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Making a "Major" Real-Life Decision: College Students Choosing an Academic Major

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College students were surveyed in their 1st year and again 1 year later about their decision regarding which major to declare. They listed criteria and alternatives under consideration, rated the importance of each, and gave overall impressions of each alternative. They also rated their affective responses to the decision-making process. Students listed approximately 7 criteria and 4 alternatives during their 1st year and approximately 7 criteria and 3 alternatives during their 2nd year. Only about half of the criteria and alternatives originally listed appeared the second time. Students' overall impressions correlated with predictions of linear models of decision making. However, confidence and comfort with the decision-making process were not correlated with measures of rational decision making, suggesting that students may have maladaptive expectations about what effective real-life decision making should be.

In this study, I investigated the way in which college students structured an important educational decision. Specifically, the task involved their reflecting on a decision-making process in which they were already engaged: the process of choosing a college major. The participants were all highly educated and presumably well practiced in analytical thinking. The decision in question was one about which they felt strongly and were presumably highly motivated to make carefully. This study therefore is a study of real-life decision making under what are arguably circumstances highly favorable to optimal performance.

The College Major Decision

Dawson-Threat and Huba (1996) showed that over two thirds of men chose male-dominated majors and almost three fourths of women chose female-dominated majors at a large midwestern university. Sullins, Hernandez, Fuller, and Tashiro (1995) demonstrated that an expectancy-value model was successful at predicting undergraduates' majors, suggesting that students take into account both their expectations for goal attainment and their values for different goals in choosing a major. Galotti and Kozberg (1987) reported that students at a midwestern liberal arts college listed the following factors most frequently as ones that they used in choosing a major: "How much I care for the subject" (79%), "Something I do well in" (54%), "Something with good career opportunities" (46%), and "What I want to do with this major after college" (32%). Taken together, these findings suggest that students see the choice of major as one that both reflects important core characteristics of themselves (including their gender role identification, their interests and values, and their abilities) and has consequential implications for their futures.

Research on the decision-making processes in which undergraduates are engaged while making this decision indicate a less-than-ideal situation, however. Phillips and Strohmer (1983, p. 395) presented data suggesting that students who lack strong decision-making skills are very likely to flounder while choosing a major or career, spending excess effort on the prechoice stage of the decision-making process. Mau and Jepsen (1992) compared the decision-making performances of students who were either taught or not taught to use formal decision-making strategies in choosing a major. Results showed that computer-assisted programs did have significant effects on students' reactions to the process. The most complex strategy taught, based on subjective expected utility theory (Baron, 1994), increased the complexity of students' thinking but did not reduce their anxiety about the decision-making process. This work suggests that there is a division between cognitive processes and affective responses to those processes, such that rationality is independent of confidence.

Laboratory Studies of Decision Making

In addition to previous studies of this particular decision, there is a larger relevant body of literature on people's decision-making process in general. Much of this literature comprises studies that present individuals with various hypothetical scenarios. The scenarios present the relevant information that the individuals are asked to consider, as well as the set of alternatives from which the individuals are to choose. Various models of decision making have emerged from this literature.

Among the most well known are linear models (Dawes, 1982; Dawes & Corrigan, 1974). In such models, decision makers are asked to (a) break a decision down into independent criteria (e.g., major requirements, career possi-

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bilities), (b) determine the relative importance weights of each criterion, (c) list all alternatives (e.g., different possible academic majors), and (d) rate the alternatives on each criterion.

Different linear models can be applied to the data generated in the process described above. For example, one model might weight each criterion equally. Another might use information only from the criterion that the decision maker regards as most important. A third might make use of the participant-generated importance weights by multiplying the ratings by the weightings and summing. In each case, the models would result in a predicted value for each alternative. Such values could be used to rank order the alternatives in terms of their overall suitability for the decision maker, given that person's own values and perceptions.

Linear models involve a weighted combination of numerical information, for example, predicting a college student's probability of graduating by use of some sort of equation to combine various predictor variables (e.g., high school grade point average, standardized test scores, family income, level of motivation). If the weights are chosen so that they optimize the relationship between the set of predictor variables and the outcome variable, then the model is said to be a proper linear model (Dawes, 1982). Depending on the particular linear model, different criteria can be weighted differentially or equally. Kleinmuntz (1990) and Dawes present elaborate arguments to the effect that the use of linear models, even inappropriate ones, almost always leads to better decisions than does the exclusive use of clinical or personal intuitions.

When linear models are applied to the college major decision, the outcome variable maps onto a student's intuitive rating of the overall suitability of a particular candidate major, whereas the predictor variables comprise that same student's ratings of that particular major on the various criteria that he or she has generated. Dawes and colleagues (Dawes, 1982; Dawes & Corrigan, 1974) have reported using linear models as paramorphic models of expert decision makers, meaning that there is no claim that the models depict actual psychological processes used, only that the processes can be simulated by the models.

Researchers generally concur with Dawes and Corrigan (1974) and Dawes (1982) in rejecting linear models as descriptions of what people actually do when making important decisions, especially if the information relevant to making the decision is extensive (Payne, 1976). In particular, linear models may not be appropriate for describing or evaluating the decision-making processes of nonexperts. One aim of this study is to discover whether linear models can simulate the processes of nonexpert but highly motivated and well-educated individuals facing an important life decision.

Goals of This Study

The primary aim of this study was to describe how students structure an important educational and life decision. The population chosen for study, college students, is of theoretical interest for several reasons. First, the students are relatively well-educated individuals, currently gaining much practice with analytical thinking. Therefore, among nonexperts, these participants ought to have the most developed and practiced cognitive skills to bring to this task. Second, previous work has established that students take this decision very seriously and recognize its ramifications for the future. Thus, these participants ought be highly motivated to make as optimal a decision as possible. Third, this decision offers a variety of options from which to choose, and there is a wealth of possibly relevant information to use in making the decision. Thus, the task itself is a complex one, allowing for a variety of approaches. Fourth, the decision is on a known timetable, so reliable estimates can be made of how far away a student is from the final decision point. At the two liberal arts colleges from which participants were selected, students are not allowed to officially declare a college major until May of their 2nd, or sophomore, year. Taken together, these factors make this decision one that ought to set an upper bound of decision-making performance among nonexperts making life decisions of consequence.

Another important objective of this project was to examine predictors of satisfaction and comfort with the decision-making process. Put simply, does making this decision more rationally (e.g., thoroughly, analytically) result in greater comfort, confidence, and enjoyment? In other words, are there affective benefits to rational decision making?

Study Design

Research participants were recruited in the winter of their 1st year of college, when they were approximately 16 months away from the point at which they would formally declare their major. One year later, many of the participants were recontacted and asked about their decision-making process once again. In addition to examining the ways in which participants' thinking about the decision changed over time, I analyzed participants' memories of their earlier thinking about the decision.

In an earlier study of choosing a college, about 8 months after making a final decision, students were asked to recall the criteria and schools that they had originally reported using or considering, as well as the criteria that they thought, in retrospect, they ought to have used in making this decision (Galotti, 1995b). The students recalled about one half of the criteria that they had originally reported using and about two thirds of the schools that they had originally reported considering. Their recall of criteria was affected by their current view of the criteria that they should have used. This result, that a person's current cognitive framework affects memory, has been widely reported (e.g., Blackburne-Stover, Belenky, & Gilligan, 1982; Dellarosa & Bourne, 1984; Ross, 1989). Svenson, Rayo, Andersen, Sandberg, and Svahlin (1994) argue for a process that they call postdecision consolidation, in which a decision maker may (among other things) distort his or her memory of both the chosen and the nonchosen options.

Table 1
Example of Worksheet for Listing Factors and Alternatives

		Column				
Criterion	Importance weight	A Major: Psychology	B Major: Biology	C Major: Mathematics	D Major: Classics	E Major: Sociology
Interest in	9	9	8	7	4	6
Job prospects	8	7	9	8	1	3
Faculty in department	5	3	4	3	9	5
Requirements	7	5	4	3	7	8

Note. This example does not show columns 8 and 9.

Specific Hypotheses

1. Linear models will correlate significantly and substantially with students' holistic impressions of different candidate majors.
2. Effective decision making (as indicated by the correlation of students' holistic impressions with the predictions of linear models) will correlate significantly with students' confidence and comfort with the process.
3. Students' memories of their decision-making processes will correlate more strongly with their current views of how the process should work than with their performance as it actually initially occurred.

Method

Participants

One hundred eleven 1st-year students from two liberal arts colleges in southeastern Minnesota participated. There were 33 men, 74 women, and 4 respondents who did not indicate their sex. Participants were recruited from a randomly selected sample at the first college ($N = 61$; 27 men and 34 women) (paid $4) and from the introductory psychology student pool at the second college ($N = 50$; 6 men, 40 women, and 4 whose gender was not reported) (received course credit). One year later (in 1996), students at the first college were contacted again for a follow-up session.[1] Of the 61 original participants at the first school, 39 (14 men and 25 women) came to the second session, receiving an additional $4.

Materials and Procedure

All instruments were written surveys,[2] administered at the participant's own pace during a single session. A research assistant conducted the session with small groups of students, allowing each student to work at his or her own pace. Students were given the first instrument for a session when they arrived. When they were finished with it, they gave it to the research assistant, who gave them the next instrument. Thus, participants could not look back at their previous responses. Most participants finished in about 30 min per session; some took up to 1 hr.

Round 1—January 1995, during the students' 1st year of college. The first instrument that participants filled out was a background sheet requesting such information as high school and college grade point averages, standardized test scores (Scholastic Aptitude Test and American College Test), all college courses taken, number of siblings, marital status of parents, educational levels of parents, family income, and race or ethnicity.

The second instrument instructed participants to respond to two open-ended questions describing their decision-making processes to date and their view of what an ideal decision-making process would be. Data from this instrument will not be discussed here.

The third instrument was a work sheet containing nine columns of blanks. In the first column, students were instructed to list the criteria that they were using in making the decision about a major. In the second column, students were instructed to assign each factor an importance weight on a scale of 0 to 10 (10 = *extremely important*). In the third through ninth columns, students were instructed to list each major currently under consideration and to rate each potential major on each factor, again using a scale of 0 to 10 (10 = *extremely strong in that factor for that major*). Students were invited to ask for extra sheets if they had more criteria or more alternatives than would fit on the sheet; very few students did. Table 1 provides an example of a (fictional) filled-out example. In this example, the "student" has indicated that the criterion "Interest in" has the greatest weight (9, on a scale of 0 to 10). For this criterion, psychology is rated as the major in which the student has the highest interest; this major is followed by biology (8), mathematics (7), and so forth.

The fourth instrument instructed students to list all of the potential majors under current consideration (i.e., those listed on the third instrument) and to indicate their overall feeling of how good a choice each major is for them, again using a scale of 0 to 10 (this time, decimals were allowed). No criteria were listed on this instrument; only alternatives were.

The purpose of the third and fourth instruments was to allow for a comparison of the predictions of linear models (with the data provided by the third instrument) with the students' own impressions of the overall suitability of a particular alternative (given in the responses to the fourth instrument).

In the fifth and final instrument of Round 1, participants filled out a series of 7-point rating scales measuring their attitudes and affective reactions toward the decision-making process. Each scale ranged from 1 (*not at all*) to 7 (*completely*). The scales are shown in Table 2.

Round 2—January 1996, during the students' 2nd year of college. In the second (1996) round of data collection, participants again were instructed to fill out each of the latter four

[1] Names of participants at the second college were not recorded, in accordance with the institutional research policies of that college, precluding a follow-up session.

[2] Copies of all instruments are available from the author. Some other instruments not used in the analyses reported in this study were also administered. A full description of these, along with copies, is available from the author.

Table 2
Affective and Descriptive Rating Scales

Question[a]	Mean rating[b]
How certain are you of your decision about what major to declare?	4.04
How comfortable are you with the way you are making this decision?	4.95
How rushed or pressured do you feel in making this decision?	3.54
How stressful is it to make this decision?	4.58
How satisfied do you feel with the amount of information you have obtained while making this decision?	4.14
How confident do you feel about your decision?	4.47
How independently (e.g., of other people) are you making this decision?	5.52
How much do you enjoy making this decision?	4.45
How difficult is this decision, relative to other decisions you have previously made?	5.05
How much are you using specific criteria to make this decision?	4.17
How much are you drawing on your intuitions, "gut" reactions, feelings?	5.49
How much emphasis are you placing on the future consequences of your decision?	5.47
How much are you ruling out some possibilities because of one or a few criteria?	4.16
How much are you using previous habits or policies in making this decision?	5.01
How much are you making trade-offs among different possibilities in making this decision?	4.27
How much of your decision is guided by your overall values, principles, goals, and/or objectives?	6.15

[a]Participants responded to each question by using an integer between 1 (*not at all*) and 7 (*completely*). [b]Mean ratings on a scale of 1 to 7. Pairs of means differing by more than .82 were found significantly different, $p < .01$, by a post hoc Tukey test.

instruments described above, in the same order. Then, they were asked to fill out two new ones. These included an instrument on which participants were instructed to list the criteria that they recalled using 1 year ago in considering their decision (recalled criteria) and a similar instrument on which participants were instructed to list the criteria that they currently thought they ought to have used (ideal criteria). The order of these two instruments was counterbalanced across participants. The purposes of these instruments were to assess the participants' memories of their previous thinking about the decision as well as to assess how much their memories were associated with their later view of what they ought to have done.

Results

The two colleges from which students were selected differed in a number of respects, and the method of recruitment differed for the two samples. Thus, a number of preliminary analyses were carried out for the dependent measures described below. None yielded any significant main effect or interaction with sample as a variable. Thus, data from the two samples were combined in many of the analyses reported below.

Structuring of the Decision

The number of criteria and the number of alternatives (possible majors) listed as being under active consideration were tabulated. For Round 1 (1995) of data collection, the means were 6.77 for criteria and 3.95 for alternatives. Next, I examined the number of different types of alternatives or criteria under consideration. The alternatives and criteria listed as being under current consideration by any participant were tallied. The entire list was then coded into categories by two research assistants and me. For the possible alternatives (majors), the categories used were the three major academic divisions recognized at liberal arts colleges: natural science and mathematics; social science; and arts, literature, and humanities. For the criteria listed by the students, there was no ready-made taxonomy, so one was developed after a preliminary examination of the Round 1 (1995) data. The result was 26 categories, including interest/enjoyment, ability, values, curriculum requirements, departmental reputation, parents' advice, and others.[3]

Using these categories, I computed the number of types of criteria or alternatives listed. This measure reflects not just quantity listed but also breadth. A participant who listed 10 criteria all in the same category received a score of 1; a participant who listed 10 criteria all in different categories received a score of 10. Participants considered a mean number of 5.33 different categories of criteria (out of a possible 26) and a mean number of 2.14 different categories of alternatives (out of a possible three).

Data from the 39 participants who gave complete data on both rounds of data collection were used to examine changes over time. I first examined the number of criteria listed, performing a within-subjects analysis of variance (ANOVA) on the variable of round of data collection, and found no significant effects. The mean numbers of criteria listed for these participants were 6.64 in 1995 and 6.48 in 1996, $F(1, 38) = 0.15$, *ns*.

However, examination of changes in the number of alternatives listed did yield a statistically significant decline over the course of the year. An average of 4.18 different

[3] A list of all categories is available from the author. Interrater reliabilities for the categories ranged from .59 to 1.00, with a median of .89.

alternatives (potential majors) were under consideration in 1995; the average was 2.94 in 1996. A within-subjects ANOVA showed that the decline in the number of alternatives considered was statistically significant, $F(1, 25) = 13.48, p < .001, MSE = 1.30$.

Finally, changes in the decision content over the course of the year were assessed. Specifically, I looked at how much both the criteria and the alternatives under active consideration changed over the course of the year. For all available participants, I computed the proportion of criteria listed in Round 1 (1995) that were listed in Round 2 (1996). The mean overlap in the criteria was .48. A corresponding ratio of alternatives listed in Round 1 to those listed in Round 2 yielded a mean overlap of .51.

Taken together, the results of these analyses suggest that the students limited the number of criteria and alternatives under consideration to a small number and narrowed the number of alternatives under consideration over the course of the year. However, although the structure of the decision over the course of the year remained fairly constant, the *content* of the decision showed significant change over the course of the year.

Correlations of Intuitions With the Predictions of Linear Models

The ways in which students' information integration followed three different formal linear models were assessed. For each model, I computed a predicted value for each major—a measure of the overall suitability a given major ought to have, given a particular way of combining that major's ratings on the various criteria given. These predicted values were then correlated with a student's overall impressions of the set of potential majors under consideration.

Full multiattribute utility theory model. All of the information provided by a student on the third and fourth instruments was incorporated approximately in accordance with a linear model called multiattribute utility theory (MAUT). A large body of technical literature describing MAUT and other kinds of utility theories exists (Edwards, 1992; von Winterfeldt & Edwards, 1986; Westenberg & Koele, 1994). For the purposes of this study, a brief and simplified description will suffice.

MAUT analyses consist of (a) breaking down a decision into independent criteria (e.g., enjoyment of subject matter, future career preparation), (b) determining the relative importance weights for each criterion, (c) listing the alternatives (e.g., different possible majors to declare), (d) rating the alternatives on each criterion (e.g., how does the major physics rate on the variable of enjoyment of subject matter), (e) multiplying the ratings by the weightings and summing them to determine a final value for each alternative, and (f) choosing the alternative with the highest value. MAUT, under certain assumptions, has been argued to be a normative model of decision making (Baron, 1994; Keeney, 1992). That is, people who follow MAUT maximize their utility (personal satisfaction).

To compute MAUT predicted values for the possible majors under consideration, the importance weight of a given criterion was multiplied by the subjective rank of that particular alternative (possible major) on that particular criterion, and the products were summed over all criteria listed.[4] Thus, each potential major listed received one summary score. Next, these scores were correlated with the ranks of students' overall impression ratings of potential majors given on the fourth instrument. (Recall that students could not look at previously completed instruments while giving these overall impressions.) Positive correlations indicated more calibration of a student's overall impressions with the values a major should have, given MAUT criteria derived from the student's own values and perceptions. Table 3 provides an example of the calculation of expected utility with the MAUT model.

Table 3
Expected Utility With Each Model

Model	Utility value for first five columns of worksheet example in Table 1				
	A	B	C	D	E
Full multiattribute utility theory	187	192	163	168	159
Top criterion	9	8	7	4	6
Equally weighted criteria	24	25	21	21	22

Note. See the text for an explanation of calculation of expected utility values.

The full MAUT model makes the questionable assumption that students' assessments of weights and ratings of alternatives make use of true ratio scales. That is, it assumes that a student who gives the criterion of difficulty an importance weighting of 4 and the criterion of career opportunities a weighting of 1 treats the first criterion as exactly four times as important as the second. Some evidence suggests that people are notoriously inaccurate at providing their own meaningful weights (Reilly & Doherty, 1989). Therefore, I compared the performance of the full MAUT model with that of two other, simpler linear models of information integration. Both of these models assume a linear approach to the decision but relax one or more of the MAUT assumptions regarding criterion weights.

Equally weighted-criteria model. With this model, the predicted value for each potential major was computed by giving each criterion equal weight. That is, the subjective importance weights that students assigned to each criterion were simply ignored, and the ranks of each alternative on each criterion were summed. Again, predicted values were correlated with the ranks of students' overall impression ratings of potential majors given on the fourth instrument. Table 3 provides an example of the calculation of expected utility with this model.

[4] A MAUT analysis requires that all the factors listed be "psychologically independent" (Baron, 1994, p. 342). Before data analysis, participants' responses were inspected, and any that seemed redundant were removed. This step was necessary in only a few cases. This informal procedure does not fully satisfy the stringent MAUT assumptions but provides an approximation of them.

Top-criterion model. An even simpler way of calculating the predicted value for a major is to include only the student's most important criterion or criteria. Therefore, predicted values in this model were calculated by use of only the ratings of a major on the criterion to which a student had assigned the highest importance weight. Thus, students' ratings of majors on all other criteria were ignored. If a student assigned more than one criterion the highest weight (as frequently happened), then the average rating of a major on all these criteria was computed to calculate the predicted value for that potential major. Again, predicted values were correlated with the ranks of students' overall impression ratings of potential majors given on the fourth instrument. Table 3 provides an example of the calculation of expected utility with this model.

Correlations between expected values and participants' overall impressions were calculated from Round 1 (1995) to ensure the broadest subset of participants.[5] These correlations were analyzed with a within-subjects ANOVA with model (full MAUT, equally weighted criteria, and top criterion) as the independent variable. The analysis revealed a significant main effect for model, $F(2, 122) = 3.47$, $p < .05$, $MSE = 0.31$. Mean correlations were .70 for the full MAUT model, .62 for the equally weighted-criteria model, and .76 for the top-criterion model. (The use of Spearman rank correlations instead of Pearson product–moment correlations yielded similar values.) Post hoc Tukey tests showed that the mean correlation for the top-criterion model differed significantly from that for the equally weighted-criteria model, $p < .05$.

These analyses suggest that linear models predict about 38 to 60% of the variance in a student's overall impression of the suitability of a candidate major. The top-criterion model seems to be the most strongly predictive. The results imply that linear models do function reasonably well as paramorphic models of nonexpert decision making. The results also suggest that, when decision makers are forced to specify their criteria and rank alternatives on those criteria, linear models can predict the final choice moderately well. Thus, these analyses provide support for Hypothesis 1, that linear models will correlate significantly and substantially with students' holistic impressions of different candidate majors.

Descriptions of and Affective Responses to the Decision-Making Process

For this set of analyses, I used the rating scales of the fifth instrument (presented in Table 2) as dependent measures. The ratings collected in Round 1 (1995) were subjected to a within-subjects ANOVA with repeated measures. This analysis yielded a main effect for rating scale, $F(15, 1{,}620) = 24.43$, $p < .001$, $MSE = 2.16$. Mean ratings are also presented in Table 2.

Many of the highest rated items, such as "guided by values," "intuition," and "emphasis on future," indicate that students recognize this decision as being very important and life framing. Students also report this decision to be moderately stressful and difficult.

Affective and descriptive ratings from participants taking part in both rounds of data collection were analyzed in a 16 (rating scale) × 2 (round of data collection) within-subjects ANOVA with repeated measures on the last two variables. Complete data were available for 37 participants. The analysis showed a main effect of rating scale, $F(15, 540) = 15.92$, $p < .001$, $MSE = 2.85$, a main effect of round of data collection, $F(1, 36) = 4.16$, $p < .05$, $MSE = 3.22$, and an interaction between the two, $F(15, 540) = 6.56$, $p < .001$, $MSE = 1.64$. However, specific comparison tests revealed that only one pair of means differed significantly, $p < .01$ (Tukey test): Mean ratings of certainty rose significantly from the 1st to the 2nd year (mean ratings of 3.78 and 5.95, respectively).

Affective and descriptive ratings were correlated with the dependent measures used for the last set of analyses, the correlations between holistic impressions and predictions of linear models. Coefficients of overall impressions with any of the three linear models were not significantly correlated with any of the 16 rating scales. Thus, Hypothesis 2, that effective decision-making (as indicated by the correlation of students' holistic impressions with the predictions of linear models) will correlate significantly with students' confidence and comfort with the process, received no support.

Memory for the Decision-Making Process

Recall that participants were instructed in Round 2 (1996) to list not only the criteria that they were currently using to make the decision (current criteria) but also the criteria that they recalled listing 1 year earlier (recalled criteria) and the criteria that they currently thought they ought to have used (ideal criteria).

How did participants' view of the ideal decision-making process reflect their current thinking about the process or their recall of their past thinking about the decision? Only the data for participants who took part in both rounds of data collection could be used in this analysis. Because each 2nd-year participant had also been a 1st-year participant, data were available from the criteria that they originally listed in 1995 (original criteria).

I computed the proportions of overlapping criteria between four sets of pairs as described below[6] and subjected

[5] Correlations were computed within subjects, and subjects with only one or two majors listed were therefore necessarily excluded from this analysis, leaving 62 subjects in the analysis of the 1995 data. Only 11 students provided enough data for the analysis of the 1995 and 1996 rounds; hence, these data were not analyzed. The correlations were analyzed with Fisher's r-to-z transformation but, for ease of exposition, have been converted back to Pearson r correlations.

[6] I used the original criteria as the denominator whenever possible; otherwise, I used the current criteria and, in the recalled-ideal case, the recalled criteria. Only four of the possible six pairs were used, as the remaining two could be directly computed from the other four. The four pairs used were the ones judged to be the most relevant for investigating memory distortions.

these proportions to a within-subjects ANOVA with overlap set (current–original, recalled–original, current–recalled, recalled–ideal) as the independent variable. Complete data from 38 participants were available for this analysis.

The analysis revealed a main effect for overlap, $F(3, 111) = 17.95$, $p < .001$, $MSE = 0.05$. Mean proportion overlaps were as follows: current–original, .47; recalled–original, .46; current–recalled, .72; and recalled–ideal, .72. Post hoc Tukey tests showed that the first two means were significantly lower than the last two, $p < .01$. The participants' proportion of overlap between recalled criteria was significantly higher with both the current and the ideal criteria than with the original criteria (i.e., than the criteria that they were instructed to list). This result suggests that participants' memory of the criteria used 1 year earlier was associated much more with the criteria currently being used and the criteria thought to be ideal than with the criteria actually listed. This result, a replication of that of Galotti (1995b), implicates filtering of memory for aspects of personal decision making through one's current view of how the process ought to proceed. This result provides support for Hypothesis 3, that students' memories of their decision-making processes will correlate more strongly with their current views of how the process should work than with their performance as it actually initially occurred.

Discussion

This study of real-life decision making was done with a sample of highly motivated, intellectually able college students well practiced in analytical thinking as they confronted an ongoing decision that they viewed as important, difficult, and life framing. Thus, this study ought to have revealed optimized decision-making performance. Instead, this study revealed mixed results for how well students performed.

Students reported themselves as considering approximately seven criteria in making this decision. This number remained stable over the course of the year. However, students did not use the same specific criteria during that year; about half the criteria changed. There was a significant drop in the number of alternatives under consideration over the course of the year, from about four to about three. Again, about half of the specific alternatives under active consideration changed over the course of the year.

Thus, even when more than 1 year away from the decision, students limited the amount of information that they considered. At either college involved, students could have considered at least 25 different majors and at least that many criteria (recall that in this study, 26 different categories of criteria in the data set as a whole were discerned). In fact, no participant ever reported more than seven alternatives under consideration at any point. Why then, when time and information abounded, did students engage in such a restriction? One possibility is that the early focus on a small number of criteria and alternatives is a strategy that students adopt to manage the cognitive demands of this task. By restricting their focus to a few criteria and candidate alternatives, students avoid having to collect and integrate large amounts of information.

The data from this study suggest that, once information is collected, students are moderately effective at integrating the information and making the final selection. Students' overall holistic impressions of the suitability of candidate majors correlated significantly with the predictions of several linear models of decision making, replicating the results of another study of real-life decision making (Galotti, 1995a). Curiously, in this study, the best-fitting linear model was the simplest, the top-criterion model. Again, this result may stem from a strategy used to avoid cognitive overload, as the top-criterion model requires the decision maker to keep track of and integrate fewer pieces of information. In any case, the results of this study and a previous one (Galotti, 1995a) show that the full MAUT model, in which students' criterion importance weights are used, performs no more effectively than simpler models, suggesting that students do not make use of the importance weights that they report when making a final selection.

Students did not describe themselves as actually using linear models in their processing of information. Surprisingly, even students whose decision-making process more closely followed a prescriptive rational model of decision making (as assessed by the correlation of their overall impressions with the predictions of linear models) were no more likely to report themselves as using specific criteria or making trade-offs. Thus, however well their decision-making process is modeled by linear models, students appear unaware of it. This finding, in turn, suggests that explicitly using a linear model to make important life decisions is not something that comes naturally.

When surveyed 1 year later, participants recalled about half of the criteria that they had originally listed. Recalled criteria were more related to ideal criteria and to current criteria than they were to original criteria. These results replicate those of a previous study (Galotti, 1995b) of high school students choosing a college. They lend further support to the idea that one's recall is filtered through one's current cognitive framework, supporting the assertions of Ross (1989), and Blackburne-Stover et al. (1982). These results show that filtered recall applies not only to narratively structured, autobiographical memories (Bonhannon, 1988; Pillemer, Goldsmith, Panter, & White, 1988; Robinson & Swanson, 1990) but also to memories for specific pieces of personal, self-generated information as well. Thus, this work bridges research on autobiographical narrative recall and research on recall of past learning or knowledge of impersonal facts and information (e.g., Bahrick, 1984).

Perhaps surprisingly, effective decision making, as measured by correlation of overall impressions with predictions of linear models, did not predict greater satisfaction with, enjoyment of, or confidence in the decision. This result echoes some of those reported by Mau and Jepsen (1992). Given the analytical expertise and educational level of students in both studies, it is puzzling that greater rationality in decision making did not result in better affective responses to the process.

What accounts for such a counterintuitive result? One

plausible explanation is the amount of cognitive effort expended in the decision. Students who consider more options might see themselves as less decisive and, hence, as less effective decision makers because they equate effective decision making with fast decision making or with unambiguous outcomes. Decision makers who somehow restrict their task, by considering few options, by using fewer criteria, or by simplifying the way in which information about criteria and options is integrated, have less cognitive work to do. In turn, the process appears to be more rapid and perhaps to contain less ambiguity. If people expect major life decisions to be easy or obvious or to require little thought, then they might feel better about their decision making when there are only a few pieces of information to consider and the decisions require little work. This explanation assumes that people's own cognitive efforts undermine their comfort level.

If this account is borne out in further research, it will echo some of the themes of laboratory decision-making research: "Satisficing" (Simon, 1956) abounds, even when decision makers care a great deal about the outcome of the decision and see it as a life-framing one. It further suggests that educators need to help people to become comfortable with cognitive processes that involve ambiguity and doubt and that require an investment of time and cognitive effort.

Educators and counselors can use the results of this study to focus their efforts on supporting college students facing the decision about a major. They can recognize the stress and difficulty that students (even very bright, highly motivated, and well-educated ones like those in this study) experience. They can assure students that it is "normal" to change one's thinking, perhaps even drastically, during the period before the final choice. They can be aware that students' natural tendency will be to narrow their focus to a handful of alternatives and criteria even very early in the process. Educators and counselors can encourage undergraduates to avoid this narrowing, to explore more widely, and to broaden their thinking. They can help students learn and explicitly use various methods of decision structuring (such as the subjective expected utility model of Mau and Jepsen, 1992, or the MAUT work sheets described here) to help keep track of alternatives and criteria in order to overcome cognitive processing limitations that arise when they try to make the decision "all in their head." Educators and counselors must also be aware, however, that the students who are thinking the most analytically, thoroughly, and rationally (as traditionally defined) will not necessarily find their stress levels decreased or their certainty and comfort levels increased. Indeed, the results of this study suggest the need to reassure students who do take the time to consider many options or to weigh many criteria that the processes in which they are engaging reflect effective, not "waffling," decision making.

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