Age-Related Development of Self-Regulation:

Evidence on Stability and Change in Action Orientation

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Author Note

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Abstract

Action (vs. state) orientation describes the ability to modulate affect and is at the core of goal-directed self-regulation. However, evidence on stability and change over time is scarce. In Study 1 (*N* = 368 couples), we investigated measurement invariance of action orientation (measured with the ACS-90) as well as rank-order stability and mean-level change over a period of four years. Additionally, we report results from three samples with young adults (Study 2). Measurement invariance was obtained after removing 4 items from the ACS-90, producing an adjusted scale. Rank-order stability was high. In both studies, one of two subscales – prospective action orientation – increased over time. Positive change was most consistent for middle-aged adults, implying that self-regulatory abilities improve during middle adulthood.

Keywords: action orientation, self-regulatory abilities, rank-order stability, mean-level change, life-span development

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Action vs. state orientation (Kuhl, 1994) is a prominent individual difference construct in the realm of self-regulation measuring the ability to effectively regulate affect during goal pursuit (Kuhl, 1994). Action orientation is assessed with the Action Control Scale (ACS-90; Kuhl, 1994), which consists of 24 items describing self-regulatory situations. For each situation, participants have to indicate which of two possible answers more accurately describes their behavior (e.g., "When I know I must finish something soon: (a) I have to push myself to get started, or (b) I find it easy to get it done and over with"). One of the answers describes an action-oriented reaction (in this example: b), one a state-oriented (in this example: a). Individuals high in action orientation (i.e., action-oriented individuals) effectively regulate their affect during goal pursuit and are thus able to pursue self-congruent goals and implement intentions in difficult situations (Kuhl, 2018). In contrast, individuals low in action orientation (i.e., state-oriented individuals) are unable "to terminate an unwanted affective state" (Kuhl, 2018, p. 548) when difficult situations occur: They ruminate after failure experiences and have problems implementing intentions. Abundant research confirms the significance of action orientation for adaptive goal pursuit and well-being (for a recent overview, see Kuhl, 2018). Action orientation has been studied not only in numerous laboratory studies but also in various applied areas, such as interpersonal relationships (e.g., Backes et al., 2017; Koole et al., 2006), academia and work (e.g., Diefendorff et al., 2000; Diefendorff, 2004; Herrmann & Brandstätter, 2013; Wolf et al., 2018), sports (e.g., Beckmann & Kazén, 1994; Gröpel, 2016), or clinical therapy (e.g., Hartung, 1990; Kosfelder et al., 2003).

In general, individual difference constructs, such as personality traits, are relatively stable. This might explain why – for a long time – there was only little research investigating change in personality (Roberts et al., 2008). However, in the last two decades, research has focused more and more on studying temporal development of individual difference constructs (especially personality traits), acknowledging that they might change over time but, at the same time, show a certain stability. Indices of temporal development include rank-order stability and mean-level change of a construct. Rank-order stability refers to the relative ranking of individuals within a group, whereas mean-level change refers to the absolute change in the average score (i.e., remain the same, increase, or decrease) of a group as a whole over time (Roberts et al., 2006; Roberts et al., 2008). Thus, stability and change do not preclude each other and "are better thought of as independent or orthogonal constructs" (Roberts et al., 2006, p. 2).

Information about stability and change are important for the theoretical and practical advancement of an individual difference construct, such as action orientation. Not only does this information help to support (or reject) the theoretical proposition that action orientation is a stable construct and to better understand its developmental trajectories, but it also indicates whether it is possible to improve action orientation, for example via self-practice or guided training sessions. Previous studies point to rather high rank-order stability (Frese et al., 1997; Wojdylo et al., 2016) and cross-sectional age differences (Backes et al., 2017; Hennecke & Freund, 2016) of action orientation. However, evidence is still limited because there were (a) no studies explicitly focusing on stability (rather, stability was a byproduct in these studies) and (b) no longitudinal studies on change over time. Furthermore, as a prerequisite to gain reliable estimations of stability and change over time, a construct should (c) be measurement invariant (Putnick & Bornstein, 2016; van de Schoot et al., 2012). To the best of our knowledge, there are no published studies testing measurement invariance of action orientation over time.[1]

We attempt to extend previous research with results of several longitudinal studies over a time interval of up to five years, investigating both rank-order stability of and mean-level change in action orientation. Thus, our aim is to provide information on stability and change of this self-regulatory ability. Furthermore, we assessed measurement invariance of the ACS-90 (Kuhl, 1994) over time as well as across genders and three different age groups (young, middle-aged, and old adults). Results of invariance analyses may help researchers interpret findings on action orientation in future studies.

Action vs. State Orientation

In 2000, Julius Kuhl proposed *person system interaction (PSI) theory* as an overarching theory explaining personality functioning as an interplay of various aspects, such as motivation, volition, affect, and cognition. A central claim of the theory is that the regulation of positive and negative affect is crucial for enacting own intentions (volitional efficiency) and learning from experiences (self-development; Kuhl, 2000a). Thus, self-regulation is proposed to be steered by the ability to regulate affect, that is, action (vs. state) orientation (Kuhl, 1994). Action orientation can be divided in two dimensions, a retrospective failure-related and a prospective decision-related dimension.[2] Action orientation after failure (AOF) is the ability to down-regulate negative affect when facing setbacks or loss (Kuhl, 2000b, 2018). AOF helps to maintain access to an individual's needs and thus allows for self-congruent goal pursuit. For example, when experiencing negative mood, AOF protects

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[1] There is one previous study testing measurement invariance across groups of different cultures (Chatterjee et al., 2018).

[2] There are various names for these two dimensions. The decision-related dimension has been called prospective or decision-related action orientation (Kuhl, 1994, 2000b, 2018). The failure-related dimension has been called action orientation subsequent to failure (Kuhl, 1994), failure-related action orientation (Kuhl, 2000b), or action orientation after failure (Kuhl, 2018). We use the terms as Kuhl used them in his latest publication (2018).

individuals from falsely construing externally assigned goals as self-selected goals (self-infiltration) and from unwanted rumination (Baumann & Kuhl, 2003). Similarly, AOF has been shown to help individuals to maintain congruence between implicit and explicit motives when experiencing stress (e.g., due to demanding life events), which was in turn related to higher well-being (Baumann et al., 2005).

Prospective action orientation (AOP) refers to the ability to generate positive affect when difficult intentions should be implemented (self-motivation; Kuhl, 2000a, 2018). For example, AOP showed a negative association with procrastination in undergraduate students (Blunt & Pychyl, 1998). Furthermore, it has been demonstrated that AOP is related to better overriding of task-incongruent action tendencies (high cognitive control) in Stroop color-naming tasks under demanding conditions (e.g., activation of an uncompleted intention; Jostmann & Koole, 2007). Finally, positive effects of AOP have been found in terms of action-initiation latencies under demanding conditions (i.e., low positive affect, high cognitive load) on the initiation of intentions and the choice regarding which of two goals to pursue (Kazén et al., 2008; for a more comprehensive overview on the effects of AOF and AOP, see Kuhl, 2018).

Action Orientation: Stability and Change

There are only few studies reporting the rank-order stability of action orientation. Some of these studies include very small sample sizes (i.e., 25 and 14 participants, respectively; Hartung, 1990; Kaspar et al., 2014) or very short time intervals (i.e., only two weeks; Kaspar & König, 2011), and are therefore not very informative. Only two studies have both adequate sample sizes and time intervals. Frese et al. (1997) reported a stability coefficient of .76 for a time interval of approximately one year. However, they only reported stability of the ACS-85 (a predecessor of the ACS-90) as a whole and not of the two dimensions. Wojdylo et al. (2016) measured only AOF and reported a stability coefficient of

.81 for a time interval of three to six months. Thus, the evidence is still very limited (especially for AOP). Furthermore, measurement invariance was not tested in previous studies.

Similar to other personality traits, action orientation was initially theorized to develop mainly during infancy. It is argued that socialization processes during infancy are the main determinant of action orientation development (Koole et al., 2006; Kuhl, 2000a). Action orientation is assumed to develop when individuals “are encouraged by significant others to be decisive and active when they are confronted with obstacles” (Jostmann & Koole, 2010, p. 334). As is evident from this phrasing, development might not only take place in infancy (due to social interaction with parents) but also in adulthood (e.g., due to social interaction with relationship partners; Koole et al., 2006). Indeed, several studies found evidence for a positive relation between action orientation and age, even in later life stages. Hennecke and Freund (2016) found in two cross-sectional studies that action orientation increases with age. Whereas evidence for AOF was mixed, AOP showed a statistically significant positive correlation with age in both studies. Backes et al. (2017) also reported a positive correlation between AOP and age, but the correlation was only statistically significant for men. They did not include AOF in their analyses. Finally, in a large cross-sectional study, Gröpel et al. (2004) reported a steady increase in the mean over six age groups and significantly higher means in action orientation for older compared to younger adults. However, unlike other studies, they did not measure action orientation with the ACS-90.

In a nutshell, the heterogeneous pattern of results on action orientation did not allow us to establish clear expectations regarding stability and change. Thus, it may be worthwhile to look into related areas of research, such as research on personality traits.

Personality Traits: Stability and Change

Personality traits are defined as “relatively enduring patterns of thoughts, feelings, and behaviors that distinguish individuals from one another” (Roberts et al., 2008, p. 375). This definition might explain why, for many years, the development of personality traits over time was of limited interest. However, increasing evidence on both stability of and change in personality traits has accumulated over the last two decades (Caspi et al., 2005; Costa et al., 2019).

In a meta-analysis on personality traits, a stability coefficient of .60 for a mean time interval of 6.7 years was reported (Ferguson, 2010). Costa et al. (2019) concluded that stability coefficients of the Big Five decline over time, but that “most of the decline occurs within the early part of the retest interval” and that coefficients “rarely fall below 0.6” (p. 442), even for time intervals of 10 years or more (cf. Anusic & Schimmack, 2016; Terracciano et al., 2006). There is some evidence indicating that stability of personality traits increases with age. Roberts and DelVecchio (2000) reported increasing stability coefficients from .54 for individuals at age 20, to .64 at age 30, to as high as .74 between age 50 to 70 for a mean time interval of 6.7 years. In contrast, research from Costa, McCrae, and colleagues (Costa & McCrae, 1988; Terracciano et al., 2006; Terracciano et al., 2010) indicates an increase until the 30s when stability reaches a plateau. Nevertheless, there seems to be at least some consensus: Stability increases between age 20 and age 60, which might also be expected for action orientation.

Focusing on change in personality traits, there is evidence which lends support to the so-called *maturity principle* (Caspi et al., 2005): Individuals appear to become “more dominant, agreeable, conscientious, and emotionally stable over the course of their lives” (Caspi et al., 2005, p. 468). Most of this change seems to happen until the late 30s, but there is evidence for a further increase until age 60 (Lucas & Donnellan, 2011; Milojev & Sibley, 2017; Roberts et al., 2006; Specht et al., 2011). However, after age 60, there is less agreement regarding change in these three personality traits. There is evidence for both an increase and no change in these three traits.[3] These inconsistent findings might be due to restricted data with regard to individuals above age 60 (Lucas & Donnellan, 2011). Based on this evidence, action orientation might be expected to increase with age, at least until age 60.

The Present Research

As previous research on stability of and change in action orientation was very limited, we did not formulate specific hypotheses but rather general expectations. These were based on initial findings on action orientation and on indications from research on personality traits. First, regarding stability, coefficients of at least .70 for a time interval of one year and at least .60 for time intervals of several years for both AOF and AOP might be expected. In addition, based on an increase in stability of personality traits with age, we expected an increase in the stability of action orientation until approximately the age of 60 (again not differentiating between AOF and AOP). Second, regarding change, several areas of research indicate that action orientation may increase with age as part of a maturation process. Initial cross-sectional evidence points to an increase in AOP across the life-span, whereas the picture for AOF is less clear. Thus, an increase of AOP and a potential increase of AOF over time, with a peak around age 60, could be expected.

To investigate our research questions, we used data from four studies. Study 1 was part of a larger research project on relationship development in couples. Action orientation was measured repeatedly over the course of four years. This study allowed us to examine measurement invariance of action orientation regarding time, gender, and age groups. Subsequently, rank-order stability and mean-level change over time were assessed. In Study 2, three samples of young adults are consolidated, in which action orientation was measured

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[3] For conscientiousness, one study even found a decrease (Lucas & Donnellan, 2011).

twice, with time intervals between one and five years. These three studies provided additional evidence on stability of and change in action orientation in young adults.

Study 1

Method

Participants. The total sample of this study consisted of *N* = 368 Swiss heterosexual couples from three different age-groups who had been in the current relationship for at least one year. The first group initially ranged from 20 to 35 years (young adults, *n* = 122 couples), the second group from 40 to 55 years (middle-aged adults, *n* = 125 couples), and the third group from 65 to 80 years (old adults, *n* = 121 couples; for further information, see for example Backes et al., 2017). The mean age over all groups was *M* = 47.31 (*SD* = 18.38) years for women and *M* = 49.33 (*SD* = 18.34) years for men at the first measurement time. Of the initial sample of 368 couples at time 1 (T1), 302 couples participated at time 2 (T2), 250 couples at time 3 (T3), 224 couples at time 4 (T4), and 220 couples at time 5 (T5). Dropout occurred because of inability or refusal to further participate (101 couples), separation/divorce (41 couples), or widowhood (6 couples).

The present data set has already been used in other publications (e.g., Backes et al., 2017; Bernecker et al., 2019; Kuster et al., 2015; Leuchtmann et al., 2019). Specifically, Backes et al. (2017) studied action orientation as a moderator of the effect of external stress on relationship satisfaction. However, their analyses were only cross-sectional and only included prospective action orientation (AOP). Thus, data on AOP at T1 was already reported by Backes et al. (2017). However, the present expectations and analyses (measurement invariance, change, and stability over time) do not overlap with previously reported results.

Procedure. The study was advertised in newspapers and on the radio as a longitudinal study on the impact of stress on relationship development in couples. Interested couples phoned in and were informed about the content and the procedure of the study. After they gave informed consent, couples were first asked to complete a set of self-report measures at home independently of their partner. Next, couples came to the laboratory, were given information about the session and gave their consent in order to continue. They were escorted in separate rooms and were asked to complete various questionnaires. Afterwards, couples participated together in several videotaped interactions. Finally, both partners were again separated to complete a last set of questionnaires before they received some closing information and a reimbursement of CHF 100.

Participants were invited to the laboratory annually for the next 4 years (T2, T3, T4, and T5). At these measurement times, the same procedure took place as at T1, but reimbursement increased by CHF 10 each year. The study was evaluated and approved by the ethics committee of the Faculty of Arts and Social Sciences at the University of Zurich.

Measures. Action orientation was assessed with the 24-item version of the Action Control Scale (ACS-90; Kuhl, 1994) at all measurement points. The scale comprises two dimensions with 12 items each: Action orientation after failure (AOF), and prospective action orientation (AOP). All items consisted of situational descriptions of experienced loss or failure (AOF) or anticipated difficulties or decisions (AOP), where participants had to indicate which of two possible answers applies to them more (all items are listed in the supplementary material). One of the answers describes an action oriented reaction, one a state oriented. An example for an item on AOF is: “When I am told that my work has been completely unsatisfactory: (a) I don’t let it bother me for too long, or (b) I feel paralyzed”, with (a) indicating high AOF. An example for an item on AOP is: “When I know I must finish something soon: (a) I have to push myself to get started, or (b) I find it easy to get it done and over with”, with (b) indicating high AOP. Scores (action oriented = 1, state oriented = 0) for all items were summed up, so that each scale ranges from 0 to 12. Higher scores reflect a stronger disposition toward action orientation.

Statistical analyses. Statistical analyses for this study as well as for Study 2 were conducted using R (R Core Team, 2018). We used the packages *semTools* (Jorgensen et al., 2018) and *lavaan* (Rosseel, 2012) for measurement invariance testing, *psych* (Revelle, 2018) for descriptive statistics and rank-order stability, *cocor* (Diedenhofen & Musch, 2015) for comparisons between correlations, *nlme* (Pinheiro et al., 2018) for analyses of longitudinal change, *pwr* (Champely, 2020) for a-priori power analyses, and *simr* (Green & MacLeod, 2016) for sensitivity analyses.

The sample of this study consisted of couples. Observations within couples or other forms of dyads are treated as nonindependent (Bolger & Laurenceau, 2013). Due to this nonindependence of the data, results of the two members of the couple (women and men) are reported separately.

Statistical power considerations. All power analyses assume a significance level of $\alpha = .05$. As mentioned above, stability of personality traits are estimated to increase by .10 from age 20 to 30 and again by a similar amount until age 50. The mean age difference between our age groups is approximately 20 years. Therefore, stability (T1 to T5, i.e., over 4 years) can be expected to differ by .10 for adjacent age groups and by .20 for young vs. old adults. Assuming a minimum stability of $r = .6$, we determined that these differences correspond to effect sizes of $q = .17$ between adjacent age groups and $q = .41$ between young and old adults. For acceptable (80%) or good (90%) statistical power, these effect sizes require group sizes of $n = 521$ or 696 (adjacent groups) and $n = 99$ or 131 (young vs. old adults). Due to dropouts, stability coefficients are based on 120 to 172 participants within each age group. Accordingly, we only compare stability coefficients between young and old adults, as other comparisons would lack statistical power.

For comparisons of scale means between age groups, information about expectable effect sizes comes from Gröpel et al. (2004) who measured AOF and AOP in six age groups of varying age ranges. Though they used a different instrument – the volitional components inventory (Kuhl & Fuhrmann, 1998) – this is the only available information about age group differences in action orientation we know of. Differences between groups whith age differences of about 30-45 years, were *d* = .38 (AOF) and *d* = .58 (AOP). To detect an effect size of *d* = .38 with acceptable (80%) or good (90%) power, sample sizes of 110 or 147 suffice. We therefore consider statistical power in the present sample acceptable for comparisons between young adults and old adults (40 years difference) as effective group sizes vary from *n* = 121 (young adults, T5) to *n* = 248 (middle-aged adults, T1). However, we lack the power for mean comparisons between adjacent age groups. Because expected effects for age differences of approximately 20 years are around *d* = .20 (Gröpel et al., 2004), 80% power would require a sample of *n* = 393 per group.

Regarding the longitudinal regression models, Lucas and Donnellan (2011) report changes in the big five ranging from –.01 (conscientiousness, openness) to –.11 (neuroticism) *SD*s for a period of five years. Due to this large range, we perform post-hoc sensitivity analyses to determine the effects needed for acceptable or good statistical power with our given sample and models.

For gender differences, Schlüter et al. (2018) reported effect sizes of *d* = .66 (AOF, men higher) and *d* = .55 (AOP, women higher). Good power (90%) in a *t*-test can be achieved for these effects with sample sizes of *N* = 100 and 140, respectively. However, due to the longitudinal structure of our data, we test gender differences as part of the longitudinal multilevel models. Therefore, to determine power in these models, we also perform sensitivity analyses of gender effects.

Results

Measurement invariance testing. Measurement invariance (or equivalence) indicates that a multi-item scale has the same meaning for different groups or over time. It is an important prerequisite for the interpretation of group differences or longitudinal changes in a scale (Putnick & Bornstein, 2016; van de Schoot et al., 2012). To test for measurement invariance, the following procedure is applied (Putnick & Bornstein, 2016; van de Schoot et al., 2012): First, a confirmatory factor analysis of the construct at all measurement times for all groups is fitted. This model does not have any constraints regarding the equality of item loadings, intercepts, and residual variances over times and groups (configural model). Second, constraints are sequentially added to the model, and model fit is evaluated at each step. Constraints on loadings (metric or weak invariance), on intercepts (scalar or strong invariance), and on residual variances (residual or strict invariance) are introduced, which represent increasing levels of measurement invariance. If the fit of any model is significantly worse than the fit of the preceding model, this level of measurement invariance is declined. Chen (2007) recommended the following criteria if total sample size is $N > 300$ and equal across groups: Noninvariance is indicated if ΔCFI $\geq -.010$ and ΔRMSEA $\geq .015$ or ΔSRMR $\geq .010$.[4] If at least strong invariance is confirmed, differences between groups and/or over time can be interpreted (Steinmetz, 2013). This procedure is complicated by the dyadic (couples) structure of our data. As one reviewer has correctly pointed out, the nonindependence of partner's error terms must be taken into consideration. Specifically, we treated the two partners as repeated measures from the same couple. This, together with the length of the ACS and the five measurement occasions, resulted in extreme computational demands. Therefore we used several separate models to test different dimensions of measurement invariance: First, we tested invariance over time using two models, one each for men and women. Second, we tested invariance between genders and age groups using five

[4] This recommendation refers to strong and strict invariance. Chen (2007) recommended less stringent criteria for weak invariance. However, weak invariance cannot be tested when items are dichotomous.

models, one for each measurement occasion. In all models, the items loaded on different latent factors representing AOF and AOP.

Over time, within genders. In a first step, we fitted two confirmatory factor analyses, one with women's and one with men's data, each including all five measurement times and data from all age groups. However, the models for women (χ^2 = 10'208.9, *df* = 6'735, *p* < .001, *CFI* = .950, *TLI* = .947, *RMSEA* = .055, *SRMR* = .136) and men (χ^2 = 7'867.3, *df* = 6'735, *p* < .001, *CFI* = . 988, *TLI* = .987, *RMSEA* = .031, *SRMR* = .120) had unsatisfactory and considerably distinct model fits. Thus, we decided to remove items with low factor loadings. We identified four items of the AOF scale and four items of the AOP scale, that had loadings of < .50 for both women and men at one (or more) measurement occasions or loadings of <. 40 for either women or men at one (or more) measurement occasions (see supplementary material; for a similar approach regarding action orientation, see Diefendorff et al., 2000). The adjusted scales for AOF and AOP consisted of 8 items, each. Descriptive statistics of the adjusted scales for women and men are presented in Table 1.

Insert Table 1 near here

The two models with adjusted scales showed a good fit for both women and men (see Table 2 for model fit indices and comparisons). These configural models were compared to models where loadings, intercepts, and thresholds were constrained to be equal over measurement times to test for scalar invariance. The three constraints were added simultaneously because they cannot be used separately for dichotomous items (cf. Wu & Estabrook, 2016). Model comparison revealed only marginal changes in model fit from the configural models to the scalar models (women: ΔCFI < .001, ΔRMSEA = –.001, ΔSRMR < .001; men: ΔCFI < .001, ΔRMSEA = –.001, ΔSRMR < .001), confirming strong invariance.

Next, models where residual variances were constrained to be equal over time were calculated and model fit was compared with the scalar models. Again, the changes in model fit were small (women: ΔCFI = −.005, ΔRMSEA = .007, ΔSRMR = .004; men: ΔCFI = −.006, ΔRMSEA = .012, ΔSRMR = .008), confirming strict invariance over time.

Insert Table 2 near here

Between genders and age groups, within times. For invariance testing between genders and age groups, the same adjusted scales were used. We fitted five confirmatory factor analyses, one per measurement time, each including data from both genders and all age groups. These models with the adjusted scales showed a good fit to the data (see Table 3 for model fit indices and comparisons at T1 and Table S6 in supplementary material for T2 to T5). The comparisons between configural and scalar model (T1: ΔCFI = −.003, ΔRMSEA = .012, and ΔSRMR = .001) showed only marginal change in model fit, which confirmed strong invariance regarding age groups and time. However, strict invariance was not achieved across age groups and genders because changes in fit indices between the scalar and residual model were not negligible (T1: ΔCFI = −.014, ΔRMSEA = .017, and ΔSRMR = .006).

Stability of action orientation over time. After establishing measurement invariance, we calculated the rank-order stability of the two scales for all measurement times. The stability coefficients for women and men can be found in Table 4.

Insert Table 3 near here

One-year stability. First, the stability coefficients over approximately one year are reported (from one measurement time to the next). For women, they ranged from .71 to .81

for AOF and from .76 to .78 for AOP. Old adults showed the highest stability for both AOF and AOP. However, the only statistically significant (Bonferroni-corrected) differences were between young and old adults for AOF from T1 to T2 ($z = 3.685$, $p < .001$, $q = .55$) and for AOP from T2 to T3 ($z = 3.476$, $p < .001$, $q = .59$).

For men, stability coefficients ranged from .76 to .82 for AOF and from .77 to .80 for AOP. There were no statistically significant (Bonferroni-corrected) differences between age groups.

Four-year stability. Second, the stability coefficients over four years are given (from the first to the last measurement point). For women, four-year stability was .72 for AOF and .68 for AOP; for men, four-year stability was .73 for AOF and .75 for AOP. None of the differences in stability between men and women or between young and old adults of either gender were statistically significant.

Change in action orientation over time. In a first step, we aimed to replicate the cross-sectional findings regarding the positive relation between action orientation and age (Backes et al., 2017; Hennecke & Freund, 2016). Therefore, we compared the means of the young and old adults at all measurement times. The results show that, especially at T1, action orientation is significantly higher for old compared to young adults. Further information can be found in the supplementary material.

Insert Table 4 near here

In a second step, we calculated multilevel models with measurement time as a determinant of the longitudinal (mean-level) change in action orientation. The dataset consisted of 368 (couples) × 2 (persons) = 736 individuals at T1, 302 × 2 = 604 individuals at T2, 250 × 2 = 500 individuals at T3, 224 × 2 = 448 individuals at T4, and 220 × 2 = 440 individuals at T5. In total, the dataset consisted of 2’683 data points for AOF and 2’700 data points for AOP when accounting for missing values.[5]

Following the approach of Bolger and Laurenceau (2013) for distinguishable dyads, the three levels (measurement times nested within persons nested within couples) were modelled using only two levels of analysis. Level 1 thus represents variability due to within-person repeated measures and Level 2 represents variability between couples (Laurenceau & Bolger, 2005; Raudenbush et al., 1995). A consequence of this approach is that gender differences and time effects cannot be directly tested within the same model, as effects are modelled separately for women and men. To additionally test for gender differences, interactions with a dummy-coded gender variable can be calculated in conjoint multilevel models with three levels (Kenny et al., 2006). Thus, we applied a two-step procedure in the analyses: First, we used a *double-entry* method to detect effects separately for women and men. Second, we used a *single-entry* method and interactions with a dummy-coded gender variable (0 = female, 1 = male) to test for gender differences in the linear change over time in a conjoint model. Though we had no hypothesis about gender-time interactions, the single-entry model included an interaction term to avoid distortion of the main effects in case of an interaction pattern.

To test our expectations, we modeled the change in action orientation over the course of the five measurement times. Time ranged from 0 (T1) to 4 (T5) so regression coefficients for time indicate change per year. The results of the main models are summarized in Table 5. The intercept represents action orientation at T1 for women and men. Slopes indicate the change in action orientation over time. To visualize change over time, means at all

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[5] For AOF, 46 data points had missing values (27 women, 19 men). For AOP, 27 data points had missing values (14 women, 13 men).

measurement times are depicted for women (Figure 1) and men (Figure 2) for all three age groups.

For AOF, there were no statistically significant effects for women or men using the double-entry method. Results of the single-entry method showed a statistically significant difference in AOF between women and men at T1, $B = 1.362$, $p < .001$, indicating higher AOF for men at T1. The gender × time interaction was not statistically significant, $B = 0.021$, $p = .678$, indicating that the (statistically non-significant) changes in AOF over time did not differ between women and men.

For AOP, there were statistically significant effects for both women and men using the double-entry method. The positive slopes indicate an increase in AOP over time. Results of the single-entry method showed no statistically significant difference in AOP between women and men at T1, $B = -0.192$, $p = .252$. Again, the gender × time interaction was not statistically significant, $B = -0.011$, $p = .842$.

In addition, we fitted the single entry model to AOF and AOP in each age group separately to explore potential differences between in change between age groups. However, because we expected to lack statistical power for either a time-by-group moderation analysis or even significance tests of the time effect within each group, the resulting coefficients are purely descriptive and ungeneralizable. For AOF, change per year was close to zero for all three age groups (young: -0.05, middle-aged: 0.07, old: -0.01). In contrast, for AOP change per year was highest among middle-aged adults and lowest among old adults (young: 0.09, middle-aged: 0.14, old: 0.06). More detailed results are given in the supplementary material (Table S7).

Insert Table 5 near here

Sensitivity analysis.[6] We conducted Monte Carlo simulations with varying effect sizes (Green & MacLeod, 2016) to determine at what effect size each coefficient of the single-input models would reach acceptable (80%) or good (90%) statistical power with the given sample. For AOF, the overall time effect, $B = 0.014$, yielded a power of < 5% and acceptable power would require an effect of 0.067. For AOP, the overall time effect, $B = 0.099$, was detected with a power of 69% and acceptable power would have required an effect of .113. The gender difference in AOF, $B = 1.36$, was detected with a power of > 99% and good power would have been achieved with an effect as small as .450. For AOP, an effect size as large as $B = 0.400$ would be required to achieve acceptable statistical power.

Attrition. Results on the comparison of action orientation between participants which did vs. did not participate at all five measurement times can be found in the supplementary material. The results give no indication of systematic bias due to attrition.

Discussion

In this study, we were able to confirm strict measurement invariance for adjusted scales of AOF and AOP over time and strong measurement invariance across genders and age groups. This indicates that changes over time as well as gender and age group mean differences can be meaningfully interpreted (Putnick & Bornstein, 2016; van de Schoot et al., 2012). However – as in the only other study on measurement invariance of action orientation known to us (Chatterjee et al., 2018) – model fit with the original 12-item scales was not ideal. Thus, we had to reduce the scales to 8 items each to achieve adequate model fit.

Based on evidence from studies investigating the Big Five and on initial findings regarding action orientation, stability coefficients of at least .70 over one year and .60 over

[6] Power analysis for multilevel regression is implemented for models fit with the lme4 package (Bates et al., 2015) but not for models fit with the nlme package, which was required to specify the variance-covariance structure implied by dyads. Therefore, power analyses were conducted using alternative models that closely approximate the single-entry models but do not account for within-dyad dependency.

several years were expected. The results are in line with the initial expectations regarding the level of stability. In addition, stability was expected to be higher for older adults. Indeed, we found some statistically significant differences in one-year stability between young and old adults but not in all comparisons and not in four-year stability.

Based on previous findings, an increase in AOP and a potential increase in AOF across the life-span was expected, peaking around age 60 (i.e., between middle-aged and old adults in the sample). Indeed, there was a statistically significant positive change for both women and men in AOP over time. Descriptively, this growth mainly occurred among middle-aged adults. This might indicate a maturation effect with regard to action orientation, but our sample size allowed us no test of differential changes between age groups. In contrast, there was no statistically significant change in AOF over time and this applies to all three age groups. Thus, longitudinal results indicate only a consistent pattern of change in AOP among middle-aged adults.

We further analyzed data from four additional longitudinal studies with young adults, using the adjusted scales from Study 1. We want to emphasize that the present studies comprise all data of repeated measurements of action orientation available to us (i.e., we present all of our data that allows assessing stability and change in action orientation). Study 2 consolidates three studies with students and is described below. Additionally, we report results from a fourth study in the supplementary material (Study S3). Results of this study should be interpreted with caution, as participants had very high values in both AOF and AOP, especially at T1 (the means were even higher than the means of old adults in Study 1). This may be due to the study’s special sample: Participants were applicants for training at a police department, which is a rather selective demographic[7] and, in addition, the situation may have triggered socially desirable responding.

Insert Figure 1 near here

Figure caption:

Figure 1. Longitudinal change in action orientation for women of the three age groups in Study 1. Scale ranges were 0-8 for both AOF and AOP. AOF = Action orientation after failure. AOP = Prospective action orientation.

Insert Figure 2 near here

Figure caption:

Figure 2. Longitudinal change in action orientation for men of the three age groups in Study 1. Scale ranges were 0-8 for both AOF and AOP. AOF = Action orientation after failure. AOP = Prospective action orientation.

Study 2

Method

Participants. In this study, we consolidated three samples with students aged between 18 and 34 years (M = 20.73, SD = 2.45) in which action orientation was measured twice (denoted as T1 and T2). The first sample (sample A) was collected in the context of a larger research project in which action orientation was measured twice approximately five years apart. This sample consisted of 78 participants (55 females) with a mean age of M = 20.19 (SD = 1.91), ranging from 18 to 29.

[7] There is some evidence that police officers have higher values in action orientation compared to the general population (Landman et al., 2016), which might also be the case for individuals applying for training as a police officer.

The second sample (sample B) was collected in the context of a larger research project in which action orientation was measured twice approximately one year apart. This sample consisted of 96 participants (59 females) with a mean age of $M = 20.46$ ($SD = 1.88$), ranging from 18 to 30.

The third sample (sample C) consisted of data from two separate experimental studies, which took place in the same time span and in which action orientation was used as a control variable. Approximately two years after the experiments, participants were invited to fill out a follow-up questionnaire. The sample of this study consisted of 106 participants (76 females, 1 diverse) with a mean age of $M = 21.38$ ($SD = 3.06$), ranging from 18 to 34. Combined, the three samples consisted of 280 participants (190 females, 1 diverse). Further information on the three samples can be found in the supplementary material.

Measures. Action orientation was assessed with the 24-item version of the Action Control Scale (ACS-90; Kuhl, 1994) at T1 and T2 for all three samples. We removed the same items as in Study 1 to be able to draw inferences between our studies and over time. Thus, both action orientation after failure (AOF) and prospective action orientation (AOP) were measured with 8 items. Descriptive statistics are presented in Table 6.

Statistical analyses. We used multilevel modeling to analyze change per year and to test for gender differences in AOF and AOP. Because the time intervals between T1 and T2 differed between samples, we coded time as number of years after T1, that is, 5 (sample A), 1 (sample B), or 2 (sample C), so that regression coefficients represent change per year. To test for gender differences, a dummy-coded gender variable (0 = female, 1 = male) was used. Again, a time-gender interaction term was included in the models for flexibility although we had no hypothesis about this interaction.

Insert Table 6 here

Statistical power considerations. We conducted Monte Carlo simulations with R's *simr* package (Green & MacLeod, 2016) to determine the power for detecting similar effects sizes as in Study 1 (single-entry models) given the sample size and multilevel model.

Study 1 showed that changes per year of about $B = 0.11$ can be expected for AOP whereas AOF changes less over time, if at all. This effect can be detected with a statistical power of 87% for both AOF and AOP and 80% power would be reached with an effect of $B = 0.10$. Therefore, in Study 2, effects that are similar to AOP's increase in Study 1 can be detected with acceptable statistical power.

For potential gender differences, Study 1 showed a difference of $B = 1.36$ in AOF but none in AOP. For this effect, our simulations indicate that the sample size and model in Study 2 achieve a power of > .99%. For acceptable (80%) or good (90%) power, gender differences of $B = 0.73$ or $B = 0.83$ are required in AOF, respectively. For gender differences in AOP, acceptable power would require a difference of $B = 0.93$.

Results

Stability of action orientation over time. We calculated the rank-order stability of the two scales separately for each sample because the time lag from T1 to T2 differed. All stability coefficients (r_{TT}) are given in Table 6.

Change in action orientation over time and gender differences. We found no statistically significant change over time for AOF, $B = 0.066$, $t = 1.856$, $p = .065$, whereas AOP did significantly increase over time, $B = 0.116$, $t = 2.879$, $p = .004$ (see black lines in Figure 3). When adding gender as a predictor and moderator, it had a statistically significant main effect on AOF, $B = 0.835$, $t = 3.247$, $p = .001$, indicating that men had higher values in AOF at T1. There were no gender differences in the intercept of AOP, $B = – 0.004$, $t = –$

0.012, $p = .990$, and no moderation change by gender, neither in AOF, $B = 0.077$, $t = -0.982$, $p = .327$, nor in AOP, $B = 0.043$, $t = 0.482$, $p = .630$.

Insert Figure 3 near here

Figure caption:

Figure 3. Change in action orientation over time for each sample (grey) and overall per year (black). Scale ranges are 0-8 for both AOF and AOP. Triangles = sample A, dots = sample B, crosses = sample C.

Sample effects and attrition. The pattern of means in AOF and AOP indicates some variety among the three samples regarding the baseline and change over time (see Figure 3, grey lines). Therefore, we tested whether the three samples (A, B, C) differed regarding their baseline level and changes in AOF and AOP over time. The results indicate that AOF differs significantly among the samples such that its increase per year is strongest in sample B and weakest in sample A. Furthermore, the overall change per year reached statistical significance when between-samples variability was accounted for. For AOP, in contrast, no statistically significant differences among the samples were found. The overall change per year in AOP also remained significantly positive. More detailed results are given in the supplementary material.

Results on the comparison of action orientation (at T1) between participants which did vs. did not participate at both measurement times are also available in the supplementary material. There were no statistically significant differences between the two groups (participants vs. dropouts).

Discussion

The stability coefficients obtained in Study 2 should be interpreted with great caution because the sample size for each time lag is small. Nevertheless, the one-year stability coefficients (sample B) can be used to update our estimate from study one. The combined stability estimates (means weighted by sample size) are .78 for AOP and .77 for AOF. Regarding change over time, there was a statistically significant increase in AOP but not AOF. In line with Study 1, the findings indicate more change over time in AOP than AOF.

General Discussion

In an attempt to thoroughly investigate stability of and change in action orientation, we first tested for measurement invariance, a prerequisite for interpreting stability and change over time. Measurement invariance was confirmed over time, genders, and age groups (after adjusting the scales to achieve adequate model fit).

Based on previous findings, stability coefficients of at least .70 for a time interval of one year and .60 for time intervals of several years for both action orientation after failure (AOF) and prospective action orientation (AOP) were expected. Additionally, an increase in the stability of action orientation across the life-span until the age of about 60 was expected. The results are mainly in line with these expectations. With some exceptions, stability coefficients were higher than .70 and .60 for AOF and AOP, respectively. Thus, the assumption of action orientation as a rather stable individual difference construct was confirmed.

With regard to change, action orientation (especially AOP) was expected to increase with age. Indeed, both cross-sectionally and longitudinally, there was an increase in AOP with age. This supports the notion that individuals improve in self-regulatory abilities over the life-span. However, the pattern of results was somewhat inconsistent. First, longitudinal analyses indicated no change over time for AOF. Second, in Study 1 AOP mainly increased among middle-aged adults (40 to 55 years) and less so among young adults (20 to 35 years).

In contrast, Study 2, which included only young adults, indicated positive change among young adults. This may be due to the lack of statistical power for within age group analyses in Study 1. Third, there were no changes in old adults (Study 1, 65 to 80 years) and some change patterns that were difficult to interpret in young adults (Study 2).

Stability of Action Orientation

Previous research hardly ever reported stability coefficients for action orientation. The two studies with both adequate sample sizes and time intervals reported coefficients of .81 for several months (Wojdylo et al., 2016) and .76 for one year (Frese et al., 1997). Previous research on personality traits indicates that these are relatively stable over time. Even for long time intervals (e.g., 10 years), stability coefficients usually did not fall below levels of .60 (Anusic & Schimmack, 2016; Terracciano et al., 2006).

Results of our studies provide further and more reliable evidence for the stability of action orientation. Average one-year stability coefficients were .78 and .77 for AOP and AOF, respectively, and four-year stability coefficients ranged from .68 to .75 (Study 1, not differentiating between age groups), indicating rather high rank-order stability for both AOF and AOP. Thus, results imply that action orientation is a stable individual difference construct. In addition, previous research on personality traits has pointed to an increase in stability between age 20 and age 60 (e.g., Roberts & DelVecchio, 2000; Specht et al., 2011). Indeed, some of our comparisons between young and old adults' one-year stabilities are in line with this assumption. However, most comparisons remain inconclusive because the differences between old and young adults' stability coefficients were not statistically significant.

Change in Action Orientation

Previous cross-sectional studies found a positive association between AOP and age, whereas results for AOF were less consistent (Backes et al., 2017; Hennecke & Freund, 2016). Life-span research indicates an increase in the ability to regulate emotions (Lawton, 2001) and individual goal pursuit (Hennecke & Freund, 2010) with age. Similarly, research on personality trait development indicates a pattern of maturation. Individuals show an increase in agreeableness, conscientiousness, and emotional stability across the life-span (Caspi et al., 2005). Accordingly, we assumed that action orientation would increase over time.

Results of the present studies point in this direction. Although not statistically significant for some time points, there was a rather clear picture regarding the cross-sectional differences between age groups: Old adults showed the highest values in action orientation, young adults the lowest values. Longitudinal analyses revealed a statistically significant positive change over time for both women and men in AOP, which was driven by middle-aged adults (Study 1) but also appeared among young adults (Study 2). Descriptively, old adults seem to have the least change of AOP over time, which would be consistent with a plateau effect after age 60. However, due to limited statistical power we could not test for different changes between age groups of Study 1, thus allowing no conclusion about a potential plateau effect. There was, however, no statistically significant positive change in AOF in either study. In sum, we found evidence that AOP increases with age, which implies some sort of maturation, but not in AOF, which contradicts the notion of maturation.

For young adults, there was some unexpected variation in the changes over time: Analyses revealed statistically significant increases in AOP (Study 2) and considerable variation of change in AOF between samples of Study 2. Thus, conclusions for young adults should be made with caution, although there is some evidence pointing to maturation in young adulthood. As in a previous study investigating both AOF and AOP (Hennecke & Freund, 2016), our results are consistent for AOP, where change was positive and there was evidence for change in all samples and across age groups. We agree with Hennecke and

Freund (2016) that “this result is puzzling” (p. 36) as there seems to be no reason why AOP should change more than AOF. Older adults are better at down-regulating negative affect (Lawton, 2001) and at coping with failure (Heckhausen et al., 2010) and, therefore, AOF should increase with age. This is what we found cross-sectionally, but not longitudinally.

We can only speculate about the reasons for the variation in change regarding young adults. It might have been caused by differences between the samples in terms of life situations. Despite their similarity in age, young adults in different life situations (e.g., entering a first romantic relationship, graduating) might show different patterns of change in their self-regulatory abilities and their personality (see below).

Causes of Personality Change

There is an ongoing debate about the causes of personality change (for an overview of different approaches, see Specht et al., 2014). Some scholars argue that normative age-related changes are driven by intrinsic biological maturation (Costa & McCrae, 2006; McCrae & Costa, 2008). Others reason that changes occur due to the involvement in social roles and life experiences (Helson et al., 2002; Roberts et al., 2005). There is evidence for both positions. As explained above, individuals become more agreeable, conscientious, and emotionally stable across the life-span, which might be explained by both biological and environmental factors. Additional evidence for environmental approaches comes from research on the effect of positive and negative life events on personality change. For example, experiencing a first romantic relationship has been associated with an increase in emotional stability and extraversion (Lehnart et al., 2010; Neyer & Asendorpf, 2001; Neyer & Lehnart, 2007), whereas marriage has been related with a decrease in extraversion and openness (Specht et al., 2011). Graduation has been associated with an increase in agreeableness, conscientiousness, emotional stability, and openness (Bleidorn, 2012; Lüdtke et al., 2011), whereas unemployment has been related with a decrease in conscientiousness as well as agreeableness, emotional stability, or openness (Boyce et al., 2015; Costa et al., 2000; but see Specht et al., 2011).

Similarly, life experiences might have an effect on action orientation. Supporting social interactions should improve action orientation (Hennecke & Freund, 2016), for example when starting a (first) serious relationship (Neyer & Asendorpf, 2001; Neyer & Lehnart, 2007) or experiencing a stable, satisfying, and fulfilling relationship (Lehnart & Neyer, 2006; Robins et al., 2002; Scollon & Diener, 2006).

Gender Differences in Action Orientation

One further topic should be addressed. Due to the dyadic design of the first study, we reported the main results separately for women and men. In sum, we found statistically significant gender differences which were similar to those found in a recent study (Schlüter et al., 2018): AOF was higher for men than for women, whereas AOP was higher for women than for men. However, only AOF differed between genders in Study 2. This is consistent with other studies, which only report higher values in AOF for men (Allemand et al., 2008) or women (Blunt & Pychyl, 1998, Study 2) but no gender differences in AOP. There are, however, also studies that report higher values in both AOF and AOP for men (Landman et al., 2016) or even no gender differences at all (Blunt & Pychyl, 1998, Study 1). Above that, only few studies on action orientation actually reported values for women and men separately. It is unclear whether gender differences were just not considered or whether there were no gender differences in other studies. Either way, further investigation of gender differences in action orientation would be a pathway for future research.

Limitations and Future Directions

Several limitations of the studies have to be mentioned. First, one might argue that the informative value of our results is limited because we had to adjust the scales to achieve adequate model fit. In our view, this is not the case. Only by adjusting the scales we were able to test measurement invariance and investigate change over time, which both were, from our point of view, long overdue in the study of action orientation. Above that, the poorer model fit of the original scales indicates that it might have been time for a thorough scale revision. Already 20 years ago, Diefendorff et al. (2000) identified four items of each of the two scales which they subsequently removed from their analyses due to a lack of model fit. Five of these eight items were also removed by us when adjusting the scales, which suggests that these items might be replaced or removed when revising the scale. Furthermore, more than 30 years after scale development, some items might not depict daily struggles adequately anymore (e.g., “If I have to talk to someone about something important and, repeatedly, can’t find her/him at home…”), which could explain their poor performance and indicate that they should be replaced.

Second, investigating the long-term development of action orientation was not the primary focus of the studies reported here. Although we were able to longitudinally investigate the development of action orientation, our time intervals included only a few years. Sample A of Study 2 had the longest time interval of about five years. Thus, future studies should be designed exactly for the cause of investigating the long-term development of action orientation, containing either very large cross-sectional samples or large longitudinal samples with longer time intervals (e.g., 10 or more years) to more reliably estimate stability of and change in action orientation.

Third, events that happened between two measurement times were not taken into consideration. Especially for Study 2, this might have influenced the results. As outlined above, besides social interactions, life events or changes in social roles might also lead to a change in action orientation. A fruitful approach for future studies could be to focus on specific life events (e.g., graduation, entering an intimate relationship) and investigate subsequent potential changes in action orientation.

Fourth, evidence on middle-aged and old adults was solely based on a sample of couples in rather stable relationships. As supportive social interactions are theorized to sustain action orientation, it can be argued that effects might not be generalized to other populations. Thus, it is crucial to investigate stability and change in other samples in the future.

Finally, one might argue that action orientation resembles emotional stability and that changes in action orientation might be explained by changes in emotional stability, yet, there is a clear difference between the two traits. Action orientation refers to affect regulation, whereas emotional stability refers to affect sensitivity (Kuhl, 2000a, 2000b; for a further elaboration on this distinction, see Baumann et al., 2007). In an experiment, Baumann and Kuhl (2002) demonstrated that, in contrast to emotional stability, AOF did not correlate with the likelihood of entering a negative mood but it did compensate for the negative effect of mood. The differences between action orientation and emotional stability are further demonstrated in their correlations, which do not seem to be very high: Correlations ranging from .25 to .35 between AOF and emotional stability and from .22 to .47 between AOP and emotional stability have been reported in previous studies (Baumann & Kuhl, 2002; Brunstein, 2001; Diefendorff et al., 2000; Koole & Coenen, 2007).

Conclusion

In this article, we provided first thorough evidence on the stability of and change in action orientation over time. Like other individual difference constructs, action orientation is rather stable over the course of several years. At the same time, abilities to regulate emotions in support of their goal pursuit increase with age, which supports the notion of personality maturation across the life-span – an important mechanism for upholding high well-being and successful goal striving in older adulthood.

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