

Memories of a 'Decision-map': Recall of a Real-life Decision

KATHLEEN M. GALOTTI

Carleton College, Minnesota, USA

SUMMARY

First-year students in college who had participated in a study of college-decision-making 8 to 20 months earlier were asked to recall the criteria they had used and the alternatives they had considered in making the decision. They were also asked to describe the criteria they thought, in retrospect, that they ought to have used, and to rate their satisfaction with the decision-making process and its outcome. Two hundred and seven of the original 322 participants responded to a follow-up questionnaire through the mail. Participants recalled about half of the criteria they originally reported using, and about two-thirds of the schools they originally reported considering. Their recall of criteria was affected by their current view of the criteria they should have used, providing a replication for previous findings. No gender or academic ability effects were found. Somewhat surprisingly, given existing literature, recall was unaffected by emotional responses to the decision, either those reported during the decision-making process or those reported retrospectively. Overall, the pattern of results suggests that memory is affected by a decision-maker's current cognitive framework of the decision, specifically, their retrospective view of how they ought to have made the decision. Moreover, memory is far from perfect, even for stimuli that the decision-maker generated her- or himself, and to which presumably, they gave significant amounts of thought.

After making an important life decision, how do people remember the thought processes that went into the decision? In retrospect, how well are they able to remember the criteria they used in making the decision, and/or the alternatives that they considered? How does the structure of their decision-making affect later recall? Do people's retrospective views of how they ought to have made a decision distort their recall of what they really did? Is people's recall influenced by their affective responses to the decision-making process, either during the process or when they experience the outcome?

In a longitudinal study of real-life decision making (Galotti, 1994; Galotti and

This project was funded by the Spencer Foundation and by the National Institute of Child Health and Human Development (HD-28177-R15), both to Kathleen M. Galotti.

I gratefully acknowledge the assistance of Stephanie Aubry, Jessica Bresler, Laura Gibson, Julie Greene, Ruby Hou, Perrin Klumpp, Jodi Matthes, Jennifer McGregor, Nancy Michelsen, Terrance Overby, Amy Prullage, Melissa Schneider, Katherine Seiden, Daniel Simons, Sara Voelz, Meghan Wilhelm, and especially Melissa Mark for gathering and coding data, and David Pillemer for suggesting the analyses reported here. I am grateful for the efforts of the principals, guidance counselors, and teachers at the co-operating schools in helping us recruit students and schedule survey sessions, and to the high school students who participated in this study. Lastly, I thank Lloyd Komatsu, Sara Voelz, two anonymous reviewers, and Michael Pressley for comments on earlier versions of this paper.

Kozberg, 1994; Galotti and Mark, 1994), I studied the self-reported decision processes used by college-bound high school juniors and seniors as they made decisions about which colleges to apply to, and ultimately, to attend. Students participated in one, two, or three sessions during which they were asked to describe the sources of information they had consulted, their feelings about the decision-making process, the criteria they were currently using to make the decision, and the alternatives (i.e. schools) they were currently considering.

As a follow-up to those sessions, participants were contacted by mail in January of their first year of college. They were then asked to describe their overall satisfaction with their choice, and to recall the factors and alternatives they had previously considered. They were also asked to describe, in retrospect, the criteria they should have used to make the decision. This paper reports on analyses of data from this follow-up instrument.¹

This research obviously falls into the tradition of what has been called 'everyday memory', or 'naturalistic memory' (Cohen, 1989; Harris and Morris, 1988; Neisser and Winograd, 1984). The 'stimuli' for the recall task were naturally-occurring, and in fact were self-generated by the participants. Some studies of everyday memory, including some work on so-called 'flashbulb memories' (e.g. Brown and Kulick, 1977) have not had access to the original events subjects were claiming to remember. In other studies, the point has been not to assess the veridicality of the recall, but instead to analyse other properties of the recalled memories, such as their temporal distribution or content (Goldsmith and Pillemer, 1988; Pillemer, Goldsmith, Panter, and White, 1988; Pillemer, Rhinehart and White, 1986). In the current study, however, I actually had the data showing what criteria and alternatives a given participant had reported using at a given point in time, and could use this to assess the accuracy of their later recall. Thus, this study involves memory for a process in which a subject participated, rather than memory for an event that a subject witnessed or participated in.

A classic study of recall of a real-life decision was reported by Blackburne-Stover, Belenky, and Gilligan (1982), who studied the long-term reconstructive memories of women who had faced and made decisions about abortion. Their subjects, 24 women ranging in age from 15 to 33, originally participated in a study of abortion decision-making. One year after their initial participation, 20 of the women were reinterviewed. Their cognitive development was assessed on both occasions using a Kohlbergian scale of moral reasoning. At both interviews, subjects were asked to respond to a series of open-ended questions (although they were phrased in the past tense during the follow-up interview), such as: How did you get pregnant? How have you been dealing with it so far? Has this experience changed the way you think about yourself? or Has your pregnancy forced you to come to terms with or come into conflict with what you believe in? Accuracy of memory was assessed by comparing responses made to these questions at the two sessions.

Results showed that those subjects who had made developmental gains (as indexed by a gain in 'Moral Maturity Scores' derived from the Kohlbergian interview) reconstructed their decision in different terms than they had originally used when making the decision. At the same time, women who did not show developmental gains responded to the recall questions in essentially the same terms as they had originally. Further,

¹ Papers describing other aspects of the study (Galotti, in press; Galotti and Kozberg, in press; Galotti & Mark 1994), as well as copies of all instruments used, are available from the author.

women showing the developmental gains were disproportionately likely to report 'memory loss' for the decision.

The idea that people 'reconstruct' their memories of a decision in terms of their current beliefs or other cognitive frameworks has also been supported experimentally. Dellarosa and Bourne (1984), for example, had their experimental subjects read text passages about areas such as a medical diagnosis, the stock market, or a criminal trial, then make decisions based on the information presented, then participate in a surprise recall task. Subjects recalled more facts supporting than contradicting the decisions they had made. The authors argue that the act of decision-making produces a reorganization of the memory trace, thus differentially affecting the availability of contradictory and supporting facts.

One aim of the current analysis, therefore, was to see whether such distortions would occur also in a naturally-occurring decision-making task. For reasons I have argued elsewhere (Galotti, 1989), there were reasons to suspect that performance on a laboratory thinking task might not model real-life performance. To list but a few examples, this decision was one in which the outcome had personal significance for the decision-maker; it was one in which the decision-maker actually had to obtain information, rather than one in which an experimenter supplied all relevant data; the decision is one with many ramifications (e.g. for residential proximity to family and friends, for future career opportunities), as opposed to the 'decisions' typically studied in laboratory investigations.

Another difference between this task and other 'everyday memory' studies has to do with the nature of the information recalled. Much existing literature in the everyday memory literature asks people to recall specific events, entities that are typically recounted in narrative form. Examples of this include Pillemer's work on recall of events from the first year of college (Pillemer *et al.*, 1986, 1989); all of the work on flashbulb memories (see, for example, Bonhannon, 1988; McCloskey, Wible, and Cohen, 1988; Pillemer, 1984); Neisser's famous case study of John Dean's memory (Neisser, 1981), and other work on autobiographical memory (see Robinson and Swanson, 1990, for a recent review).

Trafimow and Wyer (1993: 365) have argued that people's memories of temporally related events often provide the basis for 'judgments of people involved in them [the events], causal attributions, and, in some cases, behavioral decisions ... Event sequences of the sort conveyed in stories or narratives compose a major portion of the knowledge one has acquired and serve as a basis for understanding oneself'. In contrast, the current work calls for participants to recall information that is not necessarily embedded in an event structure. Instead, the information asked for, the criteria and the alternatives they previously considered in making a decision, may well be encoded in a format unrelated to a particular story about one's past. That is, while it is possible that this information is encoded in narrative form, it is also possible that it is not, unlike the to-be-recalled information in the flashbulb and other autobiographical studies of memory mentioned above. The current work is more akin to that of Bahrck (1983, 1984; Bahrck, Bahrck, and Wittlinger, 1975), who studied people's recall for their previous knowledge of Spanish, their cognitive maps of a city, or their recall of high-school classmates. However, unlike Bahrck's work, the to-be-remembered stimuli here were self-generated.

Four questions were posed in this part of the larger study. They were: (1) How well do students remember major aspects of a real-life decision they have made after they

have made it? In particular, how well do students remember the factors and alternatives they previously considered? (2) Does recall vary by the way the decision was originally structured? In particular, do those participants who originally considered a larger number of criteria and/or a larger number of alternatives (i.e. those who have constructed a larger so-called 'decision map') have a disadvantage on a later memory test because they have more information to recall? (3) To what degree is recall of aspects of the decision filtered through a participant's retrospective normative views of the decision? In particular, how likely are participants to remember criteria they think, in retrospect, were important to use, and how likely are they to forget criteria they no longer think were important to use? (4) How is recall influenced by affective factors? In particular, does memory performance correlate with feelings about the decision, either those at the time the decision was made, or retrospective feelings about the outcome of the decision?

METHOD

Subjects

A total of 322 high school students (88 males, 234 females) participated in one or more sessions. The breakdown of participation is as follows: 124 students (29 males, 95 females) were originally recruited in spring of their junior year of high school, and participated in the first round of sessions in April of 1991. Of these, 101 (26 males, 75 females) participated again in the second round held in October of the senior year (1991), when an additional sample of 99 students (22 males, 77 females) joined the study. Ninety of the original sample who had participated in Round 2 (24 males, 66 females), and 75 of the second sample (17 males, 58 females) again participated in the final round of sessions, held in April of the senior year of high school (1992), and were joined by a third sample of 99 subjects (37 males, 62 females) who participated in the last round only.

In January of 1993 (the students' first year of college), an attempt was made to contact everyone who had participated in any of the sessions with a follow-up questionnaire. Students who returned the questionnaire were sent \$5.00. Responses were as follows: from the original sample of 124, 82 (70 females, 12 males) responded; of the second sample of 99, 62 (50 females, 12 males) responded, and of the final sample of 99, 63 (42 females, 21 males) responded. Of the original sample of 124, 58 students (48 female, 10 male) participated in all three sessions and completed the follow-up questionnaire.

Students were recruited through high school homeroom announcements (or, for one school, through letters sent to each student's home address). Students received \$5.00 for participating in each session, with a \$5.00/session bonus for participating in a second or third session.

Instruments and Procedure

Main Sessions

Students participated in 1-hour sessions scheduled at their high school. Sessions included up to 12 students, but averaged approximately five. At least two researchers were present at each session to hand out forms, answer questions, scan completed

forms to detect errors or omissions, and to pay participants at the conclusion of the session. Participants completed six, seven, or eight (depending on the session) different colour-coded forms at their own pace. Some students took as little as 35 minutes, others took slightly over an hour, but most took about 55 minutes for their initial session, and about 45 minutes for subsequent sessions. Throughout the session, researchers were available to answer questions about the meanings of instructions or other issues of clarification, but otherwise kept interaction with participants (or among participants) to a minimum.

Presented here in the order of administration, the forms relevant to this report² were:

Self-generated factors weighting and ranking sheet. This instrument had several columns. In the first column, students were asked to list the factors (i.e. criteria) they were using in making decisions about college (e.g. cost, location, programme offerings). In the second column, students assigned each factor an importance weighting, on an integer scale from 1 to 10. The next seven columns provided spaces at the top for students to list a school under consideration. In the blanks underneath the listing, students rated that school on the corresponding factor listed in the first column, again using a 10-point scale. A second blank sheet was provided to encourage students to be complete; other blank sheets were also offered if needed.

Overall impressions of schools sheet. To complete this instrument, students listed each school under consideration and rated their overall feeling of how good a choice each school currently appeared to be for them, on a 10-point scale.

Feelings about the decision-making process sheet. Using 7-point Likert scales, students rated their current feelings about the process. Examples of items include: 'How certain are you of your decision about which college to attend?', 'How stressful is it to make this decision?', and 'How ready do you feel to make a decision?' (1 = not at all; 7 = completely).

Follow-up Questionnaire

Retrospective feelings about the decision-making process sheet. Using 7-point Likert scales, students rated their feelings about the process. Examples of items include: 'How certain are you that your college decision was the right one?', 'How satisfied do you feel with the way your decision has worked out?', and 'How well are you doing in classes?' (1 = not at all; 7 = completely).

Recall of self-generated factors weighting sheet. This instrument had two columns. In the first, students were asked to list 'the factors [you] considered in thinking about which particular college to attend'. In the second column, students were asked to 'rate the importance of each factor using a whole number between 0 (meaning 'not at all important' and 10 (meaning 'extremely important').'

Retrospective self-generated factors weighting sheet. Similar in format to the last instrument, this one also had two columns. In the first, students were asked to list 'the factors you NOW think are important for someone to consider when making a decision

² A complete description of every measure used, and/or copies of each instrument used, are available from the author.

about college'. In the second column, students again were asked to assign each factor an importance weighting, on an integer scale from 1 to 10.

Recall of schools under consideration sheet. Students were asked to list the 'final set of colleges/schools you were considering last spring'.

RESULTS

Some of the analyses to be reported below used an independent variable called 'academic ability'. This was measured by equally weighted z-scores of eleventh grade (grade point average), eleventh grade class rank, and standardized test scores (American College Testing composite scores and Scholastic Aptitude Test — Verbal + Scholastic Aptitude Test — Mathematical scores were converted to a common scale; students who took both tests had the higher score used).

Presentation of the results will be organized by the questions posed in the introduction.

How well do students remember the factors and alternatives they previously considered?

To establish a baseline on how much participants changed the criteria they used from session to session, I first calculated the average amount of change in the factors listed from one survey period to the next. Using data from all available subjects, I calculated the mean proportion of overlap between factors listed in any two sessions, always expressed as the ratio of overlapping factors to all factors generated in the earlier session. Between the April 1991 and October 1991 sessions, the mean proportion overlap was .48, (based on $n = 101$); between the April 1991 and the April 1992 sessions the mean proportion of overlap was .46, (based on $n = 93$); and between the October 1991 and the April 1992 sessions, the mean proportion overlap was .50 ($n = 165$). These data suggest that, on average, students changed roughly half of their criteria for making the decision from session to session.

In asking subjects to recall the factors they remembered using, it was not made clear which set of factors they should try to remember (i.e. from the April 1991 round, from the April 1992 round, etc.). Therefore, the list of factors subjects 'recalled' was compared to a combined list of all factors ever generated by a given participant during the first three sessions. For ease of reference, call this the 'combined list'. Participants' recall was assessed by comparing the proportion of overlap between the 'recalled' factors and this combined list. Overall, the proportion of recall was .42, and this figure did not vary significantly by either gender or academic ability.

I also calculated the proportion of factors recalled that were generated during any particular survey round. Using only the data from subjects who participated in all three sessions as well as returned the follow-up questionnaire ($n = 67$), I found the average proportion of factors generated at recall was .48 for factors from the April 1991 session, .49 for factors from the October 1991 session, and .54 for factors from the April 1992 session. A repeated measures ANOVA on these figures revealed no significant effects of academic ability, sex, or the time interval tested.

I also looked at the data from just the third and final (April 1992) session, examining the proportion of factors those participants that they later recalled (in January 1993).

Overall, the proportion of factors recalled was .53, and again, did not vary by either gender or academic ability.

Altogether these results imply that students recalled about half of the factors they ever generated. This figure is similar in magnitude to the overall proportion of factors re-generated at a second session, that had been previously listed in an earlier session. There were no effects on proportion of factors recalled of either gender or academic ability, although such effect did emerge for various decision making measures reported elsewhere (Galotti, in press; Galotti and Mark, 1994).

Because different students participated in different numbers of sessions, it was important to assess the effects, if any, that repeated participation had on memory of factors. Two different analyses were used to assess this potential effect. In the first, I examined the proportion of factors on the 'combined' list recalled, as a function of whether the subject had participated once, twice, or three times in the original decision making survey sessions. The mean proportion of factors recalled was .35, .38, and .50 for participants who participated once, twice, or three times, respectively. A one-way ANOVA revealed a main effect for group ($F(2,203) = 17.29, p < .001, Mse = .03$), and a *post-hoc* Tukey test indicated that subjects who had participated in only one session recalled significantly more of the factors they had generated than did subjects who had participated in two or three different sessions ($p < .01$).

A second analysis focused only on the proportion of factors recalled from a specific session, the April 1992 round, again as a function of whether the subject had participated once, twice, or three times in the original decision making survey sessions. The reason for choosing the April 1992 round was the one in which three different cohorts of subjects participated. This analysis, then, focused on proportion of factors recalled from a specific session, specifically, the most recent session for all subjects. The mean proportion of factors recalled was .54, .54, and .53 for participants who participated once, twice, or three times, respectively. A one-way ANOVA revealed no significant effect on performance of number of sessions a subject had participated in. Taken together with the previous analysis, results suggest that repeated testing does not affect a participant's recall of factors that were generated at a specific session. However, subjects who participated more than once in the decision-making sessions, and who therefore generated two or more distinct lists of factors, recall a lower proportion of all the factors they ever generated, than do subjects who participated only once. This may make sense, as participation in multiple sessions almost always led to a larger 'combined' list of factors, thus placing a higher cognitive load on the participant during the memory test.

We can also ask whether students recalled different types of factors (e.g. ones relating to cost) more readily than others (e.g. ones relating to campus atmosphere). Again, the data examined for this analysis came from the 67 students who participated in all sessions and returned the questionnaire. Factors generated were classified into a taxonomy of 23 categories (see Table 1; see also Galotti and Mark, 1994, for more details). The proportion of factors each subject generated that fell into a particular category was calculated. The mean proportion use of each category is shown, as a function of time of survey. A 23 (type of factor) \times 5 (time of generation) repeated measures ANOVA indicated a significant effect of category ($F(22,1452) = 29.13, p < .001, MSe = 85.91$), and a significant interaction between category and time of survey ($F(88,5808) = 2.24, p < .001, MSe = 31.33$). *Post-hoc* Tukey tests were not conducted, because of the number of comparisons involved. However, visual in-

spection of the means suggests that few if any of the categories show a dramatically different change in usage as a function of time.

The other aspect of decisions participants were asked to recall was the final set of alternatives (i.e. particular colleges or universities) under consideration. I looked first at the data from all subjects who both participated in the third session (in April of 1992) and the follow-up survey (in January 1993; $n = 184$). The average proportion of alternatives recalled (as a proportion of all schools listed during April 1992) was .72. The overall proportion of schools recalled that were listed during the two previous sessions³ was again calculated using data from all of the subjects who responded to the follow-up survey. (This means that the means to be reported here are often based on different numbers of subjects.) The overall proportion of factors recalled that were listed during the first session (April 1991) was .40, ($n = 82$) and from the second (October 1991) session was .60 ($n = 138$).

Table 1. Mean Proportion of Factors Generated by Category and Session^a

Category	Session				
	April 1991	October 1991	April 1992	January 1993 ^b	
				Recalled	Ideal
Academic challenge	3.38	1.81	2.41	1.73	2.35
Admissions requirements/policies	3.78	4.04	1.54	1.42	1.45
Campus appearance	3.46	2.42	2.89	1.51	.29
Campus atmosphere	2.58	5.51	6.41	6.78	9.28
Class size/faculty: student ratios	3.94	2.23	4.60	4.07	5.02
Cost	9.92	10.09	10.01	10.63	10.13
Course offerings/curriculum	4.76	2.01	2.19	2.79	3.48
Distance from home	5.24	3.98	4.08	6.12	4.45
Dorms/housing	2.81	3.40	4.50	4.19	5.04
Extracurricular programmes	5.02	6.16	5.95	6.23	4.98
Facilities (e.g. computer, library, athletics)	1.84	2.06	2.81	2.31	3.41
Faculty credentials/quality	1.67	1.90	.84	1.09	1.86
Financial aid	3.85	6.81	5.46	6.18	6.61
Location	6.84	7.21	8.11	7.70	7.74
Majors/programmes/internships	10.73	12.14	11.99	9.79	9.42
Parents'/friends' advice	.82	1.19	.76	1.01	.98
Peers/friends at school	2.30	1.47	1.94	2.98	1.54
Physical setting (e.g. rural/urban, near attractions)	3.31	2.82	3.56	3.70	3.71
Reputation, accreditation	3.79	4.50	4.06	5.23	4.85
School policies/regulations	1.65	1.07	.76	1.02	1.72
School size	8.20	7.64	7.67	8.38	7.21
Success of graduates	3.11	2.39	2.49	1.09	1.37
Type of school (e.g. public/private, coed/single sex)	7.00	7.13	4.94	4.01	3.12

^a Numbers refer to the mean proportion of factors generated by a subject that were classified into a given category. The April 1991 to April 1992 sessions were prior to the decision.

^b The January 1993 was the follow-up questionnaire, in which subjects were first asked to recall the factors they had used (data presented in the 'Recalled' column), and to list the factors they thought in retrospect they ought to have considered (data presented in the 'Ideal' column).

³ Subjects were actually only asked to recall the final set of schools from which they had selected.

A comparison to these recall figures is given by the average overlap in schools listed between any two sessions. Again, using all available data, I calculated the mean proportion of overlap in schools listed between any two sessions. This overlap was always expressed as the ratio of overlapping schools to all schools generated in the earlier session. The mean overlap between the April 1991 and October 1991 sessions was .47 ($n = 100$), between the April 1991 and the April 1992 sessions .43 ($n = 89$), and between the October 1991 and the April 1992 sessions .71 ($n = 164$). It appears that on average, subjects' recall of schools was similar to their rate of change of the schools listed between any two rounds during the decision-making process. Interestingly, subjects' recall of factors was only slightly correlated with recall of specific schools. The correlation between these two measures was .15 ($n = 179$, $p < .05$).

Does memory performance correlate with the breadth of the 'decision map'?

Participants varied in the complexity of the way they structured their decisions. Some participants considered few factors and few alternatives, some of them few factors and many alternatives, etc. On average, however, students, considered an average of 8.9 factors and 4.3 schools. In another paper, we reported that students of higher academic ability did generate a larger number of factors than did students of lower academic ability; however, no such corresponding difference in performance was found for number of schools generated (Galotti and Mark, 1994). The fact that more factors were generated than schools may account for the fact that the overall proportion of factors recalled (.42) is lower than the overall proportion of schools recalled (.72). (Alternatively, the difference in specificity of recall instructions may account for this finding).

It seems plausible that those students who considered fewer factors and/or fewer alternatives would have had less to remember than those students who had relatively complex 'decision maps', that is, had many factors and alternatives under consideration. To test this hypothesis, the proportion of factors (and schools) was correlated with the number of factors (and schools) generated. Proportion of factors recalled correlated significantly and negatively with the overall number of factors generated (on the combined list; $r(204) = -.42$, $p < .001$). Similarly, the recall of particular schools correlated significantly and negatively with the overall number of schools listed (during the April 1992 session; $r(182) = -.37$, $p < .001$). Not surprisingly, generation of a larger number of factors (or schools) during the follow-up questionnaire correlated positively with recall measures. The correlation between proportion of factors recalled and number of factors listed in the follow-up questionnaire was .27 ($n = 206$; $p < .001$); the corresponding correlation for number of schools was .36 ($n = 184$; $p < .001$).

To what degree is recall filtered through one's retrospective normative views of the decision?

Recall that on the follow-up questionnaire, participants were asked (after they were asked to recall the factors they had used) to list the factors they thought, in retrospect, were important to consider. For ease of reference, I will refer to this as the 'ideal factors' list. The proportion of overlap in factors generated between the ideal factors list and the recalled list of factors (henceforth 'ideal-recall') was .67. The average overlap in factors listed on the recall list and the combined list of factors (henceforth

'recall-combined original') was .42, as stated earlier. This compares with the average overlap in factors listed on the ideal list and the combined list, (henceforth 'ideal-combined original') which was .36.

None of these proportion of overlaps mentioned above varied significantly as a function of academic ability or gender. A repeated-measures ANOVA on type of overlap (ideal-recall, ideal-combined original, recall-combined original) showed that the three above-mentioned proportions were significantly different ($F(2,394) = 220.95$, $p < .001$, $MSe = .02$). Specific comparisons (Tukey tests) showed that the mean proportion overlap for ideal-recall was significantly higher than either of the other two proportions of overlap, which did not differ ($p < .01$).

Does memory performance correlate with feelings about the decision-making process?

To answer this question, I looked at students' responses to the questions, 'How stressful is it to make this decision?', 'How sure are you that your decision will turn out well?', and 'How difficult is this decision, relative to other decisions you have previously made?', posed during the April 1992 round of sessions, answered on 7-point Likert scales.⁴ These measures did not correlate significantly with the recall measures of factors nor of schools. Similarly, I examined the correlations between memory performance and responses to the questions 'How certain are you that your college decision was the right one?' and 'How well has your college or school met your expectations?', posed in the follow-up questionnaire. Again, the responses were on 7-point Likert scales, and again, there were no significant correlations between these responses and any of the recall measures of factors nor of schools.

DISCUSSION

Adolescents making arguably their first important and relatively autonomous life decision recall about half of the criteria they had generated during the course of making the decisions when asked about the decision eight months later. Their recall of the alternatives they considered (in this case, particular colleges or universities) is better—over two-thirds are recalled after the same interval. However, considering that at any given session, participants reported using about nine criteria, but considering about four schools, the fact that performance is better for the latter entity is not surprising. It also stands to reason that adolescents who structured their decision in more complex ways by generating more criteria and/or by considering more schools, thereby increasing the amount of to-be-recalled information, recalled a smaller proportion of the criteria or schools.

In line with the work of Blackburne-Stover *et al.* (1982) and Dellarosa and Bourne (1984), participants' recall of their decision was affected by their retrospective view of how they should have carried out the decision-making process. Considering the three lists of factors subjects generated—those generated during the decision, those later recalled, and those they retrospectively think should have been used—the last two overlapped much more than the first two. This suggests the presence of intrusions into memory—of incorrectly 'recalling' the use of a factor that was not mentioned during

⁴ Subjects were also asked these and other questions at the two previous sessions, but the data reported here are only those from the third session.

the process, but that, after the fact, seems to be important. In this sense, the data support Blackburne-Stover *et al.*'s (1982) view that memory is reconstructive rather than reproductive, even for information that is not necessarily structured narratively.

Throughout these analyses, no effects were found for gender or academic ability, despite the presence of such effects in aspects of the original decision-making (Galotti, in press; Galotti and Kozberg, in press; Galotti and Mark, 1994). For example, I reported elsewhere (Galotti, 1994) that students with higher academic ability did generate more complex decision maps. Specifically, more able students reported considering significantly more criteria than did their relatively less academically able peers. One interpretation of this finding is that more able students cared more about this decision and took more pains with it. If true, it is then surprising that more able students do not show better recall of the criteria and alternatives they considered. (An analysis of variance or proportion of factors recalled by academic ability, covarying out the number of factors originally generated, still revealed no significant effects.)

Lastly, past or current affective responses to the decision had no apparent effects on recall performance. Unlike work in the flashbulb memory tradition (e.g. Bonhannon, 1988; McCloskey *et al.*, 1988; Pillemer, 1984), and unlike the findings from Pillemer's autobiographical memory studies (Goldsmith and Pillemer, 1988; Pillemer *et al.*, 1986), neither being certain about a decision, nor feeling stress from the process, nor enjoying the decision affect one's later memory for the major cognitive entities being used to make the decision. Likewise, it may be somewhat surprising that retrospective affective responses to the decision, such as being satisfied with the outcome do not affect or distort recall.

It is not yet clear what sort of changes would occur over further intervals with respect to either recall or reinterpretation of how the decision ought to have been carried out. It would be interesting to survey the sample of subjects in another few years to examine whether the pattern of results reported here holds up, and whether other non-significant effects change dramatically with the passage of time. It is impossible to say whether 'sleeper' effects could occur.

The data participants were asked to recall may differ in important ways from data that typical subjects in typical memory studies are asked to recall. It may be that the factors and/or schools under consideration were updated often, even continuously, throughout the decision making process. If true, then participants' attempts at recall would reflect, at least in part, their abilities to discriminate the factors and schools they were thinking of at a particular time from factors and schools they considered either earlier or later.⁵

It is also not yet clear how specific the findings reported here are to the specifics of the decision being studied. I have argued elsewhere (Galotti, in press; Galotti and Kozberg, in press; Galotti and Mark, 1994) that the college decision is unique in many ways. It is arguably the first life decision of this magnitude that adolescents face. It is a potentially life-framing decision, in that it can affect, among other things, one's choice of career; place of residence; relationship with family, high-school friends, and acquaintances; and one's romantic relationships. It is a life decision that is remarkably scheduled by virtue of the common timeline most colleges and universities in the United States follow. For these and other reasons, it will be important to compare the results of this study to studies of other real-life decisions.

⁵ My thanks to an anonymous reviewer for pointing this out.

For the present, however, it appears that there is partial confirmation of existing findings in recall of a real-life decision. Memory is affected by a decision-maker's current cognitive framework of the decision (i.e., her view of what things she ought to have considered). Memory is far from perfect even for stimuli that the decision-maker generated her- or himself, and presumably, gave significant amounts of thought to. Unlike some other real-life memory research, however, memory for specific aspects of the decision seem unaffected by emotional responses to the decision-making process. The overall pattern of results does point to a picture of current, and implicit theories of how a decision ought to be made filtering or otherwise reshaping one's memory for the decision-making process.

REFERENCES

- Bahrick, H. P. (1983). The cognitive map of a city: Fifty years of learning and memory. *The Psychology of Learning and Motivation*, *17*, 125-163.
- Bahrick, H. P. (1984). Semantic memory content in permastore: fifty years of memory for Spanish learned in school. *Journal of Experimental Psychology: General*, *113*, 1-29.
- Bahrick, H. P., Bahrick, P. O. and Wittlinger, R. P. (1975). Fifty years of memory for names and faces: a cross-sectional approach. *Journal of Experimental Psychology: General*, *104*, 54-75.
- Blackburne-Stover, G., Belenky, M. F., and Gilligan, C. (1982). Moral development and reconstructive memory: recalling a decision to terminate an unplanned pregnancy. *Developmental Psychology*, *18*, 862-870.
- Bonhannon, J. N., III (1988). Flashbulb memories for the space shuttle disaster: a tale of two theories. *Cognition*, *29*, 179-196.
- Brown, R. and Kulik, J. (1977). Flashbulb memories. *Cognition*, *5*, 73-99.
- Dellarosa, D. and Bourne, L. E., Jr. (1984). Decisions and memory: differential retrievability of consistent and contradictory evidence. *Journal of Verbal Learning and Verbal Behavior* *23*, 669-682.
- Cohen, G. (1989). *Memory in the real world*. Hove and London: Lawrence Erlbaum Associates.
- Galotti, K. M. (1989). Approaches to studying formal and everyday reasoning. *Psychological Bulletin*, *105*, 331-351.
- Galotti, K. M. (In press). A longitudinal study of real-life decision making: Choosing a college. *Applied Cognitive Psychology*.
- Galotti, K. M. and Kozberg, S. F. (in press). *Adolescents' experience of a life-framing decision*. *Journal of Youth and Adolescence*.
- Galotti, K. M. and Mark, M. C. (1994). How do high school students structure an important life decision? A short-term longitudinal study of the college decision-making process. *Research in Higher Education*, *35*, 589-607.
- Goldsmith, L. R. and Pillemer, D. B. (1988). Memories of statements spoken in everyday contexts. *Applied Cognitive Psychology*, *2*, 273-286.
- Harris, J. E. and Morris, P. E. (Eds.). (1988) *Everyday memory, actions and absent-mindedness*. London: Academic Press.
- McCloskey, M., Wible, C. G. and Cohen, N. J. (1988). Is there a special flashbulb-memory system? *Journal of Experimental Psychology: General*, *117*, 336-338.
- Neisser, U. (1981). John Dean's memory: a case study. *Cognition*, *1*, 1-22.
- Neisser, U. and Winograd, E. (Eds.). (1984). *Remembering reconsidered: ecological and traditional approaches to the study of memory*. Cambridge: Cambridge University Press.
- Pillemer, D. B. (1984). Flashbulb memories of the assassination attempt on President Reagan. *Cognition*, *16*, 63-80.
- Pillemer, D. B., Goldsmith, L. R., Panter, A. T. and White, S. H. (1988). Very long term memories of the first year in college. *Journal of Experimental Psychology: Learning, Memory and Cognition*, *14*, 709-715.
- Pillemer, D. B., Rhinehart, E. D., and White, S. H. (1986). Memories of life transitions: the first year in college. *Human Learning*, *5*, 109-123.

- Robinson, J. A. and Swanson, K. L. (1990). Autobiographical memory: the next phase. *Applied Cognitive Psychology*, **4**, 321–335.
- Trafimow, D. and Wyer, R. S., Jr. (1993). Cognitive representation of mundane social events. *Journal of Personality and Social Psychology*, **64**, 365–376.