Accepted Manuscript

Title: Parallel Associations and the Structure of Autobiographical Knowledge

Author: Robert F. Belli Tarek Al Baghal

PII: S2211-3681(16)30018-3
DOI: http://dx.doi.org/doi:10.1016/j.jarmac.2016.03.004
Reference: JARMAC 225

To appear in:

Received date: 10-2-2016
Revised date: 18-3-2016
Accepted date: 21-3-2016

Please cite this article as: Belli, R. F., and Baghal, T. A.,Parallel Associations and the Structure of Autobiographical Knowledge, *Journal of Applied Research in Memory and Cognition* (2016), http://dx.doi.org/10.1016/j.jarmac.2016.03.004

Parallel Associations and the Structure of Autobiographical Knowledge

Robert F. Belli

University of Nebraska--Lincoln

Tarek Al Baghal

University of Essex

Corresponding Author: Robert F. Belli, bbelli2@unl.edu

Keywords: autobiographical memory; autobiographical knowledge; autobiographical periods; episodic memory; retrospective reports

Abstract word count: 149

General audience summary count: 142

Text word count: 3136

Parallel Associations and the Structure of Autobiographical Knowledge

Robert F. Belli

University of Nebraska--Lincoln

Tarek Al Baghal

University of Essex

Keywords: autobiographical memory; autobiographical knowledge; autobiographical periods; episodic memory; retrospective reports

Abstract word count: 149

General audience summary count: 142

Text word count: 3136

Abstract

The self-memory system (SMS) model of autobiographical knowledge conceives that memories are structured thematically, organized both hierarchically and temporally. This model has been challenged on several fronts, including the absence of parallel linkages across pathways. Calendar survey interviewing shows the frequent and varied use of parallel associations in autobiographical recall. Parallel associations in these data are commonplace, and are driven more by respondents' generative retrieval than by interviewers' probing. Parallel associations represent a number of autobiographical knowledge themes that are interrelated across life domains. The content of parallel associations is nearly evenly split between general and transitional events, supporting the importance of transitions in autographical memory. Associations in respondents' memories (both parallel and sequential) , demonstrate complex interactions with interviewer verbal behaviors during generative retrieval. In addition to discussing the implications of these results to the SMS model, implications are also drawn for transition theory and the basic-systems model.

General Audience Summary

How people remember their life history is an important part of psychology, and several explanations of how this autobiographical memory works has been put forward. One of the most frequently used theories suggests autobiographical memory is categorized by themes, such as employment or relationships, and all memories are contained within these themes. However, this conceptualization has been challenged in several ways, including data from interviews in social surveys. This study uses data from survey interviews where life histories are captured using a calendar tool. Results show that many of people's memories in one life area, such as employment, are recalled through the help of memories from another life area, such as relationships. The prevalence of these cross-area memories in calendar interviews suggests that previous understandings of autobiographical memory are incomplete, and the need for continued evaluation of how autobiographical memory is structured.

Parallel Associations and the Structure of Autobiographical Knowledge

For the past several decades, Conway and colleagues (Conway, 1996; Conway, 2009: Conway & Loveday, 2015; Conway & Pleydell-Pearce, 2000) developed the self-memory system (SMS) model of the structure of autobiographical knowledge. In this model, autobiographical knowledge is structured thematically and is organized both hierarchically and temporally. In terms of hierarchical organization, higher order components index and nest lower components such that lifetime periods—major periods of stability such as working for a specific employer for a number of years—index and nest general events that are often summaries of typical events, such as participating on an employer sponsored sporting team. In turn, episodic memories are indexed and nested within general events, such as having visual images of the circumstances in which one suffered a substantive injury while a player on the team. In terms of temporal organization, lifetime periods occur earlier and later in time, such as working for Employer 'X' preceded working for Employer 'Y." Similar with many conceptions of autobiographical memory (e.g., Bluck, 2003; Fivush & Waters, 2014), the SMS model is conceived as being instrumentally integrated with the conceptual self and serves functions such as determining who one is and who one may possibly become.

The SMS model has been challenged on at least two fronts. Rubin (2006, 2012) considers the most scientifically precise and productive modeling of autobiographical episodic memories to be dependent on explicating the coordination of basic neural systems, and that although hierarchical models have both scientific and heuristic value, they are best viewed as metaphorical accounts. The transition theory of Brown and colleagues (Brown, Hansen, Lee, Vanderveen, & Conrad, 2012; Svob & Brown, 2012) conceptualize autobiographical memories as being organized around routines of experience and major life transitions in which several routines are changed simultaneously, which for example, would happen if one moved from one city to another. Although the SMS model and transition

theory share similarities by including conceptions of lifetime periods of stability transitioning to temporally adjacent ones, transition theory offers a cogent conceptualization that the nature of transitions involve synchronized changes to sets of routines of daily life, and that these past transitions are defining features of autobiographical memory organization. In addition, and in contrast to the SMS model, both transition theory and Rubin's (2006, 2012) basic-systems model do not see conceptions of the self as being instrumental in the creation and occurrence of episodic autobiographical memories.

The work of Belli and colleagues (Belli, 1998; Belli & Callegaro, 2009; Bilgen & Belli, 2010) presents a third challenge to the SMS model, although one that is agnostic with regard to the instrumentality of the conceptual self. Our challenge focuses on the thematic organization that is emphasized in the SMS model, in which the hierarchical structures form partonomies in which linkages or associations are encapsulated within themes (Conway & Loveday, 2015; Conway & Pleydell-Pearce, 2000). The notion of encapsulation is highlighted by the concept of autobiographical memory organization packets (AMOPS), in which hierarchically linked components—from lifetime periods to episodic memories—are only thematically indexed to one another (see Conway & Bekerian, 1987). Hence, in the SMS model, remembering one's employer assists in remembering general and episodic events associated with this employment, but there are not linkages to other themes such as one's marriage and the general and episodic events associated with a marriage.

Although the SMS model shares Barsalou's (1988) perspective that the events that encompass different themes will follow parallel tracks, in which events and their temporal linkages within one theme will occur contemporaneously with events in another theme, the model does not share Barsalou's perspective that there are also associations across themes. In Barsalou's view, such across-theme associations, such as while working for employer 'Y" one met one's ex-spouse, become developed in attaining one's goals. Figure 1 illustrates a structure to autobiographical knowledge that includes across-theme associations. Regardless of the mechanism of the formation of these across-

theme parallel associations, providing evidence that such associations are commonplace during autobiographical recall has implications on modeling the structure of autobiographical knowledge. In this paper, we report such evidence.

Parallel Associations in Survey Interviewing

Social, behavioral, and health scientists routinely administer surveys that ask respondents to report on their past events for purposes of drawing scientific inferences that are relevant to understanding interrelationships among social organizations and individual life course trajectories (Alwin, 1995; Elder, 1985; Scott & Alwin, 1988). There have been two main interviewing methods in which reports on respondents' past events—respondents' retrospective reports—have been queried. In conventional standardized interviewing, retrospective reports are collected via questions that are written in advance and in which interviewers are constrained to ask exactly as written, alongside other criteria for purposes of standardization (Fowler & Mangione, 1990; O'Muircheartaigh, 1997). In calendar interviewing (Balán, Browning, Jelin, & Litzler, 1969; Freedman, Thornton, Camburn, Alwin, & Young-DeMarco, 1988), interviewers are afforded flexibility to ask queries that meet survey objectives which are focused on capturing the sequencing of events from a number of different themes. With both types of interviewing, the retrospective reports that are generated by respondents provide a test bed on which to observe autobiographical memory processes.

In direct comparisons between conventional and calendar interviewing, the calendar method has reliably yielded more accurate retrospective reports (for reviews see Belli 2014; Belli and Callegaro 2009; Glasner and van der Vaart, 2009). Belli and colleagues (Belli, 1998; Belli, Shay, & Stafford, 2001; Belli & Callegaro, 2009) have reasoned that the success of calendar interviewing, in comparison to conventional questionnaires, resides in encouraging the greater use of cues available in the structure of autobiographical knowledge on which to reconstruct one's past more completely and accurately. Figure

2 is a screen capture of a computerized calendar instrument designed for telephone interviewing (only the interviewer viewed the instrument). This instrument is representative of typical calendar instrument designs (e.g., see Balán et al., 1969; Dijkstra, Smit, & Ongena, 2009; Freedman et al., 1988), which have also included paper and pencil versions. As Figure 2 illustrates, the design of calendar instruments mirror the organization of autobiographical knowledge as depicted in the SMS model, although calendar design preceded the SMS model's development. Using Figure 2 as an example, there are themes including residence, marriage (actually relationships, as cohabitation had been queried), children, education, labor, and health, which form a framework on which to query respondents to report on lifetime periods such as which employers one had worked for, and when. Calendars are also designed to query for more specific information such as whether one worked full or part-time, for the entire year or not, and for hourly rates of pay, although there are not queries for respondents to provide episodic memories *per se*. In seeking reports on lifetime periods, the calendar structure encourages respondents to remember temporal linkages or sequential associations among these periods. In seeking reports of details, the calendar structure encourages the retrieval of hierarchical linkages and the drawing of top-down associations from more general lifetime periods to general events that are nested within these periods. Finally, in addition to the within-theme sequential and top-down associations, the calendar design encourages the drawing of across-theme parallel associations that may exist among contemporaneous lifetime periods such that being employed for Employer A occurred during the same time as when one lived at 333 Nice Place in Davenport, Iowa.

In comparison to conventional methods, calendar methods result in the more prevalent use of respondent parallel and sequential associations (Belli, Lee, Stafford, & Chou, 2004; Bilgen & Belli, 2010) and that respondents who more often use these associations in calendar interviews provide more accurate retrospective reports, especially when their pasts are more complicated (Belli, Bilgen, & Al Baghal, 2013). Hence, the notion that the greater use of cues in the structure of autobiographical

knowledge will result in more accurate retrospective reports has received empirical support, but note that the evidence is correlational. Importantly, parallel associations are a part of this mix. In the next sections of this paper, we will provide evidence that parallel associations are spontaneously generated by respondents, that they demonstrate characteristics consistent with being across-theme associations, and that within the context of calendar interviews they are a part of a generative retrieval activity.

The Prevalence and Characteristics of Parallel Associations

The computerized calendar instrument illustrated in Figure 2 was administered via telephone to respondents aged 45 years and older from the Panel Study of Income Dynamics in a methodological between-respondent and between-interviewer experiment that also included, for comparison, a computerized conventional instrument that was matched in content in the collection of lifecourse retrospective reports (see Belli, Smith, Andreski, & Agrawal, 2007, for details on methods). In an extensive content analysis of 165 calendar and 162 CQ interviews from this study, Bilgen and Belli (2010) identified 27 interviewer verbal behaviors and 24 respondent verbal behaviors that demonstrated acceptable intercoder reliability measured by kappa ($.40 < k < .93$). Among these behaviors were interviewers using retrieval probes and respondents' retrieval strategies, including respondents using parallel associations in their remembering of life course periods and events. In subsequent coding, Belli and colleagues (Al Baghal & Belli, 2011; Belli, Al Baghal, & Steele, 2009; Steele, Al Baghal, & Belli, 2010) were able to eliminate miscoding in Bilgen and Belli's data, by ensuring that all respondent parallel associations were spontaneously generated, that is, that the respondent parallel associations were not direct responses to interviewers' parallel probing. Although interviewers were trained to administer parallel probes in the calendar interviews, and according to Bilgen and Belli's results, did so with a mean of 3.90 probes per interview, they rarely did so in the conventional interviews, having engaged in parallel probing on average 0.54 probes per interview. Nevertheless, Al Baghal and Belli observed that there were, on average, 7.45 spontaneous respondent parallel associations per conventional interview

with a sizable majority (79.6%) of respondents being interviewed with the conventional method having at least one parallel association, demonstrating that the use of parallel associations is a natural autobiographical memory process. Respondent parallel associations occurred significantly more often in calendar interviews, with an average of 11.30 associations per interview, with 93.3% of respondents having at least one parallel association. With both conventional and calendar interviews, the rate of respondent associations was considerably higher than the rate of interviewer parallel probing indicating that parallel associations in both types of interviewers were mainly respondent-driven.

Having established that parallel associations are a common feature of generative retrieval from autobiographical memory, our attention focused on their characteristics (Al Baghal & Belli, 2011; Belli et al., 2009; Steele et al., 2010). First, we wanted to determine which themes were being retrieved in parallel associations. Our content analysis had been restricted to four themes that were queried during interviewing, 1) residence, 2) relationships, 3) labor, and 4) health, and hence, for only these themes were we able to capture associated themes. In categorizing the retrieved themes in the parallel associations, we obtained adequate intercoder reliability ($.73 < k < .96$) for seven categories consisting of residence, spousal relationship (including any life partners), other relationship, education, labor, and miscellaneous. The miscellaneous category contained mainly parallel associations regarding general holidays, historical events, and other associations not falling into the six main categories. Collapsing conventional and calendar interviews, Table 1 provides a cross-tabulation of the percentage of themes in the parallel associations that were retrieved while being queried for information from each of the four interviewed themes. The zero percentages for residence/residence, relationship/spousal relationship, labor/labor, and health/health are due to the fact that parallel associations must involve themes that are not being directly queried.

Results show asymmetries among different themes. The relationship theme appears largely encapsulated when targeted during generative retrieval as only 5% of parallel associations occur when

respondents are reporting on their relationships. However, this encapsulation may largely be a function of their having been fewer romantic relationships during the typical life course of our respondents in comparison to the number of periods reported in other themes (see Belli et al., 2013), and hence, fewer opportunities for parallel associations. Importantly, both spousal and other relationships account for a sizable percentage of parallel associations during the generative retrieval of events from other themes, especially residence, in which respondents reported more periods in comparison to other interviewed themes. Education and labor, alongside relationships, are also quite prevalent as parallel association themes, and alongside residence, generative retrieval of events within the labor theme encourages parallel associations from other themes. These results indicate that the SMS model's conceptualization of encapsulated themes does not accurately convey the interrelationships among different themes.

We also investigated the level of generality of parallel associations. We initially began coding the autobiographical memories generated via parallel associations on whether they were specific (episodic) or generic, but soon realized that a third transitional category, at times consisting of both specific and generic aspects, and concentrated on the transition from one period of stability to another, occurred fairly frequently. In independent coding, we achieved adequate intercoder reliability for the 44.9% of associations that were transitional (k = .68) and for the 53.8% of associations that were generic (k = .59), but did not achieve adequate intercoder reliability for specific associations due to their low prevalence (1.3%). Table 2 provides examples of these categorizations of parallel associations and the interviewing theme in which they occurred. The relative high prevalence of transitional associations supports the perspective of transition theory on the importance of transitions in framing the organization of autobiographical memory (Brown et al., 2012; Svob & Brown, 2012). However, the occurrence of generic associations is more consistent with the SMS model to the extent that general event knowledge is readily accessible (Conway, 1996).

Parallel and Sequential Associations in the Context of Survey Interviewing

We cannot argue, nor would we care to argue, that the method of survey interviewing, whether conventional or calendar, had no impact on the content of parallel associations. For example, Al Baghal and Belli (2011) did observe a significant difference between methods in that when only considering transitional and generic associations, the ratio of transitional to all associations in the conventional method (.415) was lower than that in the calendar method (.481). As the calendar method encourages a greater prevalence of respondent retrieval strategies in comparison to conventioanl interviewing, and as the calendar design mirrors the structure of autobiographical knowledge advocated by the SMS model, this result reveals that the SMS model does not adequately account for the importance of transitions as an organizing principle.

Survey methodologists are keenly aware that the verbal behaviors of interviewers impact those of respondents, and vice-versa. The survey interview is best characterized as a type of conversation between participants in which certain assumptions of ordinary conversation are maintained while others are ignored (Houtkoop-Steenstra, 2000; Schaeffer, 1991; Schwarz, 1996). Unlike ordinary conversation, the overall purpose of the survey interview is not for the participants to share information (although this does always occur to some extent), but for respondents to provide information about themselves that only they know. In this way, the collection of retrospective reports in survey interviewing also differs from conversations that encourage the development of shared memories (Hirst, Coman, & Coman, 2014); the memories that are reported by respondents do not encourage interviewers to make them their own.

To gain greater understanding of the role of interviewing dynamics in calendar methods in encouraging spontaneous parallel and sequential respondent associations, Belli, Miller, Al Baghal, and Soh (2015) used data mining techniques to determine which verbal behaviors that occurred in the previous three turns of speech between interviewers and respondents were predictive of respondent parallel and sequential associations in the targeted fourth turn. As noted above, parallel associations

are commonplace, although sequential behaviors, taken together, are even somewhat more common. Bilgen and Belli (2010) noted three types of sequential behaviors, 1) *timing*, in which focus is placed on the temporal location of the beginning or ending of a period, 2) *duration*, in which focus is centered on how long a period occurred, and 3) simple *sequential*, in which attention is placed on determining an adjacent later period within a theme. Although all of the verbal behaviors identified by Bilgen and Belli were subjected to data mining, which included categories of behaviors other than retrieval such as those involving clarifications, verifications, digressions, feedback, and expressions of cognitive difficulty, the predictive verbal behaviors that were in the preceding three turns are all characterized as directly involving retrieval. This result, and those from Belli et al. (2013), who found that retrieval behaviors tend to cluster together in confirmatory factor analyses, demonstrate that respondents are in a generative retrieval mode when making parallel and sequential associations.

The specific types and combinations of retrieval behaviors that encourage parallel and sequential associations are quite variable. Although interviewers using parallel probes are predictive of later parallel associations, earlier respondent timing associations and interviewer timing and duration probes also encouraged parallel associations. Similarly, although interviewer timing probes are predictive of later respondent timing associations, so are interviewer duration probes and respondents having earlier provided a timing association. Contrary to this pattern, the occurrence of duration associations are encouraged by preceding respondent timing associations and interviewer timing probes, and simple sequential associations are encouraged by respondent timing and parallel associations. Hence, although interviewers play a role in encouraging respondents to draw parallel and sequential associations, these associations occur among several different patterns and their specificity is primarily driven by respondents' generative retrieval preferences. Given that the bulk of calendar interviewing is seeking retrospective reports of lifetime periods and general events, models of autobiographical memory, such as Rubin's (2006, 2012) basic systems model, which concentrate nearly

exclusively on accounting for episodic memories or the remembering of singular event scenes (Rubin & Umanath, 2015), do not currently address the generative retrieval of associated events that occur at more general levels within the organization of autobiographical memory, as seen with our results.

Conclusions

The past few decades have witnessed tremendous interest in seeking to uncover the manner in which autobiographical memory is organized and structured. Our findings with regard to parallel associations challenges the completeness of existing models, but in different ways. As parallel associations are commonplace and will occur without direct interviewer probing, the notion in the SMS model that associations among events are encapsulated within themes is in need of modification. As parallel associations are both transitional and generic in content, both the SMS model and transition theory need to take into account that both transitions and periods of stability are essential aspects of how autobiographical memories are organized. Finally, as parallel associations rarely include only specific episodic content, and as different types of generic memories will interact in complex ways during generative retrieval, seeking primarily to explain the complexities that are involved in episodic retrieval overlooks how autobiographical remembering, in certain contexts, can primarily involve higher order levels of discourse.

Author Contributions

Robert F. Belli was the lead author on the manuscript, providing most of the text, one of the tables, and both figures.

Tarek Al Baghal contributed some of the text, one of the tables, and edited the text.

Both authors substantively contributed much of the research that is cited/referenced in the paper.

Acknowledgements

This paper is based upon work supported by the National Institute on Aging (National Institutes of Health) under Grant No. R01AG 17977 and by the National Science Foundation under Grant No. 1132015. Any opinions, findings, and conclusions or recommendations expressed in this paper are those of the authors and do not necessarily reflect the official views of the National Institute on Aging, the National Institutes of Health, or the National Science Foundation.

References

Al Baghal, T., & Belli, R. F. (2011). *Parallel memories and the structure of autobiographical memories in event history calendars*. Unpublished manuscript.

Alwin, D. F. (1995). Taking time seriously: Studying social change, social structure, and human lives. In P. Moen, G. H. Elder, & K. Lüscher (Eds.), *Examining lives in context: Perspectives on the ecology of human development* (pp. 211-262). Washington DC: American Psychological Association.

Balán, J., Browning, H. L., Jelin, E., & Litzler, L. (1969). A computerized approach to the processing and analysis of life histories obtained in sample surveys. *Behavioral Science, 14*, 105-114.

Barsalou, L. W. (1988). The content and organization of autobiographical memories. In U. Niesser and E. Winograd (Eds.), *Remembering reconsidered: Ecological and traditional approaches to the study of memory* (pp. 193-243). New York: Cambridge University Press.

Belli, R. F. (1998). The structure of autobiographical memory and the event history calendar: Potential improvements in the quality of retrospective reports in surveys. *Memory, 6*, 383-406.

Belli, R. F., (2014). Autobiographical memory dynamics in survey research. In T. J. Perfect and D. S. Lindsay (eds.), *SAGE Handbook of Applied Memory* (pp. 366-384). Los Angeles: Sage.

Belli, R. F., Albaghal, T., & Steele, C. (2009, July). Parallel associations populate the structure of autobiographical knowledge. Paper presented at the biennial conference of the Society for Applied Research in Memory and Cognition, Kyoto, Japan.

Belli, R. F., Alwin, D. F., & Stafford, F. P. (2009). The application of calendar and time diary methods in the collection of life course data. In R. F. Belli, F. P. Stafford, & D. F. Alwin (Eds.), *Calendar and time diary methods in life course research* (pp. 1-12). Thousand Oaks, CA: Sage.

Belli, R. F., Bilgen, I., & Al Baghal, T. (2013). Memory, communication, and data quality in calendar interviews. *Public Opinion Quarterly, 77*, 194-219.

Belli, R. F., & Callegaro, M. (2009). The emergence of calendar interviewing: A theoretical and empirical rationale. In R. F. Belli, F. P. Stafford, & D. F. Alwin (Eds.), *Calendar and time diary methods in life course research* (pp. 31-52). Thousand Oaks, CA: Sage.

Belli, R. F., Lee, E. H., Stafford, F. P., & Chou, C-H. (2004). Calendar and question-list survey methods: Association between interviewer behaviors and data quality. *Journal of Official Statistics, 20*, 185-218.

Belli, R. F., Miller, L. D., Al Baghal, T., & Soh, L-K. (2015). *Using data mining to predict the occurrence of respondent retrieval strategies in calendar interviewing: The quality of retrospective reports*. Paper submitted for publication.

Belli, R.F., Shay, W. L., & Stafford, F. P. (2001). Event history calendars and question list surveys: A direct comparison of interviewing methods. *Public Opinion Quarterly, 65*, 45-74.

Belli, R. F., Smith, L., Andreski, P., & Agrawal, S. (2007). Methodological comparisons between CATI event history calendar and conventional questionnaire instruments. *Public Opinion Quarterly, 71*, 603-622.

Bilgen, I., & Belli, R. F. (2010). Comparison of verbal behaviors between calendar and standardized conventional questionnaires. *Journal of Official Statistics, 26*, 481-505.

Bluck, S. (2003). Autobiographical memory: Exploring its functions in everyday life. *Memory, 11*, 113-124.

Brown, N. R., Hansen, T. G. B., Lee, P. J., Vanderveen, S. A., & Conrad, F. G. (2012). Historically defined autobiographical periods: Their origins and implications. In D. Berntsen & D. C. Rubin (Eds.),

Understanding autobiographical memory (pp. 160-180). Cambridge: Cambridge University Press.

Conway, M. A. (1996). Autobiographical knowledge and autobiographical memories. In D. C. Rubin (Ed.), *Remembering our past: Studies in autobiographical memory* (pp. 67-93). New York: Cambridge University Press.

Conway, M. A. (2009). Episodic memories. *Neuropsychologia, 47*, 2305-2313.

Conway, M. A., & Bekerian, D. A. (1987). Organization in autobiographical memory. *Memory & Cognition, 15*, 119-132.

Conway, M. A., & Loveday, C. (2015). Remembering, imagining, false memories & personal meanings. *Consciousness and Cognition, 33*, 574–581

Conway, M. A., & Pleydell-Pearce, C. W. (2000). The construction of autopbiographical memories in the self-memory system. *Psychological Review, 107*, 261-288.

Dijkstra, W., Smit, J. H., & Ongena, Y. P. (2009). An evaluation study of the event history calendar. In R. F. Belli, F. P. Stafford, & D. F. Alwin (Eds.), Calendar and time diary methods in life course research (pp. 257-275). Thousand Oaks, CA: Sage.

Elder, G. H. (1985). Perspectives on the life course. In G. H. Elder (Ed.), *Life course dynamics: Trajectories and transitions, 1968-1980* (pp. 23-49). Ithaca, NY: Cornell University Press.

Fowler, F. J., & Mangione, T., W. (1990*). Standardized survey interviewing. Minimizing interviewer-related error*. Newbury Park, CA: Sage.

Freedman, D., Thornton, A., Camburn, D., Alwin, D. F., & Young-DeMarco, L. (1988). The life history calendar: A technique for collecting retrospective data. In C. C. Clogg (Ed.), Sociological methodology (pp. 37-68). Washington, DC: American Sociological Association.

Fivush, R., & Waters, T. E. (2014). Sociocultural and functional approaches to autobiographical memory. In T. J. Perfect and D. S. Lindsay (eds.), *SAGE Handbook of Applied Memory* (pp. 221-238). Los Angeles: Sage.

Glasner, T., & van der Vaart, W. (2009). Applications of calendar instruments in social surveys: A review. *Quality & Quantity, 43*, 333-349.

Hirst, W., Coman, A., & Coman, D. (2014). Putting the social back into human memory. In T. J. Perfect and D. S. Lindsay (eds.), *SAGE Handbook of Applied Memory* (pp. 273-291). Los Angeles: Sage.

Houtkoop-Steenstra, H. (2000). *Interaction and the standardized survey interview: The living questionnaire.* New York: Cambridge University Press.

O'Muircheartaigh, C. (1997). Measurement errors in surveys: A historical perspective. In L. E. Lyberg, P. P. Biemer, M. Collins, E. de Leeuw, N. Schwarz & D. Trewin (Eds.), *Survey measurement and process quality* (pp. 1-25). New York: Wiley.

Rubin, D. C. (2006). The basic-systems model of episodic memory. *Perspectives on Psychological Science, 1*, 277-311.

Rubin, D. C. (2012). The basic-systems model of autobiographical memory. In D. Berntsen & D. C. Rubin (Eds.), *Understanding autobiographical memory* (pp. 11-32). Cambridge: Cambridge University Press.

Rubin, D. C., & Umanath, S. (2015). Event memory: a theory of memory for laboratory, autobiographical, and fictional events. *Psychological Review, 122*, 1-23.

Schwarz, N. (1996). *Cognition and communication*. Mahway, NJ: Erlbaum

Scott, J., & Alwin, D. (1998). Retrospective versus prospective measurement of life histories in longitudinal research. In J. Z. Giele & G. H. Elder (Eds.), *Methods of life course research* (pp. 98-127). Thousand Oaks, CA: Sage.

Steele, C., Albaghal, T., & Belli, R. F. (2010, May). The extent of parallel memories in autobiographical knowledge and its manifestation in calendar and conventional surveys. Paper presented at the annual conference of the American Association for Public Opinion Research, Chicago, IL.

Svob, C., & Brown, N. R. (2012). Intergenerational transmission of the reminiscence bump and biographical conflict knowledge. *Psychological Science, 23*, 1404–1409

Table 1

Percentage of parallel association themes by interview theme.

Parallel Association Theme	Interview Theme				Total %
	Residence	Relationship	Labor	Health	
Residence	0.00	1.62	6.95	0.56	9.13
Spousal Relationship	13.24	0.00	3.00	1.50	17.75
Other Relationship	12.75	1.45	5.98	3.28	23.46
Education	12.85	0.13	12.53	1.96	27.47
Labor	7.40	0.69	0.00	2.44	10.53
Health	0.40	0.07	0.89	0.16	1.51
Other	5.85	1.12	2.44	0.74	10.15
Total %	52.49	5.08	31.78	10.65	100.00

Table 2

Examples of the level of content generated with parallel associations within the different interview themes.

Parallel Association	Interview Theme			
	Residence	Relationship	Labor	Health
Specific	When I worked for Company5 he stuck a backhoe through my foot.	I been through heart--heart operation. I'm lucky to be here this morning.	Well, I had open heart surgery so I'd say, Laugh-R, and I--I probably left around March.	Because I know I finished 2nd in the junior Olympics when I was younger, so pretty good shape.
Transitional	After I got married in June of '60 I moved to City7, State1.	Well, just as soon as I got home from the service. (Ok) So, it was in November of--or September of 1946.	August, September. (m-pos) I worked off-and-on at that job until I got married.	I weigh about fifteen pounds more than what I weighed when I came out of the Navy in 1950
Generic	My parents were having their house built.	"Yeah. To the best of my recollection it was in June of '71, because we were both sophomores in college. "	Part-time, because I was in school.	Well, yeah, when I was driving trucks I lost weight.

Figure 1
A model of autobiographical knowledge that includes parallel associations

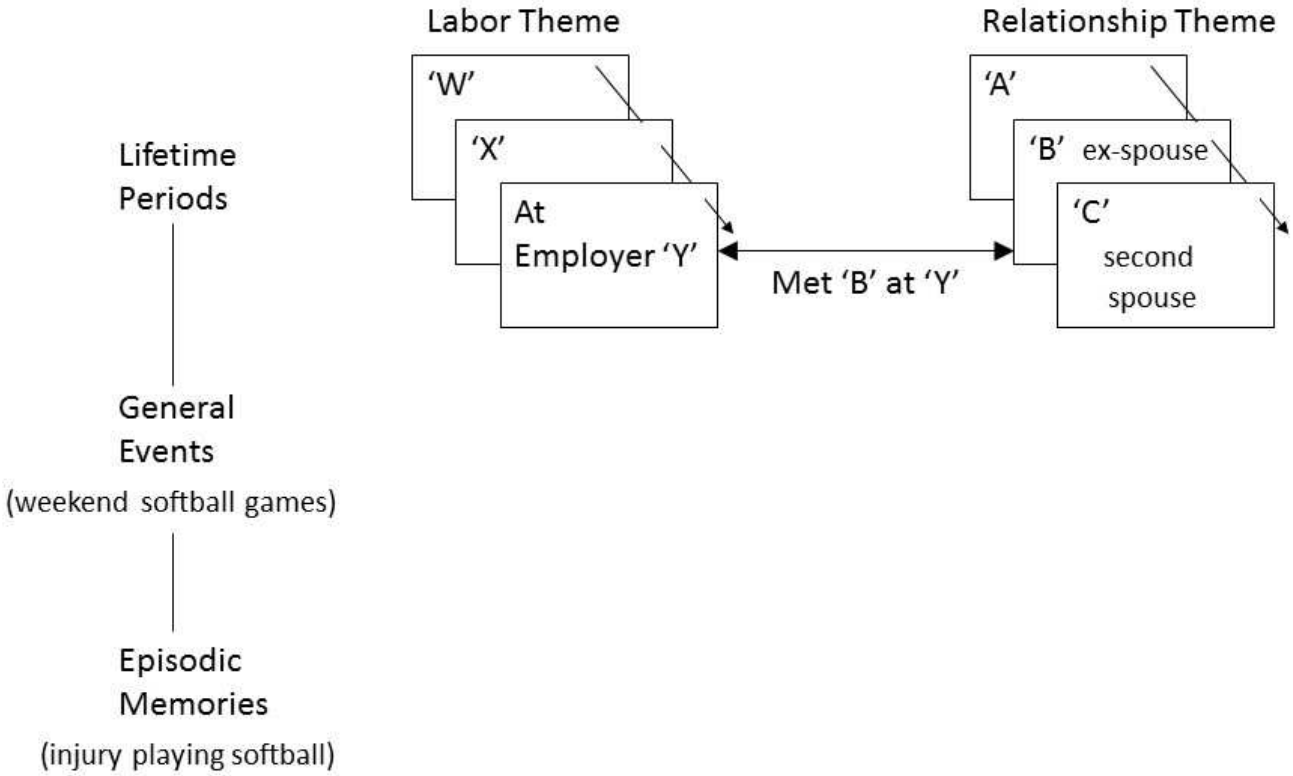
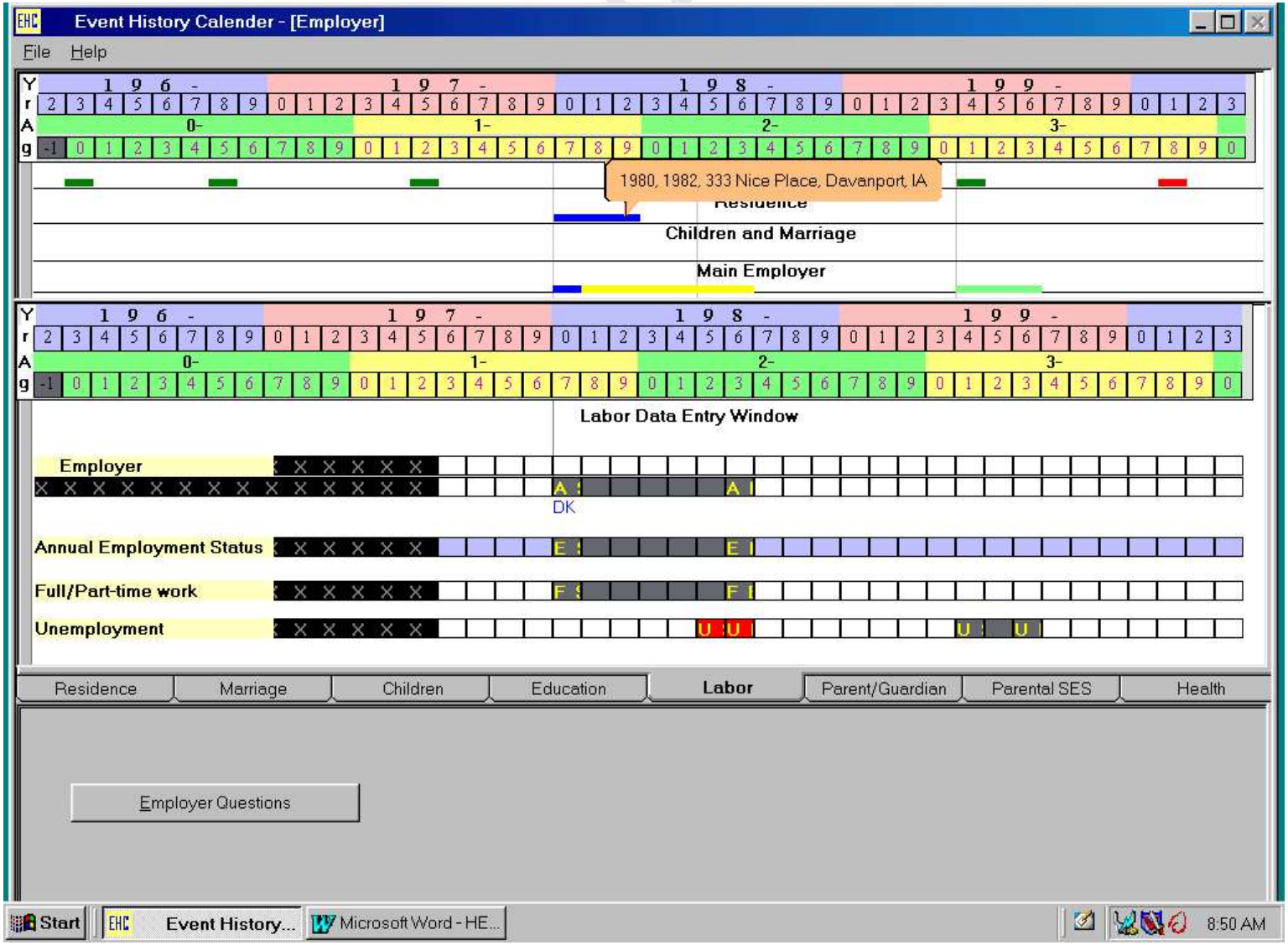


Figure 2
Screen capture of a computerized calendar


Event History Calender - [Employer]
File Help
1980, 1982, 333 Nice Place, Davanport IA
Residence
Children and Marriage
Main Employer
Labor Data Entry Window
Employer
DK
Annual Employment Status
Full/Part-time work
Unemployment
Residence
Marriage
Children
Education
Labor
Parent/Guardian
Parental SES
Health
Employer Questions
Start
Event History...
Microsoft Word - HE...
8:50 AM