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Characterizing lifespan development of three aspects of coherence in life narratives: A cohort-sequential study

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Abstract

The ability to narrate stories and a synchronic self-concept develop in the pre- and primary school years. Life story theory proposes that both developments extend to an even later developmental stage, that is, to adolescents' acquisition of a coherent life story. Cross-sectional evidence supports the emergence of a life story in adolescence, but is mixed in terms of later lifespan development. The present study examines longitudinally the development of global coherence in life narratives across almost the entire lifespan. Starting in 2003, a total of 172 participants narrated their lives over the course of eight years (aged 16, 20, 24, 28, 44, and 69 when last tested) resulting in up to four life narratives per person. Three aspects of global life narrative coherence, temporal, causal-motivational, and thematic coherence, were measured with global ratings and predicted by their respective textual indicators. Children lacked most aspects of global coherence. Almost all indicators of temporal and causal-motivational coherence increased substantially across adolescence up to early adulthood, as did thematic coherence, which continued to develop throughout middle adulthood.

"Ok, now you have the whole story" was one participant's way of wrapping up her life narrative after she had added a last episode to re-interpret her entire life in light of that episode. What exactly made this woman feel her life narrative was complete? We suggest that it was both a judgment of having included the most self-defining moments and of having tied together past events so that her development was coherently and comprehensibly narrated. To date, only cross-sectional studies have shown that the ability to narrate coherent life narratives develops in adolescence (Bohn & Berntsen, 2008, 2013; Habermas & de Silveira, 2008; Habermas & Paha, 2001). We longitudinally extended our study reported in 2008 and added a middle aged and older adult group to explore the developmental changes of life narrative coherence from childhood to adulthood. After introducing the theoretical background, we define global life narrative coherence, to finally discuss the evidence for its development to date.

Narrative Identity and the Life Story

To be understood regarding certain reactions, actions, or characteristics, one may refer to one's life story. The own history is interpreted to explain stability or change of personality. The most adequate form for such an interpretation of the self is narrative. This form of identity, named *narrative identity* by Ricœur (1991), allows constructing self-continuity across change over time. McAdams (2013) integrated this concept of narrative identity into his personality framework. At the highest level, individuals are the authors of their lives and aim to bring traits, skills, goals, values, and experiences into a meaningful life story. An entire life narrative is the most complete linguistic manifestation of the life story. Autobiographical reasoning employs the life story in a piecemeal fashion. It uses autobiographical arguments which connect specific memories to distant life parts and to personal development (Habermas, 2011), typically in autobiographical narratives of specific past events. Either way, the life story serves to interpret lives and to constitute narrative identity (Habermas & Köber, 2014).

Three Kinds of Global Textual Coherence

Any attempt to narrate a life needs to be globally coherent to succeed in constructing narrative identity. Global coherence is a fundamental aspect of life narratives, because they are expected to relate life events to their context, to each other, and to the individual's personality and development so as to present a meaningful, coherent life.

Bluck and Habermas (2000) defined four major aspects of overall global coherence: temporal, causal-motivational, and thematic coherence and the coherence-supporting function of the cultural concept of biography. The cultural concept of biography defines what a life narrative should look like. It includes a set of normative transitions with age norms, termed life script by Rubin and Berntsen (2003). Here we focus on the three kinds of textual coherence.

Temporal Coherence

Global temporal coherence enables listeners to orient themselves as to when an event happened in the narrator's life and to the textual elements contributing to that coherence. Life narratives are formed by a sequence of variously compressed representations of events, ranging from specific and repeated events to segments that chronicle extended events and entire life time periods (Habermas & Diel, 2013; Thomsen, 2009). An overarching temporal macrostructure, that is, the temporal order of events and the elaboration of beginnings and endings, helps to integrate these diverse autobiographical memories into a temporally coherent narrative (Habermas, Ehlert-Lerche, & de Silveira, 2009).

Any timeline of life begins with birth or even conception, that is, before individual memory sets in. Therefore life narratives are expected to begin no later than with birth. Sometimes birth stories or earliest memories are told to foreshadow the global interpretation of life (Lejeune, 1986). The basic way of any narrative to maintain listeners' temporal orientation is to imitate the sequence of events by narrating events in chronological order. Sometimes a narrative may deviate from linear chronology, termed anachrony (Genette, 1982). Anachronies need to be clearly marked by temporal indicators of when something happened in life in order to preserve the temporal orientation. Such indicators may refer to age, life phases, or calendar dates. In unmarked anachronies, the listener does not know when an event happened in life.

A requirement for ending a life narrative is to arrive in the present. Summarizing, most often with global biographical evaluations (Rosenthal, 1993), creates additional coherence. Because autobiographical life narratives cannot end with the end of life, the ending may also provide an outlook onto the future (cf. Bohn & Berntsen, 2013).

Causal-Motivational Coherence

Global causal-motivational coherence of life narratives enables recipients and narrators to understand the narrator's personal development. Life narratives are prototypically intended to answer the question who one is today by narrating how one became this person.

At the textual level, global causal-motivational coherence results from linking events and the narrator's personality by portraying how one event caused other events or how motives led to actions producing consequences that transcend the boundaries of local events. We have termed this activity of reflecting about life events from a biographical perspective *autobiographical reasoning*, which involves the use of *autobiographical arguments* (Habermas & Bluck, 2000). Inspired by Pasupathi, Mansour, and Brubaker's (2007) dichotomy of change-engendering versus stability-maintaining biographical links, we later specified that causal- motivational coherence is created by arguments that explain change in life or personality, thereby creating continuity across change (Habermas & Köber, 2014), whereas arguments that create or imply stability or similarity contribute to thematic coherence (Habermas, 2011). There is a variety of autobiographical arguments that explain change. One may, for example, explain past actions with one's past developmental status, tell how one learned a lesson, refer to turning points or to personal and general insights. Also, life circumstances and events may exert a formative influence, and a specific experience may create a very individual sensibility. Further, an event may motivate an enduring personality change or an event may allow new insights in the self (Pasupathi et al., 2007). Autobiographical arguments are powerful instruments to create causal-motivational coherence if they explain enduring change in the self by reference to life events.

Thematic Coherence

Global thematic coherence allows listeners to grasp the dominant life themes of narrators. It is constituted by how well the different parts of a life and the narrator's personality match in terms of similarity of themes. It is implicit if similarities between various events or actions impress the listener, but are not named. In addition, there are many ways to render thematic coherence explicit. For example, a past-present comparison may state that an element is still the same. Or an exemplification may illustrate a general point about the narrator or her or his life with a specific event (Habermas & de Silveira, 2008). Stability-maintaining self-event connections explain an action by an enduring personality trait, or declare an action as reflecting a trait (Habermas & Paha, 2001). Likewise, dismissing an action as atypical for oneself helps safeguard thematic coherence (Pasupathi et al., 2007).

Development of the Life Story and its Coherence Across the Life Span
Although 9-to 11-year-old children succeed to craft single event narratives (Peterson & McCabe, 1983), they cannot craft an entire life narrative. When asked to write their life story, 28% of the 10-year-olds in Bohn and Berntsen's (2008) study wrote an isolated life event instead of a life narrative. By age 12 children coherently related several single life events, and by age 14 most adolescents shared a detailed and coherent life story indicating the emergence of overall life narrative coherence in adolescence. However, this general observation does not answer the question what kind of coherence develops when. Reviewing the evidence, we report studies of global life narratives as well as of single event narratives.

Temporal Coherence
The little evidence regarding the emergence of temporal coherence of life narratives shows a steep increase between ages 8 and 12 and a leveling off at age 16 (Habermas & de Silveira, 2008). The development of the temporal macrostructure follows a parallel age pattern. By age 8, children typically do not begin their life story at birth, but at any point in life. Twelve-year-olds, in contrast, mostly start at birth, maintain a chronological order, and end their life narratives in the present (Bohn & Berntsen, 2008; Habermas et al., 2009).
Another aspect of temporal macrostructure is the segmenting of life in overarching periods or life chapters. When asked to recount their lives in terms of life chapters, 8-year-olds produced over two thirds of chapters consisting of specific events instead of life periods. Only at age 12 over half the chapters consisted of life periods (Chen, McAnally, & Reese, 2013). Apparently, temporal coherence emerges as soon as children understand that a life narrative consists of more than one life event and start to bring events into a temporal sequence.

Causal-Motivational Coherence
The only study of the development of causal-motivational coherence of entire life narratives, measured by a rating scale for developmental consequentiality, found an increase with age, mainly between 12 and 20 (Habermas & de Silveira, 2008), supported by a parallel increase of autobiographical arguments. Chen, McAnally, Wang, and Reese (2012) used an adapted version of this rating scale for narratives of single critical events showing that developmental consequentiality increased substantially between the ages of 12 and 16 as did the use of the change-related autobiographical arguments *learning a lesson* and *personal insight*.
Other studies measured the use of specific autobiographical arguments in single event narratives. Between ages 11 and 18 the use of autobiographical arguments *learning a lesson*, *personal insight*, and *self-event connections engendering change* emerged slowly and increased continuously (McLean, Breen, & Fournier, 2010). Also, 18- to 22-year-olds used more *learning a lesson* and *personal insight* in turning point narratives and reflected more on how three separate memories were related to each other than adolescents aged 13 to 15 (Grysman & Hudson, 2010).
These studies narrow the emergence of causal-motivational coherence to some time in early to mid-adolescence and indicate its continuous development throughout adolescence until early adulthood. Little, however, is known about the development of causal-motivational coherence in adulthood. What is known is based on studies of autobiographical arguments in single event narratives, not on entire life narratives. In a study of narratives of wisdom-related events, causal links to other life events increased linearly between adolescence and older adulthood. Drawing a lesson from this experience became more frequent between adolescence and middle adulthood, remaining stable in older adulthood (Bluck & Glück, 2004). Similarly, Singer,

Rexhaj, and Baddeley (2007) found more autobiographical arguments (learning a lesson, personal insights) in self-defining memories of older (50 to 85 years) than in those of younger adults. Pasupathi and Mansour (2006) showed that self-event connections increased in women's oral turning point narratives between young and middle adulthood, but decreased after age 70. In contrast, McLean (2008) found that younger adults aged 17 to 35 used more self-event connections engendering change than older adults aged 65 to 85. Thus, findings regarding adulthood are somewhat contradictory. This may be a result of comparing one younger with one older adult group, which prevents any examination of a possible curvilinear development.

Thematic Coherence
The least is known about the development of thematic coherence. Habermas and de Silveira (2008) rated global thematic coherence as indicated by plausible transitions between consecutive text segments in entire life narratives, finding the steepest increase between ages 16 and 20. They also coded exemplifications, that is, the use of specific events to exemplify a general statement, as textual elements contributing to thematic coherence, again finding an increase with age. Studying single event narratives, McLean (2008) found that older adults (65 to 85 years) used more self-event connections maintaining stability than younger adults (17 to 35 years). Taken together, the two studies seem to indicate that thematic coherence first develops in late adolescence and continues to develop in adulthood.

Studies of the life story's development to date are limited in several ways. Most of the studies relied on single event narratives, only allowing the coding of autobiographical arguments. Entire life narratives as the most complete manifestation of the life story can be more or less globally coherent. Thus, they allow measuring global coherence directly by rating scales, and not just textual elements that contribute to global life narrative coherence. Further, most studies used two age groups, none covered the entire lifespan, and all are cross-sectional. Also, most studies only used a single measurement method and cover only one of the three aspects of global coherence. Here we attempt to fill these gaps by studying entire life narratives longitudinally, with age groups spreading across almost the entire lifespan, using multiple methods to measure both global coherence and local text elements contributing to it.

Hypotheses

We expected that all three aspects of global coherence emerge in adolescence. For the adult age range, we expected that temporal coherence remains stable, while causal-motivational coherence continues to increase during early adulthood, and thematic coherence up to middle adulthood.

Method

Participants
This longitudinal study started in 2003 with a total of $N = 114$ participants aged 8, 12, 16, and 20 years. They provided two life narratives two weeks apart except for nine participants who narrated their lives only once (cf. Habermas et al., 2009). Of these, four participants had been excluded for various reasons from the analysis of wave 1 published earlier, but were included in the present longitudinal analysis to maximize the number of participants. Four years later, 104 individuals participated again, of whom 94 participated a third time, again, four years later (dropout 8.9% and 9.6%). For participants who had provided two life narratives in 2003 ($N = 105$),

values were averaged. In 2007, two adult age groups (40 and 65 years, N = 28 and 30) were added to investigate lifespan development. Of these, 51 participated again four years later (dropout rate 12.1%). Gender was about equally distributed in the six cohorts (Table 1).

In 2003, the youngest cohort was the higher achieving half of third graders from an elementary school, while Cohorts 2, 3, and 4 were present or former students of a Gymnasium, that is, a German higher-track high school. Its mixed social composition, mainly middle class with a substantial proportion of lower class backgrounds, was comparable to that of the elementary school population. Cohorts 5 and 6 were recruited via flyers and among continuing education university students. In 2011, all cohorts were well educated. The majority (71%) were about to or had graduated from school with Abitur, that is, the highest German school degree, 18.8% had graduated after 10 years of school (Mittlere Reife) and 1.7% had no school degree. Those who did not participate in 2011 and had still been in school when last tested made up the remaining 8.5%. A good third (35.2%) of the participants had at least one parent born outside Germany. A migrant background was present in roughly half of each of the four younger cohorts, but in fewer of the two oldest cohorts. Participants were recompensed with 20 Euros in 2003, and 40 Euros in 2007 and 2011. At each follow-up, we contacted participants up to three times by letter, then via email, phone, and social media, and obtained parental informed consent for minors.

Procedure

In 2003, the four youngest cohorts were tested twice, two weeks apart, by two different (out of three) female interviewers. In 2007 and 2011 all six cohorts were tested only once by new female interviewers unknown to the participants. Thus, participants in the four younger cohorts provided up to four life narratives, and participants in the two older cohorts provided two, resulting in a total of 531 life narratives.

Material

Seven most important memories and life narratives. Participants wrote their seven most important specific memories on index cards and put them in chronological order. This served to make sure that life narratives also contained specific events and to reduce the memory load, especially for the youngest age group. Participants were asked to narrate their life for about 15 min without being interrupted. They were instructed to include the seven most important memories and to tell their life such as to explain how they had become the person they were at the present. Interviewers only encouraged to continue, but asked no questions (for verbatim instruction cf. Habermas & de Silveira, 2008). Afterwards, participants dated the seven most important memories.

Transcription and division into propositions. Life narratives were audio recorded, transcribed verbatim, and divided into propositions, that is, into comprehensible main or subordinate clauses. For each wave, two coders independently divided 40 life narratives into propositions and agreed on between 96.2% and 98.6% of propositions. Each of the two coders divided half of the remaining life narratives into propositions.

Rating and coding of global coherence. Different coders rated the three kinds of global coherence and coded in each proposition textual indicators of all three kinds of global coherence, respectively (Table 3). To guarantee consistent coding across all measurement times, all life narratives were rated and coded anew, including the ones from 2003. This may have resulted in minor differences to the values published earlier for wave one. However, we did check interrater reliabilities with the earlier coders, unless manuals were revised or new. All reliabilities were based on the independent coding or rating of 32 life narratives, balanced for age, gender, and

measurement time. Once agreement of at least Cohens' κ = .80 or intraclass correlation r_{IC} = .80 was reached, one coder coded all the remaining life narratives. To ensure that the coder did not deviate from the manual during the ensuing coding process, a second reliability was calculated on the basis of additional 16 life narratives. Both interrater reliabilities are provided below for the rating scales and in the tables for the codes. The codes we did not change are introduced only briefly (for extensive descriptions cf. Habermas & de Silveira, 2008; Habermas et al., 2009).

Global ratings of temporal, causal-motivational, and thematic coherence. We used three 7-point scales to rate the three kinds of global coherence from the recipient's point of view. More specifically, the scales measured how well the reader is temporally oriented, how well a sense of the developmental significance of events is conveyed, and how thematically coherent the narrative is. In the earlier versions, only four of the seven points of the global rating scales had received a verbal definition, leading to a preference for these points. Therefore, we now provided verbal anchors for all scale points. The scale for global thematic coherence was constructed anew because of the relatively poor performance of the old version (cf. Habermas & de Silveira, 2008). The new scale measures the degree to which the narrator implicitly or explicitly thematically relates diverse individual elements of the life story to each other. Although monothematic life narratives have a high degree of thematic similarity, we are interested in the ability to create thematic coherence across diverse contents of life for two reasons. If a life narrative is monothematic because events are drawn only from one area of life, or are highly similar at a relatively concrete level (e.g., all deal with soccer), then this is achieved by excluding most other areas of life which normatively should be part of it. Furthermore, we are interested in the socio-cognitive ability to abstract thematic coherence from diverse experiences. Thus the scale counts as no coherence if the individual episodes are completely disconnected or if only events from one area of life are addressed (values 1-2). There is some thematic coherence if implicit similarities are discernible (values 3-4). There is thematic coherence if episodes, heterogeneous in content, are explicitly thematically connected, for example, by comparing various episodes, or by designating one episode as typical for others (values 5-7). Interrater reliabilities were r_{IC} =.81 based on 32 life narratives and r_{IC} =.78 based on 16 randomly selected additional life narratives for temporal orientation, r_{IC} =.81 and r_{IC} =.78 respectively for developmental consequentiality, and r_{IC} =.86 and r_{IC} =.83 respectively for thematic coherence.

Temporal macrostructure. Some global coherence may be provided through the temporal macrostructure, that is the overall temporal order and the elaboration of beginnings and endings (Habermas et al., 2009). Elaboration of the narrative's beginning and ending was measured on 5-point (beginning) and 4-point (ending) scales. They measured whether participants started their narratives at the beginning of life and ended in the present, and how elaborate the beginnings and endings were (Table 2). We see elaboration of beginnings and endings as contributing especially to temporal coherence, but also to causal-motivational and thematic coherence.

Local indicators of temporal coherence. Temporal indicators provide temporal orientation in the life by indicating distance from the present (e.g., 'two years ago'), age, calendar dates, and biological or social life phases (cf. Habermas & de Silveira, 2008). The number of all temporal indicators was divided by the total number of propositions per life narrative. Further, we created a negative indicator of temporal coherence, termed temporal disorientation, by z-standardizing and averaging two negative indicators. These were the relative frequency of dates with month and possibly day, but without the year (Table 3), and the absolute number of unmarked anachronies, that is, unmarked temporal leaps which lead to uncertainty or confusion about when in life an event had happened (Table 2).

Local indicators of causal-motivational coherence. Causal links between personality and

events (Habermas & Paha, 2001) were coded with a new, less complicated manual, and complemented by two self-event connections suggested by Pasupathi and colleagues (2007). Furthermore, we no longer included immature conceptions of personality (global social attitudes, personal preferences, specific abilities, habits; cf. Habermas & de Silveira, 2008), restricting self-event connections to genuine, that is, general and stable personality traits, basic values, and talents. We still assume that self-event connections, which explain change sustain causal-motivational coherence, but now think that stability-maintaining self-event connections sustain thematic coherence (cf. Habermas, 2011). Change-engendering self-event connections were either explanations of change in personality (always including values and talent) by an event or events that reveal one's personality (Table 3).

Other autobiographical arguments were coded as a second group of local indicators of causal coherence. Adding to the five arguments coded earlier (developmental status, biographical background, formative experience, lesson learned, generalized insights,), we also coded *turning points*, indicating a time of transition with enduring changes in life (Table 3). Again we calculated the relative frequency of the sum of self-event connections and other autobiographical arguments respectively.

        Local indicators of thematic coherence. We did not use any of the local indicators used earlier (Habermas & de Silveira, 2008), because those indicators either were conceptually only indirectly related to thematic coherence (hedges) or proved to be difficult to code due to their infrequency (exemplifications). Here we used self-event connections maintaining stability as local indicators of thematic coherence. These were explanations of events or actions by personality or statements that an event cannot be explained by personality, because it was highly atypical (Table 3). Again we used relative frequencies.

Results

Data Analysis Strategy

        Global coherence of life narratives produces a global impression in recipients, and is therefore best measured globally by ratings of entire life narratives. It is the product of many small local links between distant local events or between a local event and overarching elements of life such as personality or values. These local elements may be autobiographical arguments or more structural elements such as chronological order or beginnings' and endings' elaborations. Because these local elements contribute to global coherence, they also indicate it. In earlier publications we had not strictly differentiated global coherence ratings from local elements contributing to global coherence. In this study we take advantage of rating overall coherence and coding local indicators in the same life narratives, which is not possible in single event narratives, to test local indicators' contribution to global coherence

        Regarding developmental trends, the age variable indexes the development and change of a series of heterogeneous social and cognitive factors (Habermas & Bluck, 2000), which in turn enable the narrator to use local textual elements to create the final quality of global coherence. We followed the rationale of first modeling age-related trends and individual differences therein and then proceeding to explain those individual differences not accounted for by common age-related trends in terms of theory-based selections of textual elements (i.e., by including these as predictor variables into the models containing the age-related trends). We thus only test age effects on global coherence. Age effects on local indicators were not tested independently, because they are obvious in most cases. Instead, we tested the much less obvious prediction of global coherence by local elements once age had been taken into account. This is the first study to

test age-independent effects of local indicators on global coherence with a model that goes beyond mere partial correlations. Because the four younger cohorts overlap at ages of 12, 16, 20 and 24 (cf. Table 1), we checked for cohort effects in every measure via univariate ANOVAs and also for gender effects in every cohort. None was significant and was thus not reported here.

First, we provide descriptive data on the effects of age on the length of narratives. Then we explore correlations between the three global ratings and local indicators on which we based the order in which they were entered into the mixed models, which are then reported separately for the three kinds of coherence.

Length of Life Narratives

The length of life narratives increased with time and age. Descriptive statistics showed that the increase in length stopped at age 20 with about 280 to 300 propositions per life narrative. The narratives of the middle aged and older adults at time two were, on average, about 280 propositions long and at time three about 360 propositions long. To compensate for differences in length, we used relative frequencies of local indicators.

Correlations Between Global Ratings and Corresponding Codes

As each textual indicator is assigned to one corresponding global rating on a theory-guided basis, we calculated correlations prior to the longitudinal analyses in order to validate those measures. All correlations were calculated separately for each measurement time, partialling out linear and quadratic age effects (Table 4). Temporal disorientation and temporal indicators correlated most strongly and significantly across all measurement times with temporal global rating. At the first measurement time beginnings correlated slightly more with thematic global rating, but at the following measurements most strongly and significantly with temporal global rating. In contrast, endings correlated most with causal-motivational and thematic rating at all measurement times. Both other autobiographical arguments and change-engendering self-event connections correlated most strongly with the corresponding causal-motivational global rating. Also, stability-maintaining self-event connections correlated most with thematic global rating at each measurement time. Thus the correlational patterns for all indicators except endings confirmed our expectations.

Mixed Models

To investigate age-related trends in the three aspects of global coherence as well as local textual indicators as potential predictors of individual differences therein, mixed models for repeated measures data were applied, using maximum likelihood estimation with PROC MIXED in SAS 9.3. These models were applied separately for younger (8-28 years) and older (40-69 years) participants and for the different aspects of coherence (i.e., causal-motivational, temporal, and thematic ratings). For each combination of age group and coherence rating, a series of models with all possible combinations of fixed and random intercepts and slopes was estimated. The model for the age-related trends with the smallest Akaike Information Criterion was chosen as the best fitting one. Based on this, textual indicators were tested as time-varying covariates in a predefined order. If entering a covariate as predictor into the model resulted in a significant improvement of model fit, as indicated by a comparison of model deviances with χ^2 tests, it was retained in the model before the next predictor was entered. Otherwise, it was not included and the next predictor was tested. Because age-related trends were always included in the models, this procedure tested whether textual indicators could explain variance in coherence ratings over and above shared age-related trends. That is, significant effects indicated that participants with relatively high values on

textual indicators at a certain age scored higher on coherence ratings, taking into account that both, coherence and textual indicators, exhibited age-related trends.

According to their partial correlations across all measurement times with corresponding global ratings and age partialled out, the order of entering predictor variables was temporal disorientation ($r = -.361$), beginning ($r = .345$), temporal indicators ($r = .315$), ending ($r = .313$) for temporal coherence; change-engendering self-event connections ($r = .401$), other autobiographical arguments ($r = .394$), and ending ($r = .431$) for causal coherence; and stability-maintaining self-event connections ($r = .394$) and ending ($r = .453$) for thematic coherence. Ending as predictor was tested as the last potential predictor in each type of coherence, because of its high correlation with both causal-motivational and thematic rating (cf. Table 4). If the main effect of a textual indicator was significant, a possible interaction with age was also tested after inclusion of all significant main effects.[1]

Effects of Age on Global Coherence

Temporal coherence. For temporal coherence, the best model for age-related differences and changes in the younger sample included a random intercept at age 8, a random linear slope, and a fixed quadratic slope, indicating a decelerating increase with individual differences in both, the level and the rate of change. Including the textual indicators of disorientation, beginning, and temporal indicators each significantly improved model fit, all with positive regression coefficients (Table 5). Yet, adding the textual indicator of ending did not improve the model.

Regarding the older sample, the best model included a fixed intercept located at age 40 and a fixed linear slope. Only the inclusion of local indicators of disorientation and temporal indicators significantly improved model fit, whereas adding of beginning and ending did not. Surprisingly, the age trend was significant. This may be due to the decreasing use of temporal indicators and the slight increase of temporal disorientation (Figures 4 and 5).

Figures 1 to 3 portray the lifespan development of global temporal coherence, beginning, and ending. All three increased throughout adolescence and remained stable throughout adulthood. Temporal indicators, however, did not vary systematically with age (Figure 4). Temporal disorientation decreased steeply between 8 and 12 years of age and was mostly absent throughout lifespan.

In conclusion, the hypothesis that the temporal aspect of global coherence increases early in adolescence and remains stable in adulthood was supported. Moreover, it is predicted throughout lifespan by the degree of disorientation and the use of temporal indicators and additionally by the beginnings of the younger participants' life narratives.

Causal-motivational coherence. For causal-motivational coherence, the best model for age-related differences and changes in the younger sample included a fixed intercept, a random linear slope, and a fixed quadratic slope. Including the textual indicators of change-engendering self-event connections, other autobiographical arguments, and ending each significantly improved model fit (Table 6), all with positive regression coefficients. Furthermore, there was a significant negative interaction term of autobiographical arguments with the linear age-related trend, indicating that the positive effect of autobiographical arguments decreased with age.

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[1] Main effects and interaction with linear age trends were tested, even if no random intercepts or random linear slopes of age were included in the model. It might run counter intuition to test whether individual differences (in slopes) can be accounted for by predictor variables when these individual differences are not included in the model of age-related trends to begin with. However, due to different power of testing fixed and random effects, fixed effects of predictor variables can be significant even if the corresponding random effect is not. We checked whether including those random effects changed the pattern of significant effects for the predictor variables, though, which turned out not to be the case.

Regarding the older sample, the best model included a random intercept and a fixed slope. Including the textual indicator of change-engendering self-event connections improved model fit (Table 6), but the inclusion of other autobiographical arguments and ending did not.

Figures 1 and 6 show the continuous development of global causal-motivational coherence and change-engendering self-event connections up to about age 24. Equally, other autobiographical arguments increased continuously up to 20 years of age (Figure 6). All three remained stable during adulthood.

In sum, the hypothesis that causal-motivational global coherence emerges in adolescence was supported. It was absent in 8-year-olds, developed continuously up to about age 24, and remained constant during adulthood. Further, the variability among younger participants was also due to their use of autobiographical arguments and due to their way of ending the life narrative. Besides, the use of change-engendering self-event connections predicted global causal-motivational coherence in life narratives of individuals of all ages.

Thematic coherence. For thematic coherence, the best model for age-related differences and changes in the younger sample included a fixed intercept, a random linear slope, and a fixed quadratic slope. In the older sample, the best model included a fixed intercept and a fixed slope. Including the textual indicator of stability-maintaining self-event connections and ending each significantly improved model fit for younger and older participants (Table 7).

Figure 1 shows that global thematic coherence increased most steeply up to age 24 and continued to develop between ages 28 and 40. Stability maintaining self-event connections were absent in the 8-year-olds and developed continuously between ages 12 and 20, remaining more or less constant during adulthood.

Additionally, we explored the shift from implicit to explicit thematic coherence, indicated by a mean value exceeding 4 on the global rating scale. The four younger cohorts barely created explicit thematic coherence. Scores of 5 or higher began to emerge at age 20, but their mean frequency was only about 15.2% across the four younger cohorts throughout the eight years of measurement. In contrast, about 66% of the two older cohorts established explicit thematic coherence across measurement times.

In sum, the hypothesis that global thematic coherence emerges in adolescence and continues to develop to middle adulthood was supported. Global thematic ratings increased most between ages 12 and 24 and continued to increase between 28 and 40 years of age. Moreover, the occurrence of thematic coherence across all ages was influenced by the use of stability maintaining self-event connections and the elaboration of life narratives' endings.

Discussion

This first longitudinal study of the development of the life story supports the theory that global coherence in life narratives emerges in adolescence. There was both an intra- and inter-individual increase with age in ratings of three aspects of global coherence. A similar increase was observed in the formation and elaboration of a temporal macrostructure, and in the relative frequency of a variety of local indicators across the adolescent age range up to young adulthood. Most indicators of coherence remained stable across adulthood. Most importantly, local indicators of coherence differentially predicted specific kinds of global coherence.

Temporal coherence

Global temporal coherence in entire life narratives developed, as expected, earlier than the two other kinds of coherence. Visual inspection suggests that only rudimentary global temporal

coherence was present at age 8, increased most between ages 8 and 12, was established at age 16 and maintained throughout the lifespan.

Beyond age-related trends, temporal coherence was significantly predicted by the absence of temporal disorientation, the relative frequency of temporal indicators, and in younger individuals the elaboration of life narratives' beginnings, but surprisingly not by endings. Especially the finding of temporal indicators is noteworthy, because they did not vary systematically with age. Already at age 8, children were capable to use temporal indicators. However, they did not succeed in providing more than some temporal orientation for the listener. This impression is confirmed by the steep decrease of temporal disorientation between ages 8 and 12. Apparently, temporal indicators are used more efficiently with age.

To learn to craft temporally coherent life narratives is a noteworthy developmental step, because the understanding of biographical time builds on several cognitive processes. Friedman (2005) suggested that representation and manipulation of calendar time units, such as parts of the day, week and year are fundamental to date autobiographical memories and to arrange them in correct order. Children under age 10 cannot correctly use these temporal representations to indicate which of two personal events had happened earlier. Further, our findings are similar to Friedman, Reese, and Dai (2011) who in a sample of 8-12year-olds found that the ability to bring autobiographical events in correct temporal order increased between ages 8 and 12.

Besides time knowledge, the development of a temporal macrostructure of life narratives is aided by the acquisition of a cultural concept of biography between late childhood and mid-adolescence (Habermas, 2007). Knowing that individual lives are culturally structured by normative transitions, which are expected to be accomplished at a certain age, helps structure life narratives chronologically. The acquisition of the life script predicts global temporal coherence and temporal macrostructure between ages 8 and 20 (Bohn & Berntsen, 2008; Habermas et al., 2009).

Evidently, calendar time knowledge and life script knowledge, which are acquired in late childhood and early adolescence, are prerequisites for telling autobiographical events in a comprehensible temporal order. This contradicts Dunlop and Walker's (2013) claim that some form of life story without autobiographical arguments is already present in early childhood. Our findings clearly demonstrate that temporal coherence of life narratives barely starts to emerge in late childhood. This study thus provides strong evidence for the relative absence of temporal order in children's life stories.

Causal-motivational coherence

Global causal-motivational coherence was almost absent at age 8 and increased most between ages 12 and 20. It leveled off, as expected, in early adulthood at about 24 years of age. Causal-motivational coherence in younger participants' life narratives was significantly predicted, beyond age, by its corresponding textual indicators change-engendering self-event connections and other autobiographical arguments as well as by the elaboration of life narratives' endings. However, the positive effect of other autobiographical arguments decreased with age. Once autobiographical reasoning was established, it no longer predicted variations in causal-motivational coherence. Only the use of the highly specific change-engendering self-event connections still predicted global causal-motivational coherence in older adults' life narratives.

In a similar vein, elaboration of endings predicted causal-motivational coherence over and above age only in the younger sample. Visual inspection shows that endings developed only across the younger age range, expressing in the lower range of values an increase in the temporal structuring of endings. Temporal sequence is a logical prerequisite for causal-motivational sequences, which may explain part of this effect.

Confirming findings from cross-sectional studies, causal-motivational coherence emerged at age 12 and continued to develop until early adulthood. This coincides with Erikson's conflict of *Identity versus Identity Diffusion* located in adolescence and early adulthood (Erikson, 1959). Childhood identity, established by infantile identifications with parents, evolves into an adult identity, which requires commitments that may result from continuing infantile identifications (foreclosure) or from questioning of parental values and extensively exploring new identities and values (ego identity). Erikson pointed out that the life story is the most adequate format to capture an individualized psychosocial identity formed in adolescent exploratory experiences. Our findings suggest that the life story enables the individual to explain change in identity due to uncontrollable circumstances as well as due to decisions made in the light of life experiences.

Thematic coherence

As expected, global thematic coherence was almost absent at age 8, and increased steadily up to age 40 to remain constant thereafter. Its textual indicator, stability maintaining self-event connections, predicted thematic coherence over and above age throughout the lifespan, as did endings too. Once the temporal and causal-motivational structure of life narratives are mastered, individuals seem to increasingly organize their life narratives by central motives and life themes. Going beyond the early adolescent mere chronological sequencing of life events, adults structured their life narratives also causal-motivationally and thematically. Endings appear to have a special role for wrapping up life narratives by providing an overall retrospective evaluation, which states a dominant theme, and by providing a resulting outlook.

Discussions of identity development in adulthood point to the challenge of finding a balance between change and stability, between assimilating new experiences to identity and accommodating identity to events which are too discrepant from the individual's self-concept (Sneed & Whitbourne, 2003). Achieving this identity balance is facilitated by autobiographical narratives, because they allow exploring the implications of experiences and circumstances for the self (Kroger & McLean, 2012). Our findings show that both change engendering and stability maintaining self-event connections develop in a fairly parallel fashion throughout adulthood and differentially contribute to causal-motivational and thematic coherence, respectively. Cross-sectional and longitudinal identity research relying on Erikson's framework imply that change and stability of identity complement each other throughout adulthood in response to both tasks of *Identity versus Role Confusion* and *Integrity versus Despair* (Kroger, 2014). In addition, our findings suggest that concerns about stability and life themes reach a maximum in middle adulthood. Only then they became an explicit topic. McAdams (1993) suggests that the thematic lines of the life story become more nuanced and concrete in adulthood, because life changes are less dramatic than in adolescence. Adults, however, are challenged to integrate numerous private, familial, social and professional roles into a meaningful thematic whole. Maybe only when commitments are made, roles are established and life is sufficiently stable, the proverbial thematic red thread can be found and articulated in the life narrative.

However, this effect can be undermined, if the life story is rendered overcoherent by denying and leaving out discrepancies and contradictions instead of negotiating them with the aim of finally integrating them. To be both coherent and credible, life narratives need to equilibrate stability with growth, leaving room for ambiguities, discrepancies, and contradictions, which point to a future horizon of possible resolutions. Thus, overcoherence used as a possible defense mechanism remains to be studied.

Limitations

A major limitation of this study is the homogeneity of the sample in terms of educational level and cultural background. Though there was a substantial percentage of participants with at least one immigrant parent, the content of life narratives suggests that the participants were well integrated with German culture. Other studies suggest cultural differences in the content and narrative structure of autobiographical memories and people's self-concept (Wang, 2013). Therefore, possible differences in the development of life narrative coherence due to cultural variations remain to be studied.

Furthermore, 15 minutes may have unduly restrained the narration of longer lives and limited the possibility to create global coherence, most specifically thematic coherence, which requires being able to present a variety of events and then distil a theme. Perhaps with more time allotted, adults might have provided even more thematic coherence to their lives. But differing lengths of life narratives would have reduced the comparability between cohorts in other ways.

Implications

This study has important implications for other fields of psychology, particularly for the fields of narrative development, of self-concept and identity development, and of wisdom. The life story format emerges when the two developmental lines of narrative and self-concept merge in early to mid-adolescence, and this may give rise to the development of wisdom in adulthood.

First, the development of narrative competence during the preschool years allows narrating fictional stories and personal experiences and is generally accomplished by middle to late childhood (Peterson & McCabe, 1983). Autobiographical narratives studied in this line focus on narratives of single memories, which may include several episodes, but generally focus on fairly specific events. To date, narrative development has only rarely been followed through adolescence and adulthood, confirming that narrative structure in autobiographical narratives is developed in middle childhood (Berman & Nir-Sagiv, 2007). However, life narratives differ profoundly from single memory narratives, because their frame of reference is not an event, but a human life, requiring special knowledge about lives and a much more encompassing global text coherence. Life narratives are a specialized, but highly relevant form of narrative, which, as this study strongly suggests, is a later communicative-cognitive achievement than the competence to narrate single event stories. The theory of narrative development thus needs to be extended by adding a specifically adolescent and adult life story format to the standard narrative format. Also, this study adds to the sparse literature on narrative development across adulthood (e.g., Adams, Smith, Nyquist, & Perlmutter, 1997) by highlighting an increase of global thematic coherence up until mid-adulthood. Thematic coherence, however, is a complex phenomenon. Future studies would benefit from identifying additional narrative devices such as explicit statements of recurrent themes in life or metaphors of the self that integrate a variety of experiences.

Second, the life story format offers a diachronic self-concept, going beyond a merely synchronic self-concept. In the preschool years, the self is conceived of in physical terms and global evaluations, then in terms of preferences and specific abilities. In late grade school stable habits and attitudes characterize the self-concept, whereas in early adolescence a concept of underlying traits is developed. Only mid-adolescents begin to use biographical information to construct a diachronic concept of self (Damon & Hart, 1986), in accordance with Erikson's conception of ego-identity as using the life story format.

Most theories comprehend the self - consisting of personality traits, self-concepts, central motives and scripts - as being atemporal. The relationship between an atemporal, synchronous self-concept and personal memories has generally been treated as one of consistency. Klein and

Loftus (1993), for example, demonstrated that trait self-knowledge is stored as such, and not extracted from specific memories each time it is accessed. Rather specific memories may be used to exemplify aspects of the self-concept (e.g., Habermas & de Silveira, 2008), but may also be distorted to increase consistency with the present view of oneself (Conway, 2005). However, there is no clear explanation for when memories inconsistent with the present self remain accessible, when they are distorted or when their accessibility is lowered. We point to the decisive role of the life story and the role of autobiographical reasoning about personal change. The accessibility or degree of distortion of personal memories may not be influenced so much by whether they are consistent with the concept of the present self, but rather by how the individual can integrate them into a more or less coherent life story. Consistency in terms of the sameness of remembered and current self is different from the coherence of a story. The life story format and autobiographical reasoning allow creating self-continuity and identity across change in self and life. Hence, we argue that autobiographical reasoning safeguards the meaningfulness and consistency of the self-concept by explaining how the self changed over time. To the degree that this explanation succeeds, self-defining memories that are no longer consistent with the present self may nevertheless remain accessible or not be distorted.

Third, the life story format may be used to organize knowledge that permits insight, judgment and advice for one's own life and others' lives, that is, personal and general wisdom (Staudinger, 2012). Similar to the life story, wisdom as measured by hypothetical dilemmas develops between adolescence and young adulthood (Pasupathi, Staudinger, & Baltes, 2001). Mickler and Staudinger (20008) argued that wisdom was more difficult to measure in relation to one's own life, so that they chose to measure personal wisdom as the quality of reasoning about oneself from the perspective of a significant other. Admittedly there is a motivational difference between reasoning about one's own or somebody else's life: when narrating the life of a significant other one may not know enough to flesh it out, whereas when narrating one's own life one may be motivated to overlook certain events. However, we believe that the personal form of wisdom can be elicited as autobiographical reasoning about one's own life. This supports the notion that the working through of difficult life experiences may be a decisive factor for developing autobiographical reasoning and resulting personal wisdom (Bluck & Glück, 2004).

Conclusion

Global coherence in entire life narratives emerges in early adolescence and increases significantly up to early adulthood. The development of three aspects of coherence proceeds gradually with age: global temporal coherence emerging first, followed by causal-motivational coherence, and finally by thematic coherence. Specific textual elements contribute to specific aspects of global life narrative coherence. This was demonstrated by predicting the three aspects of global coherence with different textual elements over and beyond the prediction by age. The gradual development of three kinds of coherence suggests that they build upon each other allowing the life narrative to mature in response to current identity tasks.

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Table 1

Age (Mean, Standard Deviation) and Number of Participants by Cohort and Gender for Each Measurement Time

Year	Cohort 1	Cohort 2	Cohort 3	Cohort 4	Cohort 5	Cohort 6	N
2003	8.63	12.45	16.56	20.51			114
	(0.23)	*(0.34)*	*(0.41)*	*(0.53)*			
2007	12.90	16.57	20.70	24.93	41.39	64.38	162
	(0.52)	*(0.41)*	*(0.51)*	*(0.73)*	*(2.86)*	*(2.73)*	
2011	17.03	20.58	24.61	28.90	45.08	68.73	150
	(0.48)	*(0.39)*	*(0.41)*	*(0.67)*	*(3.02)*	*(2.65)*	
N		in 2003			in 2007		
Female	13	17	13	15	14	15	87
Male	14	14	15	13	14	15	85

Table 2

Temporal Macrostructure

Codes with examples

Timing and elaboration of beginning (κ_1 =.988, κ_2=.972)

0 - Unclear: "It all started with me and my mother flying to my father to Oslo."

1 - After birth: "When I was quite small, I got up to a whole lot of mischief"

2 - At birth: „ I was born, and at first I still knew very little"

3 - At birth with objective details: „ I was born in Frankfurt"

4 - At birth with details and story: "I have a twin sister. We were born on December 6 1990 by a Caesarian section."

Timing and elaboration of ending (κ_1 =.882, κ_2=.875)

0-Arbitrary: "A sort of camera was found which didn't belong to us at all. That was big trouble and everybody was always in a bad mood for the rest of the time. That was stupid. And then we made Lasagne. And then we flew back again. Finished."

1-In present: "and today we want to bake biscuits again and go to the Christmas fair. "

2-Only with Retrospect: "I don't know, I have lots of friends whom I've known for a long time, and that just gives me more confidence, that I can talk to people. I think, there's nothing else to tell."

2-Only with Prospect: "What else is there? Well, I'd love to study Medicine and become a doctor, yeah."

3-With both Retro- and Prospect: "I've taken leave. I will go to Switzerland for skiing, have a lovely time for a whole month, then come back, then term starts again. Otherwise life here is still always monotonous as it was at the beginning; you have friends of course, but nevertheless I was used to something quite different. I'm a summer person. I need lots of lovely weather, sun, beach, laughter, simply lots of life, and for me here this is no life. I've made up my mind to do my diploma as quickly as possible and then to buzz off from here. My parents will stay here."

Unmarked Anachrony: Relative frequencies (κ_1 =.859, κ_2=.938)

"That was in kindergarten, I slipped on the stairs. Once I was at home with my mum and I was on the chair, then I fell down with my head on the table, I fainted."

Table 3

Five Groups of Local Indicators of Global Coherence

Type of global coherence	Codes and Examples
Temporal	1a) Temporal indicators: % of propositions (κ_1 =.804, κ_2=.954) Distance from present: "I think this is half a year ago "; "2 years ago". Life phase: "I got to know her in fourth grade"; "When I was a baby" Age: "When I was 9" Calendar date: "In 2002"; "On May 6, 2006". 1b) Temporal disorientation: due to different measures z-standardized variable Date without year: "We married at the 13th of August." Unmarked anachrony: "That was in kindergarten, I slipped on the stairs. Once I was at home with my mum and I was on the chair, then I fell down with my head on the table, I fainted."
Causal	2) Self-event connections engendering change: % of propositions (κ_1 =.742, κ_2=.590) Event explains change in personality: "That journey changed many things for me; in that moment I understood what is meant by the meaning of life, and since then I am a little more self-confident." Event reveals unknown personality aspects: "When I came back to Vietnam, I realized that in the meantime I had grown away from my own culture, the Vietnamese way of life, let's say from these Vietnamese traditional mentalities"
	3) Other autobiographical arguments: % of propositions (first five arguments: κ_1 =.848, κ_2=.842; all arguments κ_1 =.933, κ_2=.915) Developmental status: "At the time I wasn't aware of any of that, after all I was still too young for that." Biographical background: "I really had problems with my teacher, she was my Physics teacher and today, out of defiance, I'm studying Physics." Formative experience: "My burn-out has led me to no longer attach so much importance to money today" Learned lesson: "After that I told myself, when I fall in love, then the next time I must, when I fall in love, take care that school doesn't suffer from that. Generalized Insight: "I was missing him for many months. Probably it's always like that, when it's the first kiss." Turning points: "The fact that all of a sudden the child was there turned my life upside down"
Thematic	4) Self-event connections maintaining stability: % of propositions (κ_1 =.742, κ_2=.590) Personality explains event, event is typical for personality: "In puberty I was always extremely shy and well-behaved. I mean, I never rebelled against anything. So I was very restricted and limited in my ideas and possibilities. That's why I had never a boyfriend. I really was a late bloomer." Event is atypical for, or contradicts personality: "Normally, I and the guys in my class, we are really uncool, I mean very well-behaving the whole time. But on that school trip, we freaked out. Oh man, I was so drunk."

Table 4

Correlations between Global Ratings and Local Indicators with Linear and Quadratic Age Effects Partialled Out

Year	Temporal rating			Causal rating			Thematic rating		
	2003	2007	2011	2003	2007	2011	2003	2007	2011
Temporal rating	—	—	—	.030	.290*	.179*	-.051	.125	.041
Beginning	.169	.254*	.289*	.170	.160*	.091	.185	.112	-.049
Ending	.137	.070	.046	.295*	.234*	.222*	.374*	.213*	.401*
Temporal indicators	.362*	.201*	.293*	-.099	-.136	-.134	-.155	-.096	-.168
Temporal disorientation	-.451*	-.196*	-.236	-.009	-.032	-.123	-.025	-.070	-.092
Causal Rating	.030	.290*	.179*	—	—	—	.570*	.484*	.486*
Other autobio-graphical arguments	-.045	.069	-.061	.534*	.389*	.292*	.345*	.109	.192*
Change-engendering self-event connections	-.102	.047	-.017	.321*	.254*	.249*	.251*	.124	.110
Thematic rating	-.051	.125	.041	.570*	.484*	.486*	—	—	—
Stability-maintaining self-event connections	-.028	-.093	.131	. 231*	.243*	.306*	.369*	.280*	.348*

Note. *$p < .05$.

Table 5

Mixed Models for Age-Related Trends in Temporal Coherence.

| | Growth Model | | | | | | Growth Model with Textual Indicators | | | | | | | |
| | Age 8-28 years | | | Age 40-69 years | | | Age 8-28 years | | | | Age 40-69 years | | | |
	Estimator	SE	t(df)	Estimator	SE	t(df)	Estimator	SE	t(df)	Δχ²	Estimator	SE	t(df)	Δχ²
Fixed Effects														
Intercept	3.8501*	0.152	25.41 (82.1)	5.4698*	0.3078	17.77 (109)	3.987*	0.204	19.52 (137)		5.337*	0.238	22.46 (109)	
Age	0.2953*	0.029	10.27 (150)	0.0092	0.0063	1.49 (109)	0.175*	0.030	5.76 (159)		0.013*	0.006	2.18 (109)	
Age^2	-0.0090*	0.001	-6.69 (144)				-0.005*	0.001	-3.91 (151)					
Disorientation							-53.232*	8.861	-6.01 (122)	37.9	-71.000*	29.369	-2.42 (109)	5.4
Beginning							0.1072*	0.048	2.23 (259)	7.3				
Temporal Indicators							0.057*	0.012	4.80 (278)	22.9	0.053*	0.023	2.29 (109)	5.1
Random Effects														
Intercept	0.3735	0.190					0.193	0.123						
Covariance (Intercept, Age)	-0.0266	0.016					-0.012	0.011						
Age	0.0019	0.001		0.693	0.094		0.001	0.001						
Residual (1)	0.4794	0.108					0.371	0.073						
Residual (2)	0.7236	0.112					0.651	0.098						
Residual (3)	0.4744	0.093					0.412	0.073						
Model fit														
Deviance	751.7			269.4			682.4				258.9			

Note. Nonstandardized estimates of fixed effects and random effects are presented. *t*-Tests for fixed effects in the full models are based on Kenward-Roger degrees of freedom (see Littell, Milliken, Stroup, Wolfinger, & Schabenberger, 2006). Textual indicators were tested sequentially with Δχ² tests (*df* = 1) based on model deviance (-2Log-Likelihood), that is, it was tested whether the effect was significant when entered in addition to all effects above it. For younger participants, residual variance was allowed to differ across the three occasions indicated by the numbers in parentheses. Random effects were not tested for significance individually. *p < .05.

Table 6

Mixed Models for Age-Related Trends in Causal-Motivational Coherence.

| | Growth Model | | | | | | Growth Model with Textual Indicators | | | | | | | |
| | Age 8-28 years | | | Age 40-69 years | | | Age 8-28 years | | | | Age 40-69 years | | | |
	Estimator	SE	t(df)	Estimator	SE	t(df)	Estimator	SE	t(df)	$\Delta\chi^2$	Estimator	SE	t(df)	$\Delta\chi^2$
Fixed Effects														
Intercept	0.955*	0.133	7.19 (104)	4.170*	0.239	17.42 (64.1)	0.816*	0.122	6.68 (112)		3.9229*	0.245	16.01 (74.3)	
Age	0.329*	0.032	10.31 (176)	0.016	0.012	1.34 (65.2)	0.171*	0.035	4.87 (223)		0.0163	0.0114	1.43 (63)	
Age^2	-0.007*	0.002	-4.35 (211)				-0.001	0.002	-0.34 (253)				-4.35 (211)	
Change-engendering self-event connections							0.852*	0.147	5.79 (251)	46.1	0.6111*	0.2214	2.76 (91.8)	7.5
Other autobiographical arguments							0.583*	0.153	3.81 (225)	7.3				
Ending							0.321*	0.087	3.68 (283)	14.3				
Age x Other autobiographical arguments							-0.037*	0.012	-2.98 (292)	8.8				
Random Effects														
Intercept				0.902*	0.284						0.752	0.262		
Age	0.004	0.001					0.002	0.001						
Residual (1)	0.630	0.099		0.945	0.188		0.477	0.074			0.932	0.188		
Residual (2)	0.771	0.134					0.675	0.117						
Residual (3)	1.136	0.215					1.117	0.195						
Model fit														
Deviance		928.4			362.3			851.9				354.8		

Note. Nonstandardized estimates of fixed effects and random effects are presented. *t*-Tests for fixed effects in the full models are based on Kenward-Roger degrees of freedom (see Littell, Milliken, Stroup, Wolfinger, & Schabenberger, 2006). Textual indicators were tested sequentially with $\Delta\chi^2$ tests (*df* = 1) based on model deviance (-2Log-Likelihood), that is, it was tested whether the effect was significant when entered in addition to all effects above it. For younger participants, residual variance was allowed to differ across the three occasions indicated by the numbers in parentheses. Random effects were not tested for significance individually. *p* < .05.

Table 7

Mixed Models for Age-Related Trends in Thematic Coherence.

	Growth Model						Growth Model with Textual Indicators							
	Age 8-28 years			Age 40-69 years			Age 8-28 years				Age 40-69 years			
	Estimator	SE	t(df)	Estimator	SE	t(df)	Estimator	SE	t(df)	Δχ²	Estimator	SE	t(df)	Δχ²
Fixed Effects														
Intercept	1.522*	0.179	8.52 (144)	5.274*	0.192	27.41 (109)	1.430*	0.169	8.44 (145)		3.659*	0.379	9.64 (109)	
Age	0.251*	0.038	6.60 (211)	-0.002	0.010	-0.18 (109)	0.130*	0.041	3.19 (257)		0.008	0.009	0.87 (109)	
Age²	-0.006*	0.002	-3.07 (237)				-0.002	0.002	-0.98 (256)					
Stability-maintaining self-event connections							0.856*	0.166	5.17 (286)	30.6	0.429*	0.197	2.18 (109)	8.9
Ending							0.386*	0.098	3.93 (283)	15.1	0.703*	0.178	3.94 (109)	14.5
Random Effects														
Age	0.002	0.001					0.001	0.001						
Residual (1)	1.235	0.172		1.635	0.222		1.061	0.148			1.318	0.179		
Residual (2)	1.136	0.177					1.108	0.171						
Residual (3)	0.765	0.170					0.793	0.155						
Model fit														
Deviance	970.6			362.9			924,9				339.5			

Note. Nonstandardized estimates of fixed effects and random effects are presented. *t*-Tests for fixed effects in the full models are based on Kenward-Roger degrees of freedom (see Littell, Milliken, Stroup, Wolfinger, & Schabenberger, 2006). Textual indicators were tested sequentially with $\Delta\chi^2$ tests (*df* = 1) based on model deviance (-2Log-Likelihood), that is, it was tested whether the effect was significant when entered in addition to all effects above it . For younger participants, residual variance was allowed to differ across the three occasions indicated by the numbers in parentheses. Random effects were not tested for significance individually. *p < .05.
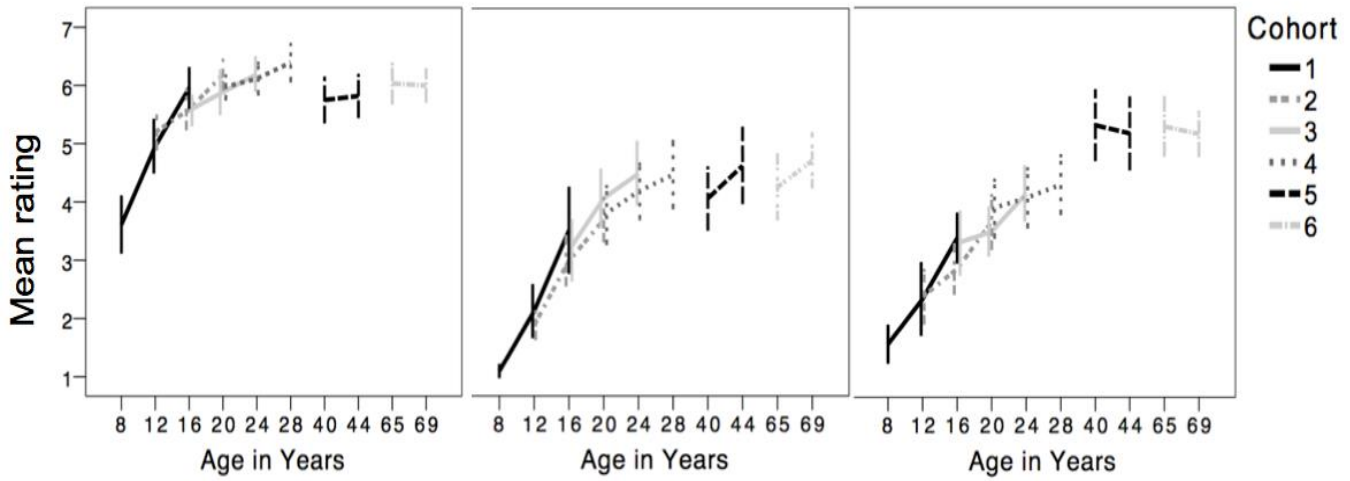
Figure 1. Mean global ratings and confidence intervals (95%) for temporal (left), causal-motivational (middle), and thematic coherence (right).
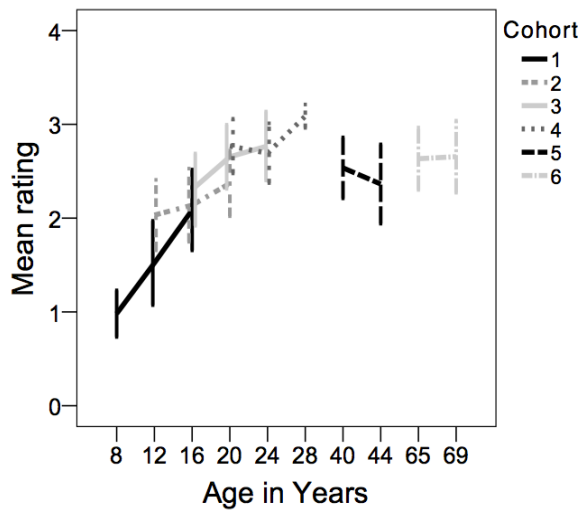

Figure 2. Mean rating and confidence intervals (95%) for beginnings.
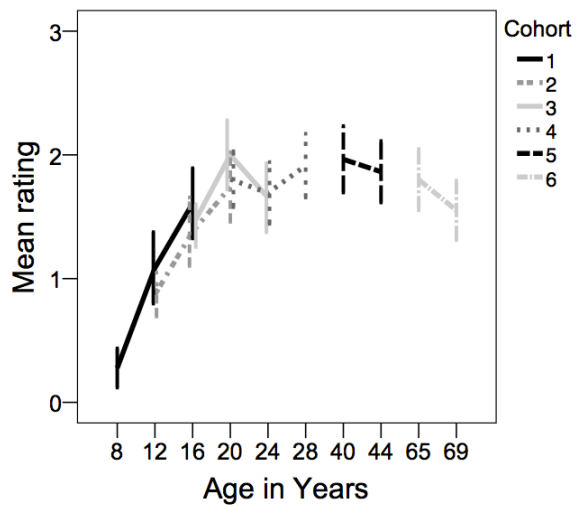
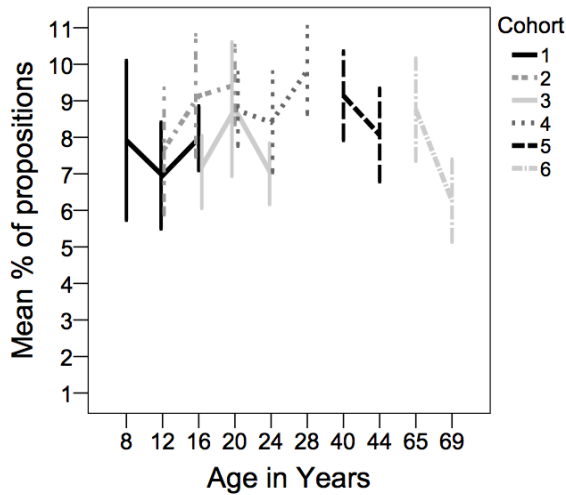*Figure 3.* Mean rating and confidence intervals (95%) for endings.

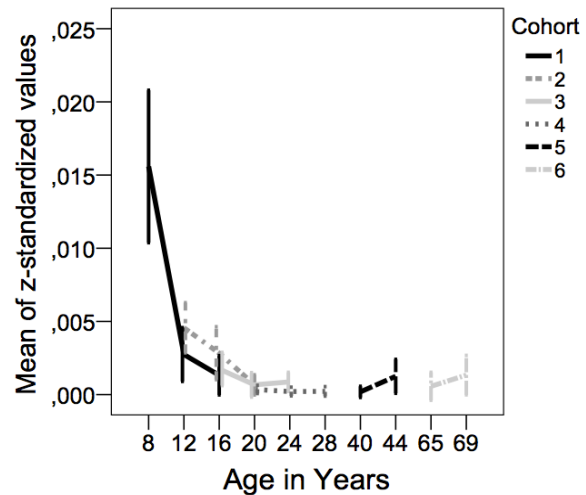*Figure 4*. Mean percentages and confidence intervals (95%) for temporal indicators.

Figure 5. Mean z-standardized values for temporal disorientation.
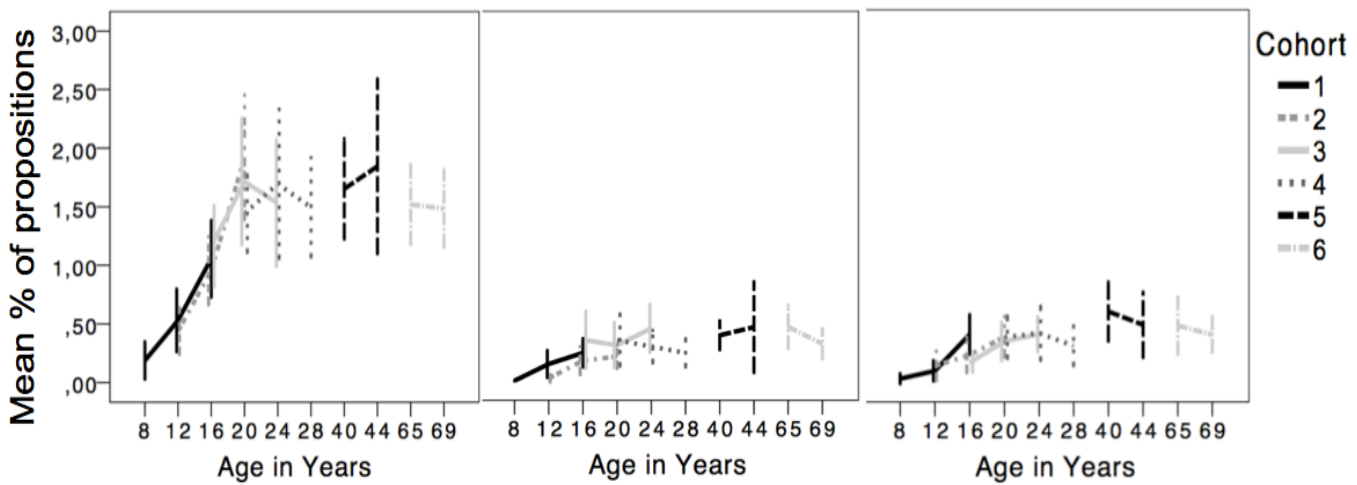

Figure 6. Mean percentages and confidence intervals (95%) for other autobiographical arguments (left), change-engendering (middle) and stability-maintaining (right) self-event connections.