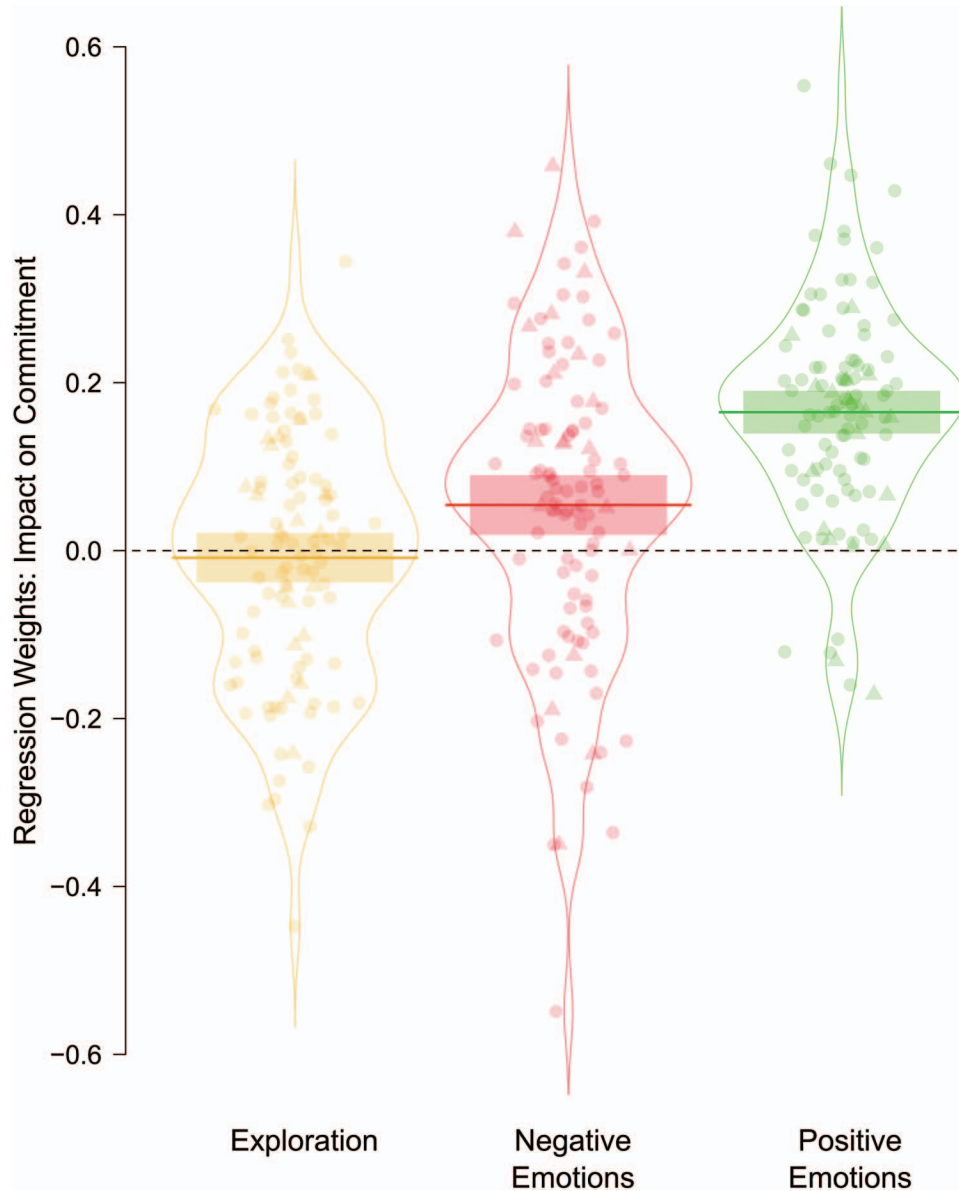


Figure 2. Smoothed empirical distributions of the regression weights of each individual. In the left pane (yellow) the exploration regression weights are shown, these are widely dispersed around zero. The middle pane (red) shows the regression weights for negative emotions that are also widely dispersed, 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 colored rectangle area's represent the 95% confident intervals around the means, the horizontal colored lines represent these means. The circles represent the regression weights of female participants, the triangles represent those of male participants. See the online article for the color version of this figure.

(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 ($\chi^2 = 7.36$, $df = 2$, $p = .03$).

Discussion

The individual dynamic linear models that we have created—in particular the intraindividual 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

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%)

Note. CI = confidence interval.

of commitment development. In fact, for most individuals, emotional experiences are more strongly related to subsequent changes in micro-level 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 toward the education may increase. Moreover, this finding is 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 toward the education and may cause educational commitment to decrease.⁴ 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). 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

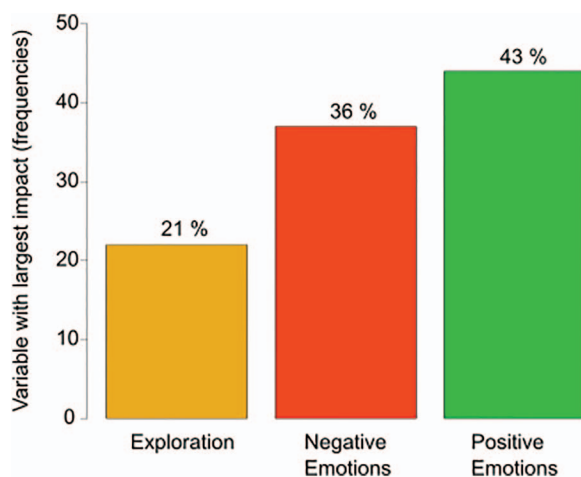


Figure 3. Distribution of the variables (exploration, negative emotions, and positive emotions) that, within an individual, show the strongest relation to commitment changes. See the online article for the color version of this figure.

⁴ 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 article.

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 that 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 intraindividual relation between commitment and negative mood on average. A difference in construct used (mood vs. 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, Iedema, 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 (that are probably also not yet fully formed at this age). Their macro-level identity commitments are not really threatened when a negative emotional experience occurs, and an elaborate assimilation process is not needed. Instead they may simply decrease their micro-level educational commitment after a negative emotional experience, without consequences for 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. Zimmermann et al. (2015) and Skhirtladze et al. (2016) have independently found that in-depth exploration can be both positively and negatively related to commitment. Therefore, they 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 affect 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, 1987), 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). However, 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 and 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 toward 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, an individual 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 intraindividual 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 and 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 (that would result in a negative correlation, as we have found). Moreover, some multicollinearity exists between exploration and negative emotional experiences: most intraindividual correlations between these two variables are negative.⁵ However, our modeling technique accounts 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 because of the use of a limited 6-point Likert scale) whereas 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). In addition 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). But of course, 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 micro-level commitment. In fact, for most individuals, emotional experiences seem to have a stronger impact on commitment than exploration does, indicating that emotional experiences are perhaps more proximal in affecting the development of commitment than exploration is. Indeed, emotional experiences may have to be included in our thinking about, and research on, the mechanisms of identity development.

⁵ 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.

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