NOTE-TAKING FORMAT AND SCHEDULE EFFECTS: TEST PERFORMANCE, PERSONAL RELEVANCE, AND BEHAVIORAL INTENTIONS

by

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Introduction

Note-taking behavior is pervasive. Individuals take notes in a variety of situations. It happens in classroom lectures, in business meetings, and in everyday activities (e.g., making a grocery list). Individuals use their notes to maintain attention and for future reference to refresh their memories. Consequently, it is important to study what variables influence the effectiveness of this activity. The present study assessed note-taking strategy effectiveness for individuals who read expository text that covered information about stress. Individuals either took notes using a traditional linear summary (*summarization*) or graphic summary (*node-link mapping*) format. They either took notes multiple times (10) using a signaled *schedule* throughout the reading (multiple), at the end of the reading (massed), or at their own pace (ad lib). Primary dependent measures included free recall, recognition, study experience ratings, and assessments of attitudes and intentions concerning stress. Participants' verbal abilities were also assessed prior to any experimental manipulations. To provide background for this study, note-taking research is reviewed in the following sub-sections.

General Findings on Note-Taking and Academics

Note-taking has been primarily studied in educational settings (for review, see Armbruster, 2000; Caverly, Orlando, & Mullen, 2000; Kiewra, 1985, 1989; Kiewra, Benton, Kim, Risch, & Christensen, 1995; Kiewra, Dubois, Christensen, Kim, & Lindberg, 1989; Kiewra et al., 1991; Kobayashi, 2005). It has been examined in the context of three basic tasks: while listening, while watching video, and while reading text. The research outcomes are similar for all tasks. The combined activities of taking and reviewing notes are best for subsequent recall, with review especially important for delayed recall (Annis, 1979; Benton, Kiewra, Whitfill, &

Dennison, 1993; Bretzing & Kulhavy, 1979; Caverly et al., 2000; Dyer, Riley, & Yenkovich, 1979; Hynd, Simpson, & Chase, 1990; Kardash & Kroeker, 1989; Orlando, 1979).

The focus of the present study was on note-taking while reading. Prior research has examined the impact of creating (and often reviewing) traditional linear written notes during reading/studying. The note-taking techniques range from verbatim copying of parts of the text to the development of idiosyncratic outlines and summaries. As mentioned earlier, taking (and reviewing) notes is generally better for recall tasks than just reading (Armbruster, 2000; Caverly et al., 2000). Note-taking has been found to assist individuals by helping them relate material to existing knowledge (Anderson & Pearson, 1984; Armbruster, 2000; Mayer, 1984; Peper & Mayer, 1986). Furthermore, notes that require the student to generate new wording and reorganize the information (e.g., outlining, summarizing) lead to better subsequent performance than verbatim notes (Trabasso & Bouchard, 2005). In general, active generative processing of this type has been shown to be effective in a variety of educational tasks (see Mayer, 1984, 2004; Meyer, 1975; Peper & Mayer, 1986; Shrager & Mayer, 1989; Wittrock, 1974, 1975, 1990).

The general findings are that note-taking while reading is more useful for difficult material, and more productive with longer material (more than 1,000 words) (Boyle & Peregoy, 1991; Caverly et al., 2000; Dansereau et al., 1979; Dansereau, Brooks, Holley, & Collins, 1983; Diekhoff, Brown, & Dansereau, 1982; Holley, Dansereau, McDonald, Garland, & Collins, 1979; Iovino, 1993; McCagg & Dansereau, 1991; Ruddell & Boyle, 1989; Schumacher, 1987). However, some students are poor note-takers (Armbruster, 2000; Hartley & Cameron, 1967; Katayama & Robinbson, 2000; Kiewra, 1989; Van Meter, Yokoi, & Pressley, 1994) and need to be taught how and when to take notes (Arnold, 1942; Caverly et al., 2000; Hynd et al., 1990; Trabasso & Bouchard, 2005).

In summary, note-taking is generally helpful in improving academic test performance, although as with most educational techniques there continues to be room for improvement. In addition, the question remains as to whether note-taking might also have effects on attitudes and intentions when individuals process personally relevant text. If so, measuring attitudes and intentions might provide an important supplementary measure of comprehension in classroom settings. It also might help clarify mechanisms influencing attitudes and intentions.

Note-Taking and Attitudes and Intentions

Although no previous literature has addressed the impact of note-taking strategies on attitudes and intentions, there have been many attitude studies dealing with reading factual information and/or persuasive arguments. Individuals' attitudes are affected by persuasive arguments depending on the communication source, content, and context (for review, see Petty & Wegner, 1998). The prevalent types of materials used in prior experiments have generally been of an argumentative nature, rather than balanced descriptions of information. Germane to this study were the prior studies that used informational messages that were not specifically intended to be persuasive. Do individuals behave differently, or indicate intentions to do so, when they are presented with information that is not directly intended to bias processing of attitude-relevant information, such as information presented in college textbooks, health related brochures, etc.?

Research suggests that individuals can be influenced by this type of information. For instance, individuals exposed to facts related to HIV subsequently showed favorable attitudes and expectancies, greater control perceptions, and stronger intentions to use condoms in the future (Albarracin et al., 2003). Another related study reported similar findings for information on other sexually transmitted diseases (St. Lawrence, Crosby, Brasfield, & O'Bannon, 2002). In

addition, employees exposed to informational training significantly increased their perceptions of helpfulness of employee assistance programs (Bennett & Lehman, 2001). Also, individuals who were exposed to printed health information on weight loss, which was tailored to meet their specific needs, reported greater intentions to change (Krueter, Bull, Clark, & Oswald, 1999).

However, the question remains as to how note-taking with stress-related material would affect attitudes and intentions. To answer this question, the present study examined note-taking effects on attitudes and intentions, as well as test performance measures and the study experience. The target material was basic scientific information on physiological and psychological stress responses from the perspective of human and animal models. Before describing the details of the present study, it is important to provide more information on note-taking strategies.

Note-Taking Strategies: Schedule and Format

As stated earlier, note-taking strategies vary according to format (verbatim, summary, outline, etc.) and schedule (multiple or at the end of reading). In the next sub-section, these two variables are discussed further.

Schedule. Although there have not been many studies that have examined note-taking schedules, results in related research prompted the present inquiry. For example, participants who infrequently summarized (twice) a 2,500 word geology text performed better on a subsequent essay test than those who frequently summarized (four times) (Spurlin, Dansereau, O'Donnell, & Brooks, 1988). This finding differed, in part, from other related research. Prior research on the frequency of using an elaboration strategy suggested that use of a multiple action strategy might have advantages over massed elaboration at the end of an article (e.g., O'Donnell, Dansereau, Hythecker, et al., 1988; O'Donnell, Dansereau, Rocklin, et al., 1985). When

individuals process information while reading, it may help to segment it into smaller parts in order to circumvent limitations on memory. One study examined elaboration frequency by having some participants elaborate four times during reading and others elaborate only once at the end of the article. Those who elaborated multiple times significantly outperformed others who only elaborated once (O'Donnell, Dansereau, Rocklin, et al., 1985). In another study, similar strategies enacted at different schedules were employed while reading text covering procedural knowledge (O'Donnell, Dansereau, Hythecker, et al., 1988). Individuals, in dyads, cooperated while reading text on setting up an intravenous infusion. Those who used a multiple action planning strategy performed the procedure better than those who used massed planning. Another study examined annotation frequencies (Moreland, Dansereau, & Chmielewski, 1997), where participants chose when to annotate text or experimenter-provided maps. In this case, frequency of use of annotation strategies did not make a difference on recall of information. Therefore, different structured frequencies/schedules have resulted in effects on memory of information, while unstructured frequencies/schedules (i.e., occurring when participants choose) alone did not reveal effects. These mixed results suggested the examination of multiple vs. massed vs. ad lib schedules of note-taking in the present study.

Format. The format of taking notes has been widely studied. The activity of generative linear note-taking, specifically summarization, presumably makes readers more aware of how text is structured and how ideas are related (Afflerbach & Walker, 1992; Armbruster, Anderson, & Osertag, 1987; Brown & Day, 1983; Chang, Sung, & Chen, 2002; Rinehart, Stahl, & Erickson, 1986; Trabasso & Bouchard, 2005). Summarization has been found to be better than other strategies. For example, participants who summarized performed better on recall than those who only re-read text (Rewey, Dansereau, & Peel, 1991), and recalled more than those

who took verbatim or letter-search notes (Bretzing & Kulhary, 1979). And, participants who summarized remembered macrostructure (Kintsch & van Dijk, 1978; van Dijk & Kintsch, 1983) better than those who read and discussed answers to questions about the passage (Armbruster et al., 1987). According to Kintsch (1994, 1998), an ideal summary expresses the macrostructure, which is a hierarchical set of propositions that represent the global structure of the text.

Ausubel (1968) originally studied participants' learning of expository text with graphic strategies (using advanced organizers). In more recent research, participants who used graphic strategies such as node-link mapping or organized charting converted linear textual statements in articles or books into nonlinear graphic presentations. This process appears to have made the content easier to retain and retrieve (e.g., Chang et al., 2002; Katayama & Robinson, 2000). Diagrammatic displays, unlike traditional linear displays, presumably assist in the processing of relational information in text (e.g., Anderson & Reder, 1979; Craik & Lockhart, 1972; Craik & Tulving, 1975; Jacoby & Craik, 1979; Reder, 1980; also see Dansereau, 2005; Holley & Dansereau, 1984).

The graphic strategy used in the present study was node-link mapping. These maps are two-dimensional spatial-semantic displays that allow for presentation of information in the form of *nodes* (spatial cues) and *link* (relational cues) assemblies. As shown in Figure 1, the nodes contain key ideas and the links express the relationships between those ideas (for review, see Dansereau, 2005; Dansereau & Dees, 2002; Lambiotte, Dansereau, Cross, & Reynolds, 1989; O'Donnell, Dansereau, & Hall, 2002).

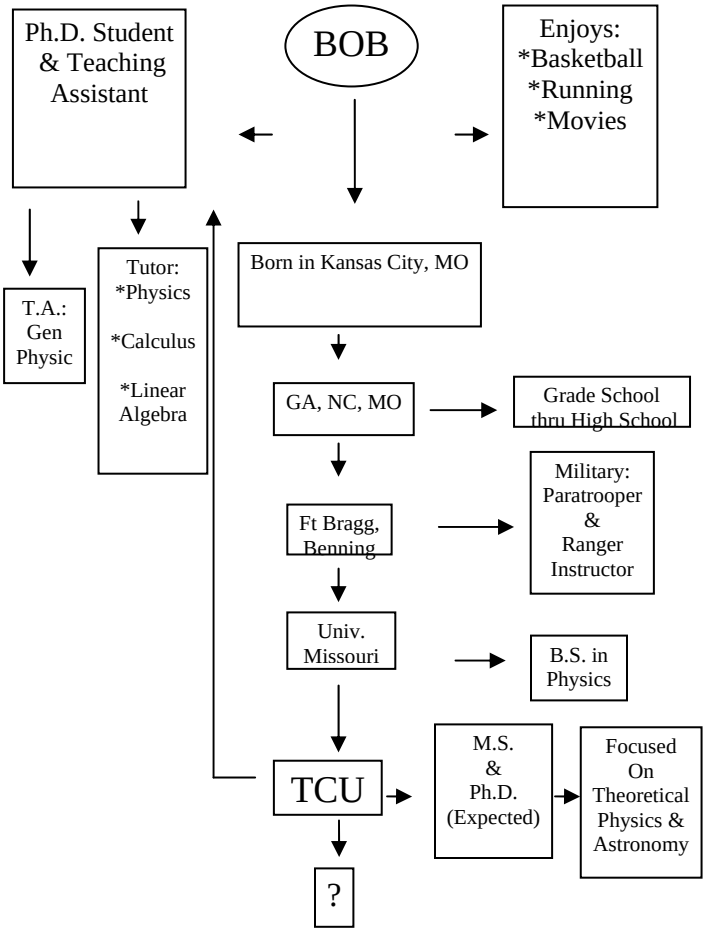

Figure 1 *Example of a node-link map of self*

Participants who generated node-link maps recalled text information better than those who used their own methods of study (e.g., Armbruster & Anderson, 1984; Barron, 1980; Cleland, 1981; Dansereau et al., 1979; Dansereau & Holley, 1982; Gillis, 1985; Holley et al., 1979; Long, 1976; McCagg & Dansereau, 1991; for review, see Holley & Dansereau, 1984; Lambiotte, Dansereau, Cross, & Reynolds, 1989), proficiently integrated information from multiple texts (Bean, Sorter, Singer, & Frazee, 1986; Readence, Bean, & Baldwin, 1985), improved outlining (Hansell, 1978), and enhanced the representation of problems (McGuiness, 1986; Spurlin, 1982). Research, which compared node-link mapping and summarization, found that participants who studied with maps recalled more descriptive and procedural information than those who studied with summarizations (Swain, 1991). There has not been additional

research that directly compared these two methods. To clarify these findings, the impact of summarization and node-link mapping were examined as described below.

The Present Study

This study assessed note-taking strategy effectiveness (traditional linear or graphic format; multiple, massed, or ad lib schedule) for college students who read expository text on stress. Test performance measures of delayed free recall and recognition, post-study ratings of the experience, and attitudes and intentions served as dependent variables. The following research questions guided the inquiry:

1. Would there be note-taking format and schedule effects on: (a.) test performance measures, (b.) post-study ratings of the experience, and (c.) attitudes and intentions measures?
2. Would differences in verbal ability lead to different answers to the first set of questions?
3. Would there be relationships between verbal ability, study experience ratings, test performance, and attitudes and intentions?

Method

Participants and Design

Participants were 209 undergraduate students who were enrolled in psychology courses, and received experimental credit. Of these, 22 (10.5%) did not complete all 3 sessions, and 12 had Delta Reading Vocabulary Test scores < 15 (considered to be a minimum for understanding the experimental task). Consequently, 175 students constituted the sample used in the data analyses. Of these, 60 were male (34%), 115 were female (66%), 128 (73%) were Caucasian, 16 (9%) were Hispanic, 13 (7.4%) were Asian, 9 (5.1%) were African-American, 8 (4.5%) were Bi-

Racial, and 1 was American Indian. Ages ranged from 18 to 39, with the mean and median age = 20.

The design was a 2 (format: node-link mapping vs. summarization) X 3 (schedule: multiple vs. massed vs. ad lib) factorial. Participants were randomly assigned to one of the 6 between-subjects conditions shown in Figure 2.

	Schedule		
	Multiple	Massed	Ad Lib
Format			
Node-Link Map	*n* = 28	*n* = 30	*n* = 29
Summary	*n* = 29	*n* = 29	*n* = 30

N = 175

Figure 2 *The six cells in the study and the number of participants in each cell*

Training and Stimulus Materials

Training packets. All materials appeared on 8.5 X 11 –in. sheets of paper. All examples for node-link mapping and for summarization were constructed to be informationally equivalent (Larkin & Simon, 1987) (i.e., all information in one set could be inferred from the other). Examples of node-link maps (as referred to in Figure 1) included a self-map (which displayed autobiographical details, hobbies, life interests, etc.), maps of sentences (on fish, dreams, athletes), and a map of a paragraph on human memory. A sample passage unrelated to information in the study, but of sufficient length and comparative difficulty was in the packets

that participants read and used to practice their designated techniques (1,622 words on bottlenose dolphins). Two forms of the text were prepared, one un-signaled and one signaled with 6 asterisk marks indicating action points (signal points were set at approximately equidistant portions of material to allow for segmentation of macrostructure propositions). The same examples of information from the self-map, sentences, and paragraph were included for training on summarization (e.g., selection of a topic sentence, trivia and redundancy deletion, detail integration, generalizing, organizing). Also, the same sample passages as in the mapping conditions were used for practicing summarization. (see Appendix A for training packet examples.)

Stimulus materials. The to-be-learned information (labeled *Dealing with Stress*) was a 3,173-word college-level text excerpt that was adapted from materials on human and animal models of psychological and physiological stress (Sapolsky, 2004). The passage contained 154 propositions. Two forms of the text were prepared, one un-signaled and one signaled (same arrangement as mentioned above) with 10 asterisk marks indicating action points (see Appendix B). These materials were revised and finalized based on 2 pilot studies (N = 19) conducted previously by the experimenter.

Individual Differences Measure

Delta reading vocabulary test. Participants completed the Delta Reading Vocabulary Test (Deignan, 1973) as a measure of general verbal ability (see Appendix C). This was a 10-minute timed test that contained 45 multiple-choice synonym questions. The Delta has been shown to have a correlation (r = .60) to more extensive verbal tests such as the verbal section of the scholastic aptitude test (SAT) (Dansereau, 1978), and to be correlated with the recall of scientific/technical information (Chmielewski, Dansereau, & Moreland, 1997; Patterson,

Dansereau, & Weigmann, 1993). Participants with low verbal ability typically benefit from using maps (see O'Donnell, Dansereau, & Hall, 2002).

Dependent Measures

Free recall. Participants were provided with blank sheets of paper and instructions that required them to write down as much information as they could remember from the reading material studied.

Recognition. This was a 20-item multiple-choice test (developed by the experimenter) that covered the ideas in the material (see Appendix D).

Study experience questionnaire. This questionnaire was developed specifically for the information in the text (see Appendix E). This was a 20-item measure using a 5-point Likert scale consisting of *1 (not at all) to 5 (very much so/a large amount)* (e.g., "The article made you think about specific things that have happened in your life"). This provided a post-study measure of participants' experience during the studying of the stimulus material.

Attitudes and intentions questionnaire. This was a questionnaire (see Appendix F) developed specifically for the information in the text. This 16-item measure used a 6-point Likert scale consisting of *1 (strongly disagree) to 6 (strongly agree*) (e.g., "This article has helped me become more confident about managing my stress").

Procedure

The experiment was conducted in three separate sessions and in two different rooms, approximately 2 hr for the first session and 1 hr for the two subsequent sessions. Participants completed each of the sessions in the same rooms that were dedicated to their respective format conditions, i.e., node-link mapping or summarization. Specifically, all participants were randomly assigned to one of the 6 experimental conditions as they arrived for the experiment and

then moved to their respective rooms. Experimenters typically differed by session and by room, so that participants usually saw new experimenters in their rooms in each of the sessions.

Session 1. Experimental packets contained written instructions for each condition. After completing consent forms and preliminary demographic information sheets, participants in both rooms completed the Delta Reading Vocabulary test on scantron sheets (10 min). Next, participants continued working through their packets. Individuals in the 3 node-link mapping conditions participated in practice and training in node-link mapping (25 min), and used the specific schedule for their respective conditions (described in Session 2). The experimenters provided only general instructions. The participants learned the techniques on their own (by reading the packets). Individuals completed a node-link map of self, node-link mapping exercises involving sentences, and node-link mapping exercises involving a paragraph. Then, participants practiced their techniques with the sample passage (25 min). The packet instructions directed participants to study and be prepared for subsequent testing, although neither a specific time-frame nor testing format was indicated. For those in the 3 summarization conditions in a different room, a self-summarization, sentences and a paragraph (each contained the same information as in the mapping conditions) were presented in the training packets to familiarize participants with summarization. Different experimenters provided only general instructions and participants learned the techniques in the same order and time as provided for those in the node-link mapping conditions (and used summarization, instead).

Session 2. Session 2 took place approximately 48 hr after Session 1. Participants studied the reading material in this session according to their experimental condition (40 min). In this session, however, testing instructions specified that only the current session material was applicable (i.e., only the current to-be-learned information would be testable—and not material

from Session 1). Participants in the node-link mapping/massed group were instructed to read the un-signaled passage in its entirety, and to then use node-link mapping as a study strategy. Participants in the node-link mapping/multiple group were instructed to read the signaled passage and stop at each asterisk, which signaled a place to use node-link mapping. The instructions further directed participants to map the portion thus far read, and to then continue to read and periodically stop as instructed in a like manner throughout the passage. Participants in the node-link mapping/ad lib group were instructed to read the un-signaled passage and to use node-link mapping to study the material (without specifying a schedule).

Participants in the summarization/massed group were instructed to read the un-signaled passage in its entirety, and to then use summarization as a study strategy. Participants in the summarization/multiple group were instructed to read the signaled passage and to perform the same multiple tasks previously mentioned for the node-link mapping/multiple condition, only using summarization in this case. Participants in the summarization/ad lib group were instructed to read the un-signaled passage and to use summarization to study the material (without specifying a schedule). After the to-be-learned information was studied, all participants completed the Study Experience questionnaire.

Session 3. Session 3 took place exactly 48 hr after Session 2. All participants were given 3 min to review their notes and study passages from Session 2. All notes and study passages were then collected. Next, participants completed a delayed free recall test (15 min) over the information from the study session (i.e., session 2). Participants were provided blank sheets of paper and instructions to write down as much of the information as they could remember from the article Dealing with Stress. Next, participants completed the multiple-choice test on scantron sheets (15 min). Then, participants completed the Attitudes and Intentions questionnaire and an

end of experiment debriefing form. To obtain enough participants, the experiment was conducted twice. Preliminary analyses indicated no differences between iterations; therefore, the data was combined across sessions.

Results

Scoring and Preliminary Analyses

Delta reading vocabulary test. The 45-item multiple-choice exam scantron sheets were scored electronically using a pre-established key and raw scores entered into the data file. This provided a measure of participants' verbal ability. The use of Delta scores is addressed in the subsequent discussion of correlational analyses.

Free recall. The free recalls were scored propositionally using a scoring technique previously developed by Meyer (1975) and subsequently modified (see Holley et al., 1979; Moreland et al., 1997). Each recall statement was matched using the following established protocol. Participants received scores for each proposition recalled on a scale ranging from 0 (not mentioned), 1(mentioned/totally inaccurate), 2 (mentioned/partially accurate), 3(mentioned/mostly accurate), to 4 (complete/precise/accurate). A proposition is a word or phrase that expresses a single idea unit (see Chmielewski & Dansereau, 1998; Czuchry & Dansereau, 1998; Holley et al., 1979; Meyer, 1975). For example, one of the 154 propositions for the stimulus passage Dealing with Stress was "human physiology is influenced by social support". The experimenter, who was unaware of participants' group affiliations, matched each recall statement with the established proposition list. Scores below 2 were not included in participants' total scores, because those reflected errors. Total scores were calculated by summing the scores for each proposition. The numbers of propositions participants recalled were entered into the data file. Interrater reliability was established by having a second rater

score a randomly selected portion of free recalls, approximately 15% (26). Whereas test reliability scores are considered valid above $r = .80$ (see Haladyna, 2002; Woolfolk, 2005), a standard for a minimally acceptable reliability coefficient of $r = .85$ has been set by psychometricians for interrater tasks (e.g., Murphy & Davidshofon, 1988). A Pearson product-moment correlation indicated an interrater reliability coefficient of $r = .99$ for free recall. Scores for free recall, out of possible scores for total propositions (154) in the passage, peaked at 22%, which approximated (max of 25%) what researchers in other studies have found with a delay (e.g., Chmielewski, & Dansereau, 1998; Hall, Dansereau, & Scaggs, 1992; Kintsch & van Dijk, 1978; Meyer, 1975).

Recognition. The 20-item multiple-choice exam scantron sheets were scored electronically according to a pre-established key and raw scores entered into the data file. This provided a measure of participants' cued memory of the information.

Factor analyses. A principal components analysis (PCA) of the Study Experience questionnaire was conducted to determine whether factor scores could be developed. A PCA with Varimax rotation, Kaiser normalization, and extracting eigenvalues over 1.00 resulted in one factor: *Personal Relevance* ($\alpha = .90$), which contained 8 items. Factor loadings are shown in Table 1. The new factor was computed as a mean of the selected items.

Table 1

Factor Analysis on Study Experience questionnaire and Loadings for Retained Factor of Personal Relevance

Statement	Loading
Personal Relevance (Cronbach's coefficient alpha = .90)	
You thought about how it related to you personally.	.75
You were motivated to learn the material.	.65
You found the material interesting.	.77
You found the material personally relevant and/or useful.	.79
The article made you think about specific things that have happened in your life.	.81
You found that you wanted more information than was given in the article about certain aspects of the material.	.72
You thought about how the information in the article related to other things you have learned.	.69
You would like to learn additional information about the topics in the article.	.78

A separate PCA of the Attitudes and Intentions questionnaire was conducted to determine whether factor scores could be developed. A PCA with Varimax rotation, Kaiser normalization, and extracting eigenvalues over 1.00 resulted in the ability to label distinguishable items, yielding two factors: *Manage Stress* (α = .90) contained 5 items and *Learn about Stress* (α = .83) contained 4 items. Factor loadings are shown in Table 2. For each of these, new factors were computed as means of the selected items.

Table 2

Factor Analysis on Attitudes and Intentions questionnaire and Loadings for Retained Factors of Manage Stress and Learn about Stress

Statement	Loading
Manage Stress (Cronbach's coefficient alpha = .90)	
This article has helped me become more confident about managing my stress.	.71
This study has influenced me to do things differently in terms of managing my stress.	.70
I expect to become less stressed, by some events, than I would have before participating in this study.	.70
This study has influenced me to actively use exercise as an outlet for stress.	.82
This study has influenced me to make some changes in my life that will probably extend my life.	.78
Learn about Stress (Cronbach's coefficient alpha = .83)	
This study has influenced me to spend more time learning about stress.	.77
I plan to talk to people about the information presented in the article.	.78
I am going to find out about techniques for calming down when stressed.	.62
I would recommend this article to a friend.	.71

Correlational analyses. Correlational analyses were performed on the developed factors and the other measures; examination of directions and magnitudes indicated that the Delta did not warrant use as a covariate. However, median splits for Delta scores were computed and used to form a supplementary independent variable (labeled *verbal ability*), which allowed the identification of high (n = 97) verbal ability participants, with test scores of 28 and above, and low (n = 78) verbal ability participants, with test scores of 27 and below. In addition, free recall

and recognition were found to be substantially correlated and so were combined into one dependent measure (labeled *test performance*)[1].

Primary Analyses

Four sets of primary analyses were conducted: The first set consisted of the test performance measure; the second set the personal relevance measure; the third set attitudes and intentions measures of manage stress and learn about stress; the fourth set consisted of regression analyses.

Test performance. A 2 (format: summarization vs. node-link mapping) X 3 (schedule: multiple vs. massed vs. ad lib) X 2 (verbal ability: low vs. high) between-subjects analysis of variance (ANOVA) on the test performance measure yielded a marginally significant main effect for verbal ability, $F(1, 163) = 3.53$, $p = .062$, where high verbal ability participants had greater test performance ($M = 59.20$) than low verbal ability participants ($M = 51.69$). Additionally, there was a significant two-way interaction (verbal ability X format), $F(1, 163) = 4.61$, $p = .03$. As shown in Figure 3, mean differences suggest that low verbal ability participants who used node-link mapping had better performance ($M = 55.35$) than low verbal ability participants who used summarization ($M = 47.42$), whereas high verbal ability participants who used summarization had better performance ($M = 63.08$) than high verbal ability participants who used node-link mapping ($M = 54.73$). Mean differences at the two verbal ability levels were not significant in this crossing interaction. (Means and standard deviations are shown in Table 3). No other effects on test performance were significant.

[1] Other approaches to this were considered. Free recall and recognition were transformed into Z scores and the analyses of standard score measures did not substantially differ.

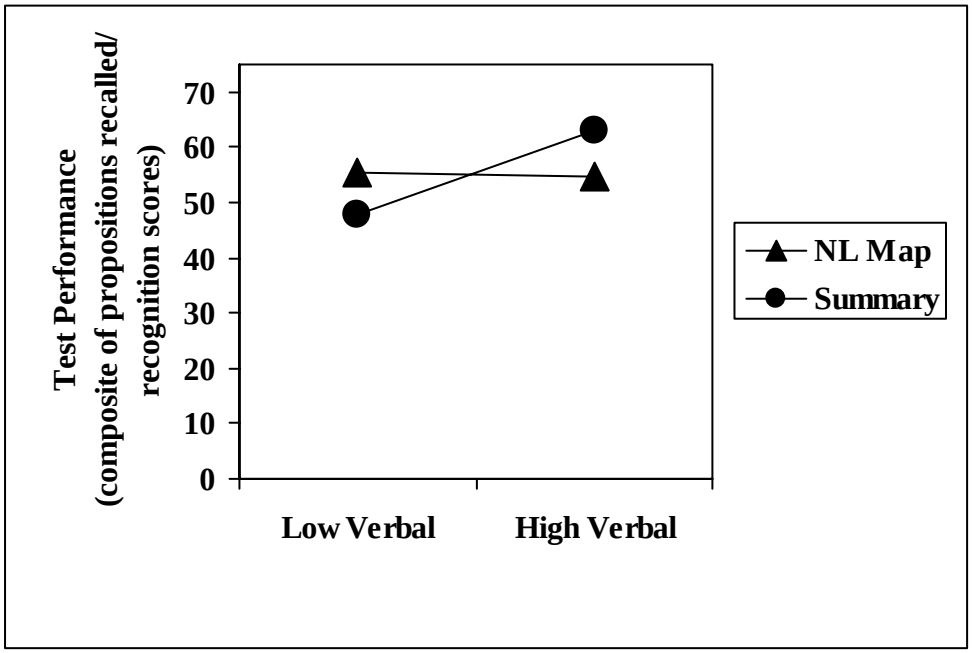

Figure 3 *Means of test performance scores for node-link (NL) mapping and summarization conditions by verbal ability in experiment*

Table 3

Means and Standard Deviations for Test Performance of Low and High Verbal Ability Participants Who Studied a Passage on Stress, as a Function of Condition

				Test Performance	
Format Condition	Schedule Condition	Verbal Ability	*n*	*M*	*SD*
Node-Link Mapping					
	Multiple	Low	11	55.36	20.08
		High	19	57.16	14.50
	Massed	Low	17	58.18	29.35
		High	11	50.63	17.18
	Ad Lib	Low	14	51.93	16.57
		High	15	54.70	25.63
Summarization					
	Multiple	Low	12	39.25	17.87
		High	17	61.23	30.50
	Massed	Low	13	50.46	24.42
		High	16	54.06	20.87
	Ad Lib	Low	11	52.72	32.34
		High	19	72.32	29.77

Personal relevance. A 2 X 3 X 2 (format X schedule X verbal ability) ANOVA was conducted on the dependent measure of personal relevance. The ANOVA did not yield a significant main effect for any of the independent variables on personal relevance. However, the ANOVA did indicate a significant two-way interaction (verbal ability X format), $F(1, 163) = 4.82$, $p = .03$. As shown in Figure 4, mean differences suggest that low verbal ability

participants who used node-link mapping indicated greater personal relevance of the study experience (M = 3.02) than low verbal ability participants who used summarization (M = 2.65). Conversely, high verbal ability participants who used summarization indicated slightly more personal relevance of the study experience (M = 3.02) than high verbal ability participants who used node-link mapping (M = 2.83). Differences between means were not significant in this crossing interaction. (Means and standard deviations are shown in Table 4). Further, no other interaction effects on personal relevance were significant.

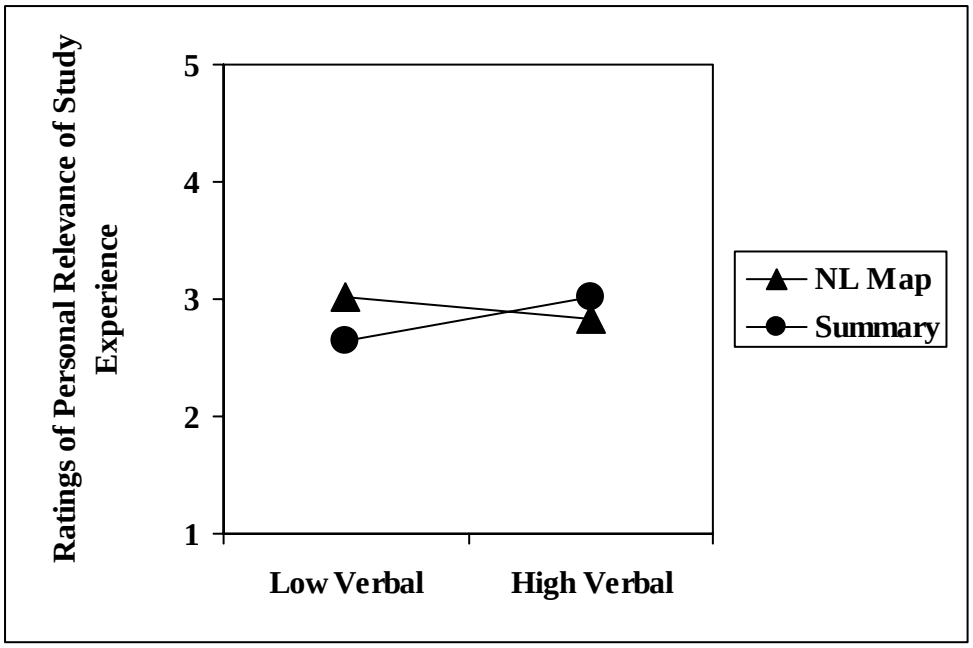

Figure 4 *Means of ratings for personal relevance for node-link (NL) mapping and summarization conditions by verbal ability in experiment*

Table 4

Means and Standard Deviations for Personal Relevance of Low and High Verbal Ability Participants Who Studied a Passage on Stress, as a Function of Condition

				Personal Relevance	
Format Condition	Schedule Condition	Verbal Ability	*n*	*M*	*SD*
Node-Link Mapping					
	Multiple	Low	11	3.15	0.86
		High	19	2.84	0.73
	Massed	Low	17	2.75	0.82
		High	11	2.55	0.83
	Ad Lib	Low	14	3.26	1.06
		High	15	3.05	0.81
Summarization					
	Multiple	Low	12	2.34	1.09
		High	17	2.94	0.98
	Massed	Low	13	2.94	1.00
		High	16	2.98	0.96
	Ad Lib	Low	11	2.65	1.05
		High	19	3.14	0.74

Attitudes and intentions. A 2 (format: summarization vs. node-link mapping) X 3 (schedule: multiple vs. massed vs. ad lib) X 2 (verbal ability: low vs. high) between-subjects multivariate analysis of variance (MANOVA) was conducted on the attitudes and intentions measures of manage stress and learn about stress. The MANOVA did not yield any significant main effects for any of the independent variables on intentions to manage stress nor on learn

about stress. However, the MANOVA did indicate a significant two-way interaction (format X schedule). Univariate analysis indicated this interaction was significant for intentions to learn about stress, $F(2, 163) = 3.60$, $p = .02$. Simple effects revealed a marginally significant effect between node-link mapping and summarization for the ad lib schedule, $F(1, 163) = 3.70$, $p = .058$, and a significant effect on the multiple schedule, $F(1, 163) = 4.13$, $p = .03$. See Figure 5 for the patterns of means. (Means and standard deviations are shown in Table 5).

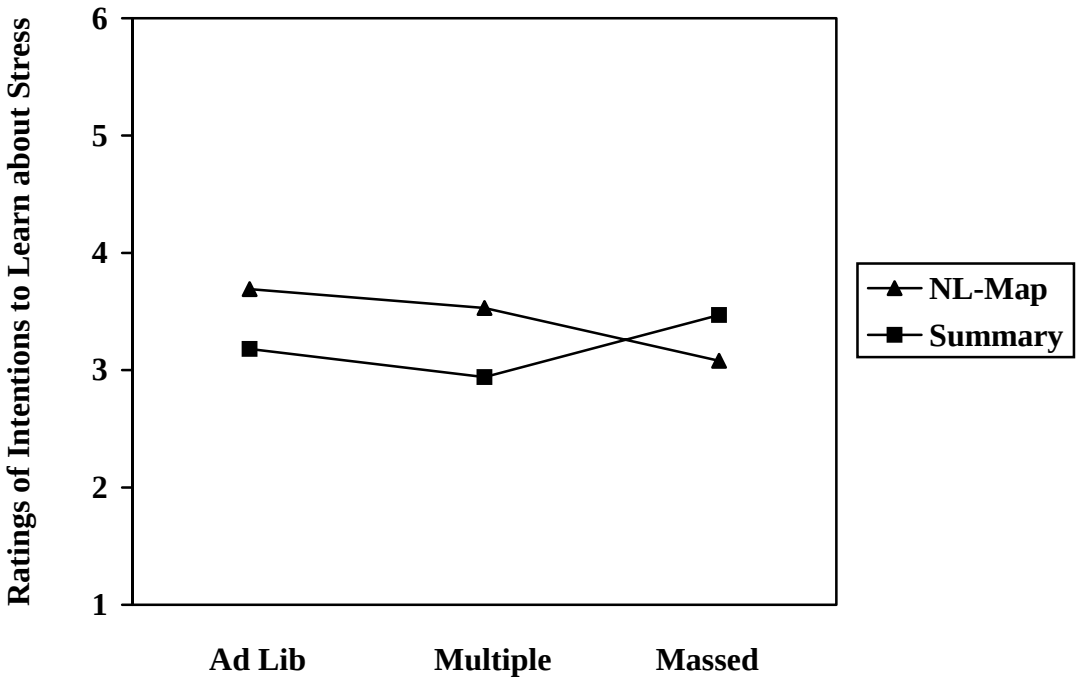

Figure 5 *Means of intentions to learn about stress for format and schedule conditions in experiment*

Table 5

Means and Standard Deviations for Intentions to Learn about Stress of Participants Who Studied a Passage on Stress, as a Function of Condition

			Learn about Stress	
Format Condition	Schedule Condition	*n*	*M*	*SD*
Node-Link Mapping				
	Ad Lib	29	3.69	0.95
	Multiple	30	3.53	0.93
	Massed	28	3.08	1.07
Summarization				
	Ad Lib	30	3.18	1.06
	Multiple	29	2.94	1.10
	Massed	29	3.47	1.18

Univariate analysis did not indicate a significant two-way interaction (format X schedule) on intentions to manage stress, $F(2, 163) = 0.527$, *ns*. However as shown in Figure 6, mean differences suggest a similar pattern as in intentions to learn about stress. (Means and standard deviations are shown in Table 6). No other effects were significant on attitudes and intentions.

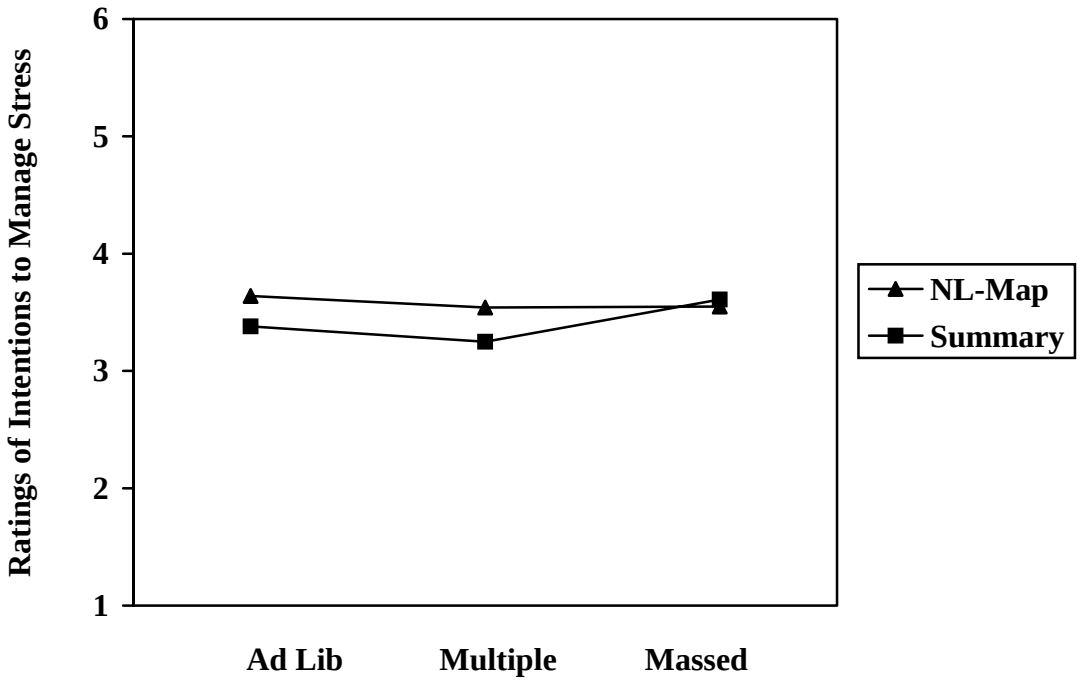

Figure 6 *Means of intentions to manage stress for format and schedule conditions in experiment*

Table 6

Means and Standard Deviations for Intentions to Manage Stress of Participants Who Studied a Passage on Stress, as a Function of Condition

			Manage Stress	
Format Condition	Schedule Condition	*n*	*M*	*SD*
Node-Link Mapping				
	Ad Lib	29	3.64	0.83
	Multiple	30	3.54	1.07
	Massed	28	3.55	1.01
Summarization				
	Ad Lib	30	3.38	1.06
	Multiple	29	3.25	1.09
	Massed	29	3.61	1.26

Regression analyses: test performance. A simultaneous multiple linear regression was conducted using Delta scores and personal relevance as predictor variables and test performance as the criterion variable for node-link mapping and summarization, separately. As shown in Table 7, for participants who used node-link mapping, test performance was predicted by personal relevance ($\beta = .23$, $p = .03$), whereas Delta scores did not significantly contribute to this prediction. Conversely, for participants who used summarization, test performance was predicted by Delta scores ($\beta = .36$, $p < .001$), whereas personal relevance did not significantly contribute to this prediction.

Table 7

Summary of Simultaneous Multiple Regression Analysis for Variables Predicting Test Performance

Format	Variable	B	SE B	β
Node-Link Mapping				
	Delta scores	0.304	0.408	.07
	Personal Relevance	5.61	2.59	.23*
Summarization				
	Delta scores	2.03	0.56	.36**
	Personal Relevance	4.73	2.91	.16

Note. $R^2 = .06$ for node-link mapping; $R^2 = .18$ for summarization.

*$p < .05$, **$p < .01$

Regression analyses: attitudes and intentions. Two sets of simultaneous multiple linear regressions were conducted on Delta scores, personal relevance, and test performance as predictor variables and the attitudes and intentions measures as two criteria for node-link mapping and summarization, separately. As shown in Table 8, for both formats, intentions to learn about stress was predicted by personal relevance ($\beta = .45$, $p < .0001$ for participants who used node-link mapping; $\beta = .69$, $p < .0001$ for those who used summarization). Additionally, for both formats, intentions to learn about stress was predicted by test performance (in different directions: $\beta = .19$, $p = .04$ in a positive direction for node-link mapping; $\beta = -.19$, $p = .03$ in a negative direction for summarization), whereas Delta scores did not significantly contribute to this prediction[2].

[2] Because the Delta scores were not a significant predictor, it was removed from the model and further analyses were then conducted. However, the results were the same for Intentions to Learn about Stress.

Table 8

Summary of Simultaneous Multiple Regression Analysis for Variables Predicting Intentions to Learn about Stress

Format	Variable	B	SE B	β
Node-Link Mapping				
	Delta Scores	0.02	0.01	.13
	Personal Relevance	0.53	0.11	.45**
	Test Performance	0.02	0.005	.19*
Summarization				
	Delta Scores	-0.008	0.02	-.03
	Personal Relevance	0.808	0.09	.69**
	Test Performance	-0.007	0.004	-.19*

Note. $R^2 = .30$ for node-link mapping; $R^2 = .45$ for summarization.

*$p < .05$, **$p < .01$

As shown in Table 9, intentions to manage stress was predicted by personal relevance for participants who used node-link mapping ($\beta = .29$, $p = .007$) and also for those who used summarization ($\beta = .52$, $p < .0001$), whereas neither Delta scores nor test performance significantly contributed to this prediction[3].

Table 9

Summary of Simultaneous Multiple Regression Analysis for Variables Predicting Intentions to Manage Stress

Format	Variable	B	SE B	β
Node-Link Mapping				
	Delta Scores	0.02	0.01	.12
	Personal Relevance	0.32	0.11	.29**
	Test Performance	0.005	0.005	.12
Summarization				
	Delta Scores	-0.04	0.02	-.19
	Personal Relevance	0.62	0.11	.52**
	Test Performance	-0.0003	0.004	-.007

Note. $R^2 = .13$ for node-link mapping; $R^2 = .27$ for summarization.

*$p < .05$, **$p < .01$

[3] Because the Delta scores were not a significant predictor, it was removed from the model and further analyses were then conducted. However, the results were the same for Intentions to Manage Stress.

Discussion

In the present 3-session study, participants first completed a verbal ability measure and were then trained in one of 6 note-taking strategy conditions. For Session 2 (study session), participants generated notes using the formats of node-link mapping or summarization performed in multiple, massed, or ad lib schedules while reading text on stress-related information. At the conclusion of that study session, participants rated the study experience, designated as the dependent measure of personal relevance. A subsequent testing session (Session 3) 48 hr later required participants to review notes taken during the study session, for 3 min, and then to complete the dependent measure of test performance, composed of free recall and recognition tests. Participants then completed a questionnaire that contained measures of attitudes and intentions covering "stress", the topic of the study passage. During primary analyses, verbal ability, as measured by the Delta Reading Vocabulary test, was examined as a median split variable along with the two factors of format and schedule in ANOVA's and MANOVA, to assess mean differences. Predictions of relationships among variables were ascertained via multiple regression analyses.

Test Performance

Low verbal ability participants who generated node-link maps had higher means on the combined tests than those who summarized, whereas the means in this crossing interaction of format and verbal ability for high verbal ability participants who summarized were higher than those who generated node-link maps. This finding for low verbal ability participants partially replicates and extends previous research where low verbal ability participants have shown advantages when using node-link mapping (e.g., Amer, 1994; Chmielewski & Dansereau, 1998; Dees, 1989; O'Donnell, 1992; O'Donnell, 1994; O'Donnell & Adenwalla, 1992; O'Donnell &

Dansereau, 1990; Patterson, Dansereau, & Weigmann, 1993; Rewey, Dansereau, Skaggs, Hall, & Pitre, 1989; Weigmann, Dansereau, & McCagg, Rewey, & Pitre, 1992). However, in these studies, there were not typically differences among high verbal ability participants. It is possible that the differences found in the present study might be due to the type of node-link maps used. Weigmann et al. (1992, exp. 3) found differences in free recall and recognition for low and high verbal ability participants who studied two versions of experimenter-provided maps, labeled (with spatial and relational cues available to participants) and unlabeled (lines only, with only a spatial aspect). Whereas high verbal ability participants benefited from labeled maps, low verbal ability participants did not. Conversely, low verbal ability participants who used unlabeled maps benefited, whereas high verbal ability participants were hindered. In the present study, node-link mapping training consisted of only unlabeled examples. So during the study session (Session 2), participants generated node-link maps that did not contain labeled links. Given Weigmann et al.'s findings, it is possible that high verbal ability participants would have performed better with labeled links. Further research is necessary to explore this possibility.

It was surprising that there were no note-taking schedule effects on test performance. The length of the stimulus material and the schedules used may not have been sufficient to reveal differences in frequency of processing. Further research using a variety of schedules will be necessary to assess this effect.

Personal Relevance

There were also no note-taking schedule effects on personal relevance. However, as with test performance, participants' verbal abilities interacted with format in terms of how personally relevant the study experience was. The results showed that those who tested as low verbal ability participants in the node-link mapping conditions indicated greater personal relevance than

low verbal ability participants in the summarization conditions, whereas the reverse occurred for high verbal ability participants.

Participants who indicated higher levels of personal relevance are considered to have been more interested in the material and the study experience. In prior research, participants enrolled in memory and cognition and in general psychology undergraduate courses rated their generation of node-link maps as more interesting and more informative than traditional writing assignments (Czuchry & Dansereau, 1996). Also, Hall and O'Donnell (1996) found that participants who studied node-link maps and completed subjective graphs on their motivation and concentration during study indicated more favorable subjective reactions towards studying and testing than those who only studied text. In another study, participants who used computer versions of maps indicated improved affective states (and less frustration) compared to those who used computer versions of text (Reynolds, Patterson, Skaggs, & Dansereau, 1991). If the maps used in the present study were more suitable to low verbal ability participants, as mentioned above, then their use by these participants may have led to the realization of benefits suggested by prior research, while the hi verbal ability participants may not have achieved the same benefits from these types of maps.

Attitudes and Intentions

There was a significant crossing interaction for format and schedule on intentions to learn about stress. Overall, participants who generated node-link maps and could do so as they read (ad lib) or stopped multiple times (multiple) throughout the passage indicated greater intentions to learn about stress than those who summarized under the same schedule conditions. Conversely, the schedule that required participants to wait until having read the whole passage first (massed) contributed to the crossing interaction by resulting in lower intentions for those

who used node-link mapping than for those who used summarization. Possibly, participants who had to wait to construct node-link maps until the end of the reading might have been inhibited in processing the information, by not being able to expeditiously apply the training to the study material as they read, and thus reported reduced intentions to learn about stress. In summary, it's possible that those participants were frustrated in having to wait to apply what they had learned in training.

Participants indicated a similar pattern for intentions to manage stress. Those who used node-link mapping and could perform it as they read (ad lib) or stopped multiple times (multiple) to use this technique during reading indicated greater intentions to manage stress than those who summarized in the same schedule conditions, whereas the opposite occurred in the massed conditions.

Notwithstanding the massed schedule results, participants who could use node-link mapping during the course of the initial studying of the material (i.e., ad lib and multiple schedules) indicated greater intentions to both learn about stress and to manage stress. These findings are intriguing and require further replication and clarification. In general, attitudes and intentions measures may have importance as supplementary measures in educational studies, since these measures were sensitive to schedule effects while the test performance means were not.

Predictability of Relationships

Numerous experiments have shown that the meaning participants ascribe to material (i.e., how they think about it vs. the text material itself) is highly related to recall of the information (e.g., Barclay, Bransford, Franks, McCarrel, & Nitsch, 1974; Hyde & Jenkins, 1969). Also, participants often remember self-generated material better than experimenter-provided material

(e.g., Slamecka & Graf, 1978; also see Willingham, 2006). Consequently, the role of personal relevance as a predictor of test performance and of attitudes and intentions was explored in the present study.

A consistent relationship that transcended format for all participants was that personal relevance predicted both attitudes and intentions to learn about stress and to manage stress. It is not surprising that personal relevance during studying was related to participant's intentions towards the topic studied. Two types of interest, in the classroom, are represented in educational literature, s*ituational interest* and *personal interest* (Hidi & Baird, 1986; Renninger, Hindi, & Krapp 1992; Schiefele, 1999; for review see Schraw, Flowerday, & Lehman, 2001; Schraw & Lehman, 2001). Situational interests for participants are suggested to be temporary, malleable and spontaneously activated in the environment (Renninger et al., 1992) by text, materials, or activities that capture their attention (Woolfolk, 2005). Alternately, personal interests for participants develop internally, are of enduring personal value, can be precipitated by previous situational interest (Renninger et al., 1992; Schiefele, 1999), and are characterized by lasting effects, e.g., interests in sports, music, art, etc. (Woolfolk, 2005). Situational interest is typically the experimental focus in studies due to its malleability and the spontaneity with which individuals' attention may be captured (Schraw & Lehman, 2001), whereas personal interest is less manipulable, although considered essential to maintaining attention (Hidi & Baird, 1986; Mitchell, 1993). Both of these types of interest are related to text learning (Woolfolk, 2005). Participants who have more interest process more deeply and perform better on tests over the material (Renninger et al., 1992; Schraw & Lehman, 2001). Even when participants are not initially interested in a subject, they develop interest as they gain competence through experience (Stipek, 2002).

While the designated conditions in the present experiment may have facilitated participants' levels of situational interest in the study session, ratings of more personal relevance may indicate that those participants began to internally develop personal interest, which may therefore have translated over the 48 hr delay into subsequent effects on attitudes and intentions. Overall, if measures indicating more personal relevance do lead to continued and enduring interest in a topic, strategy, or learning scenario these measures may provide insight into future advances in classroom learning.

There were some inconsistent relationships as well. For example, although the node-link mapping condition produced a test performance prediction of *higher* behavioral intentions to learn about stress, the summarization condition produced the opposite. That is, for those in the summarization condition greater test performance actually predicted *lower* behavioral intentions to learn about stress. Also, for participants who generated node-link maps, personal relevance was important for predicting subsequent test performance, while Delta vocabulary scores were not. For participants who used summarization, vocabulary skill on the Delta alone predicted test performance. It appears that participants who generated node-link maps performed better on test performance when the study experience was personally relevant. These relationships essentially repeat the interaction findings for the dependent measures of test performance and personal relevance. In general, it appears that node-link mapping increased the role of participants' personal relevance in predicting test performance and both behavioral intentions to learn about stress and to manage stress. Participants who generated node-link maps appear to have had a more consistent experience, wherein personal relevance, test performance, and attitudes and intentions were positively related. Conversely, generating summaries led to a somewhat

disconnected experience, wherein only personal relevance was important for intentions, and not for what was learned (via test performance).

The findings regarding predictability of personal relevance and test performance on attitudes are heretofore unexplored, although other research has explored similar reverse relationships, i.e., attitudes as predictors of test performance (e.g., see Holbrook, Berent, Krosnick, Visser, & Boninger, 2005). The development of strategies that assist in improving test performance in the classroom, as well as engaging students in the material and resulting in greater behavioral intentions towards the topic, would seem to be an important goal. Getting students interested during the learning process may be better than only improving levels of regurgitated knowledge as reflected by test scores. It seems appropriate for learners to have a strategy that can be employed, to gain knowledge and enhance behavioral intentions. Although not definitive, node-link mapping may have the potential to fulfill both of these objectives. Obviously, further research is necessary to determine if this is a viable possibility.

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List of Appendices

Appendix A: Training Packet Examples

A1. Node-Link Mapping

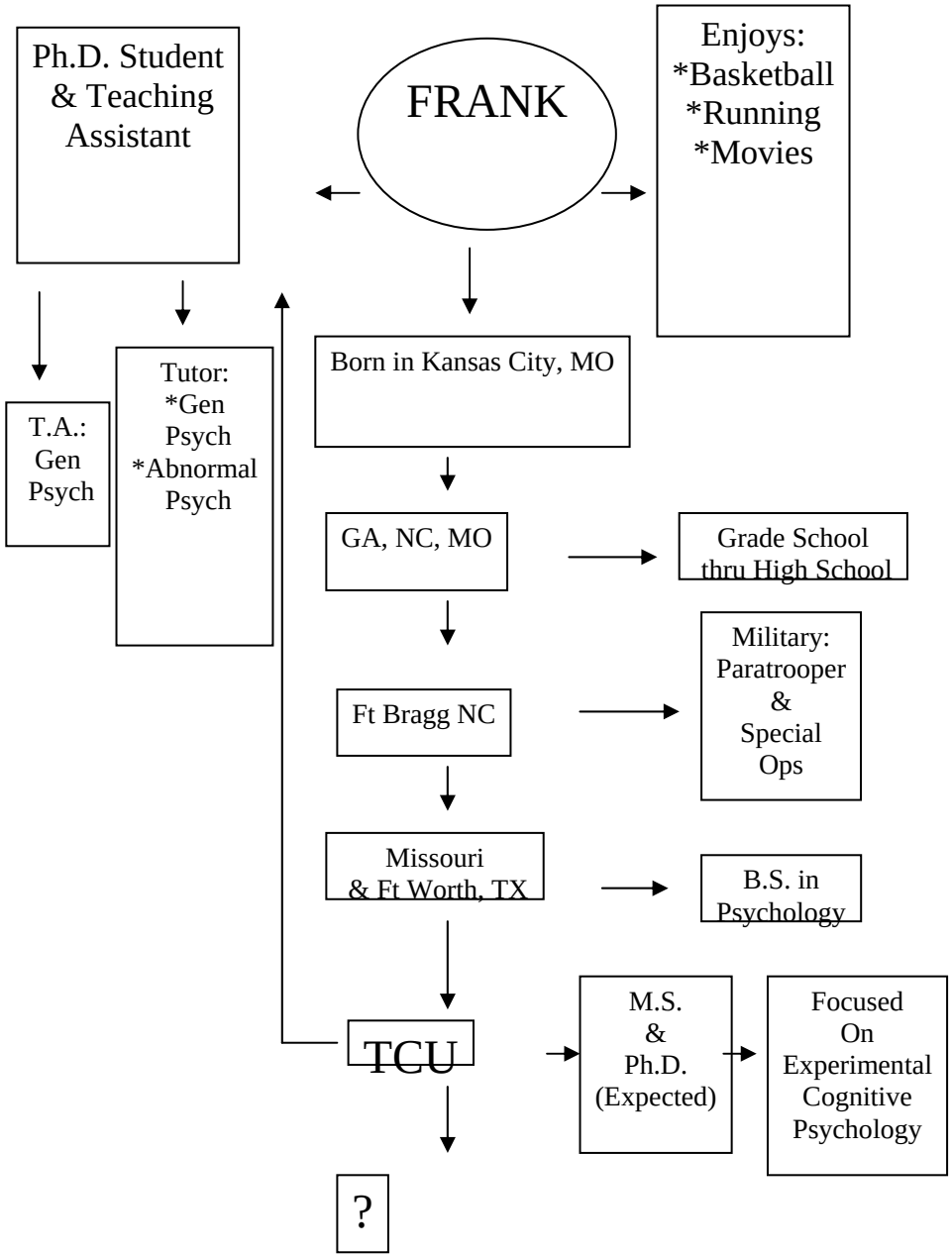
A2. Summarization

A3. Practice Passage

A1. Node-Link Mapping Packet

On the following page there is an example of something called a node-link map that represents one person's description of some parts of his life. Please notice how you can understand what the person is displaying, and also understand the person, by looking at the main ideas in each of the nodes and following the arrows that link to other nodes. As you look at the map, think about how you might make one of yourself. Your map may look a lot different. Keep in mind that even if someone draws a map by hand, and it is not so organized as the computer drawn version, the important part is the ideas that can be represented and understood by the person who made it. So, the good part is that you can do this by hand without worrying about making it very neat, as long as the ideas can be understood.

This is a technique of representing information that those of us conducting research here are curious about. We want to introduce this to you and see if it helps you to study by representing information differently than you may have considered before. Please look this map over, and then follow the instructions on the next sheet. If you have any general questions please raise you hand for an experimenter. If you do not have questions at this time, please continue to the map.


Ph.D. Student & Teaching Assistant
FRANK
Enjoys: *Basketball *Running *Movies
T.A.: Gen Psych
Tutor: *Gen Psych *Abnormal Psych
Born in Kansas City, MO
GA, NC, MO
Grade School thru High School
Ft Bragg NC
Military: Paratrooper & Special Ops
Missouri & Ft Worth, TX
B.S. in Psychology
TCU
M.S. & Ph.D. (Expected)
Focused On Experimental Cognitive Psychology
?

Please complete a map of your self…

MAPPING EXERCISES

Now, try to convert the following sentences into maps.

PROBLEMS

ENGLISH

MAP

Good athletes possess
tremendous concentration.

Dreams are important for maintaining
good mental health and they can also
be a lot of fun.

Frontal displays and lateral
attacks are two kinds of
aggressive behavior in the
paradise fish.

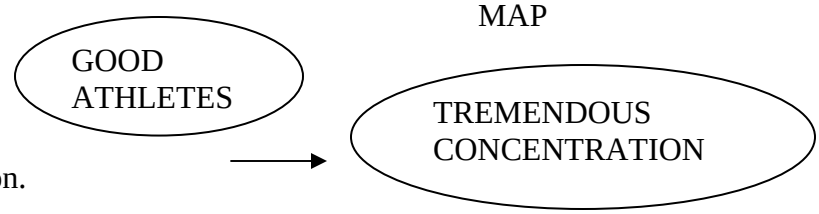
MAPPING EXERCISES

These are illustrative answers. There are many correct ways to map the same set of English sentences. However, you should be able to recognize why our answer is one of the correct ones.

PROBLEMS

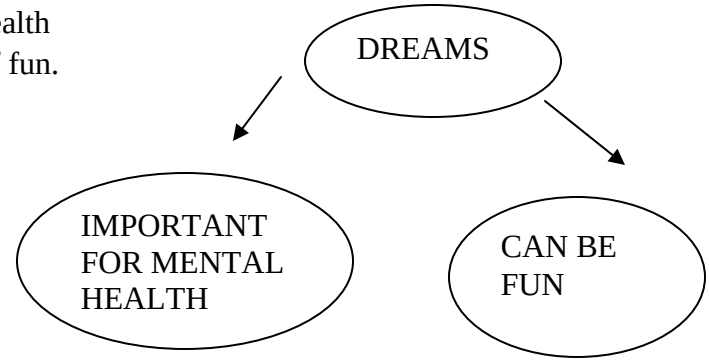
MAP

ENGLISH

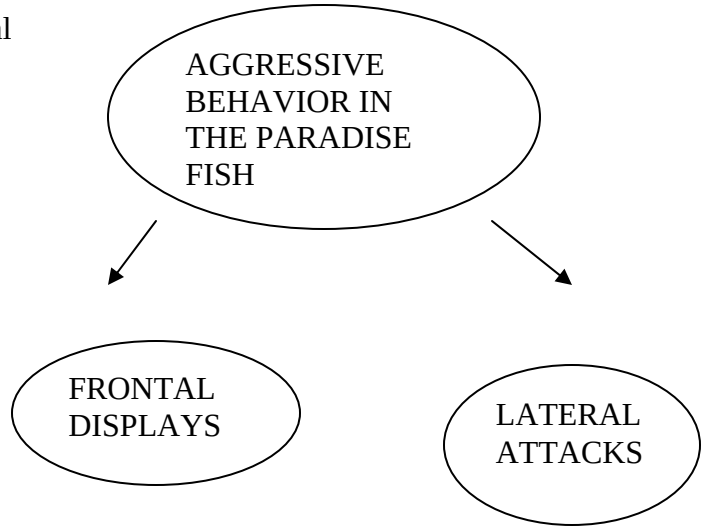


Good athletes possess tremendous concentration.

Dreams are important for maintaining good mental health and they can also be a lot of fun.



Frontal displays and lateral attacks are two kinds of aggressive behavior in the paradise fish.



For the following paragraph, please make a map that could help you study and remember the information for a test.

ENGLISH

We measure human memory not only by what a person can recall when she is asked to remember something, but also by what she can recognize. Since a person can often recognize an answer that she can't recall, recognition is generally a more sensitive measure of memory. You may not recall Polk or Arthur when asked to name past presidents, but you might still be able to recognize them as past presidents if you were given a list that included those names. A still more sensitive measure of memory is the amount of saving there is in re-learning something, when the time or trials required in re-learning are compared with the time or trials required to learn it

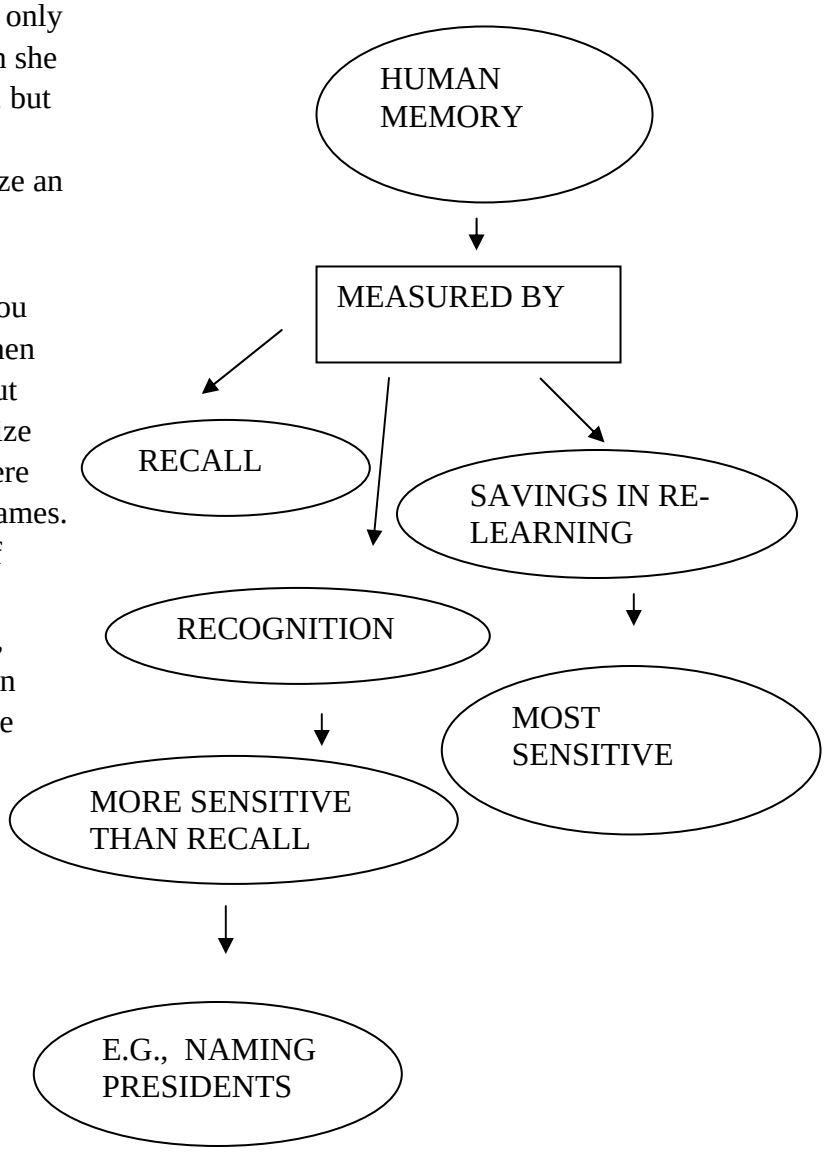
MAP

Again, these are illustrative answers. There are many correct ways to map the same paragraph. You should see why our answer is one of the correct ones though.

ENGLISH

We measure human memory not only by what a person can recall when she is asked to remember something, but also by what she can recognize. Since a person can often recognize an answer that she can't recall, recognition is generally a more sensitive measure of memory. You may not recall Polk or Arthur when asked to name past presidents, but you might still be able to recognize them as past presidents if you were given a list that included those names. A still more sensitive measure of memory is the amount of saving there is in re-learning something, when the time or trials required in re-learning are compared with the time or trials required to learn it

MAP



Next in the training packets were 3 different brief instruction statements for the schedule conditions of ad lib, multiple, or massed that applied to the practice passages (A3 in these appendices)

A2. Summarization Packet

On the following page there is an example of a summarization that represents one person's description of some parts of his life. Please notice how you can understand what the person is summarizing, and also understand the person, by looking at the main ideas in each sentence. As you look at the summarization, think about how you might make one of yourself. Your summarization may look a lot different. Keep in mind that the important part is the ideas that can be represented and understood by the person who made it. So, the good part is that you can do this without worrying about it being the same way, as long as the ideas can be understood. This is a technique of representing information that those of us conducting research here are curious about. We want to introduce this to you and see if it helps you to study by representing information differently than you may have considered before. Please look this summarization over, and then follow the instructions on the next sheet. If you have any general questions please raise you hand for an experimenter. If you do not have questions at this time, please continue to the summarization.

Frank is a PhD student focused on experimental cognitive psychology and is also a teaching assistant for general psychology at TCU. He has also tutored for abnormal and general psychology students. He enjoys basketball, running, and movies. Born in Kansas City, Missouri, he attended grade school through high school also in the states of Georgia and North Carolina. Additionally, he was in the military at Ft Bragg, NC, where he served as a paratrooper and in special operations. Most recently before arriving at TCU, he completed a Bachelor of Science in psychology. The next step after finishing at TCU is not yet determined.

Please complete a summarization of your self…

SUMMARIZATION EXERCISES

Now, try to convert the following sentences into summaries.

PROBLEMS

ENGLISH	SUMMARIZATION
Good athletes possess tremendous concentration.	
Dreams are important for maintaining good mental health and they can also be a lot of fun.	
Frontal displays and lateral attacks are two kinds of aggressive behavior in the paradise fish.	

SUMMARIZATION EXERCISES

These are illustrative answers. There are many correct ways to summarize the same set of English sentences. However, you should be able to recognize why our answer is one of the correct ones.

PROBLEMS

ENGLISH	SUMMARIZATION
Good athletes possess tremendous concentration.	GOOD ATHLETES HAVE GREAT CONCENTRATION
Dreams are important for maintaining good mental health and they can also be a lot of fun.	DREAMS CAN BE FUN AND ARE IMPORTANT FOR MENTAL HEALTH
Frontal displays and lateral attacks are two kinds of aggressive behavior in the paradise fish.	PARADISE FISH BEHAVE AGGRESSIVELY BY FRONTAL DISPLAYS AND LATERAL ATTACKS

For the following paragraph, please make a summary that could help you study and remember the information for a test.

SUMMARIZATION

ENGLISH

We measure human memory not only by what a person can recall when she is asked to remember something, but also by what she can recognize. Since a person can often recognize an answer that she can't recall, recognition is generally a more sensitive measure of memory. You may not recall Polk or Arthur when asked to name past presidents, but you might still be able to recognize them as past presidents if you were given a list that included those names. A still more sensitive measure of memory is the amount of saving there is in re-learning something, when the time or trials required in re-learning are compared with the time or trials required to learn it

Again, these are illustrative answers. There are many correct ways to summarize the same paragraph. You should see why our answer is one of the correct ones though.

ENGLISH

We measure human memory not only by what a person can recall when she is asked to remember something, but also by what she can recognize. Since a person can often recognize an answer that she can't recall, recognition is generally a more sensitive measure of memory. You may not recall Polk or Arthur when asked to name past presidents, but you might still be able to recognize them as past presidents if you were given a list that included those names. A still more sensitive measure of memory is the amount of saving there is in re-learning something, when the time or trials required in re-learning are compared with the time or trials required to learn it

SUMMARIZATION

Measures of human memory include recall, recognition, and the savings in re-learning (verses initial learning). While recognition is more sensitive than recall, e.g., in naming presidents, the savings in re-learning is the most sensitive measure.

Next in the training packets were 3 different brief instruction statements for the schedule conditions of ad lib, multiple, or massed that applied to the practice passages (A3 in these appendices)

A3. Practice Passage for Training

Example of one of the Practice Passages used in Experiment, Session 1
(signaled)

Bottlenose Dolphins

The bottlenose dolphin, whose scientific name is *Tursiops truncatus*, is probably the dolphin most familiar to the general population because of its adaptability of living in human care. Bottlenose dolphins can be seen in various show and research facilities and have been the "stars" of many movies and television shows. Because of their seeming curiosity about people and their close proximity to various shores and ocean bays, this species is the most studied of all delphinids. The bottlenose is the dolphin most often sighted off the coast and from small boats. In some places in the world, such as Monkey Mia in Australia, wild bottlenose dolphins choose to come into bays and interact with human beings.

The exact number of the world population of bottlenose dolphins is unknown. They are found world-wide and in many types of waters from coastal and inshore waters to the pelagic waters of the deep oceans, from warm tropical waters around the equator to the colder temperate regions. In general, bottlenose dolphins can be found in all coastal waters throughout the world, except for the polar seas. **

We are far from knowing the precise ranges of the various populations of bottlenose dolphins around the world, especially those who live far from shore. Most, however, seem to prefer a relatively small area within a protected bay or shallow lagoon. They seem to establish a "home base," but must often move within a larger range to find food, to mate, or to escape predators.

Scientists have found that small pods of bottlenose dolphins near San Diego, California seem to have a range of approximately 20 miles along the coastline. When Randy Wells studied bottlenose off Sarasota, Florida, he found that local populations had a range of about 85 square kilometers, with individuals defining smaller home ranges for themselves. He found that distances traveled varied by sex and age of the dolphins: females with calves seemed to have the largest home range (average 40 square km); juvenile males tended to establish a somewhat smaller one; adult male groups, adult females without calves, and juvenile females had the smallest ranges of approximately 15-20 square km. Each subrange of the larger pods was centered in different areas, possibly due to the fact that dolphin pods tend to be segregated by sex

and age. Other studies in Argentina, Texas, and California had similar results and have promoted the theory that social units of like sex and age tend to define the home ranges of various pods. **

The natural diet of the bottlenose dolphin seems to vary according to its home region. Open water pods tend to feed mostly on pelagic fish, such as blue whiting, codfish, and squid. Those found in coastal Atlantic waters feed on mullet, herring, smelt, capelin, catfish, eels, shrimp, and other crustaceans. In the Indian Ocean, dolphins will be more likely to feed on coral reef dwelling fish and mullet. Haddock, anchovies, and mackerel also seem to be favorites of some populations.

Dolphins usually forage for food in groups. Because fish tend to be distributed throughout their range in ever-moving schools, they must search for their prey. If they remained in only one small area constantly, they would soon exhaust the available food supply; therefore, they tend to leave and then revisit various feeding grounds on a periodic basis. By hunting cooperatively in groups, dolphins can cover a wider area and combine their collective experience. Knowledge of topographical features of the area, as well as their ability to scan the area acoustically under water, contribute to their ability to find food. Most dolphins and fish- or squid-eating small whales travel in groups that are broader than they are long, enabling them to scan a wider area with their echolocation. **

In the waters of South Africa, researchers have observed a single line of approximately 200 bottlenose dolphins traveling quickly and cooperatively in their search for food. Based on observations of behavior such as synchronous dives and recordings of vocalizations, scientists have theorized that pods of dolphins remain in constant acoustic contact while foraging. Bottlenose dolphins seem to work together during feeding as well as while searching for fish. Researchers have observed them using a variety of cooperative methods to entrap their prey, which reduce the amount of energy expended by any individual. Small groups may converge on a central point by purposing to that point, and bunching fish up together in the center. Groups have been observed moving synchronously in a U-shaped formation towards other individuals, trapping the fish in between. At times, individuals may dive down and herd a school of fish upwards by swimming around and under them, tightening the circle until the fish are forced to the surface where the rest of the pod is waiting to feed.

Other, more unusual methods also have been noted by researchers. Dolphins have been observed using a sloping, sandy beach as a barrier while herding schools of fish. In some areas,

dolphins will chase fish onto mudflats, and then actually almost beach themselves by sliding out of the water to seize their prey. Dolphins in the Hilton Head area have been observed to create a barrier of bubbles to entrap their prey before feeding. Scientists have theorized that some dolphins may use a burst pulse--a stream of very powerful sounds--to stun or confuse their prey.

On the west coast of Africa, bottlenose dolphins even work cooperatively with humans to ensure their food supply. The dolphins herd mullet to the shallows where native fishermen wait with gill nets to trap the fish. The fishermen allow the dolphins to eat their fill, and then take the rest. The fishermen apparently can alert the dolphins to feeding time by slapping the water with sticks as a cue for food.

In southern Brazil, bottlenose dolphins have been the initiators of another fishing cooperative. A pod of dolphins alerts the men of Laguna to "feeding time" by stationing themselves offshore in a line. When a dolphin leaves the line, swims seaward, and returns, the men wait close to shore with their nets. When the dolphin reappears, comes to a full stop, and dives just out of net range, the fishermen closest to the dolphin cast their nets, even though the water is murky and they cannot see any fish. The cue given by the dolphins is reliable; few fishermen waste their time casting until instructed to do so by the dolphins' actions. After one or more men fill their nets, others come to take their place. If the dolphins move along the shore, the men will follow. The dolphins seem to take advantage of the confusion that results as the men cast their nets, feeding on their own from the remaining fish. Town records indicate that this partnership has lasted through several generations of both men and dolphins since 1847. **

Dolphins tend to be very social animals, swimming in social groupings called pods. These groups, however, are very flexible and fluid, not at all like the social unit we refer to as a family. Dr. Deborah Duffield has determined by observing pods of wild bottlenose dolphins that the majority of pod members are not closely related. They seem to be in a periodic state of flux; an individual dolphin traveling with one group may be swimming miles away with another by the next day. A more stable subgroup of two to six dolphins may remain together over long periods. Mothers and their calves have been observed together for at least three to six years, and unrelated adults often form long-term bonds, usually within the same sex and age group. Separation by age and sex is common. Breeding groups are usually composed of mothers and their calves. As the youngsters begin to mature, they may branch off into a juvenile pod. Mature males will rarely be seen mixing with a maternity pod or a juvenile pod. The fluidity of the

groups, however, allows increased opportunities for mating, enabling males to court a wider variety of females. During feeding, smaller pods may interact and join into larger groups.

The size of the group may depend partially on the need for surveillance against predators, as well as the quantity and distribution of available food. Dolphins seem to acknowledge a hierarchy within each pod. Status may be expressed by positioning, formation of subgroups within the pod, or by feeding order. Behaviors, such as teeth raking, tail slapping, jaw popping, biting, or ramming may also express dominance. Dolphins have long been known for their playful characteristics. By riding the wake or bow waves of a boat, a dolphin can hitch a ride and move through the water like a surfer. Often they can be seen weaving back and forth, playing in the spray, and forming intricate patterns. Many species of dolphins are capable of spectacular aerial dives, and their leaps and spins seem to us to be a celebration of the joy of life. However, their play behavior may also serve functions of communication, food herding, or defense. **

Like all animals in the wild, dolphins are most susceptible to adverse conditions, disease, and predators during the first two years of their lives. A study of beached dolphins in Florida indicated that 38% died before the age of two, and 64% of the dolphins studied died within their first ten years. Although, rare, it is possible for bottlenose dolphins to live into their 50's. This age may be likened to a human living into their 90's. Scientists have found that dolphins living in human care have approximately the same longevity as those in the wild, possibly even better because of improved nutrition, a reliable food source, and the optimum husbandry and medical care made possible by our growing knowledge. **

Appendix B

Stimulus Material for Session 2 (Study Session)

Example of One of the Passages used in Experiment, Session 2
(signaled)

Dealing with Stress

When we worry or experience stress, our body turns on the same physiological responses that an animal's body does, but we usually do not turn off the stress-response in the same way—through fighting, fleeing, or other quick actions. Over time, this chronic activation of the stress-response can make us literally sick. The halls of academe are filling with a newly evolved species of scientist—the psychoneuroimmunologist—who makes a living studying the extraordinary fact that what goes on in your head can affect how well your immune system functions.

Those two realms were once thought to be fairly separate—your immune system kills bacteria, makes antibodies, hunts for tumors; your brain makes you do the bunny hop, invents the wheel, has favorite TV shows. Yet the dogma of the separation of the immune and nervous systems has fallen by the wayside. The autonomic nervous system sends nerves into tissues that form or store the cells of the immune system and eventually enter the circulation. Furthermore, tissue of the immune system turns out to be sensitive to (that is, it has receptors for) all of the interesting hormones released by the pituitary under control of the brain. The result is that the brain has a vast potential for sticking its nose into the immune system's business.

One study demonstrated the link between the brain and the immune system in a paradigm called conditioned immunosuppression. Give an animal a drug that suppresses the immune system. Along with it, provide, a la Pavlov's experiments, a "conditioned stimulus"—for example, an artificially flavored drink, something that the animal will associate with the suppressive drug. A few days later, present the conditioned stimulus by itself—and down goes immune function.

In 1982 the report of an experiment using a variant of this paradigm, carried out at the University of Rochester, stunned scientists. The researchers experimented with a strain of mice that spontaneously develop disease because of overactivity of their immune systems. Normally, the disease is controlled by treating the mice with an immunosuppressive drug. Researchers showed that by using the conditioning technique, they could substitute the conditioned stimulus for the actual drug—and sufficiently alter immunity in these animals to extend their life spans.

Studies such as these convinced scientists that there is strong link between the nervous system and the immune system. **

The primary job of the immune system is to defend the body against infectious agents such as viruses, bacteria, fungi, and parasites. The process is dauntingly complex. For one thing, the immune system must tell the difference between cells that are normal parts of the body and cells that are invaders—in immunologic jargon, distinguishing between "self" and "non-self." Somehow, the immune system can remember what every cell in your body looks like, and any cells that lack your distinctive cellular signature (for example, bacteria) are attacked. Moreover, when your immune system does encounter a novel invader, it can even form an immunologic memory of what the infectious agent looks like, to better prepare for the next invasion—a process that is exploited when you are vaccinated with a mild version of an infectious agent in order to prime your immune system for a real attack.

Such immune defenses are brought about by a complex array of circulating cells called lymphocytes and monocytes (which are collectively known as white blood cells; cyte is a term for cells). There are two classes of lymphocytes: T cells and B cells. Both originate in the bone marrow, but T cells migrate to mature in the thymus (hence the T), while B cells mature in the bone marrow. B cells principally produce antibodies, but there are several kinds of T cells (T helper and T suppressor cells, cytotoxic killer cells, and so on). **

The T and B cells attack infectious agents in different ways. T cells bring about cell-mediated immunity. When an infectious agent invades the body, it is recognized by a type of monocyte called a macrophage, which presents the foreign particle to a T helper cell and releases interluekin-1 (IL-1). A metaphorical alarm is now sounded. The T helper cell then releases interluekin-2 (IL-2), which stimulates T cells proliferation in response to the invasion. This alarm system ultimately results in the activation and proliferation of cytotoxic killer cells, which, as their name implies, attack and destroy the infectious agent. It is this, the T-cell component of the immune system that is knocked out by the AIDS virus.

By contrast, B cells cause antibody-mediated immunity. Once the macrophage—T helper cell collaboration has occurred, the T helper cells then release B-cell growth factor, which stimulates B-cell proliferation. The main task of the B cells is to differentiate and generate antibodies, large proteins that will recognize and bind to some specific feature of the invading infectious agent (typically, a distinctive surface protein). This specificity is critical—the

antibody formed has a fairly unique shape, which will conform perfectly to the shape of the distinctive feature of the invader, like the fit between a lock and key. In binding to the specific feature, antibodies immobilize the infectious agent and target it for destruction. So, what about the interaction with the stress-response?

If you are a zebra running for your life from a predator, or the lion sprinting for your meal, your body's physiological response mechanisms are superbly adapted for dealing with such short-term physical emergencies. For the vast majority of beasts on this planet, stress is about short-term crisis, after which it's either over with or you're over with. When we sit around and worry about stressful things, we turn on the same physiological responses—but they are potentially a disaster when provoked chronically. Many scientific studies show a link between something that increases or decreases stress and some disease or mortality outcome.

The approach of many psychoneuroimmunologists is based on the assumption that this link is established through determining that those individuals in question have been stressed, the physiological knowledge that the stress causes them to turn on the stress-response (secretion of glucocorticoids, epinephrine, and so on), the awareness that duration and magnitude of the stress-response in these individuals is big enough to suppress immune function, and the medical evidence that odds are increased in these individuals for getting some infectious diseases and impairs their ability to defend themselves against that disease once they have it. **

You would expect key psychological variables to be mushy concepts to uncover, but in a series of elegant experiments, the physiologist Jay Weiss, then at Rockefeller University, demonstrated exactly what is involved. The subject of one experiment is a rat that receives mild electric shocks (roughly equivalent to the static shock you might get from scuffing your foot on a carpet). Over a series of these, the rat develops a prolonged stress-response: its heart rate and glucocorticoid (steroid hormones that contribute to raising the circulating levels of the sugar glucose, which is essential for mobilizing energy during stress) secretion rate go up, for example. For convenience, we can express the long-term consequences by how likely the rat is to get an ulcer, and in this situation, the probability soars.

In the next room, a different rat gets the same series of shocks—identical in pattern and intensity; its allostatic balance is challenged to exactly the same extent. But this time, whenever the rat gets a shock, it can run over to a bar of wood and gnaw on it. The rat in this situation is far less likely to get an ulcer. You have given it an outlet for frustration. Other types of outlets

work as well—let the stressed rat eat something, drink water, or sprint on a running wheel, and it is less likely to develop an ulcer. **

We humans also deal better with stressors when we have outlets for frustration—punch a wall, take a run, find solace in a hobby. We are even cerebral enough to imagine those outlets and derive some relief: Consider the prisoner of war who spends hours imagining a golf game in tremendous detail. One person passed a prolonged and very stressful illness lying in bed with a mechanical pencil and a notepad, drawing topographic maps of imaginary mountain ranges and taking hikes through them. Determining an appropriate outlet for someone's lifestyle that positively affects their routine is a big step in adjusting to a person's strengths and weaknesses.

A central feature of an outlet being effective is if it distracts from the stressor. But, obviously, more important is that it also be something positive for you—a reminder that there is more to life than whatever is making you crazed and stressed at the time. The frustration-reducing effects of exercise provide an additional layer of benefit. The stress response is about preparing your body for and explosive burst of energy consumption right now; psychological stress is about doing all the same things to your body for no physical reason whatsoever. Exercise finally provides your body for the outlet that it was preparing for. **

A variant of Weiss's experiment uncovers a special feature of the outlet-for-frustration reaction. This time, when the rat gets the identical series of electrical shocks and is upset, it can run across the cage, sit next to another rat and…bite the hell out of it. Stress-induced displacement of aggression: The practice works wonders at minimizing the stressfulness of a stressor. It's a real primate specialty as well. A male baboon loses a fight. Frustrated, he spins around and attacks a subordinate male who was minding his own business. An extremely high percentage of primate aggression represents frustration displaced onto innocent bystanders. Humans are pretty good at it too, and we have a technical way of describing the phenomenon in the context of stress-related disease: "He's one of those guys who doesn't get ulcers, he gives them." Taking it out on someone else—how well it works at minimizing the impact of a stressor.

An additional way we can interact with another organism to minimize the impact of a stressor on us is considerably more encouraging for the future of our planet than is displaced aggression. Rats only occasionally use it, but primates are great at it. Put a primate through something unpleasant: it gets a stress-response. Put it through the same stressor while in a room

full of other primates and…it depends. If those primates are strangers, the stress-response gets worse. But if they are friends, the stress-response is decreased. Social support networks—it helps to have a shoulder to cry on, a hand to hold, an ear to listen to you, someone to cradle you and to tell you it will be okay. Social support in humans can be demonstrated even in transient instances of support. In a number of studies, subjects were exposed to a stressor such as having to give a public speech or perform a mental arithmetic task, or having two strangers argue with them, with or without a supportive friend present. In each case, social support translated into less of a cardiovascular stress-response. **

Profound and persistent differences in degrees of social support can influence human physiology as well: Within the same family, there are significantly higher glucocorticoid levels among stepchildren than among biological children. Or, as another example, among women with metastatic breast cancer, the more social support, the lower the resting cortisol levels. People with spouses or close friends have longer life expectancies. When the spouse dies, the risk of dying rises. In a study of parents of Israeli soldiers who were killed the Lebanon war, in the aftermath of that stressor, there was no notable increase in risk of diseases or mortality—except among those who were already divorced or widowed. Some additional examples concern the cardiovascular system. People who are socially isolated have overly active sympathetic nervous systems. Given the likelihood that this will lead to higher blood pressure and more platelet aggregation in their blood vessels, they are more likely to have heart disease—two to five times as likely, as it turns out. And once they have the heart disease, they are more likely to die a younger age. In a study of patients with severe coronary heart disease, Redford Williams of Duke University and colleagues found that half of those lacking social support were dead within five years—a rate three times higher than was seen in patients who had a spouse or close friend, after controlling for the severity of the heart disease. **

Weiss's rat studies uncovered another variable modulating the stress-response. The rat gets the same pattern of electric shocks, but this time, just before each shock, it hears a warning bell. Fewer ulcers. Predictability makes stressors less stressful. The rat with the warning gets two pieces of information. It learns when something dreadful is about to happen. The rest of the time, it learns that something dreadful is not about to happen. It can relax. In effect, information that increases predictability tells you that there is bad news, but comforts you that it's not going to be worse—you are going to get shocked soon, but it's never going to be sprung on you

without warning. We all know a human equivalent of this principle. You're in the dentist's chair, no Novocain, and the dentist is drilling away. Ten seconds of nerve-curling pain, some rinsing, five seconds of drilling, a pause while the dentist fumbles a bit, fifteen seconds of drilling, and so on. In one of the pauses, frazzled and trying not to whimper, you gasp, "Almost done?" "Hard to say," the dentist mumbles, returning to the intermittent drilling. Think how grateful we are for the dentist who, instead, says, "Two more and we're done." The instant the second burst of drilling ends, down goes blood pressure. By being given news about the stressor to come, you are also implicitly being comforted by now knowing what stressors are not coming.

During the onset of the Nazi blitzkrieg bombings of England, London was hit every night like clockwork. Lots of stress. In the suburbs the bombings were far more sporadic, occurring perhaps once a week. Fewer stressors, but much less predictability. There was a significant increase in the incidence of ulcers during that time. Who developed more ulcers? The suburban population. (As another measure of the importance of unpredictability, by the third month of the bombing, ulcer rates in all the hospitals had dropped back to normal.) Despite similarity in human and animal responses to a lack of predictability, there are some important differences. Human anticipation incorporates verbalized mental strategies. Predictive information lets us know what internal coping strategy is likely to work best during a stressor. We often wish for information about the course of some medical problem because it aids our strategizing about how we will cope. Among other reasons, we wish to optimize our coping strategies when we request the most devastating piece of medical information any of us will ever face: "How much time do I have left?" **

Rat studies also demonstrate a related facet of psychological stress. Give the rat the same series of shocks. This time, however, you study a rat that has been trained to press a lever to avoid electric shocks. Take away the lever, shock it, and the rat develops a massive stress-response. It's as if the rat were thinking, "I can't believe this. I know what to do about electric shocks; give me a damn lever and I could handle this. This isn't fair." Give the trained rat a lever to press; even if it is disconnected from the shock mechanism, it still helps: down goes the stress-response. So long as the rat has been exposed to a higher rate of shocks previously, it will think that the lower rate now is due to its having control over the situation. This is an extraordinarily powerful variable in modulating the stress-response. The identical style of experiment with humans yields similar results. Place two people in adjoining rooms, and expose

both to intermittent noxious, loud noises; the person who has a button and believes that pressing it decreases the likelihood of more noise is less hypertensive. In one variant on this experiment, subjects with the button who did not bother to press it did just as well as those who actually pressed the button. Thus, the exercise of control is not critical; rather, it is the belief that you have it.

The issue of control runs through the extensive literature on occupational stress. Sure, there are some jobs where stress comes in the form of someone having too much control and responsibility—that rare occupation where you are controlling the landing of airplanes or conducting brain surgery (or taking a series of difficult exams during finals week?). For most, though, occupational stress is built around lack of control, work life spent as a piece of the machine. Controlling the rewards that you get can be more desirable than getting them for nothing. As an extraordinary example, both pigeons and rats prefer to press a lever in order to obtain food (so long as the task is not too difficult) over having the food delivered freely—a theme found in the activities and statements of many scions of great fortunes, who regret the contingency-free nature of their lives, without purpose or striving. **

Loss of control and lack of predictive information are closely related. Some researchers have emphasized this, pointing out that the common theme is that the organism is subjected to novelty. You thought you knew how to manage things, you thought you knew what would happen next, and it turns out you are wrong in this novel situation. The potency of this is demonstrated in primate studies in which merely placing the animal into a novel cage suppresses its immune system. Stress-response can be modulated or even caused by psychological factors.

Obviously we differ as to the number of stressors that befall us. We differ in how fast our adrenals make glucocorticoids, how many insulin receptors we have in our fat cells, the thickness of our stomach walls, and so on. But in addition to those physiological differences, we can now add another dimension. We differ in the psychological filters through which we perceive the stressors in our world. Two people participating in the same event—a long wait at the supermarket checkout, public speaking, parachuting out of an airplane—may differ dramatically in their psychological perception of the event. "Oh, I'll just read a magazine while I wait" (outlet for frustration); "I'm nervous as hell, but by giving this after-dinner talk, I'm a shoo-in for that promotion" (things are getting better); "This is great—I've always wanted to try sky-diving" (this is something I'm in control of). Sometimes, there's a bad match between how

stressful the real world is and how stressful the person perceives it to be. This can take a variety of forms, but the one thing in common is the fact that a potentially considerable price is paid by the sufferer. **

Appendix C

Delta Reading Vocabulary Test

PLEASE DO NOT WRITE ON THIS TEST.

DELTA READING VOCABULARY TEST

Directions: Choose the word that means the same as the word underlined. On the answer sheet provided, fill in the circle with the same number of the word chosen as the correct answer. You have ten (10) minutes to complete the 45 items.

SAMPLE: Large means

1	2	3	4	5
little	big	anger	dot	red

---

1. Consecutive

1	2	3	4	5
derived	prior	successive	conclusion	immediate

2. Predict

1	2	3	4	5
certain	forecast	state	before	decide

3. Requisition

1	2	3	4	5
enables	gives	demand	pay	quit

4. Frequency

1	2	3	4	5
subsequent	seldom	repetition	silent	loud

5. Alternative

1	2	3	4	5
light	start	align	change	choice

6. Interchangeable

1	2	3	4	5
substitute	mix	access	between	par

7. Subset

1	2	3	4	5
after	aid	destroy	intradivision	independent

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8. Addendum

1	2	3	4	5
supplement	stupid	contents	precede	quantity

9. Expend

1	2	3	4	5
recover	consume	waste	lose	hasten

10. Retention

1	2	3	4	5
camp	imprison	remember	stop	return

11. Consolidate

1	2	3	4	5
unite	box	generate	mix	dual

12. Remote

1	2	3	4	5
dig	wireless	pay	distant	control

13. Annotation

1	2	3	4	5
bother	explanation	anoint	against	polarize

14. Quadrant

1	2	3	4	5
constant	fourth	radar	tangent	target

15. Mantissa

1	2	3	4	5
mantle	lady's scarf	fish	decimal log	fraction

16. Fulcrum

1	2	3	4	5
pivot	bow	axis	angle	weight

17. Inductive

1	2	3	4	5
channel	infer	conductor	denote	implicit

18. Invalidate

1	2	3	4	5
approve	correct	annul	evident	ancillary

19. Syllogism

1	2	3	4	5
alone	same	deductive	wordy	comparison

20. Gradient

1	2	3	4	5
fulcrum	latitude	quadrant	ascending	score

21. Augment

1	2	3	4	5
prevent	cut	figure	increase	hole

22. Latent

1	2	3	4	5
hidden	after	language	religion	hanging

23. Ambiguous

1	2	3	4	5
unclear	massive	surrounding	steal	intelligible

24. Futile

1	2	3	4	5
unfriendly	deadly	useless	sad	dangerous

25. Redundant

1	2	3	4	5
precise	quick	excess	inconsistent	reliable

26. Loam

1	2	3	4	5
soil	dune	rock	water	geography

27. Succinct

1	2	3	4	5
versatile	tasty	brief	false	wordy

. Inanimate

1	2	3	4	5
cartoon	dormant	lifeless	caricature	weak

. Berate

1	2	3	4	5
scold	modify	evaluate	careful	measure

. Plausible

1	2	3	4	5
believable	permissible	countable	statistical	mathematical

. Technology

1	2	3	4	5
difficult	applied science	aerospace	computerization	automation

. Hypothesize

1	2	3	4	5
water	angle	fake	insincere	assume

. Viscous

1	2	3	4	5
tall	proof	thick	hold	strong

. Abate

1	2	3	4	5
incite	agree	slacken	criminal	fly

. Connote

1	2	3	4	5
explicit	deduce	imply	musical	short

5. Variable

1	2	3	4	5
quick	consistent	fluctuate	reliable	quantity

7. Affluent

1	2	3	4	5
adjacent	opulent	greedy	sufficient	sick

38. Criterion

1	2	3	4	5
standard	definition	visible	critic	explanation

39. Rescind

1	2	3	4	5
order	burn	revoke	perforate	shorten

40. Infinity

1	2	3	4	5
compute	unlimited	end	astronomical	conclusion

41. Remuneration

1	2	3	4	5
penalty	accounting	revenge	payment	worry

42. Impetuous

1	2	3	4	5
ream	rash	unexpected	dislike	inconsistent

43. Delete

1	2	3	4	5
aggression	forbidden	cancel	provoke	include

44. Quadratic

1	2	3	4	5
erratic	cosine	squared	four times	minus

45. Invincible

1	2	3	4	5
energetic	undefeated	conquered	concurred	elastic

Appendix D

Recogniton/Mulitple Choice Exam

Exam on the Reading Material

Please use a no. 2 pencil to fill in marks on the scantron sheet. Fill in the 3 letters from your folder label in the name-block on the scantron. Note: take care to mark carefully all answers and to make any erasures as clean as possible. *You have 15 minutes. Please begin.*

1. Control over stressors is shown by

    a. Rats who refuse to press levers
    b. Rats who decide when to mate
    c. Rats who press levers to avoid shock
    d. Rats who just lay in the corner until they get food

2. Psychonueroimmunologist's have established a link

    a. Between increased stress and increases in glucocorticoids
    b. Between increased stress and decreases in glucocorticoids
    c. Between decreased stress and increases in glucocorticoids
    d. Between psychotic people and those who are immune to food allergies

3. Humans also handle stress with outlets, such as
    a. Imagining playing golf
    b. Dreaming about being chased by a tiger in the woods
    c. Getting a stiff upper lip and pushing through the tough spot
    d. Dreaming about chasing a rabbit in a field

4. Prolonged stress responses are shown by

    a. Increased heart rate
    b. Increases in long term hardiness
    c. Increases in glucocorticoids
    d. Both a and c

5. Sometimes when baboons lose a fight

    a. They never forget what happened
    b. They attack a subordinate
    c. They go and gather bananas to offer to the winning baboon
    d. They cry just like human babies

6. A Psychoneuroimmunologist studies

   a. Immunology of psychotic people
   b. How the head can affect immune function
   c. Neurological parts of the body that are part of the psyche
   d. This is not a real scientific word

7. Something interesting about control in the workplace is that

   a. People will not work for low pay
   b. Controlling the reward is more important than a person getting the reward for free
   c. Occupational stress is based on too much control
   d. People let someone else work for them and no one noticed

8. The primary job of the immune system is to

   a. Help us digest food
   b. Defend the body against infectious agents
   c. Cause disease in laboratory mice
   d. Help humans to be able to reproduce and have offspring

9. Human physiology is

   a. Unrelated to what happens at work
   b. Influenced by social support
   c. Too complex to truly know how it functions
   d. Overrated in how it is impacted by family and friends

10. In primate studies, animals in novel cages

    a. Strengthened their bodies with new food
    b. Strengthened their immune systems
    c. Suppressed their immune systems
    d. Did not do anything different than when in their old cage

11. Predictability of stressors

    a. Is really not useful for most people
    b. Is really not possible to do
    c. Is sometimes found out at the dentist office
    d. Is only more frustrating for a rat

12. B cells bring about

    a. Cell-mediated immunity
    b. Anti-body mediated immunity
    c. Causing thirst, but not hunger sensations
    d. The spreading of disease

13. In a conditioned immunosuppression related study of a mice strain that have overactive immune systems

    a. Drugs can extend the lifespan of the mice
    b. It is too late to save the mice
    c. A conditioned stimulus alone can extend the lifespan of the mice
    d. Both a and c

14. Lymphocytes

    a. Originate in the blood system
    b. Originate in bone marrow
    c. Are not good for you
    d. Are found in monkeys, but not in humans

15. For most animals with short term physical emergencies and physiological responses
    a. Stress is for a long time
    b. Short term adaptation is not good
    c. Short term adaptation is good
    d. There is no relationship between these two

16. Escape as an outlet for frustration was shown, in the text, by

    a. Letting a rat out of the cage
    b. Letting a rat pick it's mating partner
    c. Letting a rat run on a wheel
    d. Letting rats cool off by taking a quick swim

17. Conditioned immunosuppression shows how

    a. Immune function cannot go down with a conditioned stimulus only
    b. Immune function can go down with a conditioned stimulus only
    c. Conditions sometimes just can't be suppressed—so people get angry
    d. Amniocenteses are not safe procedures for pregnant women

18. T cells bring about

    a. Cell-mediated immunity
    b. Anti-body mediated immunity
    c. Causing hunger, but not thirst sensations
    d. The spreading of disease

19. The immune and nervous systems are

    a. Not related
    b. Found only in humans, and NOT in other animals
    c. Really not separate
    d. Completely separate things

20. Humans have verbalized mental strategies for anticipation of stressors, an example in the text was

    a. Japanese fishermen and the storm seasons
    b. When kids decide to make up a story rather than tell the truth
    c. Nazi bombings of England
    d. How descendents of once-tough Irish immigrants no longer participate in boxing too much

Appendix E

Study Experience questionnaire

Study Experience Questionnaire

Please respond to the following items about the study session. When you were studying the material, to what extent did you do the following?

1. After reading most or all of the article, you then made written notes on a separate piece of paper. (Please circle one choice)

1	2	3	4	5
Not at all	A little	Some	Quite a bit	Very much so/ A large amount

2. After reading parts of the article, you made written notes on a separate piece of paper as you went along. (Please circle one choice)

1	2	3	4	5
Not at all	A little	Some	Quite a bit	Very much so/ A large amount

3. You underlined ideas in the article. (Please circle one choice)

1	2	3	4	5
Not at all	A little	Some	Quite a bit	Very much so/ A large amount

4. You made notes in the margins of the article as you went along. (Please circle one choice)

1	2	3	4	5
Not at all	A little	Some	Quite a bit	Very much so/ A large amount

5. You read the article more than once. (Please circle one choice)

1	2	3	4	5
Not at all	A little	Some	Quite a bit	Very much so/ A large amount

6. You tried to picture what was being read in your mind. (Please circle one choice)

1	2	3	4	5
Not at all	A little	Some	Quite a bit	Very much so/ A large amount

7. You thought about how it related to you personally. (Please circle one choice)

1	2	3	4	5
Not at all	A little	Some	Quite a bit	Very much so/ A large amount

8. You skipped over parts of the article. (Please circle one choice)

1	2	3	4	5
Not at all	A little	Some	Quite a bit	Very much so/ A large amount

9. You took the information seriously. (Please circle one choice)

1	2	3	4	5
Not at all	A little	Some	Quite a bit	Very much so/ A large amount

10. You ignored parts because they were uninteresting (Please circle one choice)

1	2	3	4	5
Not at all	A little	Some	Quite a bit	Very much so/ A large amount

11. You spent time trying to memorize the article. (Please circle one choice)

1	2	3	4	5
Not at all	A little	Some	Quite a bit	Very much so/ A large amount

12. You were motivated to learn the material. (Please circle one choice)

1	2	3	4	5
Not at all	A little	Some	Quite a bit	Very much so/ A large amount

13. You were able to concentrate on the material. (Please circle one choice)

1	2	3	4	5
Not at all	A little	Some	Quite a bit	Very much so/ A large amount

14. You found the material interesting. (Please circle one choice)

1	2	3	4	5
Not at all	A little	Some	Quite a bit	Very much so/ A large amount

15. You found the material personally relevant and/or useful. (Please circle one choice)

1	2	3	4	5
Not at all	A little	Some	Quite a bit	Very much so/ A large amount

16. The article made you think about specific things that have happened in your life. (Please circle one choice)

1	2	3	4	5
Not at all	A little	Some	Quite a bit	Very much so/ A large amount

17. You found that the article was easy to understand. (Please circle one choice)

1	2	3	4	5
Not at all	A little	Some	Quite a bit	Very much so/ A large amount

18. You found that you wanted more information than was given in the article about certain aspects of the material. (Please circle one choice)

1	2	3	4	5
Not at all	A little	Some	Quite a bit	Very much so/ A large amount

19. You thought about how the information in the article related to other things you have learned. (Please circle one choice)

1	2	3	4	5
Not at all	A little	Some	Quite a bit	Very much so/ A large amount

20. You would like to learn additional information about the topics in the article. (Please circle one choice)

1	2	3	4	5
Not at all	A little	Some	Quite a bit	Very much so/ A large amount

Appendix F

Attitudes and Intentions questionnaire

Attitudes and Intentions Questionnaire

Please indicate for each question the degree to which you either agree or disagree according to the following rating scale by circling the number that most closely reflects your opinion.

1. This article has helped me understand myself better.

1	2	3	4	5	6
Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

2. This article has helped me understand other people better.

1	2	3	4	5	6
Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

3. This article has helped me become more confident about managing my stress.

1	2	3	4	5	6
Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

4. This article has helped me become more aware of how my life is affected by stress.

1	2	3	4	5	6
Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

5. This article has helped me better understand stress.

1	2	3	4	5	6
Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

6. This article has helped me understand how my brain affects my immune system.

1	2	3	4	5	6
Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

7. This study has influenced me to do things differently in terms of managing my stress.

1	2	3	4	5	6
Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

8. This study has influenced me to spend more time learning about stress.

1	2	3	4	5	6
Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

9. I plan to talk to people about the information presented in the article.

1	2	3	4	5	6
Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

10. This study has influenced me to put aside more time to actively reduce my stress.

1	2	3	4	5	6
Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

11. I expect to become less stressed, by some events, than I would have before participating in this study.

1	2	3	4	5	6
Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

12. This study has influenced me to actively use exercise as an outlet for stress.

1	2	3	4	5	6
Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

13. This study has influenced me to make some changes in my life that will probably extend my life.

1	2	3	4	5	6
Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

14. I am going to think more about how I perceive a stressful event.

1	2	3	4	5	6
Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

15. I am going to find out about techniques for calming down when stressed.

1	2	3	4	5	6
Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

16. I would recommend this article to a friend.

1	2	3	4	5	6
Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

VITA

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ABSTRACT
NOTE-TAKING FORMAT AND SCHEDULE EFFECTS: TEST PERFORMANCE, PERSONAL RELEVANCE, AND BEHAVIORAL INTENTIONS

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Participants either generated node-link maps or summarizations in multiple, massed, or ad lib schedules while reading text on stress-related information. Participants rated personal relevance immediately after studying and completed free recall and recognition tests as well as measures of attitudes and intentions 48 hr later. Disordinal interactions revealed that low verbal ability participants in node-link mapping conditions and high verbal ability participants in summarization conditions performed best on the tests and had higher personal relevance ratings. Ad lib and multiple schedules were related to greater intentions to learn about stress and intentions to manage stress for those who generated node-link maps than for those who summarized. Multiple regression analyses indicated that personal relevance predicted test performance for those who mapped and was consistent in predicting both intentions to learn about stress and to manage stress for all participants. Implications of these findings are discussed.