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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.

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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

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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. Bosma & Kunnen, 2001; Grotevant, 1987; Kerpelman, Pittman, & Lamke, 1997; 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 micro-level 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 (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 & Verschuere, 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, Goossens, & Soenens, 2006; Luyckx, Goossens, Soenens, et al., 2006), we include measures of broad exploration, and commitment making. Luyckx, Goossens, and Soenens (2006) and Luyckx, Goossens, Soenens, et al. (2006) operationalize commitment making as deciding on one’s life direction, and choosing 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, Goossens, and Soenens (2006) and Luyckx, Goossens, Soenens, 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 is 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.

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, Goossens, & Soenens, 2006; Luyckx, Goossens, Soenens, et al., 2006)
‘exploration of self’	Exploration of self (Germeijs & Verschuere, 2006; Van Esbroeck et al., 2005)
‘exploration of alternatives’	Exploration in breadth (Luyckx, Goossens, & Soenens, 2006; Luyckx, Goossens, Soenens, et al., 2006) and Reconsideration (Crocetti et al., 2008; Klimstra et al., 2010)
‘commitment to choice’	Commitment making (Luyckx, Goossens, & Soenens, 2006; Luyckx, Goossens, Soenens, et al., 2006)
‘commitment to fit’	Identification with commitment (Luyckx, Goossens, & Soenens, 2006; Luyckx, Goossens, Soenens, et al., 2006) and Commitment (Crocetti et al., 2008; Klimstra et al., 2010)

Finally, we added a third type of exploration to Luyckx, Goossens, and Soenens (2006) and Luyckx, Goossens, Soenens, et al. (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 environment (e.g. Germeijs & Verschuere, 2006; Van Esbroeck, Tibos, & Zaman, 2005). Van Esbroeck et al. (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. Exploration of the self is arguably never completely disconnected from the environment. However, we contend that there is more of an emphasis on the self, and less context-dependency, when exploring one's own interests and ambitions than when forming an opinion about (the fit of) a particular career alternative. 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 female¹ 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 ($SD = 1.14$, $min = 17.4$, $max = 23.0$), 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 months.² 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), 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).

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?

¹ A large proportion of female students is typical for this educational trajectory.

² 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.

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 another variable, both measured within the same individual (see Fig. 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 variability 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 negative. 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 .

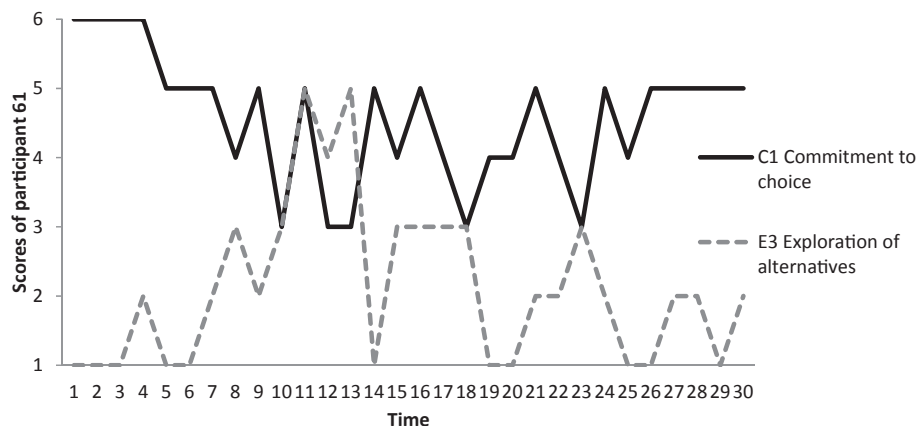


Fig. 1. Time series of participant 61. Intra-individual correlations for this participant are calculated by correlating the time series of two variables; in this particular case the Spearman correlation between exploration of alternatives (E3) and commitment to choice (C1) is negative ($r_s = -0.54$). 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.

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.

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 Fig. 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.

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 Fig. 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 $r_s = 0.5$).

Table 4
Summary of intra-individual correlations.

Type of correlation:	M	SD	Min.	Max.	n (%) Excluded: ^a	Occurrence n (%) per type of correlation: ^b		
						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.

^a 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.

^b 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 = $n \text{ occurrence} / (\text{total } n [31] - \text{excluded } n) * 100$). The largest proportions are signified in **bold** numbers.

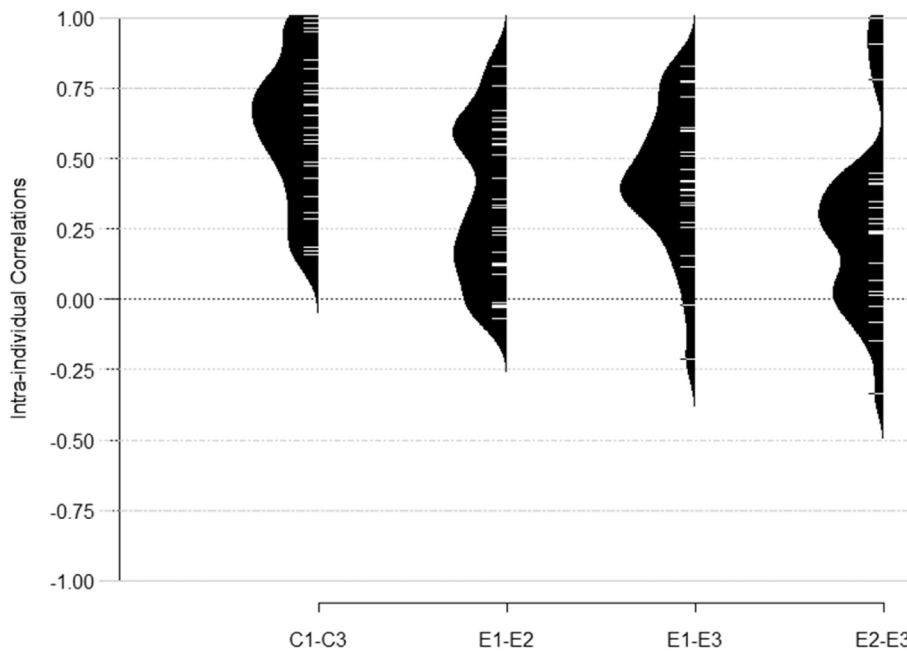


Fig. 2. Density distributions of intra-individual correlations within commitment, and within exploration. Commitment to choice (C1) is correlated with commitment to fit (C2) in the left figure, and exploration of fit (E1), exploration of self (E2) and exploration of alternatives (E3) are correlated with 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.

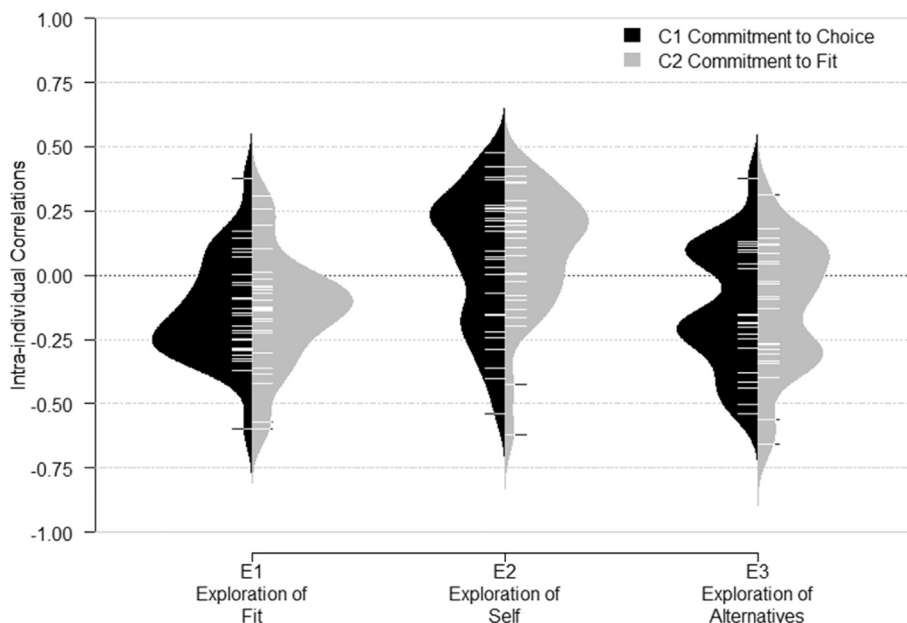


Fig. 3. Density distributions of intra-individual correlations between exploration and commitment. The three exploration types (E1, E2 and E3) are correlated with commitment to choice (C1), represented by the black areas, and with commitment to fit (C2), represented by the grey areas. The white lines 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.

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 Fig. 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 proportion 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 Fig. 3).

The individual correlations between *exploration of self* (E2) and both commitment measures (C1 and C2) resemble a highly skewed Gaussian distribution (see Fig. 3). Frequency peaks for both correlations are in the positive correlation range (between $r_s = 0.05$ and $r_s = 0.25$) (see Table 4). 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 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 (Fig. 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 Fig. 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 Verschuere (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 informative than distinguishing different types of exploration.

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 et al. (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 (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 (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.

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. Cronbach, 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.

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.

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