Entrepreneurial intention as developmental outcome

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Abstract

What predicts adults’ entrepreneurial intentions? Utilizing a cross-sectional sample of 496 German scientists, we investigated a path model for the effects of entrepreneurial personality (Big Five profile), control beliefs, and recalled early entrepreneurial competence in adolescence (early inventions, leadership, commercial activities) on two types of entrepreneurial intentions (conditional and unconditional intentions). As expected, entrepreneurial personality and early entrepreneurial competence on the one hand and both types of entrepreneurial intentions on the other were associated. Findings of structural equation modeling further revealed indirect effects via control beliefs (e.g., mediation effects). The results highlight the importance of a life-span developmental approach in entrepreneurship research and support the idea that entrepreneurship can be promoted early in life. The findings are discussed against the backdrop of the economic and societal values that entrepreneurship has in today’s societies.

Keywords: Entrepreneurship, Entrepreneurial intention, Big Five, Personality, Control-beliefs, Competence growth
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Promoting entrepreneurship may be vital for the success of today’s societies, which face enormous economic and social challenges (Audretsch, 2007). Recently, policymakers stressed that this promotion, in general, should start early in life and that public measures should target the education of “the next wave of entrepreneurs” by fostering youths’ early entrepreneurial competence (e.g., basic business knowledge or leadership) (European Commission, 2006; World Economic Forum, 2009). However, although such activities seem to partly follow a life-span developmental perspective (Baltes, Lindenberger, & Staudinger, 2006; Elder, 1998), entrepreneurship research to date has rarely addressed early antecedents of entrepreneurial activities (e.g., early entrepreneurial competence in adolescence). In contrast, entrepreneurial personality traits have received considerable attention in the entrepreneurship literature. However, whereas some researchers emphasized the central role of personality (Rauch & Frese, 2007), others argued that this may be misleading as more proximal factors such as behavioral characteristics are disregarded (Gartner, 1989). One way to combine both views is to investigate proximal variables that mediate the effects of personality traits on entrepreneurial outcomes. However, such mediation models have rarely been studied so far. In view of these research gaps, this study sought to examine early entrepreneurial competence in adolescence and entrepreneurial personality traits as predictors of entrepreneurial intentions and, in addition, to investigate underlying mediation effects.

Entrepreneurial Intentions

Humans are active agents in their own development (Brandstädter & Lerner, 1999). They do not engage in entrepreneurship by accident; they do it intentionally as a result of choice (Krueger, 2007). Accordingly, entrepreneurial intentions (defined as the conscious state of mind that directs personal attention, experience, and behavior toward planned entrepreneurial behavior; Bird, 1988) are seen as the strongest proximal predictor of entrepreneurial activity and serve as a central and widely-studied outcome variable in contemporary entrepreneurship.
research (Krueger, Reilly, & Carsrud, 2000; Lee, Wong, Foo, & Leung, in press). This study investigated entrepreneurial intentions among scientists by referring to their intention to engage in the commercialization of their research knowledge through venture foundation.

According to Ajzen and Fishbein (1980), behavioral intentions can be conditional or unconditional. In contrast to unconditional intentions (e.g., “I intend to participate in the founding of a company to commercialize my research”), conditional intentions refer to the condition under which individuals would develop such intentions (e.g., “If my research had marketing potential, I would intend to participate in the founding of a company to commercialize the research”). We examined these two aspects of entrepreneurial intentions separately. While targeting conditional intentions implies the advantage of “adjusting” for possible determinants of entrepreneurship that are beyond the scope of this paper, focusing on unconditional intentions provides the opportunity to study manifest intentions to start a business, to really engage in entrepreneurship.

What Predicts Entrepreneurial Intentions?

Previous research suggests that personality is an important predictor of entrepreneurial intentions (Crant, 1996), which is consistent with general theories on career choice, such as Holland’s (1997) assumption that “the choice of a vocation is an expression of personality” (p. 7). Recent meta-analytic findings indicate that the Big Five traits (i.e., extraversion, conscientiousness, agreeableness, openness to experience, and neuroticism) are relevant for entrepreneurship (Rauch & Frese, 2007). In contrast to previous entrepreneurship research, which focused on linear relations between various single personality traits and entrepreneurial outcomes, we suggest that the personality as a whole may be worth more than the parts and, thus, consider individual patterns of Big Five traits rather than singular traits to be of importance for entrepreneurial intentions. This assumption draws from a person-oriented approach (Magnusson, 1998), which figures prominently in contemporary psychology research. As studies indicate that individuals high in extraversion, conscientiousness, and
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openness and low in agreeableness and neuroticism are more likely to choose an entrepreneurial career than others (Schmitt-Rodermund, 2004, 2007), we expected this profile to positively predict (conditional and unconditional) entrepreneurial intentions (Hypothesis 1).

The notion that early precursors in childhood and adolescence are linked to entrepreneurial outcomes has been around in the entrepreneurship literature for many decades (Dyer, 1994). Almost 50 years ago, David McClelland (1961) suggested that children’s (age-appropriate) entrepreneurial competencies should predict the development of adults’ entrepreneurial mind-sets. However, empirical studies are scarce. Nonetheless, drawing from a famous prospective longitudinal study of Harvard graduates that was started in the 1920s – the so-called Terman study – Schmitt-Rodermund (2007) found early entrepreneurial competencies (defined by leadership and inventive behavior in adolescence) to have an indirect positive effect on engagement in entrepreneurship in adulthood via early entrepreneurial interests in adolescence and entrepreneurial career goals. These results corresponded to those of cross-sectional studies with current samples (Schmitt-Rodermund, 2004). Given these arguments and findings, early entrepreneurial competence (early inventions, leadership, and early commercial activities, measured from retrospective reports) were expected to positively predict (conditional and unconditional) entrepreneurial intentions in adulthood (Hypothesis 2).

According to Schmitt-Rodermund’s (2004, 2007) entrepreneurship studies, adolescents’ early entrepreneurial competence is also a manifestation of their entrepreneurial personality profile. She consistently found that adolescents with an entrepreneurial Big Five profile exhibited higher levels of early entrepreneurial competence. Accordingly, we expected a positive correlation between the entrepreneurial personality profile (measured in adulthood) and early entrepreneurial competence in adolescence as viewed in retrospect (Hypothesis 3). Entrepreneurship researchers (e.g., Krueger & Carsrud, 1993) have argued that Ajzen’s (1991) theory of planned behavior (TPB) serve as a suitable theoretical framework for
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understanding the impact of distal variables (e.g., personality) on entrepreneurial intentions. The TPB has received strong empirical support (Armitage & Conner, 2001) and was earlier utilized as the theoretical framework for the prediction of entrepreneurial intentions (Krueger et al., 2000). The TPB assumes that attitudes, social norms, and perceived control are the most proximal predictors of behavioral intentions. From these three predictors, we chose to put our main focus on perceived control (e.g., entrepreneurial control beliefs) as a mediator for three reasons. First, control beliefs play an important role in career development (e.g., Lent et al., 1994). Second, they represent a key variable in entrepreneurship research, in terms of both predictors and mediators (Zhao, Seibert, & Hills, 2005). Third, control beliefs lend themselves as a focus construct for potential interventions (Wilson, Kickul, & Marlino, 2007).

Drawing from Skinner, Chapman, and Baltes (1988), we examined two indicators of entrepreneurial control beliefs, namely agent-ends beliefs and agent-means beliefs (see also Skinner, 1996). Agent-ends beliefs refer to the perceived control over a desired outcome (e.g., ends-related self-efficacy beliefs), whereas agent-means beliefs refer to the perceived availability of potential means needed to produce the outcome, such as personal means (e.g., ability or effort), contextual factors (e.g., support from others), or random factors (e.g., luck). Studying such means implies the advantage of looking beyond ends-related control beliefs by focusing on “pathways through which control is exerted” (Skinner, 1996, p. 552). This further allows a realistic instead of illusionary sense of control to be studied. Note that Simon, Houghton, and Aquino (1999) found illusion of control (e.g., overestimation of one’s entrepreneurial ability) to positively predict the decision to start a venture. However, illusion of control is a cognitive bias. Thus, the authors argue that although such an illusion seems to stimulate engagement in entrepreneurship (e.g., due to lower risk perception), it may represent a barrier to entrepreneurial success due to biased decision-making. Individuals with an illusionary sense of entrepreneurial control may lack the relevant means one needs to actually solve entrepreneurial tasks. For this reason it is important to consider the possession of means
in order to achieve a more realistic picture of one’s entrepreneurial control belief.

Drawing from the TPB and previous entrepreneurship research (Zhao et al., 2005), we expected entrepreneurial control beliefs to mediate the effect of an entrepreneurial personality profile on (conditional and unconditional) entrepreneurial intentions (Hypothesis 4).

Likewise, we expected entrepreneurial control beliefs to mediate the effect of early entrepreneurial competence in adolescence on (conditional and unconditional) entrepreneurial intentions (Hypothesis 5). This assumption refers to the established life-span concept of cumulative continuity, which states that early characteristics are sustained and deepened by their own consequences (Caspi, Elder, & Bem, 1987). For example, Kokko and Pulkkinen (2000) showed that aggression in childhood was related to long-term unemployment in adulthood through a cycle of maladaptation, characterized by school maladjustment in adolescence and a lack of occupational alternatives, as well as problem drinking in early adulthood.

Furthermore, both types of intentions were expected to be related as both types should be an expression of an individual’s entrepreneurial agency altogether. Moreover, a latent (conditional) intention may be seen as the basis of (or a necessary prerequisite for) an individual’s manifest (unconditional) intention. Taken together, conditional entrepreneurial intentions were expected to positively predict unconditional entrepreneurial intentions (Hypothesis 6). This assumption thus stresses the distinctiveness of both types of intentions (Ajzen & Fishbein, 1980) – a view that is in contrast to previous studies on entrepreneurial intentions, where conditional and unconditional intentions were not investigated separately but taken together into one intention construct (e.g., Lee et al., in press).

Finally, the condition in our conditional intention measure (marketing potential of the person’s research) was expected to moderate the effect of conditional intentions on unconditional intentions (Hypothesis 7). Put differently, the effect of conditional intentions on unconditional intentions was expected to be most pronounced where scientists perceive their
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research as marketable (Shane, Locke, & Collins, 2003).

Method

This study is part of the Thuringian Founder Study (“Thüringer Gründer Studie”), which is an interdisciplinary German research project that examines technology-oriented entrepreneurship from the perspective of economics and psychology. Regarding our study, time and cost limitations prohibited a prospective longitudinal design. The method chosen was a survey with one measurement occasion to collect retrospective and current data via an online questionnaire (cf. Gosling, Vazire, Srivastava, & John, 2004). Retrospective study designs are a common method in life-span research, have been successfully employed in past entrepreneurship studies investigating entrepreneurial precursors in adolescence (Schmitt-Rodermund, 2004; Zhang & Arvey, 2009), and, most importantly, findings have been validated using prospective study designs (Schmitt-Rodermund, 2007). Before we conducted our study, we pilot tested and optimized the questionnaire and the procedure in an independent sample of 133 scientists in the Federal State of Saxony, Germany.

Participants

In a first step of sample selection we screened Internet homepages of research institutions in the Federal State of Thuringia, Germany, in order to collect all available email addresses of scientists working there. Thuringia is located in the center of Germany, with a legacy of academic entrepreneurship and a broad spectrum of research institutes like universities or non-university research institutions (e.g., Max Planck Institutes). Using the resulting list of 4,638 entries we selected a random sub-sample consisting of 2,319 email addresses, which was the basis for the survey. In June 2008, we received completed questionnaires from 565 participants, representing a response rate of 24.4%, which is an acceptable rate compared to other web-based studies (Cook, Heath, & Thompson, 2000). Compared with official statistics for Germany (Statistisches Bundesamt, 2008), the survey sample appeared to be representative in terms of age, gender, and academic rank. Before we conducted our statistical
analyses, we excluded 15 participants due to incomplete data or non-serious responses. We also excluded participants who reported that they do not conduct any research, as this study targeted scientists’ intentions to commercialize their own research. The final sample consisted of 496 scientists.

Participants were on average 38.8 years old ($SD = 11.55$, range: 23–65) and mostly male (70.8%). Almost two-thirds worked in a university (65.4%); 24.1% worked in a non-university research institution and 10.5% in a university of applied science (“Fachhochschule”). In terms of their occupational status, 69.8% worked as research associates, 18.5% were professors or university lecturers, and 11.7% reported another field of activity, for example as project-related specialists. Just over half of the sample (53.3%) described their type of engagement in research as applied science, and the remainder (46.7%) as basic science. Most participants worked in the field of natural science (49.8%); 31.5% worked in engineering and 18.7% in economics, law, or social science.

Measures

Entrepreneurial personality. Entrepreneurial personality was measured drawing from the five-factor (i.e., Big Five) model of personality using a well-validated German 45-item questionnaire (Ostendorf, 1990). Agreeableness (e.g., “good-natured vs. cranky”; $\alpha = .77$); conscientiousness (e.g., “lazy vs. diligent”; $\alpha = .83$); extraversion (e.g., “uncommunicative vs. talkative”; $\alpha = .77$), neuroticism (e.g., “vulnerable vs. robust”; $\alpha = .85$); and openness (e.g., “conventional vs. inventive”; $\alpha = .70$) were measured by nine bipolar items each with answers ranging from (0) to (5). In order to calculate an index for an individual’s match with an entrepreneurial personality pattern, we defined a specific entrepreneurial reference type with the highest possible score (5) in extraversion, conscientiousness, and openness, and the lowest possible score (0) in agreeableness and neuroticism. Schmitt-Rodermund (2004, 2007) developed this definition on the basis of the empirical literature and showed this personality profile to indeed be associated with an individual’s entrepreneurial characteristics, activity,
and success. With regard to this reference type, we calculated the “goodness-of-fit” of each person’s Big Five profile. First, we estimated each person’s squared differences between the reference values and the personal values on each of the five scales. If a person, for instance, scored a 3 in neuroticism, the squared difference was 9 (because the reference value was 0). Second, the five squared differences were summed up for each person, and third, the algebraic sign of this sum was reversed (e.g., a value of 5 became -5). The resulting value served as the final variable entrepreneurial personality ($M = -23.75; SD = 6.67$) – the closer to zero the value in this variable, the better the fit between the person’s Big Five personality profile and the defined entrepreneurial reference type. Note that measurements of personality that take into account the deviation between an empirical personality pattern and a prototypical pattern have already been successfully used (Block, 2008).

*Early entrepreneurial competence in adolescence.* Following Schmitt-Rodermund (2004, 2007), three indicators for early entrepreneurial competence in adolescence were measured retrospectively, namely early inventions, leadership, and early commercial activities. Altogether, 23 different activities were explored using a mnemonic technique (memory anchors). Participants were asked to “Think back to the time when you were 14 or 15 years old. This was probably the time when you were in the eighth or ninth grade and your ‘Jugendweihe’ or confirmation took place” (ceremonies in which 14-year-olds are given adult social status in Germany). In general, Germans deem these ceremonies to be an important and memorable life event as they represented the formal beginning of their adulthood. *Early inventions* were measured by 14 items that targeted inventive behavior during leisure time (e.g., building something, technical constructions, or being creative in music or arts) at age 14 or 15 (e.g., “How often did you construct new technical things?”; 1 = never, 5 = very often; $M = 2.29; SD = .60; \alpha = .72$). Note that leisure time usually represented a significant portion of time in respondents’ daily routine as there were generally no all-day schools in Germany during the time in question. *Early leadership* was measured by six dichotomous items that
asked for leadership roles (e.g., class spokesman or captain in a sports team) at age 14 or 15 (e.g., “Did you have important responsibilities in your classroom (e.g., class spokesperson)?”; $0 = \text{no}, 1 = \text{yes}; M = 1.40; SD = 1.27$). The number of positive answers was summed up into an index of leadership experience. *Early commercial activities* were measured by three items on age-related selling activities during leisure time (e.g., trading things with friends or thinking about things that could sell well) at age 14 or 15 (e.g., “How often did you sell things (e.g., to friends)?”; 1 = never, 5 = very often; $M = 1.91; SD = .79; \alpha = .65$). Note that previous findings support reliability and validity of such retrospective information. First, scales tapping at behavior during adolescence have been successfully employed in other cross-sectional as well as longitudinal studies on adult entrepreneurs, with very similar results (e.g., Schmitt-Rodermund, 2004, 2007, Zhang & Arvey, 2009). Second, these items refer to a clearly-defined period in life and several anchors for accurate timing were used. Both of these factors contribute to an accurate recalling. Third, such factual and relatively broad life-history data in general appears reliable and valid (Rutter, Maughan, Pickles, & Simonoff, 1998).

**Entrepreneurial control beliefs.** In order to measure control beliefs, we adapted an established questionnaire (CAMI; Little, Oettingen, & Baltes, 1995) to the domain of entrepreneurship focusing on agent-means and agent-ends beliefs. The list of items targeting *agent-means beliefs* considered relevant means mentioned in the literature (e.g., Shane, 2004), namely three ability-related means (basic business knowledge, experience in entrepreneurship, prior work experience in industry), three context-related means (state-funded sponsoring initiatives, business contacts, supportive policy of the university/institution), and one mean concerning the perception of luck. Participants rated the perceived availability of those seven means (e.g., “My business knowledge is very good”; 1 = completely disagree; 5 = completely agree; $M = 2.23; SD = .81; \alpha = .82$). Entrepreneurial *agent-ends beliefs* were measured by three items that addressed scientists’ perceived effectiveness and expectations of success concerning academic entrepreneurship (e.g., “If I
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decided to participate in the founding of a firm, I am confident that I would succeed”; 1 = completely disagree; 5 = completely agree; $M = 2.96; SD = 1.01; \alpha = .84$). Finally, agent-ends and means-ends beliefs (which strongly correlated; $r = .68, p < .001$) were taken together into the entrepreneurial control beliefs variable.

**Conditional entrepreneurial intentions.** This construct was measured with the item “If my research had marketing potential, I would intend to participate in the founding of a company to commercialize the research.” (1 = no, 5 = yes; $M = 3.17; SD = 1.07$).

**Marketing potential.** This variable was measured with “Does your research have the potential for commercialization by a firm?” (1 = not at all; 5 = absolutely; $M = 2.88; SD = 1.17$).

**Unconditional entrepreneurial intentions.** This construct was measured by three items that were selected according to past research (Krueger et al., 2000). These items assessed individuals’ unconditional intention to found a firm to commercialize their own research (Item 1: “In the foreseeable future, do you intend to participate in the founding of a firm to commercialize your research?”; 1 = no; 5 = yes; $M = 1.80; SD = 1.10$; Item 2: “In your opinion, how high is the probability that, in the foreseeable future, you will participate in the founding of a firm to commercialize your research?”; 1 = 0 %; 6 = 100%; $M = 1.80; SD = 1.15$; Item 3: “I have recently sought information about the ways and means of founding a firm with the object of commercializing my research”; 1 = no; 5 = yes; $M = 1.39; SD = .94$).

As noted earlier, unconditional entrepreneurial intentions should forecast entrepreneurial behavior. To put this notion to a test, we conducted a follow-up survey 18 months after the baseline survey. Respondents were asked whether they had pursued founding activities in order to start a new business since the first survey (no/yes). We were able to collect this information from 219 of our participants and found that unconditional entrepreneurial intentions indeed predicted entrepreneurial activity ($r_s = .32, p < .001$). **Control variables.** We controlled our analyses for occupational status (1 = professor; 0 = else; $M = .18; SD = .39$).
and gender (0 = male; 1 = female; $M = .29; SD = .46$) (Shane, 2004; Blanchflower, Oswald, & Stutzer, 2001).

**Results**

We set our conceptual model to the test through structural equation modeling (SEM) utilizing AMOS (Arbuckle & Wothke, 1999). SEM allows for the modeling of latent variables that are not affected by measurement errors. We were able to model almost all our study variables as latent variables as they were measured by several items (e.g., indicators). SEM also makes it possible to examine different direct and indirect (e.g., mediation) effects and provides information on how well the conceptual model fits the data. Among the various fit indexes available, we decided to focus on $\chi^2$, CFI, and RMSEA (Kline, 2005).

**Preliminary Analyses**

Zero-order correlations between the manifest variables are provided in Table 1. All correlation coefficients were positive and significant (except for the first column, which shows relationships to gender). There were positive relationships between early entrepreneurial competencies (interventions, leadership, and commercial activities) and entrepreneurial personality (Big Five pattern) on the one hand and entrepreneurial control beliefs (agent-means and agent-ends beliefs) and entrepreneurial intentions on the other. This was also the case after controlling for gender and occupational status. We also tested the measurement model, which included the latent variables used in this study (early entrepreneurial competence, control beliefs, and unconditional entrepreneurial intentions). This model achieved an acceptable fit ($\chi^2 [17] = 39.65, p = .001, CFI = .985, RMSEA = .052$), indicating that the factorial structure of these variables is sound.

**Model Test**

*Step 1.* In order to test Hypotheses 1, 2, and 3, we put forth two models to examine direct effects of entrepreneurial personality and early entrepreneurial competence on conditional and unconditional entrepreneurial intentions, respectively (see Figures 1A and
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1B). The effects were controlled for gender and occupational status. The models had an acceptable fit (Figure 1A: $\chi^2 [8] = 23.39, p = .003, \text{CFI} = .937, \text{RMSEA} = .062$; Figure 1B: $\chi^2 [20] = 39.34, p = .006, \text{CFI} = .983, \text{RMSEA} = .044$). Both models consistently revealed that an entrepreneurial personality profile predicted neither conditional nor unconditional entrepreneurial intentions. Thus, Hypothesis 1 was not supported. Good predictors, however, could be found non-significant due to multicollinearity between independent variables. Using SPSS, we conducted collinearity diagnostics to examine whether the “unimportance” of personality as a predictor of intentions could be due to multicollinearity. As a result, variance inflation factors (VIF) for the regression models shown in Figures 1A and 1B ranged from 1.139 to 1.146, which does not indicate a multicollinearity problem (Kline, 2005). Moreover, Hypothesis 2 was supported by our data. Early entrepreneurial competence in adolescence predicted conditional ($\beta = .20; p < .01$) and unconditional entrepreneurial intentions ($\beta = .38; p < .001$). Hypothesis 3 also received support as entrepreneurial personality and early competence were shown to be correlated.

Step 2. In order to test Hypotheses 4, 5, and 6, we added control beliefs as a mediator and integrated both entrepreneurial intentions into one model. Again, all effects were controlled for gender and occupational status. The tested model (shown in Figure 1C) had an acceptable fit ($\chi^2 [37] = 90.08, p = .000, \text{CFI} = .972, \text{RMSEA} = .054$). As expected, early entrepreneurial competence and entrepreneurial personality had a positive effect on control beliefs, which in turn positively predicted conditional and unconditional entrepreneurial intentions. Early entrepreneurial competence had no direct effect on conditional entrepreneurial intentions ($\beta = -.03; \text{ns}$) in this mediation model. Moreover, there was a small direct effect of early entrepreneurial competence on unconditional entrepreneurial intentions ($\beta = .14; p < .05$). In order to test the mediation hypothesis to a strict test, we used a $\chi^2$-comparison test following Holmbeck (1997). Specifically, the model shown in Figure 1C was tested against another model where the paths from early competencies to conditional and
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unconditional entrepreneurial intentions were set to zero. The two models did not differ significantly in their fit ($p = .08$). This confirmed that the effect of early competence on entrepreneurial intentions was indeed mediated by control beliefs. Taken together, Hypothesis 4 received no support. Control beliefs did not mediate the relationship between personality and entrepreneurial intentions in our model as there was no direct path to be mediated (Figures 1A and 1B). Hypothesis 5, however, was supported as control beliefs indeed mediated the relationships between early entrepreneurial competence and entrepreneurial intentions. Finally, conditional intentions predicted unconditional intentions, so Hypothesis 6 was supported. In a follow-up analysis, we examined whether the mediating effect of control beliefs remained stable when the two other TPB predictors of intentions, attitudes and social norms, were taken into account. We specified a model where we included cognitive attitudes (belief-based measure; Ajzen; 1991; combination between the subjective assessment of potential consequences of academic entrepreneurship, 3 items, e.g., higher personal income, and the assessment of the probability of those potential consequences, 3 items; $M = 1.60; SD = 2.10$), affective attitudes (e.g., “completely uninteresting vs. extremely interesting”; 4 items; $M = 3.41; SD = .96; \alpha = .89$), descriptive social norms (e.g., “Colleagues whose opinions matter to me have already participated in the founding of a firm to commercialize their research”; 2 items; $M = 1.62; SD = .68; \alpha = .64$), and injunctive social norms (e.g., “Most of my colleagues whose opinions matter to me would support my participation in the founding of a firm to commercialize my research”; 2 items; $M = 3.10; SD = .79; \alpha = .68$) as additional mediators besides control beliefs. We allowed for correlations between all mediators. All other model specifications remained stable. Model fit was acceptable ($\chi^2 [58] = 148.38, p = .000, CFI = .963, RMSEA = .056$). All effects (as shown in Figure 1) remained stable. In other words, the mediating effect of control beliefs remained stable even after controlling for other possible mediators.

**Step 3.** In Hypothesis 7, we expected the effect of conditional entrepreneurial
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intentions on unconditional entrepreneurial intentions to be particularly high if scientists perceived that their research had high marketing potential. As this interaction between unconditional intentions and marketing potential referred to one-item measures (and thus manifest and not latent variables), we chose to test this hypothesis not using SEM but using a regression analysis following the recommendations of Aiken and West (1991) for the testing of interaction effects. Note that Aiken and West’s regression approach is the “widely-recommended” strategy for conducting and interpreting interaction analyses if the interaction term is calculated with manifest variables (instead of latent variables), as was the case here (Marsh, Wen, & Hau, 2004, p. 275). Moreover, standardized variables were used and all effects were again controlled for gender and occupational status. Conditional entrepreneurial intentions ($\beta = .39, p < .001$) and marketing potential ($\beta = .46, p < .001$) both predicted unconditional entrepreneurial intentions. Moreover, an interaction effect emerged ($\beta = .22, p < .001$). According to Aiken and West (1991), interaction effects should be plotted in order to interpret them. We therefore estimated separate regression slopes for low, moderate, and high values of the moderator marketing potential. The weakest effect of conditional entrepreneurial intentions on unconditional entrepreneurial intentions was found when marketing potential was low ($\beta = .15, t = 3.15, p < .01$). A stronger effect was found when marketing potential was moderate ($\beta = .36, t = 10.45, p < .001$). The strongest effect emerged when marketing potential was high ($\beta = .56, t = 12.96, p < .001$), thus supporting Hypothesis 7 (the figure illustrating the interaction effect can be obtained from the authors).

Discussion

This study examined early entrepreneurial competencies in adolescence, reported retrospectively, and entrepreneurial personality as predictors of entrepreneurial intentions in adulthood. Moreover, entrepreneurial control beliefs were studied as mediators.

Consistent with the trait approach (e.g., Rauch & Frese, 2007), personality appeared to be relevant for entrepreneurship. Drawing from a person-oriented approach (Magnusson,
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1998), we examined an entrepreneurial personality pattern by considering the goodness-of-fit between an observed Big Five personality pattern and a given entrepreneurial reference type (i.e., highest values in extraversion, consciousness, and openness; lowest values in neuroticism and agreeableness). We found that those participants with higher similarity to the reference type showed higher conditional and unconditional entrepreneurial intentions.

Moreover, participants who had shown entrepreneurial competencies (i.e., leadership, inventions, and commercial activities) at around 14 or 15 years of age also had higher entrepreneurial intentions now. Our findings hint at considerable continuity between adolescence and adulthood in terms of entrepreneurial agency, manifested by age-appropriate expressions of relevant activities. It was an *early form* of entrepreneurial activity in adolescence that predicted the intention to engage in “real” entrepreneurship (e.g., founding a firm) in adulthood. This is consistent with longitudinal findings on the relation between age-appropriate competencies in adolescence and work outcomes in adulthood (Clausen, 1991; Roisman, Masten, Coatsworth, & Tellegen, 2004) and underlines a basic notion of modern developmental psychology. Life-stage appropriate achievements in one developmental epoch are probabilistically associated with life-stage appropriate outcomes in the next, “however phenotypically dissimilar” (Roisman et al., p. 123; Sroufe & Rutter, 1984; for the case of vocational development see also Super, 1980). Note that entrepreneurial personality and early entrepreneurial competence also correlated with both intentions when considering latent variables (which are shown in Figures 1A and 1B).

As expected, personality and early competence appeared to be associated. Participants with an entrepreneurial personality profile reported higher levels of early entrepreneurial competence. This is in line with Schmitt-Rodermund’s (2004, 2007) developmental model, which assumes that adolescents’ early entrepreneurial competencies are, along with the influence of early stimulating environments, affected by their personality profile. Even though we had to deal with retrospective reports on early entrepreneurial competence while we only
had current data on personality, it seems feasible to assume that the relationship with an entrepreneurial personality profile is not one of common variance with a third variable. At least this is how we interpret the fact that the same relationship was found in studies on adolescent participants, and, even more importantly, in a prospective longitudinal study on the early entrepreneurial competences of the Terman boys in relation to their parents’ reports on their sons’ personalities a year earlier (Schmitt-Rodermund, 2007). Bringing these findings together with the fact that numerous studies found personality traits to be widely stable over long periods of time (Caspi, Roberts, & Shiner, 2005), we are confident of the important role of personality in the early process of competence growth.

There are two aspects that deserve closer attention. Interestingly, there were no direct effects of personality concerning the plan to start one’s own business, neither on conditional nor unconditional intentions. Rather, entrepreneurial intentions were fed by early entrepreneurial competences such as early leadership experiences or the number of inventions during adolescence. However, this does not indicate irrelevance of an entrepreneurial personality profile as an antecedent of scientists’ entrepreneurial intentions. It shows rather that personality does not predict entrepreneurial intentions over and beyond the effect of early entrepreneurial competence. It seems that personality assets are the motor of activities and expectations that channel an individual’s career development into a certain direction, a view that is supported by theories on interest development (Eccles, 2005). This clearly underscores the importance of a developmental perspective in addition to the (well-established) personality approach in entrepreneurship research.

Moreover, we were interested in the role of entrepreneurial control beliefs as a more proximal mediator for entrepreneurial activity in the future. Drawing from the theory of planned behavior (Ajzen, 1991), we focused on control beliefs. Specifically, following Skinner et al. (1988) we examined whether individuals perceived that they had the relevant means to succeed as entrepreneurs (i.e., agent-means beliefs) and whether they actually
thought they could successfully found a business (i.e., agent-ends beliefs). We found that the effect of early competencies on entrepreneurial intentions was partially mediated by control beliefs. Even though our data was only correlational in nature, the story may read as follows: Participants who had shown entrepreneurial competence early in life developed higher entrepreneurial intentions in adulthood because they were confident that they could be successful. In other words, early characteristics and experiences seem to be associated with entrepreneurial thinking in adulthood (Krueger, 2007). We also found that participants with entrepreneurial personality patterns had higher entrepreneurial control beliefs. Such control beliefs in turn predicted conditional and unconditional entrepreneurial intentions. Personality thus had an indirect effect on entrepreneurial outcomes via control beliefs but, in contrast to what was expected in our model, we found no mediation effect here.

In sum, control beliefs emerged as a key variable in understanding the effect of early competencies and personality on entrepreneurial intentions. Control beliefs figure prominently in psychological research (Skinner, 1996) and are closely related to concepts such as self-efficacy (Bandura, 1997) or locus of control (Rotter, 1966). Moreover, control beliefs may set off actual control-striving processes (e.g., Heckhausen & Schulz, 1995) and, thus, not only pave the way to forming entrepreneurial intentions, but in addition may eventually lead individuals to cross the decisional “Rubicon” (Heckhausen, 1991) and actually engage in specific entrepreneurial activities (see also Ajzen, 1991). Finally, it is notable that early entrepreneurial competence still had a (small) direct effect on unconditional intentions in our mediation model ($\beta = .14, p < .05$; see Figure 2C), which might be due to additional mediators (besides control beliefs). Although we can only speculate, our data suggests that early entrepreneurial competence could also operate via participants’ perceived entrepreneurial opportunities. As shown in Table 1, early inventions, leadership, and commercial activities correlated positively with the perceived marketing potential of their own research. For example, scientists who frequently developed ideas during their teenage
years about things that could sell well might have also developed ideas about how to commercialize their research. Likewise, Shane et al. (2003) stress that specific skills and abilities underlie entrepreneurial opportunity recognition.

Limitations

This study has several caveats that merit careful consideration. Our correlational design does not allow for causal conclusions. Moreover, we used a concurrent study design and assessed early entrepreneurial competence in adolescence retrospectively. The fact, however, that our findings are very similar to results from a prospective longitudinal study investigating almost the complete lives of the participants (Schmitt-Rodermund, 2007) provides vital support for the validity of our study. Furthermore, we used memory anchors (“cognitive landmarks”) to facilitate the recalling, a technique known to bring about reliable results (Belli, 1998). Retrospective data, furthermore, is reasonably reliable and valid when referring to clearly-definable events rather than requesting evaluations (e.g., Rutter et al., 1998), particularly so when they occurred during adolescence (e.g., Conway, Wang, Hanyu, & Haque, 2005), as was the case in this study (see also Henry, Moffitt, Caspi, Langley, & Silva, 1994). Nevertheless, for future research longitudinal designs with prospective data would be advisable, but given the requirements of such studies – both financially and in terms of the effort that needs to be undertaken – such data will remain rare. Another important limitation of this study is the fact that all information was collected from a single source. This could lead to an artificial inflation of correlations between variables. However, our findings fit with results from other studies using methods different than those used here, indicating validity of our results.

Implications for Future Research and Applications

This study has implications for future research and applications. First, we hope that it inspires researchers to investigate entrepreneurship drawing from a life-span developmental perspective, preferably using prospective longitudinal designs. Life-span perspectives on
Entrepreneurial intention as developmental outcome 21
career development have yielded important insights (Vondracek, 2001), and interesting propositions have been put forth regarding entrepreneurship, e.g., by McClelland (1961), that await further investigation (see also Krueger, 2007).

Second, we hope that our findings encourage researchers, particularly those interested in personality antecedents of entrepreneurial outcomes, to further study personality patterns and proximal mediators. We focused on control beliefs as one central mediator and showed that the mediating effect of control beliefs remained stable when including the other intention predictors described by TPB. However, future research may examine the mediating role of social norms and (affective) attitudes more closely. For example, do individuals with a specific personality profile find entrepreneurship fun and exciting, whereas others are scared of taking the risk?

Finally, as our results underscore the importance of entrepreneurial cognitions (see also Hisrich, Langan-Fox, & Grant, 2007), policy schemes aimed at stimulating entrepreneurship should promote entrepreneurial mindsets, e.g., entrepreneurial control beliefs. A closer look at the entrepreneurial means that were investigated in this study and that seem to be crucial for entrepreneurial control beliefs suggests that such interventions should target both the individual and the context (Bandura, 1997). For example, they might target personal entrepreneurial means such as entrepreneurial experience (Zhao et al., 2005) as well as contextual entrepreneurial means such as “successful” role models and contacts to the world of entrepreneurship. Moreover, our findings once more suggest that interventions designed to foster individual entrepreneurial development should be implemented early in life, in childhood and adolescence. However, such programs have to prove their effectiveness. For instance, despite the current extensive efforts to implement entrepreneurship education that targets children and adolescents, few adequately-evaluated programs are available (e.g., Schröder & Schmitt-Rodermund, 2006). Future research would have to focus on evidence from a life-span perspective in order to effectively consider personal development in
entrepreneurship interventions. Likewise, experts have called for more research on the successful adaptation to the changes in the world of work in the 21st Century “prompted by the global economy, information technology, and postindustrial society” (Savickas, 2001, p. 288). To facilitate adaptive vocational development, societies will have to prepare adolescents for this future. The promotion of early entrepreneurial competence may be one such activity.
References


Entrepreneurial intention as developmental outcome


Entrepreneurial intention as developmental outcome


Entrepreneurial intention as developmental outcome


Entrepreneurial intention as developmental outcome

*Personality and Social Psychology, 54*(1), 117-133.


Table 1

**Correlations between the Variables**

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*p < .05, **p < .01, ***p < .001
Figure 1. Empirical models. (A) Direct effects of early entrepreneurial competence and entrepreneurial personality on conditional entrepreneurial intentions. (B) Direct effects of early entrepreneurial competence and entrepreneurial personality on unconditional entrepreneurial intentions. (C) Mediation model. *Note. Standardized coefficients are given. $R^2$ is shown at the upper right corner of the dependent variables. *$p < .05$. **$p < .01$. ***$p < .001$. 