A Dynamic Approach to the Co-construction of Autobiographical Memory: Insights From Dyadic Conversations About the Past

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Abstract

Autobiographical memory can be conceived of as the personalized verbal narrative and imagistic structure that conveys a coherent personal history and contributes to the definition of the self. The purpose of the study is to apply a novel approach – inspired from the dynamic systems methodology – to the investigation of early autobiographical memory development. Ten mother-child dyads' conversations about unique past events were recorded longitudinally at three successive time points; the children's mean age was 35, 41 and 47 months, respectively. The conversational style of *the dyad* was explored using *state space grids* (Lewis, Lamey, and Douglas, 1999), a dynamic systems method which allows the plotting of the dyadic interaction as it proceeds in real time. Results are discussed in a framework that emphasizes the dynamic, co- and re-constructive nature of the autobiographical discourse and its role in the shaping of future autobiographical memory skills.

Keywords: Autobiographical memory; dynamic systems; state space grids; mother-child conversation; development.

Introduction

Autobiographical memory represents the personalized verbal narrative and imagistic structure that conveys a coherent personal history and contributes to the definition of self. As Neisser (2004) points out, research regarding the emergence of autobiographical memory was triggered by its relationship to the puzzling phenomenon of infantile amnesia, a number of theories being proposed to explain this phenomenon (see Nelson, 1993; Pillemer & White, 1989, for reviews). Since then, a consistent body of research has been devoted to potential factors involved in the early beginnings of autobiographical memory, one of the most critical being *the social construction of personal narratives* during parent-child conversations. The social dimension of narrative discourse about the past has been extensively studied (see Nelson & Fivush, 2004; Reese, 2002, for recent reviews) and acknowledged as a territory at the interplay of multiple social, cognitive and neural dimensions (Benga & Petra, 2002).

Traditional methods of measuring change

The emergence and early development of autobiographical memory has previously been approached by several longitudinal studies, focused on changes in the format and content of adult-child conversations (e.g, Fivush, Haden & Reese, 1996; Fivush & Hamond, 1990; Hudson, 1990; Reese, Haden & Fivush, 1993). Various developmental perspectives can be circumscribed either by a *scaffolding model,* considering that the parent is initially providing all the conversational support and retiring it in time when it is not needed anymore; or by a *spiral model,* emphasizing the role of the joint reminiscing, both dialogue participants reciprocally enriching and embellishing their conversational style in time. Although based on a social constructivist framework and focusing on parent-child / adult-child joint reminiscing, these studies are constrained – by the very analytical tools they use – to quantify punctual performance in each partner of the dyad, and to connect time-points in correlational models. Such approaches are limited in their power to adequately capture even individual change, not to mention dyadic changes via verbal interactions.

The dynamic approach

Reese (2002) claimed that recent theories of autobiographical memory required something that "has much in common with a dynamic systems approach to development […] in order to discover how change in the system as a whole is taking place as a result of at times minute changes at a particular age or level" (p. 137).

Our paper aims to provide such a dynamic perspective that can be characterized by some particular elements: first of all, the classical analysis that correlates global features of the maternal discourse with the child's narrative skills (analyzed separately) is replaced by a *dyadic* analysis. Each unit of analysis from the state space (behavioral repertoire) represents a two-event sequence, or a simultaneously coded parent-child event (i.e., a dyadic state).

This leads us to the second aspect of the approach we are proposing, namely the re-construction of the discourse as a trajectory in time. Each individual trajectory consists of

successive dyadic points (events) in the temporal sequence they were recorded (see Figure 1).

Based on dynamic systems methodological principles, Lewis, Lamey and Douglas (1999) developed a graphical approach that utilizes observational data to quantify two ordinal variables that define the *state space* of the system. This state space grid (SSG) technique has been adapted for the study of parent-child interactions (Granic, Hollenstein, Dishion & Patterson, 2003; Granic & Lamey, 2002).

This method was considered appropriate for a study investigating the emergence and development of autobiographical memory for two reasons: first of all, it is a convenient way of representing dyadic states of interaction and second, because it exports several measures describing the dynamics of the mother-child discourse for further analyses.

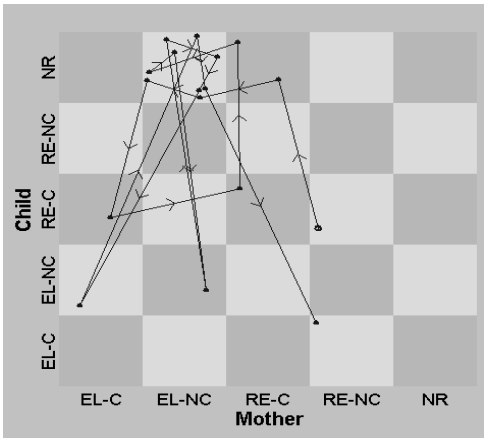

Figure 1: Sample of one mother-child conversation represented in a state-space grid. Each cell of the grid represents a possible state of the dyad during the conversation. Dyadic states result from the intersection of the mother's (axis x) and the child's (axis y) individual codes. In the sample represented here the interaction starts in the RE-NC/RE-C cell. Each point on the grid represents an event (i.e., the mother's utterance and the child's response to it), while the lines with arrows represent transitions between these events.

Method

The study investigated the emergence and development of autobiographical memory in children, by analyzing mother-child conversations about past events.

Participants

Ten mother-child dyads participated in the study. A written informed consent was obtained from the mothers (which also guaranteed the confidentiality of the information they would provide). The children (five girls and five boys) had a mean age of 35 months at the beginning of the study. Mothers came from diverse socioeconomic backgrounds.

Procedure

Mothers were asked to engage their children in conversations about past, commonly shared, non-routine events, and to separately talk about each one of them. Conversations were tape-recorded. This procedure was identically conducted three times, as follows: T1 – when the children were 35 months old, T2 – 6 months later, and T3 – 12 months after T1. At T2 and T3 mothers were instructed to talk to their child about the same events they had talked about at T1, in whatever order they would choose. At T2, four mother-child dyads were not available for recording while at T3 this happened in the case of one dyad.

Coding The coding scheme combined previously employed coding formats into the framework of the state space grids. The recorded interviews were first transcribed verbatim. The procedure subsequently involved the following steps:

First, utterances for both mother and child were coded for *conversational style* according to a coding scheme adapted from Reese and Fivush (1993). The text was divided into independent clauses, which were used as the coding unit for all codes. The codes used here were fewer than the ones used by Reese and Fivush (1993), but narrowing down the number of categories was considered necessary in this case in order to facilitate analysis using the State Space Grids. Thus, the four categories were as follows:

- *Elaboration (EL)* – an utterance that structured the conversation by either moving to a new aspect of the event, or by adding details about a particular aspect of the event.
- *Evaluation (EV)* – an utterance that confirmed or denied what the conversational partner had said, or conveyed a positive or negative appraisal.
- *Repetition (RE)* – a repetition of the content or the gist of a prior utterance (either one's own, or of the conversational partner).
- *Prompt (PR)* – the partner is asked to provide more details regarding an event, but without being given any additional information.

Second, a coding scheme adapted from Jimerson and Bond (2001) was used to code utterances according to their *contingency*. A contingent (C) utterance was defined as one that was related to the conversational partner's prior utterance, developing a topic to which he/she had an explicit contribution. Utterances that were irrelevant with respect to the partner's prior utterance were coded as non-contingent (NC).

The first author coded the whole set of data according to both coding schemes. Then 25% of the data were coded by an independent rater. Interrater reliability was 92% for the first coding scheme (EL/RE) and 87% for the second (C/NC).

The third step was to compress the number of coding categories. Reese and Fivush (1993) used factor analysis to determine which parental conversational styles clustered together. They identified two factors, which they termed "Elaborative" (comprising Elaboration and Evaluation) and

"Repetitive" (composed of Repetition and Prompt). Following this classification, elaborative and evaluative utterances were collapsed into one single category – elaboration (EL), and all repetitive and prompting utterances were coded as repetitions (RE). After combining these two categories with the contingency codes, each clause received a double code:

- Elaborative, contingent (EL-C).
- Elaborative, non-contingent (EL-NC).
- Repetitive, contingent (RE-C).
- Repetitive, non-contingent (RE-NC).
- No response (NR). This was a code added to classify instances in which either the child gave no response, or the mother spoke for more utterances in a row, giving the child no opportunity to intervene. (This code had to be added in order to simultaneously have the mother and the child's verbal behavior represented for each data point).

After coding, the data was fed to GridWare (Version 1.1 Beta - Lamey, Hollenstein, Lewis, & Granic, 2004). This required that for each data point both the mother and the child's verbal behavior be represented. As the events were not simultaneous in the dialogue, we decided to enter the mother's statement as the initiator and the child's statement as a reply because it best reflects the natural order in which the discussion takes place at this age. In this way, conversations could be represented in a manner similar to the one depicted in figure 1.

Analysis and Results

The analysis was performed in terms of *conversational style* and *contingency* of the dyad. Additionally the *mean length of utterance* (MLU) was computed. This is a broad indicator of the linguistic proficiency of young children, as revealed by the length of syntax (Brown, 1973). The intention was to find out whether differences in level of elaboration between dyads could also be accounted for simply by differences in children's language skills.

Due to missing cases at T2, some of the analyses were performed only for T1 and T3.

Identifying attractor states An attractor represents an absorbing state that "pulls" the system from other potential states, over time generating recurrent patterns that stabilize and become increasingly predictable (Granic & Hollenstein, 2003). Lewis, Lamey and Douglas (1999) suggested a "winnowing" procedure for identifying attractor states by using the SSG. A similar procedure was used in this study for identifying attractor states for each mother-child conversation, in the manner described below.

The number of events for every cell of the grid was computed. We then applied the following procedure: we first eliminated the cells that contained no event, then computed the variance among the remaining cells. The next step was to eliminate the cells with the maximum number of events, and again computed the variance for the remaining group of cells. The procedure was repeated until the variance dropped to less than 50% of the initial value. The cells that had been eliminated up to this point were considered attractors, because they accounted for the greatest part of the variance. By using this procedure, we could identify up to three attractors for each trajectory. But there were cases when after eliminating the attractors, some (one or two) of the remaining cells still contained a high number of events. We also included these cells in the final analysis as secondary, potential attractors.

A total of 21 attractors were identified for T1, 11 for T2 and 22 for T3. In each of the three cases up to four attractors were identified for each trajectory. Most of these attractors occurred in more than one mother-child pair (see Table 1).

Table 1: Frequencies and percentages of mother-child dyads that settled into each attractor.

Attractors	T1 (N=10)	T2 (N=6)	T3 (N=9)
EL-C/NR	2 (20)	-	3 (33.3)
EL-NC/NR	9 (90)	4 (66.6)	7 (77.7)
EL-NC/EL-C	2 (20)	4 (66.6)	9 (100)
RE-C/NR	1 (10)	-	1 (11.1)
RE-NC/NR	5 (50)	3 (50)	1 (11.1)
RE-NC/EL-C	1 (10)	-	2 (22.2)

Attractor characteristics In order to characterize the attractors, three measures were computed, in a manner similar to the one used by Lewis, Lamey and Douglas (1999):

Return time. This is a measure that can be automatically generated by the software. It represents the latency (measured by the number of events) to return to a cell once the trajectory has exited that cell.

Influence. This measure reflects the probability that events in grid cells outside the attractor will move to the attractor on the next time step. It was computed as the ratio between the number of visits to the attractor cell and the total number of visits outside the attractor.

Consistency. This is a measure of attractor recurrence (attractor stability in developmental time). Only conversations recorded at time 1 and time 3 were taken into account. Each attractor was assigned a value of either 1 – if it occurred at both time points, and 0 – if it only occurred in one of the two times.

Logistic regression was employed to determine whether return time and influence were good predictors of attractor consistency. Out of the two measures taken into account, only influence seemed to predict attractor consistency (chi-square=8.32, $p<.05$), while return time failed to significantly predict consistency (chi-square=21.64, $p<.42$).

Conversational style in time Studies that analyzed mother-child conversations about the past (Engel, 1986; Fivush & Fromhoff, 1988; Hudson, 1990; McCabe & Peterson, 1991) have identified two maternal styles: *elaborative* (topic-extending, providing rich descriptions, context embedded, evaluating the child's contribution pursuing a specific topic) and *repetitive* (topic-switching, providing little descriptive information, repeating the same questions, prompting the

child to answer or switching to another topic when this does not succeed). The present study attempted to classify *dyads* according to a similar procedure. The *elaboration ratio* of the dyads was computed by dividing the number of events in what we defined as the "elaborative area" of the dyad (EL-C/EL-C; EL-C/EL-NC; EL-NC/EL-C; EL-NC/EL-NC) to the number of events in the "repetitive area" (RE-C/RE-C; RE-C/RE-NC; RE-NC/RE-C; RE-NC/RE-NC).

Based on the median split of the elaboration ratio scores, dyads were categorized as either *high-* or *low-elaborative* (due to the small number of cases, it was hard to make a reliable decision on whether dyads were elaborative or repetitive). The elaboration scores were computed without taking into account if the utterances involved were contingent or non-contingent. Figure 2 represents the elaboration index for each dyad.

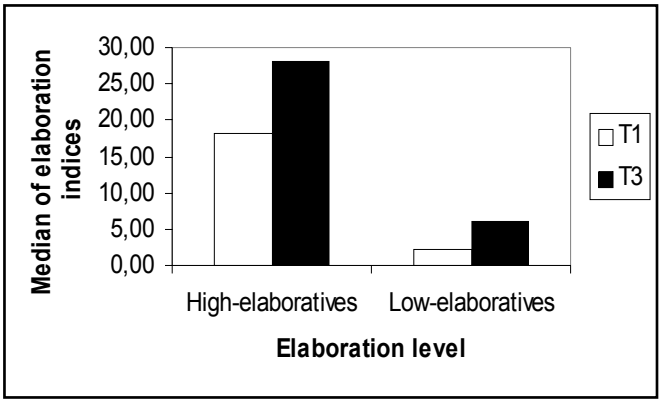

Figure 2: Median values of elaboration indices for high- and low-elaborative groups at T1 and T3.

Nonparametric tests were performed on the dyadic elaboration indices to determine the degree to which the two groups (high- and low-elaboratives) differed, and the extent to which their conversational style developed in time. The overall comparison between the high-elaborative and low-elaborative groups (with elaboration and indices collapsed for T1 and T3) revealed a highly significant difference between the two groups across time (Mann-Whitney U=1; p<.001). The same comparison, performed separately for T1 and T3 also revealed statistically significant differences between groups (Mann-Whitney U=0; p<.008 for T1; Mann-Whitney U=0; p<.016 for T3). In order to determine whether the conversational style of the two groups had changed in time we performed a Wilcoxon signed ranks test separately for each group, comparing elaboration indices at T1 and T3. The high-elaborative group change was marginally significant (Z=-1.82; p<.06), while the low-elaborative group seemed to show no statistically significant change (Z=-1.21; p<.22).

Rigidity and conversational style A rigidity index was computed for each mother-child conversation. We were interested to determine whether repetitive or elaborative dyads would have a more rigid conversational pattern. Hollenstein, Granic, Stoolmiller and Snyder (2004) identified three characteristics of rigidity: (1) a diminished behavioral repertoire (fewer states available to the parent-child system), (2) a limited capacity to shift among behavioral states and (3) a tendency to persevere in any particular behavior. In order to characterize conversational rigidity, we analyzed the number of cells visited by the mother-child dyad (as a characteristic of its behavioral repertoire).

Nevertheless the analysis failed to identify any significant difference between rigidity indices for high- and low-elaborative dyads (Mann-Whitney U= 10.5, p<.67 at T1; Mann-Whitney U=6.5, p<.38 at T3).

Mean Length of Utterance A comparison of the children's MLU between the high- and low-elaborative groups at T1 revealed that there was no significant difference in their initial linguistic abilities (Mann-Whitney U=9, p <.46). The same holds true for MLU at T3 (Mann-Whitney U=10, p <.98).

Discussion

The analysis revealed several important results related to the co-construction of autobiographical memory via mother-child dialogues about the past. Conversational style has been considered a substantial indicator of the child's memory skills, especially by the social cultural developmental theory, evidence pointing to the fact that narrative skills lead to better memory skills rather than the reverse (Nelson & Fivush, 2004). Language functions as a tool that helps to organize personal memories as canonical narratives (Labov, 1982; Peterson & McCabe, 1983), by "utilizing local narrative resources to 'freeze' thoughts about the past" (Sutton, 2002). Learning how to remember is therefore more important than rehearsing specific content, because it provides transferable skills / strategies for accessing specific knowledge (Nelson, 1993; Nelson & Fivush, 2000).

Beyond representing a comprehensive and accessible visualizing tool for the data, plotting the mother-child interaction as the discussion about the past unfolds, presents several advantages, as compared to traditional methods of measuring change. The possibility to analyze successive dyadic states that describe the whole behavioral repertoire of the dyad (circumscribed by the mutually exclusive and complementary codes) creates a dynamic picture presenting the development of the child's, the mother's and the dyad's reminiscing style. What are the conclusions that can be drawn from examining this picture?

First, the attractors that have been identified at each time point tend to confirm the progress of the conversational style for both mother and child. At the first time point the main attractor for almost all the dyads is EL-NC/NR, followed by RE-NC/NR (while the mother elaborates and repeats her own statements in a non-contingent manner, the child is not contributing significantly to the interaction). Six months later, there seems to be a balance between dyads that have a non-responsive child and dyads that have an already more elaborative child. Finally, twelve months from the initial discussion, mothers' contingency slightly improves, as they have a more pertinent dialogue partner, while the child

definitely becomes more elaborative (the most prominent attractor being EL-NC/EL-C).

Adding to these conclusions the comparisons performed between the high- and low-elaborative dyads in time, we obtain partial evidence supporting the *spiral model* of autobiographical memory development (Haden, Haine & Fivush, 1997). This means that as the child becomes a more competent dialogue partner, both adult and child will engage in constructing more elaborate, detailed stories, embellishing and enriching each other's contribution to the joint reminiscing.

We believe that provided we had a larger sample, we would have been able to point out the essential role of maternal contingency as a link between the development of the mother's and child's degree of elaboration in time. A maternal style that is elaborative, yet not contingent to the child's contribution may not yield the same benefits as a contingent interaction, but that is still to be proven. So far, the results only show that the most elaborative mothers are not necessarily the most contingent and the ones with the most elaborative children.

We could not establish rigidity of interaction as characteristic for the elaborative or the repetitive style, although we believe that this direction of research could also be pursued with a larger sample.

Future Directions

The conclusions are clearly tentative, due to the small sample size. Another limitation stems from the fact that there has been no systematic evaluation of the children's linguistic abilities (the MLU being the only indicator of their language competence, which may not represent the best indicator of their language skill by the preschool years – Reese, 2002).

From a broader perspective, a consistent *dynamic approach* would imply the longitudinal collection of data in order to identify critical periods and transition points for the development of autobiographical memory, thereby revealing the intervals during which the maternal conversational style exerts the largest impact upon the subsequent structuring of the child's remembering style.

Employing an elaborative style in reminiscing is vital in various familial, educational or legal contexts. A parental style that deploys strategies to elicit richer accounts during reminiscing may assist children to search their memories in a more systematic fashion (Haden, Haine & Fivush, 1997). Current implications of research in the field have emerged, such as programs designed to train mothers to use an elaborative conversational style in order to enhance children's recall (Hendrick, Coffman, Elischberger, Boland, Ippolito, Haden & Ornstein, 2002). Still, a timing of the intervention specifically "tuned" to the dynamics of autobiographical memory development would obviously lead to an improvement in their effectiveness.

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