

The Development of Global Coherence in Life Narratives across Adolescence:
Temporal, Causal and Thematic Aspects

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Abstract

Extending the study of autobiographical narratives to entire life narratives, we tested the emergence of globally coherent life narratives in adolescence, as hypothesized by McAdams (1985). A total of 102 8-, 12-, 16- and 20-year-olds narrated their lives twice. Half of each age group participated in tasks designed to train autobiographical reasoning between narrations, the other half participated in control tasks. Coherence was measured by the relative frequency of local temporal, causal, and thematic linguistic indicators identified qualitatively at the level of propositions, as well as by quantitative global rating scales measuring the impressions of the listeners. Coherence increased across the age span. Overall, repeated narrating and training did not increase coherence. Crystallized and fluid intelligence, number of negative life events, and frequency of biographical practices and confiding in others did not contribute substantially to the prediction of coherence beyond age. Results are interpreted in the context of adolescent identity development.

Key words: life narratives, adolescence, autobiographical reasoning, life story, autobiographical memory

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Based on early memory abilities such as deferred imitation and recognition (Bauer, 2006) autobiographical remembering and a corresponding autobiographical self emerge with the ability to verbally refer to past episodes as experienced by the self, which, by the end of the preschool years, are organized by the acquisition of the story structure (Nelson & Fivush, 2004). The life story is a coherent organization of multiple single narratives which are interweaved within the context of the personal development of the individual. The study presented here sets out to demonstrate that the development of the organization of narrative remembering continues beyond childhood. We present the first attempt to systematically test McAdams' (1985) hypothesis that the life story develops first in adolescence. We set out by delineating the theoretical background, then the developmental context of the emergence of the life story. Finally we introduce the conceptual framework and research strategy pursued in this study.

Identity and the Life Story

The term life story can be used in an objective sense to designate the course of a life as seen from an observer's point of view, in terms of what really has happened in a life. Sociologists and anthropologists are interested in this aspect of lives, which is often termed *life history*. We will here reserve the term life story for the subjective representation of the course of a life, as it is retrospectively remembered, reflected upon, or narrated.

Life stories are used in various contexts in everyday life. They are used to identify individuals, such as in personnel files or criminal files, and they are used to introduce oneself to others, both when getting to know someone more intimately and when applying for a job. Biographies are written about exemplary lives, autobiographies are written to publicize

interesting facts about oneself and to explain and justify how one has become the person one is at present.

In psychology, the intimate link between subjective accounts of one's own development and personality has been used by clinicians (Freud, 1905) and personality psychologists (Allport, 1942; McAdams & Pals, 2006) as a rationale for using autobiographical material as a source of detailed information about an individual. But it was not until Erikson (1968) that the development of a subjective life story was made the hallmark of the attainment of a mature psychosocial identity, occurring typically by the end of adolescence. Erikson created the concept of psychosocial identity to integrate social, clinical, and developmental aspects of identity. It defines a person's individuality, consistency across situations, and continuity across time, requiring the creation of coherence between different role demands and identifications across situations and across development, as well as the synthesis of social, moral and hedonistic demands. A well-integrated identity provides a feeling of well-being, a background sense of self-sameness and continuity, a sense of being at home in one's body, a sense of purpose and direction, and an anticipation of being confirmed by significant others (Erikson, 1968).

Erikson's specific developmental hypothesis is that in modern societies, a new, complex and flexible form of identity, ego-identity, has to be achieved in adolescence. Adolescence requires going beyond childhood identifications by consciously confirming or repudiating identifications, and creating a self-chosen and unique synthesis of commitments to values and roles. Erikson implies that ego-identity needs to be organized not only synchronously, based on identifications with roles, but first of all diachronically as a life story. Only a self that is defined by its history can include the highly individual choices made in adolescent identity exploration, and will prove more flexible when adapting to continuing change throughout adulthood.

In more recent theorizing, the continuing malleability of identity across adulthood has been stressed (Gregg, 2006; Kroger, 2007). Although Erikson underscored the importance of enduring commitments formed in adolescence, the flexible form of the life story is especially well-suited to integrate change across adulthood (Pals, 2006). That identity development implies a certain stability, however, is evidenced by the so-called reminiscence bump of autobiographical memories, which describes a relative oversampling of memories from adolescence relative to other times of life (Rubin, Rahhal, & Poon, 1998). In the case of migrants the oversampled period is shifted to the time in life in which they migrated (Schrauf & Rubin, 2001), underscoring that periods formative of identity, most typically adolescence, do leave a stable trace.

Whereas Erikson never defined the life story as a theoretical concept, McAdams (1985) explicitly spoke of the life story as a narrative, theorizing that identity takes on the form of a life story in adolescence. McAdams proposes that ego identity manifests itself in the “good” form of a life narrative, in its coherence and consistency. McAdams’ thesis does not mean that after adolescence identity does not change anymore, but only that it is then that it first takes on the form of a life story, and it is from then on that it is subjected to norms of global textual coherence. Coherence concerns relations between elements of a text at one point in time and is not to be confounded with notions of stability across time.

McAdams’ claim that a coherent life story develops first in adolescence has, however, never been tested. Empirical research on psychosocial identity and the life story has been hampered by the abstractness and complexity of both concepts. The past 15 years have seen the development of a rich field of research into narrative identity, which, again following McAdams (1985), has used autobiographical memory narratives of single episodes (cf. Singer, 2004). But McAdam’s

interest in the life story is directed towards differences between persons and not so much towards development. In keeping with this personological approach, these studies use single memories as typical examples of the life story that reflect the person’s individuality (e.g., McAdams et al., 2006), but have not studied the specific form of a coherent life story in adolescence.

The life story may be considered the most comprehensive form of describing an individual. The life story also serves to create a sense of coherence, unity and purpose, which is considered to be of prime importance for mental health and well-being (Antonovsky, 1985; Kernberg, 1984). Therefore the development of the life story merits study.

Developmental Precursors of the Life Story

When the ability to construct coherent life narratives emerges, two previously independent developmental lines merge: the development of narrative and the development of the person concept. The life story adds a diachronic dimension to personality and contextualizes past events within personality, or the self. We maintain that in adolescence, the person concept becomes historical, and narrative becomes explicitly linked with the development of the self.

We have reviewed probable motivational and cognitive developmental precursors to the emergence of the life story in detail elsewhere (Habermas & Bluck, 2000). In a general vein, social-cognitive development in adolescence allows the construction of complex reflective thinking (Fischer & Pruyne, 2003) and the complex combination of information from the situation and from the individual’s history to predict behavior (Marini & Case, 1994). More specifically, the development of the person concept in adolescence provides some support for the development of the life story in adolescence. The person concept develops from an additive model of unrelated habits to a unified psychological conception of personality in early

adolescence. In mid- to late adolescence a biographical dimension is added to the self-concept (Gurucharri & Selman, 1982; Damon & Hart, 1986).

Narrative is a universal, basic form not only of remembering, but also of sharing and understanding experiences. The narrative sequence follows the sequence of original events, and narrative interprets and evaluates what has happened (Labov & Waletzky, 1967). Children learn to narrate events in their preschool years and improve their skill during grade school years (Peterson & McCabe, 1983). They learn to narrate in conversations with parents who implicitly teach how to narrate by asking, complementing, and evaluating (Fivush, 2001). By the end of grade school the ability to recount experiences is in place. Some childhood researchers seem to suggest that narrative development or the development of a narrative identity reach their endpoint in early (Stern, 1989) or late childhood (Nelson, 1998). However, only in early adolescence does the ability to coordinate several episodes into a hierarchically organized, multi-episode narrative (van den Broek, Lynch, & Naslund, 2003) emerge.

Two developmental studies of adolescent narrative development did show that adolescents increasingly use biographical information to understand others. McKeough and Genreux (2003) asked 10-, 12-, 14-, and 17-year-olds to write a story about someone with a problem and to include flashbacks that provide a biographical background to the character. Flashbacks increased in frequency with age, as did their interpretative quality. Feldman, Bruner, Kalmar, and Renderer (1993) studied the comprehension of a short story by preadolescents, late adolescents, and adults. Only the older adolescents and adults included biographical information about the protagonist to explain and predict his actions.

A third developmental line relates more indirectly to the development of the life story. We argue that constructing coherence in a life narrative requires complex interpretative abilities and,

correspondingly, the awareness that the facts of a life do not in themselves suffice to make a convincing true story, but that a life needs to be interpreted and evaluated. There is pervasive evidence that epistemological reasoning develops throughout adolescence, with an awareness of the necessity of interpretation emerging only in mid-adolescence (King & Kitchener, 2004).

In addition to cognitive factors, the formation of a life story is probably motivated by corresponding societal demands. These are reflected in biographical practices such as writing diaries, collecting memorabilia, photographs and videos, reading biographies, and discussing personal problems with close friends or parents.

Conceptual Framework and Research Strategy

To test the claim that the life story develops first in adolescence (McAdams, 1985), some conceptual differentiations need to be introduced (cf. Habermas & Bluck, 2000). The *life story* is defined by the coherence it creates among different circumstances and events in an individual life, and between these and the development of the individual's personality, including his or her central values and life decisions. Like McAdams, we treat the term life story as the overarching theoretical concept. McAdams' idea of an internalized life story together with the literary theorist Philippe Lejeune's (1994) idea that everybody carries with him or her a raw version of her or his life story that is continuously updated and revised, suggest a skeletal knowledge structure or *life story schema* (Bluck & Habermas, 2000) containing the macrostructure of one's life story. It may be conceived of as the top level in a hierarchical model of the knowledge base of autobiographical memory, which is activated whenever remembering or reflecting on the personal past in the context of one's life (Conway, Singer, & Tagini, 2004). While the life story schema is a hypothetical construct, the life story manifests itself in two classes of phenomena. Entire *life narratives* are linguistic products and are the most specific manifestation of the life

story. They may vary with the specific circumstances of their production, such as who they are told to, for which purpose, and at which age. Still listeners expect life narratives to vary only within the limits of historical truth (Conway, Singer, & Tagini, 2004). Listeners also expect life narratives to be coherent and to explain how the narrator has become the person he or she is now. Thus it is not enough to simply add narratives of specific incidents to each other without connecting them, even if these are coherent within themselves. What is required is more than local coherence between sentences or within single narratives. A life narrative requires *global coherence*.

Life narratives are rarely produced in their entirety. The life story manifests itself most frequently in a partial fashion in what we term *autobiographical reasoning* (Habermas & Bluck, 2000). It may show in arguments and narratives that establish links between distant parts of the personal past and the personal present, between life experiences and the development of personality.

In text linguistics, overall global coherence is understood to be “a complex, composite meta-phenomenon, involving multiple strands” (Givon, 1995, p. 59). We have suggested that four kinds of coherence are decisive for the overall global coherence of life narratives (Habermas & Bluck, 2000). Global *temporal coherence* in life narratives refers to the listener’s orientation as to at which point a given event has taken place in the narrator’s life. Global *causal coherence* in life narratives refers to the listener’s orientation as to how actions and changes in personality are caused and motivated by biographical experiences. Both temporal and causal coherence help the listener to put events into sequence and to bridge change by providing temporal or causal-motivational links. Global *thematic coherence* refers to the reader’s orientation as to which are the dominant thematic strands in the life. Dominant themes create coherence by repeating and

varying the same theme again and again. A fourth kind of coherence is specific to life narratives, which is coherence with a *cultural concept of biography*. The more a life narrative conforms to cultural expectations of what a life story should look like, the more the listener is able to follow the narrative. In this paper, we will be concerned with the first three kinds of textual coherence. Conformity with the cultural concept of biography has also been studied with the sample used in this study by comparing the seven most important memories selected for the life narratives with a list of normatively salient biographical life events (Habermas, 2007; cf. Berntsen & Rubin, 2004).

The only other developmental study of free standing responses upon being asked for a life narrative did not aim at measuring textual coherence but at describing the grammatical means used to construct a responsible and active self, analyzing the use of modal verbs in a total of 36 five-, eight- and twelve-year olds (Quigley, 2000). However, Quigley only informally observes that the 12-year olds’ anxiousness to conform to expected patterns of autobiography shows that it is only at this age that children try to create a globally cohering autobiographical self in the strict sense (Quigley, 2000, p. 158).

We argue that in order to study the development of a coherent life story, it is necessary to construct measures of global coherence. We pursue two different strategies, one based on global impressions of the listener or reader, the other based on formal elements of the text itself. Listener-based ratings of aspects of global coherence do the greatest justice to the global nature of coherence (cf. Fiese, Sameroff, Grotevant, Wamboldt, Dickstein & Fravel, 1999). Because life narratives are complex texts, and coherence is a complex, multifaceted phenomenon, global ratings are a very coarse measure that should be complemented by more objective, text-based measures. Ratings of global coherence can only be applied to entire narratives, whereas local

indicators of global coherence may also be identified in more partial autobiographical texts such as narratives of single memories. Here we only report measures used in whole life narratives, while a separate test of autobiographical reasoning regarding one specific episode will be reported elsewhere (Habermas, Fröhlich, & Diel, 2007).

To test the hypothesis that a coherent life story develops first in adolescence, we had to develop an approach to autobiographical narratives that differs from other approaches because our aim is to differentiate globally coherent from globally non-coherent (Linde, 1993) narratives. First, we analyze entire life narratives, not just narratives of single memories. Second, we complement ratings of the entire text with an analysis of formal syntactic-semantic elements. Third, we assume that the contribution of these local elements to global coherence is additive, so that relative frequency of indicators may be used as a continuous measure of degree of local contributions to global coherence. Fourth, we do not interview participants by asking a series of questions, but invite them to produce a free standing monologue in order to minimize the influence of the interviewer on how much or little coherence is created. To compensate for the absence of probing and countersuggestions, which are essential in the Piagetian tradition to test for cognitive competence, several elements were introduced into the task and the design to maximize participants' production of coherence (see below). Fifth, oral and not written life narratives were collected to lower the threshold for producing narratives and to eliminate writing skill and ease as an additional factor contributing to the resulting narratives.

We briefly present the rationale for defining local indicators of global coherence and rating scales and review the few studies in which they have been used. Almost all indicators used in this study were developed in an earlier, exploratory study with a total of 12 12-, 15-, and 18-

year-olds and found to increase with age (Habermas & Paha, 2001). Indicators are grouped into temporal, causal, and thematic indicators.

Temporal indicators that contribute to global temporal coherence are all those specifications which allow the listener to locate events in the frame of the narrator's life, such as specifications of age, life phase, date, and distance to the present. Temporal specifications that relate only to other parts of the narrative, such as 'and then' or 'three days earlier' do not by themselves contribute to global temporal coherence in a life narrative.

Causal relations in a text express natural causes of events or human motives for actions and evaluations. A mere count of causal relations, however, does not distinguish whether they contribute to local or global coherence. We argue that if one of the *causally linked statements covers an extended period of time*, this may indicate that the causal relation contributes to global coherence. In a study of wisdom narratives of late adolescents, middle, and older adults (Bluck & Glück, 2004), causal connections between an event and later life were named increasingly with age.

Linde (1993) defined two more specifically biographical indicators of causal coherence in life narratives, namely *explanations of actions in terms of personality*, and, vice versa, *explanations of (changes in) personality by events*. Pasupathi found an increase in these indicators across adulthood up to age 60 in some types of narratives (Pasupathi & Mansour, 2006; cf. Pasupathi, Mansour & Brubaker, 2007).

Causal coherence is also supported by *biographical arguments* which create causal connections within the frame of life without requiring explicit causal syntactic links. Two biographical arguments are *learning a lesson* for similar future situations and extracting an abstract *life maxim* from an experience (McCabe, Capron, & Peterson, 1991; Pratt, Arnold,

Norris, & Filyer, 1999). McLean and Thorne (2003; McLean, 2005; Thorne, McLean, & Lawrence, 2004) found either lessons or life maxims in 20% to 30% of narratives of single memories by young adults. Bluck and Glück (2004) found an increase of lessons learned and maxims mentioned in wisdom-related memories between adolescence and mid-adulthood.

Thematic coherence is inherently more content-based and thus harder to grasp for a formal approach to coherence such as ours. Thematic coherence is created by relations of analogy or similarity, such as those which are created by nuclear or prototypical episodes and their variants (McAdams, 1985). These, however, tend to be highly individualistic. A more formal means to create global coherence is found in *exemplifications*. In autobiographical narratives, general statements are often backed up by specific episodes that illustrate them (Schütze, 1984), thereby creating a hierarchical thematic link between general statement and specific instance.

Thematic coherence may be enhanced by the interpretive activity of the narrator. While the development of a subjective perspective in narrative begins at preschool age with the inclusion of evaluative statements (Fivush, 2001), only adolescents begin to realize the necessity of interpreting past events by relating a variety of subjective perspectives and circumstances, as described by studies of epistemological reasoning (King & Kitchener, 2004).

Although we do expect local indicators to contribute mostly to one kind of coherence, this does not preclude that they also contribute to other kinds of coherence. For instance, temporal order also offers information about implicit causal relations. In addition to the local indicators, we constructed three rating scales to measure one aspect of each kind of global coherence for the whole narrative. We expected local indicators contributing to a specific aspect of coherence to correlate with the corresponding global rating.

As for the relative timing of the development of the three kinds of coherence, we expected temporal coherence to develop first, followed by causal and then thematic coherence (Habermas & Bluck, 2000). To measure ability and not just chance performance, participants need to be enabled and motivated to narrate as coherently as they can. We therefore reduced the memory load of the task, which is extraneous to the central ability to create coherence and differentially affects participants of different ages. In addition, we asked for life narratives twice, two weeks apart, giving one half of each age group a biographical training, while the control group was given formally equivalent tasks with an unrelated content. We expected a combined effect of mere repetition with training, so that the second life narratives of the training group could be interpreted as reflecting ability more than the first narratives.

Three predictors of coherence other than age were also measured. Crystallized intelligence has been found to be somewhat related to the quality of personal narratives (Pratt & Robins, 1991) and to the amount of free eyewitness recall, while there seems to be no relation to fluid intelligence (cf. Henry & Gudjonsson, 2007). We explored the possible contribution of crystallized and fluid intelligence to the telling of coherent life narratives. Secondly, it is generally assumed that a major motivation to think about and create coherence in life is the experience of unexpected events and turning points in life. This expectation is supported by the finding that negative events are narrated and elaborated more extensively than positive ones (Baumeister, Bratslavsky, Finkenauer & Vohs, 2001). We therefore asked participants to name the number of negative life events experienced. Thirdly, creating coherence in life narratives may be facilitated by everyday practices of discussing problems with others as well as by biographical practices such as reading biographies or writing a diary.

This study tested the general hypothesis that the life story develops first during adolescence, predicting an increase in a variety of indicators and ratings of temporal, causal, and thematic coherence in life narratives. To ensure that we measured ability, participants were motivated to perform at their maximum level by training and repeated measurement. Therefore we also expected the maximum coherence to result in the second measurement after the training. The main hypothesis was complemented by the second hypothesis that coherence was also predicted, in addition to age, by intelligence, negative life events, and frequency of biographical practices. Finally we tested the third hypothesis that measures of global coherence correlated with the corresponding global rating.

Although this study is focused on general development, we will also test coherence for gender effects, because there is some evidence that females narrate more, narrate more specific events, and include more emotion words (Fivush, Brotman, Buckner, & Goodman, 2000; Pillemer, Wink, DiDonao, & Sanborn, 2003), although gender differences are not always found (Habermas, Ott, Schubert, Schneider, & Pate, in press).

Method

Participants

A total of 102 participants was divided into four groups with 25 eight-year-olds ($M = 8.70$, $SD = .24$), 27 twelve-year-olds ($M = 12.50$, $SD = .37$), 25 sixteen-year-olds ($M = 16.62$, $SD = .45$), and 25 twenty-year-olds ($M = 20.57$, $SD = .49$), almost equally divided between the sexes, with 12, 14, 12, and 13 girls and young women included in the four age groups respectively. Six other participants from all four age groups had to be excluded due to technical problems or unwillingness to narrate.

The youngest were sampled from the top of the three classes of an elementary school in

Frankfurt am Main, since in Germany children are sent to different levels of school at age 10, Gymnasium being the top level. The 12- and 16-year-olds were sampled from three classes of an average Frankfurt secondary school, Gymnasium, comparable in the mixed social composition of its students to the elementary school. The oldest age group was sampled from former students of the same Gymnasium. The three younger groups were approached via their parents. We presented the study at the parents' meetings of each of the three classes in each age group, with each class comprising between 24 and 32 students. Parents willing to participate returned written informed consent by mail. The addresses of the oldest group were taken from published 'graduation journals' of the school, and former students were approached by mail. About 38% of participants had at least one parent with a migrant background, ranging from East Asia to the Americas, Southern and Eastern Europe and the Near East, distributed about equally between the age groups. All participants spoke German fluently. Each participant received € 20.

Procedure

All participants were tested twice, two weeks apart, by two different (out of three) female interviewers, who were distributed equally across conditions. In the first session they recounted a life narrative. Roughly half of each age group (13, 14, 13, and 12 respectively in each age group), divided about equally between the sexes, was trained by performing biography-related tasks to enhance their ability to create a coherent life narrative. One such task was the Autobiographical Reasoning Interview (Habermas & Fröhlich, 2007), in which one significant event not told in the life narrative is asked to be related temporally, causally, and thematically to other parts of life by posing specific questions. Two other tasks asked for the normative age of 25 life events and whether each of 40 life events were to be included or excluded from a life narrative (Habermas, 2007). Here they were to be treated merely as training devices. The control

group was also divided roughly equally between age and sex, with a total of 49 participants. They performed three tasks which were structurally similar to the training tasks, but focused on neutral topics. Two weeks later, participants again recounted their life story and answered a series of questionnaires. Sessions lasted between 45 and 60 minutes.

Material

Intelligence. Fluid intelligence was measured with the digit-symbol substitution subtest, crystallized intelligence with the vocabulary subtest of the German version of the Wechsler Intelligence Scale for Children – R (Tewes, 1991) or, for the 20-year-olds, with the German version of the Wechsler Adult Intelligence Scales (Tewes, Rossmann & Schallberger, 1991). IQ-values were higher in the group of 8-year-olds for both measures. Therefore we z-standardized IQ scores separately for each age group.

Life events. Participants were asked whether they had ever experienced 14 specific life events, taken from a German study of adolescents (Geyer, 1992a, b): death of parent, severe illness, suicidal ideation, separation of parents, death of grandparent, loss of friend, parent job losses, drop out of job training, birth of sibling, relocation, difficult final exam, leaving parental home to go to school, change of school, and mandatory repetition of a school year.

Biographical practices. The frequency of five biographical practices (keeping a diary, writing poems, looking at old pictures, reading old letters, reading biographies) and of confiding in same- and cross-gender parent and friend (Zinnecker, 1985) were reported on a 9-point scale ranging from *very often* to *never*. Biographical practices had a moderate reliability of $\alpha = .68$, confiding in others of $\alpha = .60$.

Seven most important memories and life narratives. Participants were instructed twice, two weeks apart, to recount their life stories for about 15 minutes. They were informed that the

second interviewer did not know the first life narrative. Prior to recounting their life, they wrote their seven most important specific memories on index cards and ordered them in chronological order on the table in front of them. They were instructed to include these seven memories in their life narratives. The selection of the seven most important memories served two ends: We wanted to make sure that all participants recounted specific events so that they had to integrate these into their life narrative, and we wanted to prevent them from providing simply a very general summary description of their life. Furthermore the cards served to reduce the memory load, especially for the youngest age group.

Instructions said “First I’d like to ask you to think about the seven most important events which happened in your life. These may be events that have just happened or they may have happened a long time ago. Then please write your seven most important memories on these seven cards. Please name only memories of very specific events. [...] Now please arrange these cards in the order in which they have happened on the table in front of you.” The following life narrative instruction said: “Next I’d like you to tell me a story involving your whole life. Please think about all the events that have happened in your life since you were born. Please integrate the seven events into your story. For example you can tell me about the most important events in your life and the biggest changes. You can tell me things which someone like me, who doesn’t know you, might like to know about you. You can also tell me how what you have experienced is still important to you today and how it has influenced what kind of person you are today. Please take about 15 minutes time to tell your story. I will not interrupt you. After 10 minutes I will tell you that you still have another five minutes. There are no right or wrong answers.” Participants were asked to repeat the instruction to make sure they had understood it. Interviewers did not intervene in the narrative, but encouraged participants to continue whenever

necessary. After the life narrative, participants dated all seven most important memories. The additional eight participants told their lives without first being asked for important memories, so as to explore the intended supportive effect of the memory cards for the younger children and to exclude other distorting effects introduced by the memory cards.

Transcription, segmentation, and interrater reliabilities. Each life narrative was tape recorded and transcribed verbatim. The text was divided into propositions. Propositions were defined as all main or subordinate clauses that were understandable, even when incomplete, or as a causal prepositional construction such as ‘because of ...’ This allowed all causal relations to be coded. Incomplete sentences that were not understandable were not counted as propositions. The following example is the beginning of a life narrative of an eight-year old. Slashes separate propositions:

“Well, first thing, I -, I was born / and then I grew bigger and bigger / and then was – my first birthday with lots and lots of presents, and um many things / and then um my parents of course had to work / so they sent me to Kindergarten and not to baby nursery / because – she because a friend of my mother worked in kindergarten / and that is better / because otherwise be- become come af- so afraid / ...” (translated by the first author)

Two coders independently divided twenty life narratives balanced for sex, age, training vs. control group, and measurement time into propositions, agreeing on 98.6% of the propositions. The remaining life narratives were divided into propositions, half by each coder.

Then groups of three coders worked on seven groups of codes (temporal indicators, causal relations and exemplifications, time span covered by statement, biographical arguments, hedges, cognitive processes, comparisons between then and now), refining a manual that had been successfully used in the aforementioned exploratory study (Habermas & Paha, 2001). The two

local indicators referring to causal links were constructed by combining the coding of causal relations and the coding of the time span covered by the causally related statements, while the other local indicators corresponded to the codes identified in the texts. Codes are categorical and were coded for presence or absence in each proposition. Due to the dropout of one collaborator, the interrater reliabilities could not be based on three coders for all codes. Therefore only four out of the original seven Kappas are based on three coders (for these we report averaged Kappas). Of the latter codes, we failed to reach a very good level of agreement for one code, comparison between today and then, which remained around $\kappa = .70$. Rating scales were created for this study (see below) and applied by two judges. All reliabilities are based on the independent coding or rating of twenty life narratives balanced for age, gender, treatment, and measurement time. Coders were initially blind to these characteristics, but narratives often contained clues for age and gender. Coders were informed about the general thesis of the study, but not about the hypotheses for single codes. After a good agreement of at least $\kappa = .87$ or $r_{ic} = .80$ respectively was reached, one judge coded all the remaining narratives, while conflicting codes for narratives used for exercise were resolved by discussion. To ensure that the one coder did not deviate from the manual in the course of coding the remaining narratives, the other (one or two) judge(s) coded eight extra narratives located at about one third and two thirds the way through the remaining narratives to calculate agreement also in later phases of coding.

Most local indicators of global coherence were taken from an earlier, exploratory study of the development of a coherent life story of 12-, 15- and 18-year olds ($N = 12$; Habermas & Paha, 2001). We present one group of indicators for temporal coherence, and three groups each for causal and thematic coherence. The indicators of causal coherence include causally related statements which cover an extended span of time, causal relations between statements about

events and personality, and a group of five biographical arguments. The indicators of thematic coherence include exemplifications, specific hedges, and statements about specific complex cognitive processes (see Table 1 for examples).

Indicators of temporal coherence. Several kinds of temporal indicators were identified which allow the listener to locate an event in the life of the narrator (initial κ based on 20 life narratives = .90, second κ based on two sets of four life narratives = .93).

Indicators of causal coherence. Two indicators of global coherence were constructed by combining two codes. The first code was causal relations, the second the temporal extension of causally related statements. Propositions were coded as causally related if they were causally related in the strict sense ('because') or consecutive ('so that'), contrastive ('although', 'nevertheless'), conditional ('if ... then'), or instrumental ('in order to') following Sanders, Spooren, and Noordman (1992, 1993; first κ = .88, second κ = .90).

To distinguish between causal relations contributing to local and to global coherence, we also coded the temporal extension of each causally related proposition. We coded circumscribed events shorter than one month ('and then he hit me, so that ...'), extended events lasting longer than one month ('in grade school I never fought with others, although ...'), and statements about personality, i.e. about a personal state lasting longer than a month. This latter category of personality included personality traits ('I was someone who could never admit he was wrong') basic values ('caring for my family is what is most important to me in my life'), and biographical facts such as place of residence, profession, enduring physical attributes. We also coded expressions of those personal states which are typically used by children to describe persons, namely global social attitudes ('nice'), preferences ('I love spinach'), abilities ('She was so good in basketball'), and habits ('I used to play soccer'; cf. Selman, 1980; κ = .87, second κ = .90).

Two related indicators of global causal coherence were constructed from causally related statements. The first indicator 'causally related statements of long duration' identifies causally related propositions concerning extended events or personality, thereby contributing to global coherence. Secondly, we defined two codes for causal relations between statements about personality and statements about events (of short or extended duration). Personality may be used to explain an action, and events may be used to explain changes in personality.

In addition, five biographical arguments were coded. Reference to the *developmental status* of a person may serve to explain something she or he did or was not able to do (McCabe, Capron, & Peterson, 1991). Explaining a protagonist's behavior by referring to his or her individual *biographical background* and experiences is a second biographical argument (Feldman, Bruner, Kalmar, & Renderer, 1993). *Learning a lesson* was coded when the narrator said that she or he had learned to react in a certain way in a quite specific situation. The code is comparable to 'learning a lesson' (McLean & Thorne, 2003) and 'gaining factual or procedural knowledge' (Bluck & Glück, 2004). *Life maxims* were coded when generalizations to life maxims or general rules of life were stated, which are comparable to 'insight' (McLean & Thorne, 2003) and 'life philosophy' (Bluck & Glück, 2004). Finally we coded all explicit statements about formative experiences and influences (κ = .89, second κ = .84).

Indicators of thematic coherence. Exemplifications are narrations of specific events which serve to render credibly to a general statement made earlier and were coded simultaneously with causal relations. All hedges such as 'maybe' or 'I'm not sure' were coded, because in combination with interpretative statements such as explanations or descriptions these express awareness of an interpretative stance that motivates the construction of coherence. The objects of the narrator's insecurity were coded as *explanation, evaluation, interpretation or description,*

knowledge ('He probably had a better job anyway'), *memory* ('that was, I believe, in 3rd grade'), and the process of *narrating* ('I don't know whether I've already mentioned ...'; $\kappa = .93$, second $\kappa = .89$). Only hedges regarding explanations and interpretations are used as indicators of global coherence. Finally we coded statements of two complex cognitive processes which indicate the subjective processing of events in the world, statements of opinion including convictions and expectations lasting longer than at least a day, and statements of understanding or realizing something ($\kappa = .90$, second $\kappa = .89$).

Global rating scales for temporal orientation, developmental consequentiality, and plausible transitions. To complement the coding of the propositions, three 7-point scales were used to rate global properties of whole life stories, related to temporal, causal, and thematic coherence. Each was defined in a paragraph and by brief anchor definitions for each point (see Table 1). Single intraclass correlations were computed between two raters on the basis of twenty life narratives, resulting in correlations of $r_{ic} = .80$ ($r_{ic} = .91$ for the second correlation) regarding temporal orientation, $r_{ic} = .84$ ($r_{ic} = .91$) for developmental consequences, and $r_{ic} = .82$ ($r_{ic} = .85$) for plausible transitions. Remaining life narratives were rated half by each rater.

Results

Throughout the analyses, continuous variables were first tested for deviation from a normal distribution and then for outliers. Outliers and variables were transformed to approach normal distribution whenever necessary. For each of the three aspects of global coherence, we first tested effects of age, training, and gender in multivariate analyses of variance (MANOVA) for repeated measurements. Gender was controlled for because of the slightly unequal distribution across age groups. Significant multivariate effects were followed up by univariate analyses. Multivariate results are reported in the text. Means and standard deviations by age group are

listed in Table 2, together with F-values, significance and effect size for univariate main effects of age, and with significant results of planned contrasts for differences between neighboring age groups. Significant effects below $p = .05$ will be reported in the text for all other effects tested. To limit the number of significance tests, only the seven summary local indicators (e.g., the sum of all biographical arguments) and three ratings have been tested. In addition, means and standard deviations of component local indicators (e.g., the single biographical arguments) are reported for descriptive purposes. For each indicator the mean correlation between the two measurement times will be reported. Age means are presented for all local indicators in Figure 1 and for the three ratings in Figure 2. Because some of the local indicators are, as was expected, very rare in the youngest age group, the percentage of participants who use an indicator at least once is presented in Table 3.

We will first test narratives for differences in length, then the main hypothesis of age effects on global coherence in three MANOVAS, one for the indicators and ratings of each kind of coherence. Then we will explore the correlations between ratings and local indicators. Finally we will test additional predictors for their influence on global coherence.

Length of Life Narratives

The number of propositions ($r_{1,2} = .77$) increased significantly with age, as did, to a lesser degree, the duration of narrations. Number of propositions differed significantly between ages 8 and 12 ($p = .005$) and ages 12 and 16 ($p = .012$), and likewise duration between ages 16 and 20 ($p = .015$). There was a trend for women to produce longer narratives ($M = 229.7$, $SD = 79.0$) than men ($M = 200.1$, $SD = 89.1$), $F(1, 86) = 3.87$, $p = .053$, partial $\eta^2 = .04$. The mean number of words in propositions did not vary with age. To compensate for the differences in length of narratives, we will compare not absolute but relative frequencies of indicators per proposition.

Effects of Age, Gender, Training and Retesting on Local Indicators and Ratings of Coherence

Temporal coherence. First, the sum of all indicators allowing to temporally locate an event in the narrator's life ($r_{11,12} = .51$) and the global rating of temporal orientation ($r_{11,12} = .43$) were tested for effects of age, gender, training and retesting in a MANOVA. Significant multivariate effects showed for age, Pillais' $F(6, 172) = 7.53, p = .000$, partial $\eta^2 = .21$, for the interaction of age with gender, Pillais' $F(6, 172) = 2.39, p = .030$, partial $\eta^2 = .08$, and for retesting, Pillais' $F(2, 85) = 4.91, p = .010$, partial $\eta^2 = .10$. Univariate tests revealed the expected age effects in the rating of temporal orientation, which increased monotonously with age (see Table 2 and Figure 2), while local temporal indicators failed to reach significance ($p = .072$) when testing overall differences between age groups (see also Figure 1). Inspection of age differences in single temporal indicators (see Table 2) reveals that life phases were used increasingly with age as were correct dates, which were near-absent in the youngest group (see Table 3). This suggests that life narratives are increasingly anchored in calendar or historical time as well as in a structured concept of the life course.

A significant interaction between age and gender showed in the rating of temporal orientation, $F(3, 86) = 2.99, p = .036$, partial $\eta^2 = .09$. Whereas temporal orientation increased monotonously in women, men had lower values than women at ages 8 and 16, resulting in a local maximum at age 12 and an absolute maximum at age 20. Finally, retesting resulted in an increase in temporal orientation after two weeks, $F(1, 86) = 8.97, p = .004$, partial $\eta^2 = .09$ ($M_{t1} = 4.68, SD = 1.40, M_{t2} = 5.17, SD = 1.57$).

Causal coherence. To construct two of the local indicators of causal coherence, we proceeded in two steps. First, all four kinds of causal relations were coded (causal-consecutive, contrastive, conditional, instrumental; mean $r_{11,12} = .29$) which did increase almost monotonously

with age, $F(3, 86) = 4.25, p = .001$, partial $\eta^2 = .13$. To differentiate contributions to global from contributions to local causal coherence, we then constructed two specific indicators, namely the relative frequency of causally related statements of long duration (mean $r_{11,12} = .60$) and causal links between events (brief or extended) and personality (mean $r_{11,12} = .19$).

First causally related statements of long duration, causal relations between events and personality, the sum of all biographical arguments (mean $r_{11,12} = .32$), and the global rating of developmental consequentiality (mean $r_{11,12} = .69$) were tested for effects of age, gender, training and retesting in a MANOVA. Significant multivariate effects showed for age, Pillais' $F(12, 255) = 9.86, p = .000$, partial $\eta^2 = .32$, for retesting after two weeks, Pillais' $F(4, 83) = 3.46, p = .012$, partial $\eta^2 = .14$, and for an interaction between retesting and age, Pillais' $F(12, 255) = 2.39, p = .006$, partial $\eta^2 = .10$. Univariate tests revealed the expected age effects in all four dependent variables.

It could be argued that the causal relations of long duration and causal relations between events and personality only increased with age because all causal relations increased with age. Therefore we also tested the effects of age on the frequency of these two indicators relative not to all propositions but to all causal relations, with the same analysis of variance (ANOVA) (age, gender, training, and repetition as factors). Both causal relations of long duration $F(3, 86) = 43.79, p = .000$, partial $\eta^2 = .60$, and causal relations between events and personality continue to increase significantly with age, $F(3, 86) = 4.28, p = .010$, partial $\eta^2 = .13$ (with increasing age $M = 18.9\%, SD = 12.4\%, M = 28.7\%, SD = 10.6\%, M = 40.9\%, SD = 10.9\%$, and $M = 53.3\%, SD = 10.8\%$ of all causally related statements of long duration, and $M = .01\%, SD = .01\%$ for age 8 and $M = .02\%, SD = .02\%$ for each of the three older groups of all causal relations between personality and events).

Since the distribution of relative frequencies of causal relations between personality and events strongly deviated from a normal distribution due to the large number of participants who did not use them even once (see Table 3), age differences were also tested non-parametrically with the Jonckheere-Terpstra-test, which is designed to detect linear differences between ordered classes such as age groups. Again there was a significant overall increase in the use of causal relations between personality and events.

Univariate tests of the effects of retesting and of its interaction with age revealed significant effects only for biographical arguments, with $F(1, 86) = 11.47, p = .001$, partial $\eta^2 = .12$ for retesting after two weeks, $F(3, 86) = 7.04, p = .000$, partial $\eta^2 = .20$ for the interaction between retesting with age. Inspection of means by age and measurement time showed that at ages 12 and 20 fewer biographical arguments were used at time 2 than at time 1.

Inspection of means (Table 2, Figures 1 and 2) reveals a monotonous increase with age in all indicators except for causal relations between personality and events, for which an increase was only measurable between the 8- and the 12-year olds, with no differences between the three older age groups. Table 3 also shows that the causal relations between personality and events and the biographical arguments are used by none or extremely few of the children in the youngest age group, rising considerably in use up to age 20. This is strong evidence for the absence of global coherence in life narratives in children.

Thematic coherence. Four dependent variables related to thematic coherence were tested for the effects of age, gender, training and retesting in a MANOVA: the global rating of plausible transitions (mean $r_{11,12} = .22$), exemplifications (mean $r_{11,12} = .69$), hedges (mean $r_{11,12} = .59$) regarding explanations and descriptions, and cognitive processes of understanding and opinion (mean $r_{11,12} = .74$). Significant multivariate effects showed for age, Pillais' $F(12, 255) = 6.56, p =$

$.000$, partial $\eta^2 = .24$, for gender, Pillais' $F(4, 83) = 3.82, p = .007$, partial $\eta^2 = .16$, and for an interaction between retesting, age, and gender, Pillais' $F(12, 255) = 2.07, p = .019$, partial $\eta^2 = .09$. Univariate tests revealed the expected monotonous age effects for all four dependent variables (see Table 2, Figures 1 and 2).

Univariate tests revealed that female participants used more cognitive processes, $F(1, 86) = 19.30, p = .000$, partial $\eta^2 = .15$ ($M = 2.93\%$, $SD = 1.64\%$ versus $M = 1.97\%$, $SD = 1.59\%$ in men). A significant interaction between age, gender, and measurement time was found both for exemplifications $F(3, 86) = 2.94, p = .038$, partial $\eta^2 = .09$, and for ratings of plausible transitions, $F(3, 86) = 5.834, p = .026$, partial $\eta^2 = .10$. Inspection of means by age, gender, and measurement time showed complex patterns. Deviations from a monotonous increase of exemplifications with age showed for 16-year old males at the first testing and for 20-year old females at the second testing, while deviations from a monotonous increase in plausible transitions showed for 12-year old girls in the first testing and for 16-year old boys in the second testing.

Only hedges regarding explanations and descriptions increased monotonously with age, whereas hedges regarding knowledge decreased (Table 2), indicating that concerns regarding correctness of statements, as reflected in the use of hedges, shifts with age from simple knowledge to more interpretative descriptions and explanations.

Thus age had a pervasive effect on local indicators and ratings of global coherence. Repetition had very few effects, namely an increase in the rated temporal orientation and a decrease of the use of biographical arguments in two age groups, while neither training nor the interaction of training and repetition had any effect whatsoever.

Intelligence, Life Events, and Biographical Practices.

We explored whether fluid and crystallized intelligence, number of negative life events, biographical practices and confiding in others contribute to the prediction of coherence. Because three of these predictors also correlated with age, number of life events $r = .42$, biographical practices $r = .27$, and confiding in others $r = .28$, we calculated four hierarchical analyses of covariance (ANCOVA) or multivariate analyses of covariance (MANCOVA), one for length of narrative, and one for each kind of coherence. The factors age and gender and their interaction were tested first, then the five continuous predictors were entered in the order listed above. Dependent variables were averaged across measurement time. The rationale was to test whether continuous variables could predict coherence in addition to age. Age was highly significant at the $p = .000$ level in all analyses. Of the continuous predictors, only biographical practices significantly predicted one kind of coherence, i.e., temporal coherence, $F(2, 88) = 3.19, p = .046$, partial $\eta^2 = .07$. However, in neither univariate analysis were biographical practices a significant predictor. Crystallized intelligence reached borderline significance in the prediction of length of life narratives, $F(1, 89) = 3.90, p = .051$, partial $\eta^2 = .04$.

Intercorrelations between Local Indicators and Global Ratings

The text-based local indicators and global ratings were correlated with each other to test whether indicators correlated with the ratings of the same aspects of coherence, encircled in Table 4. We interpret correlations only with a significance of $p < .01$, that is from $r = .26$ upward, because of the great number of correlations ($n = 21$). Since most indicators correlated highly with age, we partialled out age.

Of the local indicators, only temporal indicators, biographical arguments, and exemplifications correlated with the corresponding global ratings. When testing the total

distribution of expected (3 significant and 13 non-significant) versus unexpected (1 significant and 4 non-significant) correlations between local indicators on the one hand and the three global ratings on the other hand, it proved to deviate significantly from chance, $\chi^2(1, N = 21) = 3.86, p = .049$.

Discussion

This first study of the development of entire life narratives has shown an increase in the relative frequency of a variety of local indicators and an increase in ratings of global coherence across the adolescent age range, providing the first direct test of and overwhelming support for McAdams' (1985) hypothesis that the life story develops in adolescence.

Temporal coherence increases most between the ages 8 and 12, most clearly in the ratings and with a similar trend in local indicators. This expected finding is mirrored by a comparable developmental pattern in the acquisition of biographical knowledge in one half of the sample that received training (Habermas, 2007). The near absence of calendar dates in the youngest age group confirms experimental findings on the acquisition of calendar time between ages 10 and 12 (Friedman, 2004).

Both local indicators and global ratings of causal coherence increased with age as expected. The relatively high percentage of participants in the three older age groups who used causal event-personality links and biographical arguments at least once when compared with adults (cf. Bluck & Glück, 2004; McLean & Thorne, 2005; Pasupathi & Monsour, 2006) probably results both from the greater length of narratives analyzed here and from our wide definition of personality, which included descriptions of personality typical for grade school children. This wide definition was tailor-made for our age range. However, when analyzing biographical

reasoning, in the future an adult concept of personality should be used because only this corresponds to an adult understanding of biography.

Thematic coherence also increased across all measures. Thus indicators and ratings of all three kinds of global coherence increased with age, confirming the main hypothesis that global coherence in life narratives develops across adolescence. However, it might be argued that the hypothesis requires children to produce life narratives with a total lack of indicators of global coherence. Some indicators indeed are missing in all or almost all of the youngest. These are also the indicators that are most specifically biographical because they explicitly refer to personal development, namely biographical arguments and events explaining personality development, and also exemplifications and calendar dates. Knowledge of calendar time allows the most precise temporal coordination of life events, and using exemplifications in response to the demand to recount one's life does reflect an understanding of the task as talking about events in order to describe oneself. Thus the indicators which are most inherently biographical are nearly missing in children, thereby providing even stronger support for McAdams' (1985) hypothesis than is given by a mere increase in indicators and ratings across adolescence.

Another objection to the interpretation of the results could be that the relative frequency of central local indicators is low and that therefore their relevance is limited. However, in any given life narrative the bulk of propositions is needed to provide the biographical material that is then made coherent. It might even be more appropriate to compare the percentages of individuals in each age group who do and don't use, for example, a biographical argument (cf. Pasupathi & Mansour, 2006). But even when pursuing a quantitative strategy, as was done in this paper, not very many local indicators are required to render a life narrative coherent.

Inspection of global ratings suggests that temporal coherence increases most between ages 8 and 12, causal coherence most between ages 12 and 16, and thematic coherence most between ages 16 and 20. Although this pattern does correspond to expectations (Habermas & Bluck, 2000), planned contrasts only partially confirm visual impressions. Moreover, the increases in local indicators of causal and thematic coherence with age do show a different pattern, with the steepest increase between ages 8 and 12.

Training and repetition of narrating one's life showed few effects on global coherence. Therefore we could not distinguish between mere performance and competence. On the other hand, the stability of performance in spite of training suggests that limitations in coherence in younger ages are not due to a lack of trivial skills or a lack of practice. To summarize, for the first time this study provided direct evidence that the life story emerges and develops across adolescence using the criterion of global textual coherence in life narratives.

In addition to age, neither intelligence, nor life events, nor biographical and confiding practices predicted coherence. Possibly other cognitive and developmental factors discussed by Habermas and Bluck (2000) influence the development of coherence in life narratives more than the ones tested here.

Finally, correlations between local indicators and ratings only partially conformed to the hypothesized pattern. For each kind of coherence, one local indicator correlated with the correct rating scale. These were temporal indicators, biographical arguments, and exemplifications, that is, three of the four indicators that had very low frequencies in the youngest group. Therefore concurrent evidence points to these local indicators as specific for the respective kind of coherence. In addition, if personality was defined more narrowly, causal relations between events and personality might also qualify as a good indicator of causal coherence. Possibly

causally related statements of long duration are not specific enough to life narratives, and hedges regarding explanations and interpretations and complex cognitive processes are too indirectly related to global thematic coherence to be good indicators.

A major limitation of this study is that it was restricted to a relatively homogeneous sample in terms of educational level and cultural identity. Although the cultural background of participants' parents was quite diverse, as is typical for a major European city, the content of life narratives suggests that almost all participants were well immersed in German culture. Moreover, the two older groups showed a very good knowledge of cultural age norms (Habermas, 2007). Anthropological evidence points to the non-universality of telling one's life (Tonkin, 1992) and developmental evidence points to strong cultural differences in remembering and the related construction of the self (Wang, 2004). As a consequence, possible variations in the development of life narratives remain to be studied both in educationally and culturally distinct groups. In addition, cohort effects cannot be excluded. However, the maximal difference in birth year is only 12 years, rendering cohort differences improbable.

Future research needs to address three areas of interest. First, the attempt to quantify a complex phenomenon such as the global coherence in life narratives warrants the development of additional, qualitative measures especially for thematic coherence, such as explicit statements of recurrent themes in life or metaphors of the self that integrate a variety of experiences. Also, for temporal coherence deviations from a linear temporal order could simply be counted. Global ratings of coherence could be supplied by experts such as teachers of literature. These additional measures should correlate with the more successful measures introduced here.

Also, the development of the life story in adolescence should be compared to related phenomena. The expected close relationship between life narrative coherence and

autobiographical reasoning in more partial narratives, for example, could be confirmed in half of this sample (Habermas, Fröhlich, & Diel, 2007). The development of coherence in life narratives should also be demonstrated in the spontaneous tendency to use the past to define the current self, for example, in free self-descriptions. Our theoretical assumptions also predict that autobiographical reasoning parallels what could be called *heterobiographical reasoning*, that is the ability to create biographical coherence in narratives of others' lives. Other related constructs differ from the life story due to their focus on individual differences, such as Marcia's (1966) identity status and attachment security. The moderate positive correlation between ratings of 'meaning making' in turning point narratives, which corresponds to our indicators 'gaining insight' and 'life maxims', and an index supposedly reflecting identity achievement (McLean & Pratt, 2006) does not contradict a more distant relationship between the constructs. Similarly, although coherence is the single most important criterion for attachment security in the Adult Attachment Interview (AAI; Main, Kaplan, & Cassidy, 1985), this kind of coherence is less formal and more content-based, asking for the absence of incoherence or implicit contradictions. We suggest that the relation between the life story and coherence in the AAI is one of presupposition: Answering the questions of the AAI directed at a biographical understanding of one's life requires the ability for autobiographical reasoning. Accordingly, the AAI is not administered before about age 15.

Finally, there is a need to explore social, social-cognitive, and motivational developments that possibly facilitate the development of the life story. Neither the number of negative life events nor the frequency of biographical practices were related to the life story in this study. Social practices such as specific ways of talking about lives with parents, similar to the

socializing practices of memory talk in preschool children (Haden, Hayne, & Fivush, 1997), might be influential, as might more general social-cognitive developments in adolescence.

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Table 1
Examples of Local Indicators of Global Coherence Identified at the Level of Propositions and Definitions of Global Ratings

Code	Example
Local indicators of temporal global coherence	
<i>1. Temporal indicators</i>	
Life phase	“I got to know her in fourth grade” “When I was a baby”
Age	“When I was 9”
Calendar date	“in 2002” or “on May 6, 2006”
Distance from present	“that was last year”, “two years ago”
Local indicators of causal global coherence	
<i>2. Causally related statements of long duration <L:</i>	
Extended event	“I would really like to have a real change in my life, because everything’s gotten so confused.”
Personality	“I was a very shy person then. Therefore I never dared to ask her”
<i>3. Causal links between personal states and events</i>	
Personality explains action	“We did a lot of boating, because my father likes rowing.” “I actually had problems with the teachers throughout school, because I am someone who doesn’t like to adapt himself.”
Event explains personality	“If I hadn’t joined the sports-club then, I wouldn’t have friends now and I would still be a shy person.” “After age 10 I became a shy person because the separation of my parents made me distrust others”
<i>4. Biographical arguments</i>	
Developmental status	“My parents' divorce didn’t affect me much. I wasn’t really aware of what was happening - I was still too little.”
Biographical background	“When suddenly a car raced towards us, he panicked. He had been

	run over by a car when he was small”
	“All throughout childhood my parents helped me with everything, they took care of all the paperwork, everything. And now I am 18 and I am still unable to organize my life.”
Lesson learned	“That’s why I told myself, next time I fall in love, school work should not suffer from it.”
	“I swallowed a cent. Then I learned that I better not swallow small objects”
Life maxim, generalization	“I had received a bad mark, and I thought that she had given marks in a mean way. That’s what you usually think when you get a bad mark “
	“I was really emotionally hooked up with him for a long time. Probably that’s what always happens when it’s the first kiss.”
Formative experience	“My first relationship has influenced me extremely.”
Local indicators of thematic global coherence	
5. <i>Illustration</i>	“I haven’t learned to do things on my own [general statement], although I am able to use the subway on my own and stuff like that, but, for example, I do not have the faintest idea how to go about anything bureaucratic. [exemplification]”
6. <i>Hedges</i>	
Regarding explanations	“Anna is a very complicated person, just like me. <i>Maybe</i> that’s why we make such a good fit.”
	“ <i>Maybe</i> that’s why I am so lazy”
Regarding descriptions or interpretations	“ <i>I’m not sure</i> whether I’m going to be good at the exam”
	“Now I am better able to control myself, <i>I believe</i> ”
7. <i>Complex cognitive processes</i>	
Understanding	“Even then I had understood that my mother was mentally ill”
	“Then I realized, how little I meant to him”
	“Then I had already understood that my mother was mentally ill”

Opinion	“I was always convinced that he didn’t care for me”
	“I was of the opinion that I didn’t need it”

Global rating scales (Values range from 1 to 7 points)

8. *Rating of temporal orientation (temporal coherence)*

Degree to which the reader is able to follow the temporal sequence or/and the absolute timing of events in life, ranging from 0 to 100% of events.

9. *Rating of developmental consequentiality (causal coherence)*

Degree to which the reader understands how past experiences explain how personality, life, or outlook have changed and what the turning points and motives for these developments were, ranging from ‘no change in personality is described’ to ‘the development of the personality is presented with its turning points and motives.’

10. *Rating of plausible transitions (thematic coherence)*

Degree to which events followed each other in an unrelated way versus the degree to which implicit or explicit plausible links between events were provided. Rater had to decide on the relative amount of events or themes that had good transitions to the following event or theme, again ranging from 0 to 100%.

Table 2

Means and Standard Deviations of Length of Life Narratives, Relative Frequencies of Local Indicators, and of Global Ratings

	Age Group								ANOVA Age Group ^a		
	8		12		16		20		F(3,86)	η^2	partial significant contrasts ^b
	M	SD	M	SD	M	SD	M	SD			
Number of propositions	146.66	68.37	201.04	86.57	248.58	88.93	274.80	63.34	17.01***	.37	8 < 12 < 16
Duration (minutes)	11.95	3.14	12.54	2.60	13.47	2.33	14.49	2.64	5.14**	.15	16 < 20
<u>Percent of propositions</u>											
1. All temporal indicators	3.79	2.01	5.09	3.09	5.23	1.52	6.30	1.95	2.42	.08	
<i>Life phase</i>	1.93	1.32	1.91	1.15	2.58	1.25	3.08	1.39			
<i>Age</i>	1.37	1.08	1.72	1.63	1.13	.82	1.50	.78			
<i>Calenda date</i>	.02	.06	.74	1.56	.37	.48	.94	1.11			
<i>Distance from present</i>	.48	.56	.73	.59	1.15	.72	.78	.61			
All causal relations	7.84	3.61	9.67	3.01	10.59	2.48	10.29	2.53			
2. Causal rel. long duration	1.34	.83	2.85	1.38	4.38	1.45	5.51	1.74	44.20***	.61	8 < 12 < 16 < 20
3. Causal rel. pers. + events	.11	.24	.51	.55	.49	.42	.51	.53	7.24***	.20	8 < 12
<i>Personality explains event</i>	.09	.24	.33	.41	.32	.33	.34	.38			
<i>Event explains personality</i>	.02	.07	.17	.23	.17	.25	.17	.26			
4. All biographical arguments	.32	.52	.55	.55	1.08	.90	1.48	1.18	14.99***	.39	12 < 16
<i>Developmental status</i>	.08	.19	.20	.24	.25	.26	.27	.30			
<i>Biographical background</i>	.01	.04	.11	.28	.15	.26	.06	.10			
<i>Lesson learned</i>	.00	.00	.01	.06	.05	.12	.00	.00			
<i>Life maxim</i>	.23	.51	.23	.32	.44	.54	.69	.61			

Formative experience	.00	.00	.00	.00	.20	.45	.46	.51			
5. Exemplification	.18	.24	.56	.45	.64	.50	.92	.51	20.77***	.42	8 < 12, 16 < 20
6. Hedges explan. interpret.	1.15	.85	2.61	1.86	2.89	1.51	3.55	1.70	10.17***	.26	8 < 12
<i>Explanation</i>	.26	.29	.54	.55	.58	.59	.67	.50			
<i>Interpretation</i>	.89	.80	2.12	1.57	2.31	1.15	2.88	1.34			
<u>Other hedges regarding</u>											
<i>Knowledge</i>	.35	.37	.31	.32	.16	.19	.10	.12			
<i>Memory</i>	.99	1.05	.69	.77	.83	.71	.76	.72			
<i>Narration</i>	.01	.02	.14	.18	.39	.41	.31	.29			
7. Complex cognitive proc.	.87	.84	2.35	1.71	2.93	1.62	3.81	1.23	28.81***	.50	8 < 12, 16 < 20
<i>Understanding</i>	.23	.37	.43	.34	.70	.88	.98	.61			
<i>Opinion</i>	.64	.77	1.92	1.53	2.24	1.28	2.84	1.25			

Rating scales (values 1 to 7)

8. Temporal orientation	3.76	1.36	5.02	1.09	5.16	.87	5.90	.76	19.77***	.41	8 < 12, 16 < 20
9. Developmental consequent.	1.52	.37	2.23	.73	4.08	1.26	4.80	1.22	69.74***	.69	8 < 12 < 16 < 20
10. Plausible transitions	2.76	1.01	2.98	1.14	3.10	.92	3.70	.94	4.00**	.12	12 < 16 < 20

Additional predictors

Number of life events	2.84	1.28	4.19	1.69	3.47	1.95	5.61	1.96			
Autobiographical practices	1.65	.33	1.89	.31	1.92	.34	1.91	.32			
Confiding in others	3.14	1.97	3.68	1.08	4.11	1.69	4.40	1.64			

Note. Only the seven local indicators have been tested for significance. Means and standard deviations of the component codes of local indicators and of some other variables for which no hypotheses were formulated are set in italics and are reported merely for descriptive purposes.

*Only age effects are reported here, significant effects of gender, treatment and measurement time and all interactions are reported in the results section.

^b Planned contrasts were to test the differences between neighboring age groups. Significant differences are indicated by < or >, no significant difference by a =.

Table 3

Percentage of Participants Who Use Local Indicators at least once in any of the Two Life Narratives

Local indicator	Age group			
	8	12	16	20
1. All temporal indicators	100.0	100.0	100.0	100.0
<i>Life phase</i>	92.0	100.0	96.0	100.0
<i>Age</i>	92.0	81.5	92.5	100.0
<i>Date</i>	8.0	59.3	56.0	92.0
<i>Distance from present</i>	56.0	85.2	96.0	88.0
2. Causal long duration	96.0	100.0	100.0	100.0
3. Causal event-personality	20.0	77.8	76.0	80.0
<i>Personality expl. event</i>	12.0	66.7	72.0	68.0
<i>Event expl. personality</i>	8.0	54.4	54.0	40.0
4. All biogr. arguments	44.0	74.1	92.0	100.0
<i>Developmental status</i>	20.0	51.9	68.0	64.0
<i>Biograph. background</i>	4.0	22.2	40.0	32.0
<i>Lessons learned</i>	0	3.7	16.0	0
<i>Life maxim</i>	24.0	40.7	68.0	88.0
<i>Formative experience</i>	0	0	28.0	68.0
5. Exemplifications	44.0	81.5	88.0	96.0
6. Hedges	80.0	85.2	100.0	100.0
<i>regarding explanations</i>	52.0	66.7	88.0	84.0
<i>regarding interpretation</i>	80.0	85.2	100.0	100.0

7. Complex cognitive proc.	68.0	92.6	100.0	100.0
<i>Understanding</i>	36.0	77.8	80.0	92.0
<i>Opinion</i>	56.0	92.6	100.0	100.0

Table 4

Correlations of narrative coherence variables with age and partial correlations among coherence variables, age partialled out

Measure	Age	1	2	3	4	5	6	7	8	9
<i>Local Indicators</i>										
1. Temporal indicators	.24									
2. Long duration ^a	.75	-.07								
3. Events-personality ^b	.37	-.01	.40							
4. Biographical arg.	.52	-.02	.08	.20						
5. Exemplifications	.53	-.22	.00	.43	.08					
6. Hedges explan. interpr. ^c	.48	-.07	.08	-.03	-.11	.01				
7. Cognitive processes	.60	-.16	.09	.11	.19	.09	.07			
<i>Rating Scales</i>										
8. Temporal Orientation	.57	.35	-.04	.07	.00	.05	-.11	.06		
9. Dev. consequentiality	.80	-.12	.13	.14	.39	.14	-.05	.22	-.06	
10. Plausible transitions	.31	-.29	.08	.10	.01	.26	.03	.02	.17	.11

Note. Expected significant correlations between indicators of the same aspect of global coherence are circled.

^aCausally related propositions about states lasting longer than one month ^bCausal relations between personality and events. ^cHedges regarding explanations and descriptions and interpretations.

Levels of significance for correlations $p < .01$ for $r = .26$, $p < .001$ for $r = .32$. all $p < .05$ are marked in bold.

Figure Captions

Figure 1. Mean percentage of propositions with local indicators of global coherence - temporal indicators, causally related propositions of long duration, hedges regarding interpretations and descriptions, and cognitive processes regarding understanding and opinion by age, averaged across measurement times.

Figure 2. Mean percentage of propositions with local indicators of global coherence - biographical arguments, exemplifications, and causal relations between events and personality by age, averaged across measurement times.

Figure 3. Mean values on global ratings for temporal orientation, plausible transitions between events, and developmental consequentiality by age, averaged across measurement times.

