Chapter 1 (Draft, Feb. 1993) of a Dissertation entitled:

Promoting productive language learning strategies in an implementation of computer-based cloze through an investigation of ESL learner interaction with the program

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BACKGROUND

In the foreword to her recent work on research in computer-assisted language learning (CALL), Dunkel (1991:xiv) cautions that software developers tend to base purely on intuition what they think is being done by students using their programs, whereas actual use might yield contrary results (a point made by Hosenfeld, 1976, and echoed in Chapelle and Mizuno, 1989). The fact that unsubstantiated claims are commonly, if innocently and unwittingly, made for CALL courseware remains a major problem in the field. This dissertation will examine one instance of CALL software - computer-based cloze - which intuition would suggest is a viable language learning tool despite the fact that the cloze procedure itself has been scrutinized in recent research. The dissertation will attempt to create as its final product a tested version of this program which does what its developers expect it to do.

The researcher will examine the program's potential by tracking student progress with it, designing feedback mechanisms to promote productive language learning strategies and to counter those deemed undesirable; testing these feedback mechanisms to see that they in fact result in improved strategies; and eventually designing a computer-based cloze program that results in the expected learning outcomes. Student use of the final product will be investigated with regard to the effects of language proficiency, cognitive style, and teacher modeling of the program.

WHAT IS MEANT BY CLOZE?

Cloze is a procedure for preparing language learning exercises in which words are systematically deleted from otherwise intact prose passages, to be restored by learners. Two deletion systems are typically followed: a fixed-ratio deletion pattern gaps every nth word in the text, while a rational deletion pattern allows selective deletion according to some pedagogical or methodically applied scheme. Due to programming constraints, computer generation of cloze exercises is most conveniently done on a fixed-ratio system.

In addition, there are several ways to assess the suitability of answers to clozed gaps. Several near-fit schemes are examined in Alderson (1980); plus there is the clozentropy approach (Taylor, 1954; Darnell, 1968; and Cousin, n.d.) whereby learners are scored based on prior performance on the same test by a sample of native-speakers. In this scheme, greatest weight is given answers corresponding to those given by the greatest number of native-speaker respondents, with less weight given to alternative answers in proportion to the frequency in which the alternate responses were supplied by the native speakers. The two most commonly used assessment schemes require either exact reconstruction of the original text or some semantically appropriate alternative. Computer-based approaches generally require exact-fit because of the difficulty (and to date, impossibility) of programming a computer to emulate native speaker judgments on semantic acceptability. The one conceivable alternative, providing a list of semantic alternatives for all possible words that could be gapped in a computer-generated cloze passage (i.e. practically every word) is impractical if the computer is to retain its unique and powerful advantage of being able to generate a cloze passage on demand from any text it happens to be given.

Before proceeding further, we must decide whether it makes pedagogical sense to use computers to impose exact-fit answer judging criteria on the fixed-ratio cloze tasks it generates; in other words, is this an activity CAPABLE OF providing pedagogic benefit to students, or is it simply a trick we do with computers because it is convenient to program them that way, part of the illusion being to imbue the activity with acceptable face validity? The following sections address the extent to which it matters if an every-nth deletion, exact-fit generation and assessment scheme is used in the present project, and also the extent to which such a scheme might prove beneficial to students.

THE RELATIONSHIP OF CLOZE TO LANGUAGE PROFICIENCY AND HIGHER-ORDER PROCESSING SKILLS

Most, if not all, of the underline research that has been done on cloze and its derivatives addresses the question of its validity as a measure of language proficiency. (This researcher is not aware at this point of any research done on cloze addressing its effectiveness as an exercise tool for use with L2 learners.) Alderson (1979, 1980) finds that as native speakers do not perform consistently on such tests (in part because language proficiency is a function of intelligence, which varies among individuals), cloze tests do not discriminate between native and non-native speakers and are hence of dubious value as measures of proficiency. In Alderson's view cloze tests are sentence- and syntax-bound and require "lower-order" linguistic skills (clause-level syntactic processing) for their solution. They vary widely in content, and as no two fixed-ratio deletion cloze tests will have the same aggregate of lexical items, syntactic patterns, discourse characteristics, and rhetorical traits, then each must be considered uniquely as to reliability. "In short, computers cannot produce automatically valid tests." (Alderson, 1986) Furthermore, if one were to use a cloze test to measure language proficiency, then a near-semantic-equivalent scoring system would provide the best discrimination (Alderson, 1980).

On the other hand, Chavez-Oller, Chihara, Weaver, and Oller (1985) see reading comprehension more as a function of interaction between texts and people which invokes higher-order processing skills, and suggests, as Jonz puts it, that cloze "challenges universal processing mechanisms ... at all levels from word recognition through concept building; therefore, responding to cloze tests must necessarily involve a great deal of higher-order language processing. Any variation in cloze test scores that might be attributed to superficial variation across texts is more apparent than real." (Jonz, 1990:62-63) Furthermore, Oller and Inal (1971) found that when prepositions were gapped, native speakers were consistently able to restore them, so that performance on at least this one skill maydiscriminate between native and non-native speakers.

Working with rational-deletion cloze, Bachman (1982) was able to demonstrate that cloze scores reflect a range of lower- to higher-order processing skills. Then his 1985 study employed an every 11th-word deletion ratio and established four categories of constraints on successful closure of an item (within clause, across clause but within sentence, across sentence but within text, and extratextual). According to Jonz (1990:64), Bachman "concluded that across versions there were no systematic differences in the relative frequency of item types" and "went on to hypothesize that the same relative frequency of the four item-types discovered in this study would be characteristic of fixed-ratio cloze tests generally."

In a test on Bachman's system for classifying constraints on cloze solution, Jonz (1990) established that the percentages of items in each category were "impressively similar" for each of eight passages analyzed. Because a constraint on application of the chi-square statistical analysis was violated, one of Bachman's categories was further subdivided, again with results supporting the contention that "the fixed-ratio cloze procedure is far from erratic in its selection of item types." (p.72) Furthermore, as constraints on cloze response derive mostly from lexical selection (41.8%) and textual cohesion (34.1%) as opposed to syntax (24.1%), "These findings support the contention that the cloze procedure is sensitive to constraints on response ranging well beyond the level of local syntax." (p.72)

Whether or not cloze is a valid and reliable measure of language proficiency may be somewhat beside the point regarding its use as a pedagogical device; however, there is evidence here supporting a directly

proportional relationship between cloze performance and language proficiency. Furthermore, there is evidence that a fixed-ratio deletion scheme will hit on items that challenge a variety of faculties in language learners requiring their powers to interact cognitively with the text, which is desirable pedagogically if reading is viewed as an activity in which the reader is actively and interactively engaged with the text.

FURTHER READING
References from Jonz:

Brown, J.D. (1983). A closer look at cloze: Validity and reliability. In J.W. Oller, Jr. (Ed.), Issues in language testing research (pp. 237-250). Rowley, MA: Newbury House.

Lee, Y.P. (1985). Investigating the validity of the cloze score. In Y.P. Lee, A. Fok, R. Lord, and G. Low (Eds.), New directions in language testing (pp. 137-147). Oxford: Pergamon Press.

Ilyn, Steve Spurling, and Seymor. Learner variables and cloze. 1987. System 15, 2:

Blondel, M., N. Brick, G. Horrocks, and N. McBride. 1990. Theory and reality of evaluation: Evaluation and text jumbler. CALL 3: 55-67.
- I read this one; not much here

ALTERNATIVE CLOZE CONFIGURATIONS

In response to the argument that cloze tests with fixed deletion ratios do not discriminate between native and non-native speakers, several alternatives have been proposed. One such alternative is the C-test, which is created according to a "rule of twos;" that is, starting with the second sentence, the second half of every second word is deleted, up through the second from last sentence. There is support for the C-test as an integrative measure of overall language competence in first, second and foreign languages in Gaies (1986), Klein-Braley & Raatz (1984), and Klein-Braley (1985a, 1985b).

[However, Feldmann and Stemmer (1987:251) point out that "what it measures, i.e. its construct validity, is, in our opinion, thus far quite unclear." (and did they clarify things?) Although Klein-Braley (1983? but check if it is that article or another) argues that native speakers are able to complete such tests with consistent accuracy, she also cautions against their being too easy for proficient L2 learners (but then, Klein-Braley & Raatz, p. 144, say that "from the point of view of test construction, it is desirable that a C-Test should be so difficult that on average only 50 per cent of the blanks are successfully filled." - I suppose difficulty depends on the text).]

Another alternative to gapped-prose cloze (besides C-tests and clozentropy procedures) is given in Butler (1991). Being among those who feel that a fixed ratio cloze test may not be valid, Butler presumes that in order to produce a valid test, a test writer must select a text appropriate to the target group and then selectively delete only those words contextually related to their neighbors. In order to avoid this, Butler proposes a concordance generated cloze. In his view, bias toward text content (i.e. "a mutilated text derived from a single source" p.29) can thus be overcome. Butler's technique is similar to that proposed by Stevens (1991/ESPJ), in which target words were concordanced in accumulated corpora and four contexts selected of each to produce a single item (comprising the set of four contexts) with the targeted word clozed out in each. Stevens (1991/ELRJ) presents data suggesting that despite its unfamiliarity to students, this method of cloze presentation does not present particular difficulties to students as compared with the familiar gapped-prose cloze presentation, and may even be easier because of the multiple contexts.

Still another variation on the cloze procedure, the second-hand cloze, was derived by Laufer and Osimo (1991). The second-hand cloze is a summary of a student reading assignment with target words deleted.

The procedure differs from cloze in that (1) the aim of the exercise is to reinforce vocabulary, not highlight other aspects of the text, (2) the context is familiar to students, (3) the text is abridged, and (4) learners are dictated possible solution words in mother tongue. Laufer and Osimo were able to show that words submitted in this way were better retained than by dictated translation. The first two differences are also characteristic of exercises available to students in the present study in cases where the cloze program is configured to delete words on a course vocabulary word list, and when students work with texts that they have encountered elsewhere in their course of studies (as they are encouraged to do).

Although the validity of cloze as a measure of language proficiency may only obliquely have pedagogical ramifications, suggestions in the literature that higher-level cognitive processes may be involved in cloze solution leads us to an examination of the extent to which the interactive restoration of text might trigger cognitive processes conducive to language learning.

PEDAGOGICAL IMPLICATIONS FOR COMPUTER-BASED CLOZE

In its computer-based implementation, cloze is an example of a text reconstruction program (and also of a text manipulation program; Stevens (1990/CAELL) defines text manipulation programs as comprising the complete set of text reconstruction programs plus concordancing programs). Such programs can make large quantities of text available for interactive learning through templates requiring students to restore or manipulate the material (cloze being one such template, where the computer gaps the text and the students restore it). The fact that the template will work on any ascii text it is supplied is one of the singular advantages of this form of CALL delivery, since authentic materials can be readily enlisted in the learning process, and very minimal configuration need be performed by teachers (see Stevens, 1988). However, the potential for expedient presentation of material is often overlooked by teachers who expect the medium to emulate more closely what a teacher is able to do in the classroom; i.e. respond appropriately on a one-to-one basis to any conceivable student query. As this is clearly impossible, it becomes crucial to examine whether there are pedagogical benefits to be derived from what it is the computer can do efficiently, and that is to permute text in bulk (something teachers often do but can never do enough of) and guide students toward putting it back the way it was before (something teachers do well, but only for one student at a time, and only during class or consultation hours). And here again, there is scope for dissatisfaction, as a computer can only permute text in a purely mechanical way (although, if the mechanics were well worked out, the machine would perform in a correspondingly sophisticated manner).

The pedagogical acceptability of every-nth deletion ratios and exact-fit answer judging has been raised by Higgins (1988), who anecdotally reports a heated discussion of the issue at a demonstration of CLOZE-MASTER (Jones, 19??). As has been pointed out above, fixed-ratio deletion patterns are quite likely to hit a range of items requiring various levels of cognitive processing in students working the cloze exercises, and Higgins's stance is that there are pedagogical benefits to students once they understand that the game is not to fill the gap with any acceptable word, but to fill it with the word that was there to begin with. And unlike paper-based cloze tasks, where it could be considered unfair to indicate to students that their choice of word is wrong when it is in fact an acceptable alternative, the computer makes no such judgments. The message that the computer intends to convey to the student is only that he or she has not restored the word that was there originally. Through various means (e.g. hints) the computer is then capable of negotiating that word with the student ("no, that wasn't the word I was thinking of" is a part of the negotiation).

[Make this a footnote: It was in response to a teacher's expressing dissatisfaction with the arbitrary nature of the mechanical deletion pattern of computer-generated cloze that a teacher-marked deletion option was provided as a cloze-generation option in the software used for the present project. That option has subsequently been taken advantage of only once in several years - the teacher who requested the option marked a few texts when the option was first made available, but has since accepted the fixed-ratio deletion patterns supplied by the computer rather than do any further marking of texts.]

In reviewing TEXT TANGLERS (a battery of text reconstruction programs containing a version of cloze reconstruction precursor to the one in the present study) Garrett (1988) writes that: "the pedagogical approach is the overall problem with this programming ... many teachers will not want their students to

spend much time doing this kind of task." (p. 59) This is because, "letter-by-letter decoding of words, sentences, and paragraphs is not a very communicative or authentic activity no matter how many software programs use this technique." (p. 61)

In response to Garrett's critique, Stevens (1990/CAELL) suggests that students solving cloze might be expected to emulate the inductive reading skill of making predictions about the meanings of unfamiliar words they encounter in the text, except that the predictions made concern the nature of the words which fit the gaps in cloze passages. Stevens extrapolates (to text manipulation) Johns's (1988) assumptions justifying the use of concordancing for language learning. The first assumption deals with three aspects of authenticity. These are, authenticity:

a. of script; that is, the teacher's role moves from that of text preparation to text presentation

b. of purpose; that is, "the text should be of value to the learner quite apart from its use in a language-teaching context" (p. 10)

c. and of activity; "what is done with the text should be transferable to the situation outside the class-room where the learner is trying to make sense of the language without the help of the teacher or of teaching materials." (p. 10)

The first of these applies equally well to text reconstruction as to concordancing, as does the second in cases where the text base is of interest to the students in a context apart from language learning. The last one is debatable in the case of text reconstruction; however, Johns argues that, whereas multiple choice and quiz-like activities have low transferability, text reconstruction is transferable "in the sense that piecing together coherent text from disconnected ideas or minimal clues lies very close to the heart of language learning and language use." (p. 11)

In psychology, this process of forming complete images from disconnected clues is called closure, and it is this process which in fact is the source of the name cloze. Closure gives us the ability to infer a complete picture from its disjunct parts, and the inference is made based on some prior knowledge which gives rise to expectations of what the final product must be (give an illustration of such an image). An interesting adjunct of this ability is illustrated in cases where these expectations produce conflicting images, resulting in our interpretation of "impossible" drawings (give an example). The prior knowledge assumed may be linguistic, which is why we interpret the same pattern of splotches or squiggles as different letters, depending on their context, as in the following examples. Inability to resolve degraded data into meaningful units has also been referred to as signal-limits to cognitive processing (Feldmann and Stemmer, 1987).

This ability to reconstruct degraded or ambiguous text fragments is definitely transferable to authentic situations; for example, it allows us to resolve the typographical error in "This can doesn't use a lot of pe-trol." [Make this a footnote: This example, incidentally, is from a text presented to about 150 first-year Arab university remedial English students, many of whom were unable to spot the error - and on having it point-ed out to them, many students persisted that no, the text said 'can' and not 'car', so what then did it mean?] Many other instances can be imagined, as when: (a) one makes sense of a highway sign whose text is partially weathered away; (b) one is able to read a fax, lines of which have been smeared in trans-mission; (c) one reads a photocopy of an article with near perfect comprehension despite the fact that several letters along the entire right or left margin are missing; (d) one is able to read a fifth-generation photocopy whose letters are blurred and grainy; (e) one infers the context of a bit of concordance data despite arbitrary truncations after a number of characters both left and right of the keyword. On the aural front, one comprehends a short-wave radio broadcast in one's own language transmitted from a distant country despite static and distorting oscillations. (But try doing this with a broadcast in a foreign language! One's ability to interpret such a transmission is obviously contingent on some threshold competence in that language.)

Another benefit to students exposed to text reconstruction is that it forces them to attend to grammar in an inductive, problem-solving manner. Although presentation of items with grammatical import is arbitrary in text reconstruction, when such items do appear and pose problems for the students, the process of resolu-tion may lead to insights on the way the language is structured.

Although his remarks are made with respect to the role of data-driven learning in concordancing, Johns (1991/Should) expresses what may be a common factor in both DDL and text reconstruction: "The DDL approach ... makes possible a new style of 'grammatical consciousness-raising' (Rutherford 1987) by placing the learner's own discovery of grammar at the centre of language-learning, and by making it possible for that discovery to be based on evidence from authentic language use." In the case of DDL (e.g. concordancing) this discovery takes place when the learner examines numerous instances of authentic language in an attempt to discern the underlying principle; in the case of text reconstruction (e.g. cloze), it occurs when the learner experiments with various possibilities for completion of a clozed gap in a text (which could easily be selected from the same authentic text base) and eventually restores the item as it was in the original text.

This ties in with suggestions elsewhere (e.g. Feldmann and Stemmer, 1987; Butler, 1991) that students solving cloze make use of cues from redundancies in the text and their pragmatic expectancy grammar (Oller, 1976) to solve the problems. Proponents of this view see the exercise of filling gaps in a second language as one in which the learner is developing a sense of what fits in that language based on what he or she thinks the author of the discourse is trying to say. Such conceptions support the arguments of Jonz, Bachman, and Chihara-Oller et al. that cloze tests (and exercises) tap higher-order processing skills and give some indication of competence in the language.

Piper (1986) also speculates on the effectiveness of text reconstruction in fostering second language acquisition. In an examination of student conversation when using CALL programs (including CLOZE-MASTER), she finds lack of evidence of students engaging in linguistic inquiry and though many speech acts wereisolated, they are marked with an impoverishment of language. "However, there is comprehensible input in these conversations and there is negotiation -- but the comprehensible input is from the text on the screen and the negotiation is going on between the text and the learner's thought processes. This poses the speculative question as to whether these two theoretical phenomena provide a new justification for the long-established popularity of text-manipulation tasks like cloze." (p.197)

As to whether these assumptions are borne out in practice, the present project will examine records of student interaction with a computer-based cloze exercise generation program and attempt to find evidence of student engagement in a range of cognitive processes while working computer based cloze. These processes could include use of extra-clausal/extra-sentential reading in solving cloze blanks, engagement in grammatical consciousness-raising, use of expectancy grammar, inductive resolution of grammatical issues, student negotiation with the text, use of particular strategies for arriving at meaning while reading ... The project will attempt to improve the program so that it promotes as many of these desirable outcomes as possible, and then test the program for effectiveness taking into account individual learning styles.

SUPER CLOZE: RESULTS OF PILOT STUDIES

The cloze program used here (SUPER CLOZE, Millmore and Stevens, 1990) presents one screen-sized paragraph at a time with words gapped according to customized cloze generation features provided in the program. These cloze possibilities include fixed ratio deletion (the range being every 2nd to every 9th word), deletion by word list (e.g. prepositions, pronouns, etc.), and deletion according to teacher markup (i.e. rational deletion scheme; this feature is only rarely used and will not figure into the data in the present research). It is also possible through use of wild cards in the word lists to target words of exactly n letters or words of n or more letters, or any combination of these (e.g. words of up to n letters, including cloze deletion of every word in the passage). Students type letters into the blanks, and the problem is solved if, on pressing Enter, the letters correspond with the word from the original passage; otherwise, the letters disappear and the gap remains. The present version of the program utilizes (besides instructions for working the program) two forms of help: (1) the program will reveal on demand the letter required at the present cursor position for any blank in the paragraph; and (2) the program will reveal on demand the entire paragraph, with options to either continue working on that paragraph or to skip to the next one.

In order to learn more about the processes involved when students use text manipulation, pilot research has been carried out at Sultan Qaboos University to examine student interaction with two text manipulation

programs: HANGMAN and SUPER CLOZE (both programs are provided with a means of recording student key presses). The results have shed light on strategies and levels of cognition employed, and suggest that Arab university students working under self-access conditions with the two programs in question tend to abuse help features rather than to consistently apply their own cognitive abilities toward solving the problems (Stevens, 1991/CAELL; Stevens, 1991/ERIC, Cloze; Stevens, 1991/ERIC, Hangman).

INTRUSIVE VS. NON-INTRUSIVE STUDIES: COGNITIVE CONSIDERATIONS

This work differs from much previous work on student strategies while working computer-based tasks in that it is carried out non-intrusively; that is, the software was configured so as to record student keypresses without students, or in many cases even their teachers, knowing that any record of the session was being kept, thus maintaining complete privacy during self-access. It is often envisaged that CALL materials are ideal for self-access use; that is for students to use in their own time and with the outcome being their business and no one else's. One important condition for self-access is therefore an ability to work in complete privacy, and it is of interest to the present researcher to understand how his materials are utilized under this condition. This is a main reason why the present project gathers data on student use of SUPER CLOZE without students being aware that they are being tracked.

The results from the pilot studies differ somewhat from those obtained from at least one obtrusive study of student interaction with computer-based cloze; that of Windeatt (1986), whose subjects, while working with video equipment trained on them, hardly ever used the help options provided. Conversely, in the non-obtrusive studies mentioned above, the students made extensive use of the help available, possibly to the detriment of their learning outcome. Of course, one objective of the present study is to design software which will encourage students to use help judiciously, even (especially) when working privately.

The major problem with examining student strategies in solving linguistic problems is that people are not always aware of the strategies they use, and so these strategies often must be inferred. McClelland, Rumelhart, and Hintor (1986) touch on the automaticity of many aspects of human behavior in analyzing how a person reaches out and grasps an object that is awkwardly placed: how the hand must twist at just such a juncture, and the fingers contort in a certain way - and yet most people could grasp the object in question, would do it without thinking about it, and would later be unable to explain just how they had done it. In such a case, the action could be filmed and later analyzed by breaking each movement into its discreet components, but still, any mental processes involved must be inferred. (And it is interesting to speculate how the performance of a person who had just reached over and grabbed the object would change if that person were then asked to repeat the action while "talking through" the mental processes undergone; I play guitar, and I find when faced with explaining to people what I am doing, I often can't repeat the performance, but must perform a segment in silence first before I can then back up and explain to the other person how to replicate what I could do effortlessly before being asked to explain it.)

In the case of linguistic exercises, where most of the processing is internal, the recorded evidence, whether taken on film or through recorded keypresses, can be scant compared to the amount of mental activity that is actually going on. Thus many researchers resort to introspective data, often through post-facto interviews, or by having subjects attempt to talk through whatever mental processes they are engaged in while performing a task. This technique is not without drawbacks, particularly as the act of talking while thinking may interfere in some way with the subject's performance of the exercise under study, or post-hoc recall may be inaccurate, or the presence of recording equipment may cause some modification of behavior, and this is one possible explanation for the difference in results reported in Windeatt and Stevens, above (other possible explanations being that the students were different, the texts were different, etc.).

Anderson (1991) provides evidence which questions the confounding effect of self-report protocols on experimental results. In his study, the standardized measure was given twice, once before the study and once after the intrusive self-reporting protocols had been applied. There were no significant differences in results, suggesting that for his study, the use of an intrusive protocol had no effect on outcome. Anderson's study is the only one of which I am aware where such a comparison has been made within a single experiment.

This evidence runs counter to a pervasive view, commonly recognized by researchers in all sciences, that the act of studying something can alter aspects of that which is being studied (until recently, for example, the structure of membrane common to all cells was for years understood to be a lipid-protein "sandwich" until it was finally realized that one of the layers was in fact an artifact caused by a common staining technique). Numerous threats to validity of research utilizing self-report protocols are examined in Faerch and Kasper (1987). For example, Feldmann and Stemmer (1987) recorded students thinking aloud while solving C-test exercises. They found that students encountered (1) signal data-limits, where the quality of the data is eroded (i.e. by the blanks), (2) memory data-limits when language items are encountered which the learner does not know or has forgotten, and (3) resource-limits, where learners are given too much to process beyond their capabilities. Focus on multiple tasks can be maintained until one starts drawing attention preponderantly from the others, and having to think aloud could aggravate this development.

McLaughlin (1990) sees such limits in terms of controlled vs. automatic processes. The former regulate flow of information from short to long term memory and serve as "stepping-stones" for building the latter, which take time to evolve and are associated with long term memory (see McLaughlin, Rossman, & McLeod, 1983; Shiffrin & Schneider, 1977). McLaughlin cites Reber and Allen (1978) who introduced subjects to finite state grammar systems and then had them assess the grammaticality of novel utterances. Reber and Allen found that their subjects were significantly accurate but "cannot tell us very much about what they know" (p.204). Dulany, Carlson, & Dewey (1984) replicated the Reber and Allen study and found that their subjects developed rule systems that, while not the same as those producing the grammar, resulted in the same grammatical classifications, and they took this as evidence for conscious learning. Referring to Schmidt (1990) who finds both conscious and unconscious processes to be involved in language learning, McLaughlin concludes that although the evidence suggests that "adult humans do not learn without awareness" (p.626), "whether the subject has the ability to report accurately on knowledge or on the intent to use particular strategies in learning ... Subjects' reports may derive more from what they think they should have been doing than from what they actually were doing." (p.629)

Thus there are many notes of caution regarding the interpretation of data collected through means intrusive on the process under study. Despite the findings of one study contravening this view, the present researcher suspects that intrusive studies can alter or compromise the phenomena under investigation. For this reason, and because non-intrusive data collection best maintains conditions of self access, non-intrusive measures have been chosen for the present study.

STRATEGIES IN READING
The relation of TEXT and READING skills to cloze ability

Due to the unelucidated effects of research technique on findings, the state of knowledge of learner strategies when studying second and foreign languages is itself a bit of a lipid-protein sandwich. Keeping in mind that the literature on the subject is overwhelmingly extensive, this section reviews some salient aspects relevant to the present study. These are: (1) what research into reading strategies reveals about students working computer-based cloze, (2) what is known about student strategies when working text manipulation in general, (3) what is known about student strategies when students use cloze, and (4) what is known about students' interaction with authentic text.

STRATEGIES IN READING SECOND AND FOREIGN LANGUAGES

Solving cloze requires that students read, and the skill of reading (in so far as reading can be considered a discreet skill) is often associated with cloze. Alderson and Urquhart (1984) point out in their introduction, p. xv, that the literature on the topic of reading in foreign languages is so vast that an overview is impossible "to summarize or synthesize, or indeed simply read." (p.xv)

Candlin, in his preface to Alderson and Urquhart (1984), says that reading focuses on the reader, text, and interaction between reader and text; "Reading ... sets these centres in motion." (ix) A subskills approach

therefore cannot be as revealing as a process approach which takes into account the role of flux in its model of reading. According to Alderson and Urquhart, a process model should shed light on learner strategies, distinguish good readers from poor ones, and suggest strategies that can be taught to the latter (p.xix). Hosenfeld, Harri-Augstein, and Thomas and Fransson examine the nature of this process in their articles in the same volume.

Further reading from Alderson and Urquhart:

Rodriguez de Arcienega, Maria Elena. 1991. Developing CAI lessons for second language reading instruction. CAELL Journal 2, 3:17-22.

Oxford and Crookall are cited for an excellent review of findings etc. related to strategies in reading, and several other articles on reading strategies are cited as well by Anderson, 1991

As reading strategies must be used in solving cloze, it seems incumbent to review such strategies. At this stage, I have simply noted where inventories of reading strategies can be found. For example, miscue analysis (see Goodman 1974, mentioned in Alderson and Urquhart) posits the following basic reading strategies: prediction (chunk by chunk), sampling (selecting text consistent w/ prediction), confirming (testing prediction against sample), and finally correction (if confirmation fails, generate another prediction).

Feldmann and Stemmer (1987) discuss C-test elucidation in light of bottom-up and top-down processing strategies. Using bottom-up strategies, the learner identifies small units such as phonological segments and from these builds words, sentence constituents, etc. With top-down strategies, a learner starts holistically and reduces. Learners should do both; Adams & Collins (1979:5) say bottom-up processing sensitizes readers to what is novel or does not fit hypotheses about text content, whereas top-down processing helps readers resolve ambiguities and make choices in interpreting data.

Cziko (1980) also compares bottom up and top down views of reading. Bottom up assumes a one-way flow of information beginning with the visual (graphic) input and deriving meaning from progressively higher-order processing stages; whereas top down presumes higher cognitive processes generating hypotheses as to meaning based on contextual information primarily. Cziko reviews research showing that L2 learners do not use context extensively, but rely heavily on graphic bottom-up strategies. Although his study is an analysis of pronunciation when learners are reading aloud, which seems to me to be measuring some process other than strategies employed in normal (i.e. silent) reading (as Cziko himself points out), Cziko concludes that readers with less competence are proportionally less sensitive to contextual clues in interpreting meaning, but that as competence increases, even for L1 learners, then more interactive strategies are used, for both NS and competent NNS. Cziko's findings suggest that weak L2 readers would tend to struggle with computer-based cloze on a gap by gap basis with little attention to surrounding context, which is indeed what seems to happen.

Anderson (1991) expands on Pritchard's (1990) inventory of reading processing strategies and Nevo's (1989) Multiple Choice Strategy Checklist to produce a list of 47 strategies employed by readers taking both academic and general reading comprehension exams. One finding from Anderson's comparison of the two is that language proficiency accounts for much variance in standardized test results (general reading), but little in the academic reading results. Also it was found that although strategy use on the two types of reading was similar, in general, there is no single strategy that accounts for success in reading either type of text, and that even the number of strategies used had little effect, as success in reading depends on whether the reader can determine if application of the strategy is successful and apply corrective feedback. Segel (1986) also found that academic reading skill is attributable to factors such as motivation, learning style, and background rather than to language proficiency.