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Ordering Our World:

The Quest for Traces of Temporal Organization in Autobiographical Memory

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Abstract

An experiment examined the idea, derived from the Self Memory System model (Conway & Pleydell-Pearce, 2000), that autobiographical events are sometimes tagged in memory with labels reflecting the life era in which an event occurred. The presence of such labels should affect the ease of judgments of the order in which life events occurred. Accordingly, thirty-nine participants judged the order of two autobiographical events. Latency data consistently showed that between-era judgments were faster than within-era judgments when the eras were defined in terms of either: (a) college versus high school, (b) academic quarter within year, or (c) academic year within school. The accuracy data similarly supported the presence of a between-era judgment effect for the college versus high school dichotomy.

Key Terms: Autobiographical Memory, Judgments of Recency, Temporal Knowledge, Temporal Judgment; Self-Knowledge

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Important knowledge derived from comparisons of the past self to the current self depends on at least some degree of accuracy in recalling how one was *then* – which, in turn, depends on at least some degree of accuracy in remembering *when*. The functionality of such accurate temporal memory is reflected in difficulties exhibited by temporal amnesiacs (Shaw & Aggleton, 1995) and Korsakoff's psychosis patients (Downes, Mayes, MacDonald, & Hunkin, 2002; Squire 1982).

In accord with its functional importance, the cognitive underpinnings of temporal knowledge received substantial empirical attention. Methodologies have included: (a) event age estimation (Huttenlocher, Hedges, & Prohaska, 1992); (b) judgments of how old an event "feels" (Ross & Wilson, 2001); (c) reconstruction of event dates using a blank calendar as a dating aid (Skowronski, Betz, Thompson, & Shannon, 1991; Thompson, Skowronski, Larsen, & Betz, 1996);(d) temporal estimation using memory for stimulus sequences (Burt, Watt, Mitchell, & Conway, 1998; Burt, Kemp, Grady, & Conway, 2000); and (e) temporal estimation from the number of items judged to intervene between two other items (Skowronski, Betz, Thompson, & Larsen, 1995; Underwood & Malmi, 1978).

One additional method involves judgment-of-recency (JOR): judgment of the order in which two events occurred. Results typically evince a *temporal distance effect:* Judgments become more accurate and faster as events become more widely separated in time (Hurst & Volpe, 1982; Linton, 1975; Skowronski, Walker, & Betz, 2003; Squire, Chace, & Slater, 1975, 1976; Underwood, 1977).

One variable affecting JOR performance may be the extent to which events are era-labeled. Examples of such labels are *when I was in graduate school* and *when I was a kid*. Conway and Pleydell-Pearce's (2000) Self Memory System model[1] suggests that order judgments of events tagged as occurring in different life eras should be especially easy compared to order judgments of events tagged as occurring in the same era. Many era labels imply sequencing (e.g., *when I was a kid* comes before *graduate school*), so an order judgment of events from different eras can be easily made using those era labels. When no labels exist, when events are from the same era, or when era labels do not precisely specify event orders, people may have to access specific event knowledge, and do so repeatedly, to determine event orderings. Such repeated access should produce responses that are slow and often incorrect.

Preliminary support for this hypothesis exists. Participants in Fuhrman and Wyer's (1988) research responded faster when judgments were about events that crossed high school eras (e.g., a freshman event versus a sophomore event) than when events were from the same era (e.g., two freshman events). However, Fuhrman and Wyer's analyses did not control for absolute time differentials between events. Hence, their result may simply reflect temporal distance effects.

Our study eliminates this problem and extends their study by looking at multiple temporal labeling schemes at different levels of specificity. Participants recorded personal events, each occurring in a specific academic quarter (summer, autumn, winter, spring) starting with the summer just before starting the usual four years of high school and ending at the summer after freshman year of college. All told, that spanned five and one-quarter years (21 quarters).

Participants made JORs about event pairs in which each event was randomly chosen (with replacement) on each trial. The presence of labels would be suggested if event orders were judged more rapidly, and perhaps more accurately, when events occurred in different eras than in the same era. Participants provided event date estimates that were used to control for the time that actually passed between events in a pair. Thus, evidence suggestive of era labeling effects cannot be attributed to the processes contributing to the symbolic temporal distance effect (e.g., event context similarity).

Five classes of era labels were explored: (a) college versus high school; (b) year within school (high school freshman, high school sophomore, high school junior, high school senior; college freshman); (c) quarter within year (summer before high school, autumn of freshman year of high school, etc.); (d) class standing (underclassman in high school, upperclassman in high school); and (e) school year versus summer.

The five era schemes were selected based on several criteria. Selection of the year-within-school scheme was driven by our desire to explore whether Wyer and Fuhrman's (1988) results held when temporal distance was accounted for. Moreover, the academic class labels explored by Wyer and Fuhrman made sense to us – our observations suggested that students often used these labels when describing life events. In our view, this process of describing events is one variable causing temporal labels to become attached to events. Our observations similarly suggested that two other label types are often used: college versus high school labels and quarter within year labels. Hence, we expected to find between-era versus within-era effects for these labeling schemes, as well.

We thought that it was important to demonstrate that between-era versus within-era effects would not emerge for any logical temporal system. Such specificity would lend credence to the idea that era effects are caused by labels attached to events in memory, and are not the consequence of the use of any logical temporal labeling system when making order judgments.

Accordingly, two labeling schemes examined in the present paper were chosen because we thought that they were not often used in describing events. These were the upperclassman versus lower classman distinction and the summer versus school year distinction. Because of their infrequency of use, we thought that these labels would not often be present in memory as event labels, and hence, between-era versus within-era differences would not emerge in order judgments of events falling into these eras.

Method

Participants

Thirty females and nine males completed the study and received partial credit toward fulfillment of a research requirement in a psychology course. All were at or beyond their sophomore year of college. Ages ranged from 19 to 43 ($M = 23$).

Event Collection Phase

Participants recorded autobiographical events on the pages of a take-home booklet. Each event page designated a period in which the event was supposed to have occurred. The first was the summer prior to entering high school. Each subsequent period reflected a subsequent quarter of the academic year. For example, the second period was the autumn of the first year of high school; the third period was the winter of the first year of high school. The pages continued in this fashion, ending with the summer between the first year of college and the second year of college. The period sequence occurred twice, so participants recorded two events from each of 21 periods.

Participants provided an event title of eight words or fewer for each event (e.g., “Snowboarding in Wisconsin with Cory and Jeremy.”). They were told that it was crucial that each title was unique and personally meaningful: Later, they would have to remember the event cued only by the title.

Participants were informed that events recorded should meet two constraints. First, events should be unique, occurring only once in an academic term and possessing characteristics distinguishing them from similar events. Second, participants were told to avoid recording overly personal events that might cause embarrassment should they become public.

Participants provided additional information about each event, rating various event properties (e.g., how well it was remembered, valence, rehearsal rate, etc.) irrelevant to the present article (for more on such measures, see Skowronski et al., 2003). However, two items were critical: The participant's age at an event's occurrence and an estimate of the date of the event's occurrence. These were used to determine an event's age and how much time passed between events in each pair presented in the JOR phase of the experiment.

The JOR Phase

Four to six weeks after completing their booklet, on each of 200 trials participants judged the order of two events. Items were randomly selected from each participant's own booklet for each pair on each trial, with replacement across trials. Whenever possible, exact event labels were used. However, excessively long labels were shortened, preserving the label's meaning while minimizing reading time.

A personal computer running custom software controlled the task. On each trial, an event label appeared at the top of the computer screen. A cue word (*Sooner* or *Later*) simultaneously appeared below the event label. The cue word, varied randomly across trials, conveyed the direction of the judgment. If the word *Later* appeared, participants were to judge whether the second event occurred after the first. If the word *Sooner* appeared, participants were to judge whether the second event occurred before the first. Participants were told to respond as quickly as they could without making errors.

After reading the event and the cue word, pressing the space bar started the timing routine and caused the second event label to appear at the bottom of the screen. If participants were given the *Later* prompt and thought that the second event occurred after the first, or were given the *Sooner* prompt and thought that the second event occurred before the first, they were to press the *Y* key on the keyboard. If participants were given the *Later* prompt and thought that the second event occurred before the first, or were given the *Sooner* prompt and thought that the second event occurred after the first, they were to press the *N* key. When a key was pressed, the response and its latency were recorded and the next trial initiated. This continued until all 200 trials were completed.

After assignment to a computer, participants pressed the *Return* key on the keyboard. This initiated a series of instruction screens. Participants accessed the screens at their own pace, pressing a key to receive additional instruction screens. After reading all instructions, participants completed practice trials. These used generic events (not from participants' booklets). After completing these trials, participants pressed a key to begin the 200 critical trials. After these were completed, the computer program provided a debriefing and dismissed the participant.

Although up to eight participants could simultaneously engage the JOR task, the task was presented on individual computers that were physically isolated. Hence, participants' responses could not influence responses of others.

Results

An Overview of the Measures and the Regression Analyses

Treatment of response latencies and analysis methods. One dependent measure was response latency. Latency data are often transformed prior to analysis (Fazio, 1990). Our analyses examined results obtained after three different transformations (e.g., deletion of latencies greater than 3 *SD* from the overall latency mean, natural logarithmic transformation, and inverse transformation), as well as results using raw latencies. Results from all analyses yielded similar inferences. For simplicity and clarity, and in accord with the recommendations of Ratcliff (1993), we report only *raw latency* results in which responses that were longer than 3 *SD* from the overall latency mean were deleted from the data set prior to analysis.

The latencies served as a criterion variable in multiple pooled within-participant regression analyses simultaneously incorporating data from all participants. Dummy-coded

variables corresponding to each participant were entered into all regression models to control for within-subject effects. As in within-subject analysis of variance, the analytic procedure partials out effects of between-subjects variance, allowing for tests of within-subjects effects against an error term that is uncontaminated by between-subjects variance (see Cohen & Cohen, 1983). Dummy-coded variables for each trial were also entered into each regression to account for linear and quadratic trials effects (Skowronski et al., 2003). Other procedural dummy-coded control variables in the analyses included judgment direction (*sooner* or *later*), congruency between the item order presented and the judgment requested (*congruent* or *incongruent*), and whether event pairs were temporally arranged by *earlier-then-later* or *later-then-earlier*. These were not variables of interest, thus, results from these variables are not reported (see Skowronski et al., 2003, for a description of results for such variables). However, it is important to remember that results for the main predictor variables of interest control for effects of all of these procedural variables.

The first predictor of interest was the difference between the ages of the two events presented on each trial. This difference was calculated from the date estimates provided by each participant for each event. These data should yield a *temporal distance effect*: The greater the time differential between the two events, the faster the judgment. In addition to being a variable of interest, entry of a temporal distance effect term into the regression models serves to control for that effect. Hence, any other effects that emerge as significant in the regression models are independent of the actual temporal distance between the two events on each JOR trial.

This is of particular importance when examining between versus with era effects. This predictor examined whether an event pair occurred within- or between- eras. An event pair was coded as *between* when a hypothetical labeling scheme suggested that the events crossed major life boundaries; it was coded as *within* when a hypothetical labeling scheme suggested that the two events were from the same life period. Because temporal distance is included in all regression models, any era effect that emerges from the analyses is, by definition, independent of temporal distance. Separate analyses examined the five hypothetical labeling schemes described in the *Methods* section.

Treatment of accuracy data and analysis methods. The second dependent measure was judgment accuracy, a dichotomous variable. It has been argued that dichotomous data are best-analyzed using logit models. Allison (1999) argues that, when the data are longitudinal or otherwise clustered (as in our experimental design), the SAS GENMOD procedure is preferable to the SAS PROC LOGISTIC procedure. Accordingly, we used GENMOD to conduct our analyses and the Generalized Estimating Equations (GEE) routine was used as the logit estimating method. This method outputs a likelihood-ratio chi-square that tests "the null hypothesis that all the coefficients in the set are equal to 0" (Allison, 1999, p. 27). In these analyses, we always modeled the likelihood of a 1, an accurate judgment.[2]

Variables entered into the logit analyses duplicated those in the latency data analyses. One main interest in these logit analyses was whether a temporal distance effect emerged, such that judgment accuracy increased as the time lag between events in a pair increased. The second main interest was whether, for any of the five labeling schemes, accuracy would be greater when events crossed era boundaries than when they occurred within the same era. As in the latency analysis, simultaneous entry of the temporal distance and between-versus-within-era variables into the analysis ensures that significant effects of each variable are independent of the other.

The Temporal Distance Effect

Greater time lags between autobiographical events were reliably associated with briefer response latencies and lower error rates. These outcomes emerged regardless of the era scheme included in a given analysis. Slope estimates across regression analyses of the latency data ranged from -.13 to -.14, with all standard errors equal to .02 (smallest $F(1,5251) = 35.00$, largest $F(1,6980) = 66.29$, all ps < .0001). Slope estimates of errors across logit analyses ranged from .89 to .92 and standard errors ranged from .13 to .18, (smallest *GEE* $\chi^2(1, N = 38) = 16.70$; largest *GEE* $\chi^2(1, N = 38) = 24.09$, all ps < .0001).

Probing For Life Period Labels: Judgments Within versus Between Temporal Eras

If autobiographical events are linked to era labels, then when events occur in different eras people can use the labels to short cut the search process that may otherwise be needed to make a JOR. This idea was examined in the context of each of the five separate potential era schemes described earlier in this article. The mean latencies and accuracies for the within-era versus between-era judgments for each of these era schemes are presented in Table 1.

College versus high school. For this classification scheme, participants took longer to judge the order of two events when they were both from the same era than when they were from different eras, $F(1, 5251) = 59.10$, $p < .0001$, MSE =0 .80. Participants also made more errors when both autobiographical events were from the same era than when they were from different eras, $GEE\ \chi^2(1, N = 38) = 13.62$, $p < .005$**.** These results suggest that people attach the life era labels of college and high school to events and use them to make event order judgments.

Academic quarter within college or high school. For this classification scheme, participants took longer to judge the order of two events when they were both from the same era than when they were from different eras, $F(1, 6980) = 5.98$, $p < .02$, $MSE = 2.17$. However, differences in the accuracy of whether the events to be judged occurred in the same quarter or not merely approached significance, $GEE\ \chi^2(1, N = 38) = 2.14$, $p > .10$. These results are moderately supportive of the idea that people attach academic quarter labels (e.g., the autumn of my freshman year) to events and use them to make event order judgments.

Year within college or high school. For this classification scheme, participants took longer to judge the order of two events when they were both from the same era than when they were from different eras, $F(1,6980) = 11.80$, $p < .001$, $MSE = 2.17$. However, the accuracy of these judgments was not significantly affected by whether the events to be judged occurred in same academic era, $GEE\ \chi^2(1, N = 38)$ = 0 .24, $p > .60$. These results are moderately supportive of the idea that people attach academic year within school labels to events and use them to make event order judgments.

Upper classman versus lower classman within high school. For this classification scheme, participants' judgment latencies were not affected by whether the two events to be judged were both from the same era or were from different eras, $F(1, 6980) = 1.15$, $p = .28$, $MSE = 2.17$. Moreover, while accuracy was reliably predicted by era, $GEE\ \chi^2(1, N = 38) = 8.43$, $p < .005$, as shown in Table 1 the means for this effect were *opposite* of the predicted direction, with judgments being easier for events that were in the same era than for events that occurred in different eras. These results suggest that people do not routinely attach the labels of upper classman or lower classman to events.

School year versus summer. For this classification scheme, participants' judgment latencies with respect to whether the two events to be judged were both from the same era or were from different eras merely approached significance $F(1, 6980) = 3.65$, $p = .06$, $MSE = 2.17$. Moreover, the accuracy of these judgments was not significantly affected by whether the events to be judged both occurred in the context of school or not, *GEE* $\chi^2(1, N = 38) = 0.56$, $p > .40$. These results suggest that either these labels are not linked to events, or that, because of a lack of label specificity (e.g., failure to specify which year or which summer), the presence of such labels does not facilitate order judgments.

Supplementary Data: Self-reports of Time Period Use

The presence of era labels was only inferred from the judgment patterns obtained. We did not ask participants directly whether they used the inferred temporal labels, nor did we examine the extent to which some labels might have been used more than other labels.

We addressed these concerns by collecting supplementary data from a separate sample of participants. These were 25 female (85.3%) and 5 male undergraduates (*M* age = 21.6, *SD* = 2.0) who were students in an upper-level psychology course. They received course credit as compensation for their participation.

Participants completed an on-line autobiographical event journal. They typed in brief descriptions of two events in each the 21 periods specified for the JOR study. Participants were then given a selection of temporal labels for each event and were asked to rate on a four point scale (0 = *never*, 1 = *occasionally*, 2 = *sometimes*, 3 = *frequently*) how often they used the label in describing the event. The temporal labels were identical to those inferred in our JOR study. If the inferences about temporal label use made from the latency data were correct, then the frequency of use data should complement the JOR data: JORs should be slow and erroneous when both events were especially likely to be labeled with the same time-period (as reflected in high frequency of label use).

Events that occurred in summer were accompanied by three event labels. One included only the term *summer* (e.g., *One summer, I...*), the second specified the summer before college or high school (e.g., *One summer during high school, I...*), and the third specified the summer before a specific year of college or high school (e.g., *One summer before my freshman year of high school, I ...*). School year events were accompanied by five temporal labels, each designating: (a) a school-year event (e.g., *One year in school, I...*); (b) the high school versus college distinction (e.g., *When I was in college, I...)*; (c) whether one was an upper-classman or lower-classman within college or high school (e.g., *When I was an upper-classman in college, I...*); (d) one's academic level within high school or college (e.g., *When I was a freshman in college, I ...*); and (e) the term within each academic year in high school or college (e.g., *During the winter of freshman year in college, I...*).

Participants preferred some era labels. For summer events, $F(2, 603) = 16.44$, $p < .0001$, $R^2 = 0.09$, the era label that included semester and academic year information (*One summer just before X year of high school/college...)* was rated as the most frequently used, ($M = 1.71$). The two other era labels were rated as used with middling frequency (*One summer, I...* $M = 1.00$ and *One summer before high school/college, I…* $M = 0.95$). Era label preferences were also observed for academic school year events, $F(4, 990) = 130.08$, $p < .0001$, $R^2 = 0.35$. For these events, participants reported that they used three kinds of era labels with relatively moderate-to-high frequency (*When I was a freshman/sophomore/junior/senior in high school/college… M* = 1.86, *When I was in high school/college... M* = 1.31, and *During the X semester of my Y year in high school/college… M* = 0.91). Two era labels were not used frequently (*One year in school… M* = 0.54) and *When I was an under- or upper-classman…M* = 0.30).

The frequency data imply that JORs should have been especially hard when both events were likely to both be labeled as occurring in: (a) a given year (freshman, sophomore, etc.) within college or high school; (b) college or high school; or (c) a given academic quarter within a given year in college or high school. Indeed, the data in Table 1 show that the latency differences of within-period decisions relative to between-period decisions for events within these periods were especially large (within – between *M*'s = 0.21, 0.63, and 0.54 respectively), as were the relative error rate differences (within – between *M*'s = 0.01, -0.08, -0.04 respectively). In comparison, the data also suggest that JORs involving events that were both: (a) upper-class high school/college or lower-class high/school college events, or (b) summer events or in-school events, but were relatively unlikely to be labeled as such (as indicated by the frequency ratings) should not be particularly difficult. Indeed, this lack of difficulty is reflected in both latency data (within – between *M*'s = -0.09, 0.23) and the error rate data (within – between *M*'s = 0.05, 0.01).

However, the frequency-to-ease mapping was not perfect. If temporal labels were all that were involved in JORs, the hardest JOR decision should have been between events that both occurred within the same year of college or high school. Instead, the data show that these within-year order judgments were only moderately difficult. However, the event retrieval process suggested by the Conway and Pleydell-Pearce model implies that a time cue linked to an event is only one of the variables that might affect a temporal order judgment. Other variables, such as the number of events sharing a temporal tag and the similarity of details shared by events in the order comparison, may similarly affect the ease of JORs. Nonetheless, on balance the frequency-to-ease mapping data show that JOR discriminations involving events that are both frequently assigned the same era label are especially difficult. This result suggests that era labels, indeed, are assigned to autobiographical events and are one of the variables that contribute to JORs.

Discussion

This article explored the idea that people sometimes tag an autobiographical event in memory with labels reflecting the life era in which the event occurred. In support of this idea, latency data from JORs showed that between-era judgments were faster than within-era judgments when event eras could be defined as: (a) college versus high school; (b) academic quarter within year (e.g., Autumn of high school freshman year, etc.); or (c) academic year within school (e.g., high school freshman, high school sophomore, etc.).

Accuracy data, though weaker, similarly supported the presence of these labels, with greater accuracy for between-era than within-era judgments. That these results were weaker for the accuracy data is consistent with the implications of the Conway and Pleydell-Pearce model. People have access to multiple sources of temporal information (Skowronski et al., 1995). Hence, if informative era tags are not available, reasonably accurate event age reconstructions can be concocted using other information sources, such recall of event details. However, despite their accuracy, such judgments should be slower than judgments using era labels.

The between-era versus within-era judgment effect cannot be accounted for by the temporal distance effect: It emerged even when that effect was controlled for (i.e., when temporal distance was a variable in the regressions). However, it is also important to note that the temporal distance effect emerged, even when various labeling schemes were accounted for. Given that temporal information about autobiographical events can come from a host of sources

(Friedman, 1993, 2004), it would be surprising if any single variable could fully account for the temporal distance effect.

It might be argued that the order of any similarly themed event pair might be more difficult to judge than the order of differently themed events, regardless of theme. That two thematic systems (summer versus school and upper classman versus lower classman) failed to affect order judgments is inconsistent with this idea. Similarly, Skowronski et al. (2003) found that order judgments were not affected by whether events were between- or within-theme for event themes of work, school, or home. Hence, as predicted by the Conway and Pleydell-Pearce's (2000) model, labeling effects seem to be limited to labels that have *temporal era* implications.

However, despite the clarity of our results, methodological concerns remain. One concern is that evidence for the various labeling schemes was induced by the data collection method. The event recording booklets were structured around academic era themes. It is possible that such structuring may not have been present prior to event recording, but could have been produced by the event recording procedure. A future study could ask third parties to provide events; such a procedure avoids this method-induced structuring concern. Alternatively, self-reports of events of various ages could be obtained without overtly mentioning the academic calendar.

A second concern is that participants recalled events relatively near to completion of the JOR task. A longitudinal study in which dated journal entries are collected at the time of event occurrence and used in a temporally distant JOR task would provide an opportunity to examine JOR performance for events that have not been recently recollected.

Our results also raise several theoretical issues. Although the Self Memory System model predicts era labels in memory, it makes no provision for how such labels initially emerge or change across time. We think that temporal labels often have a social origin, used when communicating events to others. Moreover, as time passes, an individual might change their labeling scheme for an event so that that label becomes less temporally specific. Such a progression might follow from Gricean rules of communication (Grice, 1975) that specify a compromise between efficiency and informativeness in discourse (Skowronski & Walker, 2004). Thus, for a spring semester freshman in high school, a recalled event might be initially labeled in memory as a fall semester event. In that person's senior year, the event might be more likely to be referred to as a freshman event. In that person's senior year of college, the event might come to be referred to as a high school event. That labels may change with time and may have social origins is a hypothesis to be investigated in future research.

Another research direction explores how era labels affect temporal judgments about events in the lives of others, a direction consistent with increasing interest in time and social psychology (McGrath & Kelly, 1986). One might expect that the same kinds of between-era versus within-era effects that we have observed for self-events might also emerge in temporal judgments of others' events. However, a complicating factor may be that events of others could be tagged with one set of temporal labels that are relevant to the other, but a second set that is relevant to the self. It is unclear which set of labels might be employed to make JORs.

Coda

Obviously, understanding how people know when events occurred requires much future research. New studies can explore the types of temporally relevant information that can be stored in memory and the retrieval and temporal estimation mechanisms that can operate on such information. Knowledge generated by such studies has profound implications. The self-concept is partially dependent on individuals' knowledge that some events are "old" and other events are "new." Such knowledge allows the abstraction of information about self-development and change, as well as about growth and change in the world. Hence, to understand the self fully, one must understand mechanisms by which people store and use event-specific temporal knowledge. We hope that the data in the present article contributes to this understanding and stimulates future research.

References

Allison, P. D. (1999). *Logistic regression using the SAS system: Theory and application.* Cary, NC: SAS Institute.

Brown, N.R., & Schopflocher, D. (1998). Event clusters: An organization of personal events in autobiographical memory. *Psychological Science, 9*, 470-475.

Burt, C. D. B., Kemp, S., Grady, J. M., & Conway, M. A. (2000). Ordering autobiographical experiences. *Memory, 8,* 323-332.

Burt, C. D. B., Watt, S. C., Mitchell, D. A., & Conway, M. A. (1998). Retrieving the sequences of autobiographical event components. *Applied Cognitive Psychology, 12*, 321-338.

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

Downes, J. J., Mayes, A. R., MacDonald, C., & Hunkin, N. M. (2002). Temporal order memory in patients with Korsakoff's syndrome and medial temporal amnesia. *Neuropsychologia, 40, 853-861.*

Fazio, R. H. (1990). A practical guide to the use of response latency in social psychological research. In C. Hendrick & M. S. Clark (Eds.), *Review of personality and social psychology: Research methods in personality and social psychology* (Vol. 11, pp. 74-97). Newbury Park, CA: Sage Publications.

Friedman, W. J. (1993). Memory for the time of past events. *Psychological Bulletin, 113*, 44-66.

Friedman**,** W. J. (2004). Time in autobiographical memory. *Social Cognition, 22, 591-605.*

Fuhrman, R.W., & Wyer, R. S., Jr. (1988). Event memory: Temporal-order judgments of personal life experiences. *Journal of Personality & Social Psychology, 54,* 365-384.

Grice, H. P. (1975). Logic and conversation. In P. Cole and J. L. Morgan (Eds.). *Syntax and semantics 3: Speech acts* (pp. 26-40). New York: Academic Press.

Hurst, W., & Volpe, B. T. (1982). Temporal order judgments with amnesia. *Brain & Cognition, 1,* 294-306.

Huttenlocher, J., Hedges, L.V., & Prohaska, V. (1992) Memory for day of the week: A 5 + 2 day cycle. *Journal of Experimental Psychology: General, 121,* 313-325.

Linton, M. (1975). Memory for real-world events. In D. A. Norman & D. E. Rumelhart (Eds.), *Explorations in Cognition* (pp. 376-404). San Francisco: Freeman.

McGrath, J. E., & Kelly, J. R. (1986). *Time and human interaction: toward a social psychology of time.* New York: Guilford Press.

Ratcliff, R. (1993). Methods for dealing with reaction time outliers. *Psychological Bulletin, 114,* 510-532.

Ross, M., & Wilson, A. E. (2001). Constructing and appraising past selves. In D.L. Schacter and E. Scarry, (Eds.), *Memory, brain, & belief* (pp. 231-259). Cambridge, MA: Harvard University Press.

Shaw, C., & Aggleton, J. P. (1995). Evidence for the independence of recognition and recency memory in amnesic subjects. *Cortex, 31, 57-71.*

Skowronski, J. J., & Walker, W. R. (2004). How describing autobiographical events can affect autobiographical memories. *Social Cognition, 22, 555-590.*

Skowronski, J. J., Walker, W. R., Betz, A. L. (2003). Ordering our world: An examination of time in autobiographical memory. *Memory, 3, 247-260.*

Skowronski, J. J., Betz, A. L., Thompson, C. P., & Larsen, S. (1995). Long-term performance in autobiographical event dating: Patterns of accuracy and error across a two-and-a-half year time span. In A. F. Healy & L. E. Bourne (Eds.), *Learning and memory of knowledge and skills: Durability and specificity* (pp. 206-233). Thousand Oaks, CA: Sage Publications.

Skowronski, J. J., Betz, A. L., Thompson, C. P., & Shannon, L. (1991). Social memory in everyday life: The recall of self-events and other-events. *Journal of Personality and Social Psychology, 60,* 831-843.

Squire, L. R. (1982). Comparisons between forms of amnesia: Some deficits are unique to Korsakoff's syndrome. *Journal of Experimental Psychology: Learning, Memory, & Cognition, 8, 560-571.*

Squire, L. R., Chace, P. M., & Slater, P. C. (1975). Assessment of memory for remote events. *Psychological Reports, 37*, 223-234.

Thompson, C. P., Skowronski, J. J., Larsen, S., & Betz, A. L. (1996). *Autobiographical memory: Remembering what and remembering when.* Hillsdale, NJ: Erlbaum.

Underwood, B. J. (1977). *Temporal codes for memories: Issues and problems.* Hillsdale, NJ: Erlbaum.

Underwood, B. J., & Malmi, R. A. (1978). An evaluation of measures used in studying temporal codes for words within a list. *Journal of Verbal Learning & Verbal Behavior, 17*, 279-293.

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Footnotes

[1]We do not mean to imply that the Conway and Pleydell-Pearce Self Memory System model is the only model that might make these predictions. For example, similar predictions with respect to event ordering might be derived from Brown and Schopflocher (1998). Our use of the Self Memory System model was driven largely because of our preference for other elements of the model that are not relevant to the present article (e.g., the hypothesized process of cyclic retrieval), and because of the model's explicit attempt to link autobiographical memory to the self.

[2]We also analyzed the data using the multiple regression procedures that we previously employed for the accuracy data (Skowronski et al., 2003). The conclusions that would be drawn from such analyses were essentially unchanged from the conclusions derived from the PROC GENMOD GEE analyses.

Table 1

Judgment Accuracy Means and Latency Means (in Seconds) for Autobiographical Events Within Temporal Eras and Between Temporal Eras.[a, b]

		Between	Within
College / High School	Accuracy	0.88	0.80
	Latency	3.88	4.51
Quarter College / High School	Accuracy	0.83	0.79
	Latency	4.22	4.76
Year College / High School	Accuracy	0.83	0.84
	Latency	4.09	4.30
Upper- / Lower class High School	Accuracy	0.79	0.84
	Latency	4.32	4.23
Between / Within Season	Accuracy	0.82	0.83
	Latency	4.02	4.25

[a]Latency means are calculated from criterion variables adjusted for all predictor variables entered into regression models (e.g., are SAS *LSMeans*).

[b]To enhance readability, each accuracy mean reported was back-transformed from the results of the logit analysis using the algorithm $LSMean_{\text{Original}} = \exp(LSMean_{\text{Genmod Logit}}) / ((1 + \exp(LSMean_{\text{Genmod Logit}}))$; in this case, *LSMean* is the mean of the logit criterion measure adjusted for other variables entered into the logistic regression. The equation was taken from PROC GENMOD Least Square Means Estimates in SAS, Version 8.02 for Windows.