PROMOTING EFFECTIVE LEARNING STRATEGY USE IN CALL

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Abstract: This paper presents research in the area of language learning strategies, focusing on both general research and the treatment of learning strategies in CALL. Despite a recent interest in the subject of learning strategies in language learning, few CALL programs include a treatment of this issue. A small number which do consider this aspect are described, and although some are useful in this regard, most include only a limited view of learning strategies. The learning strategies component of Mr. Collins, a system aimed at promoting learners' awareness of their knowledge and approaches to learning, is presented. Research on language learning strategies demonstrates that this is an important issue; the implementation of Mr. Collins shows that detailed consideration of learning strategies in CALL is feasible.

1. Introduction: Many CALL systems are created apparently without the authors of these programs considering the research on how students learn languages. There is a great deal of literature available on the process of second language acquisition, and although not always conclusive, it should at least be taken into account if programs are to be maximally effective. This paper describes just one area of this literature, and presents part of an intelligent CALL (ICALL) system which is based on the findings. For simplicity the system will be referred to as Mr. Collins — though this name actually applies to only the student model of the system. Mr. Collins also considers other (though not all possible) issues in second language acquisition\(^2\); however, the purpose of this paper is to illustrate the relevance of considering learning issues when developing CALL by providing more detail on just one of these aspects.

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2 Error types: acquisition order of rules; language transfer; language awareness (see Bull, Brna & Pain, 1995; Bull, Pain & Brna, 1995).
The current domain of the system is pronoun usage in European Portuguese, focusing mainly on the placement of pronouns. However, for this paper the target language is less relevant, as it is the principles behind the design of the system which are at issue. Therefore the domain will be described only briefly.

The first section of the paper presents general research on language learning strategies. The second section provides an illustration of a few CALL systems which have considered this issue. Some of these are quite effective, though their handling of learning strategies is not necessarily deep (thus even a limited understanding of learning strategies may benefit a CALL program). In the final sections the (more detailed) treatment of learning strategies in Mr. Collins is described, to illustrate how a system can entice students to reflect on learning strategies, and find out more about what might work well for them. Finally a few pointers to possible further research in this area are offered.

2. Language learners' use of learning strategies: An important part of learning involves the use of learning strategies. This has been shown to be equally true for the learning of foreign languages as for other subjects. Fox and Matthews (1991) describe learning strategies as being 'concerned with how learners use their brains consciously and purposefully to handle their learning and make it more effective'. It appears that the same types of strategies are employed by the language learner as by learners of other subjects, and these strategies apply to both instructed and uninstructed language learning (O'Malley and Chamot, 1990).

Abraham and Vann propose that learners have, at some level of consciousness, a philosophy of how language is learned. This philosophy guides the approach they take in language learning situations, which in turn is manifested in observable (and unobservable) strategies used in learning and communication. These factors... directly influence the degree of success learners achieve.

(Abraham & Vann, 1987, p.96)

Weiden (1987) distinguishes three groups of learners: those who believe in using the language, those who wish to learn about the language, and those who consider personal factors such as emotions or aptitude to be important. The types of strategy used can be determined by the particular set of beliefs held by a student. Horwitz (1987) presents BALI (Beliefs About Language Learning
Inventory) to identify learner beliefs, and to try to answer questions such as the links between beliefs about language learning and strategy selection, and variables affecting beliefs.

Based on his study of seven exceptional language learners, Stevick (1989) also concludes that students differ in the manner in which they approach language learning, and locates learners generally as falling within an overall pattern focusing on verbal and non-verbal imagery. He describes each of his learners as having a distinct technique, classifying them thus: 1. intuitive learner; 2. formal learner; 3. informal learner; 4. imaginative learner; 5. active learner; 6. deliberate learner; 7. self-aware learner. Due to these variations in approach and beliefs about learning a language, it seems fair to assume that different learners will adopt different strategies, some possibly more successful than others. For example, Rubin (1987) observes that in general, learners who rely too heavily on a strategy of literal translation enjoy very little success. Ellis (1992) distinguishes learners who strive to develop their knowledge of linguistic rules, and learners who focus on communication with less attention to grammatical correctness (studial versus experiential learners). Ellis concludes that learners are likely to progress differently depending on their chosen approach; moreover, in his data, acquisition of linguistic rules and fluency are inversely related. Of course, some learners may have an approach which is more balanced, and such learners may achieve greater success overall.

Using the term 'personal competence', Stevick (1982) states that students need techniques which can be used with new material. Techniques are defined as things a student knows how to use. It is not only the techniques themselves which should be learned, but also timing for techniques (e.g. how long flash cards should be used, and the appropriate time intervals between their use). Once various techniques are known it should become possible for individuals to identify what is most effective for them. Following this stage it should be possible to develop an awareness of how to adopt a new technique or modify an existing one (and an awareness of the individual's reactions to different techniques, and ways to deal with these reactions).

Oxford (1990) states that more aware learners who are further advanced in their study tend to use better strategies. Similarly, O'Malley and Chamot (1990) claim that the most effective learners have a larger repertoire of strategies, and use strategies more effectively than less efficient learners. Skehan (1989) warns of the
need for caution and for longitudinal research to determine whether broader strategy use facilitates learning, or whether it is proficiency which allows broader strategy use.

It is possible for a single learner to approach the learning of different languages in different ways; for example Stevick (1989) describes one student whose approach to the learning of Finnish grammar contrasted with his previous (also successful) attempts at learning German and Russian. The present author's experiences, relating to tolerance of errors and risk-taking, reveal two distinct approaches depending on whether or not the language in question had been formally taught. Contrasting techniques can also be applied within the same language; Stevick cites a learner who combines a formal with an informal approach, although these two aspects were not equally balanced. It should also be remembered that not all learners are able to manage both techniques.

Holmes and Ramos (1991) identify the existence of negative strategies such as 'copying' and 'classroom coping'. Horwitz (1987) cites a learner who asked whether it was true that some learners do not actually translate from their first language when speaking in a foreign language. On hearing that this was indeed the case, and moreover, more fluent speakers tend not to translate, this learner decided to think about his approach. It is clear that such learners could benefit from the simple knowledge that not everyone shares the same belief about learning a language.

It would appear from these studies that those students who use appropriate learning strategies can achieve better results in their learning of a foreign language. Moreover, it is those learners who use a greater variety of strategies that tend to be the most successful. Rubin (1975) therefore proposes that poorer learners should be taught the strategies employed by good learners. However, Vann and Abraham (1990) present contradictory evidence to the claim that poorer learners use less learning strategies. Indeed, it seems that some unsuccessful learners use many of the same strategies as those students who are more successful. In such cases the focus should be more on the facilitation of strategies appropriate to the task. Wenden (1991b) also calls for training in learning strategies to take account of the tasks which the learners involved are required to carry out.

Kohonen (1992) maintains that reflection on learning leads to an increase in awareness, which in turn aids the development of autonomous learning. Kohonen states:
Strategies ... can become automatized and function without conscious control. But they can also be brought to conscious observation and awareness and can be modified as a result of conscious effort. (Kohonen, 1992, p.24)

Several researchers (e.g. Awang Hashim & Syed Sahil, 1994; O'Malley & Chamot, 1990; Sharkey, 1994-95) claim the need to provide more information about language learning strategies or to teach them directly. Holmes and Ramos (1991) state that in order to help learners assume greater control over their own learning it is important to help them to become aware of and identify the strategies that they already use or could potentially use. (Holmes & Ramos, 1991, p.198)

Oxford (1990) and Wenden (1991a) provide information for teachers for promoting learners' language learning strategies. Rubin and Thompson (1982) offer accessible guidelines for the learner to follow. Oxford (1993) states that the most successful attempts at strategy training have been explicit, rather than implicit. Wenden (1986) also concludes that learners should be advised of the advantages of using the strategies in which they are being trained, and induced to experience the benefits. Cohen (1991) argues for the encouragement of awareness of the learning process, thereby increasing learner awareness of what works for them.

This section has shown that there is now quite extensive literature on the use of learning strategies in foreign language learning, most of which assumes that actual strategies used by students may affect their learning outcomes. Several researchers also claim the benefits of strategy training. Regardless of whether one adopts the view that all learners should be taught a (certain) range of strategies — which, in fact, we do not: we prefer the approach of helping learners identify what works best for them as individuals — it will at least be useful to enhance the awareness of learners of the variety of approaches available.

3. Other language learning systems concerned with learning strategies: Although, as we have seen, the general second language acquisition literature shows a recent interest in the issue of learning strategies in foreign language learning, there have been few attempts to incorporate an understanding of different approaches to learning into the CALL environment. The main difficulty is that traditionally CALL programs are very limited in their ability to adapt to the individual, tending either to offer fixed,
inflexible routes through material, or hypertext programs which allow the user far greater freedom in navigation, but no guidance as to the route or method which may be most suitable for their own learning, and certainly no facilitation of appropriate learning strategies. Multimedia tends also to be similarly limited, and even programs using artificial intelligence techniques do not usually include an understanding of learning strategies.

However, one system which has looked at this issue is that of Fleissner et al (1991), who constructed a system to test the hypothesis that 'slow learners will benefit from a language learning program that explicitly gives the opportunity to acquire strategic thinking'. Comprehensive feedback is provided 'to guide the learner to develop a metacognitive concept in regard to her language activities'. They proposed that a language learning program should both allow acquisition of the language structure and promote learner control over the particular strategies used. However, this learner control appears to be limited to easing navigation, help on the specific problem and the selection of various resourcing options.

An ICALL system currently being designed is taking a broader view of learning strategies. As in Mr. Collins, Martinxal and Díaz de Iarraza (1994) are also basing their system's treatment of learning strategies on the classification described by O'Malley and Chamot (1990). This aspect of their work has not yet been precisely defined; it will be interesting to see how the two systems compare once their implementation is further underway. The fact that the issue of learning strategies is being comprehensively investigated by these authors is likely to lead to a more thorough system than that of Fleissner et al.

A different approach is taken by Gillespie and Gray (1992), in MetaText. MetaText encourages students to note new information relevant to their translation process, and also to consult information recorded by themselves on previous occasions, to help in the completion of the current translation task. Although MetaText is not an 'intelligent' system: it is not able to judge a student's success in his note taking, or resourcing of previously recorded information (and has no way of understanding the domain, the student or teaching), the simple fact that it reinforces learners' resourcing, categorisation and note-taking skills is likely to make students more autonomous, and therefore more successful language learners.

Another system aimed at promoting learner autonomy is proposed by Moulden (1986/87), who describes the specification of
a counselling system (which could also be used in browsing or consultation mode, or provide exercises), for 'self-directed' learners. Twelve aspects of the proposed program are summarised; those most relevant here include the 'language learning resources file/locator' and the 'learning project progress check up'. The 'language learning resources file/locator' provides information on all the available resources, and the function of the 'learning project progress check up' is to help learner to assess progress, to diagnose causes of unsatisfactory progress and to find better ways of working.

Help learner to acquire habit and means of monitoring progress and adjusting process alone.

(Moulton, 1986/87, p.106)

Although not encouraging students to explore the use of learning strategies, ArtCheck (Sentance, 1993) uses the distinction between experiential and studial approaches to learning (described in Ellis, 1992) in order to better tailor its explanations to the individual. Thus, in system explanations, learners preferring the experiential approach receive example sentences instead of rules, or where both are used, examples are presented first. The reverse occurs for studial learners. This use of learning strategies differs from those described above in that it is not the two strategies which are taught, nor are students encouraged to become aware of various strategies, but rather, this distinction is used to individualise explanation to suit the learner's own (stated) style.

Another ICALL system which includes a distinction between a semantic (communicative) and grammar-based approach is LICE (Bowerman, 1990). In the grammar-based approach tutoring occurs at the time a problem occurs, whereas with the communicative approach all tutoring takes place at the end of the session. A main difference between ArtCheck and LICE is that in ArtCheck students choose the type of explanations received, according to their own learning preferences; in LICE the teaching approach is based on the student's level (intermediate or advanced), and does not take account of his own learning strategies or style. However, Bowerman does state that information about students' learning strategies and learning styles should be included in a student model; it is therefore assumed that if LICE were to be

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5 Note that Steri (1992) states, that from the theoretical perspective it is possible to argue for both directions, i.e. for either teaching approach to precede the other.
developed further, this issue of preferred approach would be linked into the selection procedure for LICE's teaching actions.

Another program which considers learning strategies, but from a rather different perspective, is Cognate? (see Musson & Bull, in preparation). This system has been implemented initially to research different presentations (colour, font size, position on screen) for (in this case) the learning of vocabulary. Three types of word pairs are presented: cognates, near cognates and false cognates, and students are made aware of the different forms of presentation as an aid to their learning of the separate groups. For example, if a student remembers that a certain word pair is red and in the bottom left hand corner, he will know that these are false cognates, and he should exercise caution. The aim is to eventually be able to configure systems to use those presentation strategies which are most effective in general or for an individual, and where appropriate to also encourage students to adopt these strategies for their own use in their learning (having as an example the system's method(s) of presentation).

It has been seen that language learning strategies are an important consideration in second language acquisition. Some systems include a 'knowledge' of such strategies, and even though these tend often to have a more restricted view of learning strategies, most benefit from their understanding of the strategies included. In the following sections we look at the implications for our system, arguing that a more comprehensive treatment of learning strategies can be used to encourage more reflective learning.4

4. Learning strategies in Mr. Collins: It can be seen that there are a variety of factors which should be taken into account when designing an ICALL system with an understanding of learning strategy use. Although there are some general language learning strategy programmes aimed at teaching learning strategies, the approach of Mr. Collins is based on discussion between the student and the system, in order to enable the student to maintain greater, but informed control over the interaction. We do not assume that certain learning strategies will necessarily be best for all students, thus it is important to raise learner awareness of various approaches

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4 Reflective not as 'bouncing back what the teacher throws' in the sense of reflective versus productive performance (as described in Stevick, 1976), but in the sense of reflecting on, or thinking about learning.
to learning, and then take account of each student's views. For reasons of efficiency, discussion occurs in menu format.

In order to provide some context for the discussion of learning strategies, the target domain and language task will be briefly described. However, while these are relevant to the current implementation, it should be remembered that this system is intended to be viewed as an illustration of the benefits of the type of approach adopted. The functioning of the learning strategy component of the system is generalisable, though each implementation will inevitably be tied to the possible student actions in the domain, as these actions constitute a large part of the information from which the system draws its knowledge of the strategies used by an individual.

Most exercises in the system take the form of Portuguese sentences offered to the student, with the object pronoun missing. The desired pronoun is provided separately, and students are instructed to place this in the correct position in the sentence, as in the example below:

System: Please place the pronoun 'lhes' correctly in:

Nâo disse nada.

Student: Não lhes disse nada.5

'Nâo disse nada' appears in an edit field, which is then amended by the student as he believes appropriate.

In cases where the third person direct object pronoun (o, a, os, as) follows the verb, if the verb form ends in r, s or z, phonetic contractions are required. The final r, s or z is omitted and l is affixed to the front of the pronoun (resulting in b, la, les, lat). In addition, when the stress is on the final syllable, or the verb form consists of only one syllable, a written accent is usually required. A similar change occurs after verb forms ending in a nasal sound; third person direct object pronouns become no, na, nos, nas. However, the final nasal sound is not omitted. A more complicated example is therefore:

System: Please place the pronoun 'a' correctly in:

Neste caso venderia.

Student: Neste caso vendê-la-ea.6

In the conditional tense, as in the above example, in cases where a pronoun would usually be post-verbal it must instead become an infix between the infinitive stem and the conditional ending. Vender

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5 'He did not tell them anything.'
6 'In that case I would sell it.'
ends in r, which must be dropped, an accent must be added to the e, and i must be prefixed to the pronoun a.

A few exercises involve translation from English to Portuguese. This occurs in a similar manner to the above; the difference being that the system presents a sentence (currently) in English, which the learner is asked to translate into Portuguese. In these exercises vocabulary is provided, as the system is not equipped to deal with a wide range of errors beyond pronoun use.

The interactive learning strategy component of the system is activated only if the student specifically requests interaction on the subject, or if he is performing badly, and could benefit from increased use of a strategy from his repertoire or from a new strategy that could be easily adopted, taking into account those already used. The remainder of the time, the system simply traces the learning strategies used by a student (see Bull, Pain & Brna, 1993), to use this information later, when appropriate. The strategies dealt with in the system are drawn from O'Malley and Chamot's (1990) classification, which divides strategies into three groups: metacognitive, cognitive and social. Descriptions of the strategies handled in Mr. Collins, and the manner in which students may find out about these strategies is described below. The aim is to raise awareness of the variety of strategies available, to allow students to make informed choices about the approaches most useful to them.

4.1. Metacognitive strategies: Strategy planning involves thinking about appropriate learning strategies to cope with the language task. Students may browse the learning strategies information to find (more) information about strategies, and further, they may ask the system specific questions about (particular) strategies and also about which strategies might be useful for them (by selecting from the options under 'learning strategies' on the STUDENT MENU).

Self-monitoring involves checking, verifying or correcting performance during the task. The issues relevant in this system are checking production, which may be in the form of visual monitoring (i.e., whether a sentence looks right), strategy checking (i.e., assessing how well a particular strategy works), and double checking, which includes consideration of alternatives. Students may alter (i.e., double check) a sentence before it is assessed by the system, by changing it in the dialogue box which appears after they have entered their input sentence.
Self-evaluation involves checking performance according to the student's own measures of accuracy after completion of the task. This includes evaluation of the ability to perform the task, and learning strategy use. Students must tell the system how confident they feel about their sentences by indicating this in the dialogue box which appears after input has been entered.

4.2. Cognitive strategies: Resourcing involves the use of any available references, such as books, dictionaries etc. In this system students may refer to grammar rules and/or examples, and may compare Portuguese rules and/or examples to rules and examples in other languages (by selecting 'question grammar' from the STUDENT MENU). Students may also ask questions about this grammar. They may access a translation (from 'translation') on the STUDENT MENU. They may refer to the student model ('question model'), or may review the trace of their current or previous interactions (in the 'interaction' window.) They may also consult notes or summaries made by themselves in the 'note-taking' window. Eventually a dictionary will also be available.

Note taking involves writing down important or key concepts. This may be with reference to the target grammar, comparisons between the target and another language, notes concerning the use of learning strategies, or aspects of the target rules or exercise which are found to be difficult, etc.. Students may make notes (which will be saved by the system) through selection of the item 'notes' from the STUDENT MENU. These notes may then be printed if required.

Summarization of information may be undertaken in the note-taking windows available through selection from the STUDENT MENU. (See note taking.)

Grouping of information is a useful aid to learning. It may be through ordering, classifying or labelling material according to content. The important factor is that this grouping of information is meaningful to the individual. In this system separate note-taking windows are provided to assist in the grouping of material.

Deduction involves the conscious application of rules (either learned rules or rules developed by the students themselves). Students may request descriptions of rules by selecting 'question grammar' from the STUDENT MENU.

Inferencing is the use of any available clues to predict usage of aspects of the language which are unfamiliar (or to guess meanings in cases of doubt). In this system students may actively pursue
inferencing techniques by requesting examples instead of explicit rules, or may explicitly generalise rules already acquired or explained by the system, to include other cases. (This could in some cases lead to correct production, and others, incorrect.) These possibilities may be achieved through selection of the option 'question grammar' from the STUDENT MENU.

Substitution involves the selection of an alternative structure to replace one about which a student may be unsure, e.g. 'Não os quer comprar' instead of 'Não quer comprá-los'. However, substitution will only occasionally be prompted by the system, for example, if a student has persistent problems with a structure such as the above. Substitution of some learning strategies by more effective ones may also be useful.

Translation here refers to more or less word-for-word translation. This may be useful in cases of real difficulty, but commonly leads to untarget-like production. Students may receive a translation by selecting 'translation' from the STUDENT MENU. Translation will rarely be prompted by the system.

Transfer is here defined as the use of rules from one of a student’s background languages to facilitate production in the target language. Such transfer may be either positive or negative — i.e., the rules used may be the same or different in the two languages. Transfer can be either conscious or unconscious. It is useful to make (many) students aware of when languages coincide and when they do not. The system will advise students of cases of negative transfer as they arise, and suggest possibilities for positive transfer if appropriate when they are experiencing difficulty. Students may find out more about transfer in relation to languages known, and about their own use of this strategy (by selecting 'other languages' from the STUDENT MENU). They may also obtain explicit comparisons of rules of different languages (by selecting 'question grammar' from the STUDENT MENU).

4.3. Social strategies: Questioning involves asking for explanations, verifications or examples. In this system students may use questioning with reference to the target grammar, relationships between the target and other languages (by selecting 'question grammar' from the STUDENT MENU), or with reference to learning strategies (by selecting 'learning strategies' from the STUDENT MENU).

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7 Unless students have specifically requested no interaction about transfer.
8 For more on transfer in Mr. Collins see Bull (1995).
Students may question or argue about the contents of the student model\(^9\) (by selecting 'question model' from the STUDENT MENU).

Cooperation implies the idea of working with others, usually peers. Students will in this case be working together with the system in an attempt to clarify their knowledge and beliefs (both to the system — to create a more accurate student model, and to themselves — to promote reflection). Students may state their beliefs about their learning strategy use at any time, or negotiate their future use of learning strategies, through choosing 'Your Use of Strategies', and also ask questions. They may assert their confidence level in a particular sentence by using the dialogue box which appears after entering their input. They may discuss grammar (target only, or transfer-related) by selecting 'question grammar' from the STUDENT MENU. They may discuss the representations in the student model by selecting 'question model' from the STUDENT MENU. The system will initiate discussion on any of the above topics if it requires information, and students are encouraged to cooperate with such requests (they are told that this ultimately results in a more accurate representation of their knowledge in the system, which will in turn enable the system to anticipate their requirements more effectively). The system will, of course, cooperate with all student requests for information.

As the classification of O'Malley and Chamot is extensive, this is a very useful starting point. However the two situations are different: the Cognitive Academic Language Learning Approach (CALLA) of O'Malley and Chamot is not computer based. In addition, Mr. Collins is (currently) designed for older (university level) students who are beginners in their foreign language, and who are not also trying to learn any specific content area (such as science or mathematics) through this language as is the case with CALLA. Therefore this is not an attempt to implement CALLA on a computer, but to use those strategies from CALLA which are relevant, and others identified by O'Malley and Chamot which are not taught in CALLA, but which students have been observed to use. Figure 1 shows which of the learning strategies identified by O'Malley and Chamot were considered appropriate for treatment in the iCALL environment. In the remainder of this section, those strategies which are either taught in CALLA but not represented in

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Mr. Collins, or those which are not taught in CALLA but are treated in Mr. Collins, will be the focus of discussion.

<table>
<thead>
<tr>
<th>LEARNING STRATEGIES TAUGHT IN CALLA</th>
<th>in Mr. Collins</th>
<th>not in Mr. Collins</th>
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<tbody>
<tr>
<td><strong>mesocognitive:</strong></td>
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<td>self-evaluation</td>
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<td>advance organization</td>
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<td>self-monitoring</td>
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<td>advance preparation</td>
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<td>(organizational planning or strategies)</td>
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<td>organizational planning</td>
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<td></td>
<td>selective attention</td>
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<td></td>
<td></td>
<td>self-management</td>
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<tr>
<td><strong>cognitive:</strong></td>
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<tr>
<td>deduction</td>
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<td>auditory representation</td>
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<tr>
<td>grouping</td>
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<td>elaboration</td>
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<td>inferencing</td>
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<td>note taking</td>
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<td>summarizing</td>
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<td>transfer</td>
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<tr>
<td><strong>social:</strong></td>
<td>cooperation</td>
<td>self-talk</td>
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<tr>
<td>question for clarification</td>
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</tbody>
</table>

Figure 1. Comparison between strategies in CALLA and in Mr. Collins

4.4. Learning strategies taught in CALLA, but not handled in Mr. Collins\(^\text{10}\): *Advance organization* involves previewing concepts and key ideas in material to be studied. This, although useful, is less appropriate for Mr. Collins, as students are not using the system in preparation for an approaching class; the language exercises in the system are (at the moment) the final point of practice. In addition, the target domain is currently very restricted.

*Advance preparation* is concerned with rehearsal of language in order to handle a task. Again, this is less appropriate for Mr. Collins, as any such preparation would have occurred before a student's use of the system.

*Organizational planning* (apart from planning of learning strategies, which is handled in Mr. Collins), is concerned with planning sequencing, parts and key ideas. Again this can be useful,

\(^{10}\) Information about these strategies is available in the system for student consultation, but their use cannot be recorded or discussed.
but the domain of Mr. Collins is currently too restricted to enable this strategy to be implemented to good effect. (This could be a good strategy to include in a future, broader version of the system.)

Selective attention is not yet implemented. It would be interesting to see which aspects of the interaction were deselected by which students in their selective attention. However, the current aim of the system is to discover the extent to which the various aspects of the system can be promoted. Once this is established it will become feasible to research whether some students have more success when using only certain parts of the system, and what type of students work well in which areas of the environment.

Self-management is not so appropriate for consideration in this ICALL system, beyond consideration of the amount of time spent using it, and selection of what to do in the system. As stated above, the current possibilities are still relatively restricted. However, this could be considered in the future.

Auditory representation is not appropriate in ICALL, as a computer system cannot access the personal, internal auditory representation the learner effects.

Elaboration is also very personal; the system cannot share all the other knowledge of a student, or guess at personal associations learners may make.

Imagery also works best if it is personal, so although students could potentially be encouraged to express their images, the system could not interpret such 'free' drawings. Indeed, there is no reason why a learner should use his time in externalising his images if imagery is working well and faster when remaining internal to the student. Pre-stored images could be offered, which the system would be able to reason about, however this would only be worthwhile if these proved to be more effective than students' own images. This is probably unlikely, at least for those learners with a more graphical orientation.

Self-talk is also very difficult as it involves mental techniques which are not accessible to the system.

4.5. Learning strategies handled in Mr. Collins, but not taught in CALLA: There are two further learning strategies which are treated in Mr. Collins, but not taught in CALLA:

Substitution is used by students, so the system must be able to identify that this occurs in order to suggest alternatives at
appropriate times. (Substitution can, in fact, be useful if the student is experiencing persistent difficulty.)

*Translation* is also used by students, thus although direct translation can be negative, and *Mr. Collins* will try to guide students away from this, it must be able to trace the use of this strategy in order to know that it has occurred.

*Summary:* some learning strategies which are taught in *CALLA* are not handled directly in the |CALL system because this is not an appropriate environment. Other strategies were not included at this stage because this is still an early investigation, and the system is necessarily limited. Such strategies may be considered in the future. Two more negative strategies, which are not taught in *CALLA* are included in *Mr. Collins.* This is simply because some students use these strategies, and |CALL system is a reasonable place to encourage alternatives.

5. **Strategy use and learning in the domain:** To illustrate how learning strategies may be relevant to students in their use of this system, an example is provided in Figure 2 below.

*System:*
Please place the pronoun 'a' correctly in:

* Neste caso venderia.

The student may be aware that there is 'something strange' about the use of pronouns in the conditional tense, but cannot remember precisely what form this takes. He therefore requests to view the grammar rules for the conditional tense. (reversing; deduction.)

*System:*
In cases where the pronoun would usually occur post-verbally, in the conditional tense it becomes an infix. Do you require further information?

- view examples
- compare to other rules
- question system
- compare to other languages

*The learner thinks that in this case the pronoun should probably be an infix, but wishes to obtain verification. His hypothesis is that a pronoun occurs post-verbally in positive main clause statements, and therefore in this case of the conditional tense, it should become an infix. His problem is that he is not 100% sure of the rule for positive main clauses. Instead of risking*

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11 This is a hypothetical interaction, though the implementation to produce it is in place.
an error at this point he chooses to question the system. (questioning; resourcing; deduction; self-monitoring.)

Student (selects):
Is the pronoun post-verbal in positive main clause statements?

System:
Yes.

The student is now sure that he knows the position of the pronoun for his conditional sentence, however he is aware that there are probably some phonetic contractions necessary, but is not sure what they are. He decides to try to work out the rules from examples he requests from the system. (resourcing; inferring.)

After receiving examples the student feels confident, and selects to enter his sentence.

Student:
Neste caso vendè-la-ia.

The student decides to note down some of the information about phonetic contractions in a new note window, to ensure that he reviews it later. (not-taking; grouping.)

Student:
PHONETIC CONTRACTIONS
before 3rd person DO pronoun:
1. leave out r, s, z at end of verb
2. put I on front of pronoun
3. add accent
e.g. venderia becomes vendè-la-ia

Figure 2. Learning strategies in use

The strategies used are recorded by the system\(^\text{12}\) to inform the student model (see Bull, Pain & Brna, 1993).

6. The system’s use of strategies: A few of the strategies are also used by the system in a manner which is obvious to the student. As well as being useful strategies for the system, this provides the student with actual examples of good strategy use. Other strategies are also used by the system, but this does not occur in a way which is transparent to the student. For example, the system uses

\(^{12}\) Students can also volunteer information directly.
inferencing in its construction of its representations for the student model, and although it will explain its resulting 'beliefs', it does not use such explanations as a focus for later discussing inferencing with the student.\textsuperscript{13}

Strategic planning is demonstrated by the system during discussion of which strategies might be useful for a student to try. For example, if a student appeared to be using an approach of trial and error, the system might suggest that he try either examining rules or examples, or that he compare with other languages (all of which are aspects of resourcing), and then discuss with the student what would be the most appropriate strategy for him (depending on the student's intuitions, and also on the types of strategy the system has observed the student to be already using). The student here receives a model of how to consider the appropriateness of different learning strategies.

Resourcing is also undertaken by the system when it is seeking explanations for the user. It may retrieve information from many of the same places as the student (for example, relevant sentences from the interaction trace, grammar rules, examples, comparison with other languages, etc.). Although the system does not explicitly describe its actions as resourcing at the time it is carrying this out, the student will see that the information presented comes from different places, and will thus be reminded of the variety of sources of information available for consultation.

Summarization is also demonstrated in system explanations. Each source used by the system is not presented in full; only the relevant parts are drawn on.\textsuperscript{14} Thus the student will see, for example, that the system only refers to that part of the previous interaction which is important to the point it is making, and does not present the whole trace. Similarly the system will only present relevant rules or examples in Portuguese, or the equivalent rules or examples in other languages, etc.

The grouping strategy is also used overtly by the system in its presentation to the student of some of the available information.

\textsuperscript{13} Although, in theory, it could. The question here is whether it is a good idea to focus on a possibly incorrect student belief as the object when explaining inferencing. Alternatively the system could use only those representations which match correct performance. This may be a matter for investigation.

\textsuperscript{14} In Mr. Collins', summarization as a learning strategy is concerned with summarization of relevant or important information, and not summarization of all available information.
example, Figure 3 shows how, if the student requests to view all twelve rules of Portuguese pronoun placement, these are retrieved from the knowledge base and presented in different areas on the screen, according to the position of the pronoun.

<table>
<thead>
<tr>
<th>The pronoun is pre-verbal in:</th>
<th>The pronoun is post-verbal in:</th>
</tr>
</thead>
<tbody>
<tr>
<td>negative clauses</td>
<td>affirmative main clauses</td>
</tr>
<tr>
<td>open questions</td>
<td>positive imperatives</td>
</tr>
<tr>
<td>certain adverbial phrases</td>
<td>infinitives</td>
</tr>
<tr>
<td>relative clauses</td>
<td>yes/no questions</td>
</tr>
<tr>
<td>subordinate clauses</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>The pronoun is an infix in:</th>
<th>The pronoun is between:</th>
</tr>
</thead>
<tbody>
<tr>
<td>future tense</td>
<td>aux. &amp; past participle</td>
</tr>
<tr>
<td>conditional tense</td>
<td>(main clauses)</td>
</tr>
</tbody>
</table>

**Figure 3. Example of system grouping (Portuguese pronoun placement rules)**

The same layout is generated for the presentation of examples of the use of these rules, and also for the presentation of a combination of rules and examples. Similarly, a learner wishing to view information about the similarities and differences between rules of different languages will receive this information separated according to these differences and similarities, as depicted in Figure 4 (examples for affirmative main clauses, for a learner who knows English, Spanish, Catalan and French).
Portuguese
Compra-os

Pronoun in different position:
Spanish
Los compra

Pronoun in same position:
Catalan
Els compra

English
He buys them

French
Il les achète

Figure 4. Example of system grouping (similarities and differences in different languages)

It is intended that separating information into groups according to some such salient feature, and presenting this information on different areas of the screen, will aid the student in his remembering of these items. It also provides examples for the student of use of the strategy of grouping.

In its maintenance of the student model the system also uses the strategy of questioning for clarification when it is unsure about which of two (or more) alternatives is the correct representation of the student's beliefs. As well as providing information needed by the system, this also offers the student a model of the strategy of questioning.

Similarly the strategy of cooperation is made transparent to the user, as the system cooperates with all student requests. It will also try to involve the student in negotiation where relevant.

7. Introducing learning strategies to students: It is, of course, not sufficient to simply implement learning strategies in an ICALL system without consideration of how the system should introduce them, or the order in which they should be introduced to students. This should depend on the student's instincts and preferences (as he has a valid point of view regarding the types of learning strategy he should use!), and also on some mechanism to guide the system's introduction of strategies if the student expresses no preference. This mechanism should take account of how likely a learner is to understand the use of the different strategies, which is likely to be influenced by those strategies already used.
Figure 5 indicates the manner in which the learning strategies are inter-linked in Mr. Collins. The links are in addition to the three-way distinction between O'Malley and Chamot's (1990) metacognitive, cognitive and social strategies; the additional categorisation was developed in order to enable Mr. Collins to more easily suggest alternative or additional strategies to students, depending on which strategies are currently used or known by the individual. Thus, a strategy within the same 'boundary' or category as another strategy which is already used (e.g., deduction and resourcing), will be easier for the system to explain and introduce to a student than a strategy from outside the boundary. Subsets within categories reflect even closer relationships between certain subcomponents, and it should therefore be even easier to move between strategies in these subcomponents (e.g., deduction and inferencing). In addition there exist three connections between less closely related groupings of strategies (marked by solid arrows). These connections indicate that although there are some fundamental differences between the groups concerned, there is some quality which makes progression from one set to another relatively easy to introduce. (This progression is not necessarily bidirectional.) The 'ease of introduction or discussion' factor is expected to coincide with ease of comprehension on the part of the student, as strategies within the same boundary, or those which are otherwise linked, are in some way conceptually closer. (This is not a psychological observation, but is based purely on intuition. The groupings are to enable this system to function usefully in its handling of learning strategies.)

![Diagram of learning strategy groupings](image)

**Figure 5. Learning strategy groupings**

Key: **underlined** = metacognitive strategies; **plain text** = cognitive strategies; *italics* = social strategies; (bracketed strategies) = less useful strategies; **CAPITALS** = categories and sub-categories
7.1. Manipulating information: The top, left-hand box of figure 5 contains three cognitive strategies concerned with the manipulation of information. Although *Mr. Collins* is able to detect when the strategy of *note taking* or *summarization* has been used, it is not able to distinguish *which* of the two strategies was used unless the student explicitly informs the system. Therefore these strategies will tend to be treated in an identical manner in the system. However it is easy to see, for example, that if a student were already using one or both of these strategies, but was not *grouping* information, it would not be difficult for the system to introduce the *grouping* strategy to this student. The reverse is less likely; the student will not be already *grouping* information unless he is already *noting* it down, or making a *summary*, i.e., if he does not *note* or *summarize* (some type of) information, what is it that he should *group*?

7.2. Assessing performance/approach: This box contains three metacognitive learning strategies, two of which (*self-monitoring* and *self-evaluation* — defined as SELF ASSESSMENT), are more closely connected to each other than they are to the third (*organizational planning of strategies*). Thus for a student who evaluates his performance against some (external or internal) measure once his work is completed, it is not a great leap to suggest that he extend this type of evaluation to the monitoring of work while it is still in progress, and vice versa. Extending this notion of assessment of performance to the assessment and planning of approaches to learning will also be relatively unproblematic, as will the reverse: moving from *organizational planning of strategies* to the SELF ASSESSMENT strategies.

7.3. Finding an alternative: The strategies in this set are all cognitive learning strategies, and are concerned at least partly with finding an 'alternative', or a way around a problem. With *transfer* in particular, this may or may not be a conscious action. Two of these strategies, *transfer and translation* (defined in sub-group **USING L1**), are L1 focused (or concerned with another L2 apart from the current target language). The other, *substitution*, is concerned directly with the target language. *Translation* is not necessarily positive, and would not tend to be encouraged. The distance from word-forword *translation* to the potentially more beneficial *transfer* of word order rules is comparatively small. *Substitution* is an avoidance
strategy, and it is therefore better to overcome the use of substitution if possible. However, if a student experiences persistent difficulties with a particular construction it may actually be useful to suggest attempting alternative solutions. A student who already uses L1 based strategies will probably grasp the idea of substitution with little difficulty. Similarly, a student who exhibits substitution could be encouraged to use positive transfer if appropriate, in order to diminish the need to substitute.

7.4. Actively seeking information: This set contains three cognitive strategies (deduction, inferencing and resourcing), and the two social strategies (question for clarification and cooperation). This is the only mixed set. It is composed of the strategies learners use when actively trying to find out more information. Acquiring one of these strategies in addition to another (already used) from this group, should be relatively simple for a student (as compared to moving from translation to cooperation, for example). The two social strategies form a sub-group: ASKING/DISCUSING, and two of the cognitive strategies (deduction and inferencing) comprise their own sub-set: WORKING IT OUT. Therefore the extension from questioning to cooperation, should be relatively easy for a student to achieve, and also for the system to explain or introduce. Likewise it is not a great conceptual jump from deduction to inferencing, or from inferencing to deduction. Although a step further away, it is also relatively easy to move between the two sub-groups ASKING/DISCUSING and WORKING IT OUT, and from either of these to the strategy of resourcing, and from resourcing to one of the strategies in either of the two sub-sets.

There are two additional links connecting strategies in the group ACTIVELY SEEKING INFORMATION with some strategies from outside this group. The first is with the NOTING strategies in the group MANIPULATING INFORMATION. Clearly, if a student has sought information in some manner (e.g. resourcing, questioning), he may usefully manipulate this information in some way. Similarly, though a different type of process, if a student has sought information he may be encouraged to use this information as a measure against which to assess his own performance. Hence the link to the metacognitive strategies of SELF ASSESSMENT in the category ASSESSING PERFORMANCE/APPROACH.
7.5. Using L2: This final group overlaps partially with two of those described above: FINDING ALTERNATIVE and ACTIVELY SEEKING INFORMATION. There are no strategies in USING L2 which are not also in either of these other two groups. Nevertheless, USING L2 is a category in its own right, equal to the other four groups described above. USING L2 is composed of learning strategies which involve using the target language directly. It contains substitution from FINDING ALTERNATIVE, and deduction and inferencing which together comprise the sub-group WORKING IT OUT, which is included in ACTIVELY SEEKING INFORMATION. There is a connection between substitution and the strategies in WORKING IT OUT, in the same way that there is a connection between substitution and the strategies in USING L1 (as described in FINDING ALTERNATIVE, above).

Finally there is an additional, bi-directional link between USING L2 and USING L1 (in FINDING ALTERNATIVE). A student who uses overwhelmingly L1 focused strategies should be able to appreciate the difference between these and the L2 based strategies, and vice versa.

7.6. Summary of motivation for groupings: This further categorisation of the strategies selected from O'Malley and Chamot (1990) is used as a means to guide Mr. Collins' management of its introduction of new strategies to students. It will still, of course, try to avoid the prompting of 'less desirable' strategies for this context, such as translation and substitution, and also take account of student preferences, but in its presentation and discussion of strategies it will base its movement around the strategy domain at least partly on the 'relative closeness' of those strategies already used by a student, to those to be introduced. In student-initiated discussion it will naturally answer the questions asked by the student, but if possible it will tailor its response to include a relevant context of 'similar' strategies already used, to those under discussion. This 'closeness' factor is a more useful guide for the system to follow than some measure of total frequency of use of different strategies, because, as Politzer and McGroarty (1985) point out, the use of a particular learning strategy may be the result of good learning behaviour, or it may indicate a simple lack of progress! In the latter case, it might be more useful to try a different strategy from those currently used.
8. Moving between strategies: A student may decide to use a new learning strategy at any time. This may be as a result of previous interactions with the system about learning strategy use (for example, after system prompts to try a particular strategy), or may be a result of the student's own (unprompted) desire to try a different approach. In this section, the manner in which the system uses the groupings between strategies (as shown in Figure 5), to help the student's selection of a useful strategy, is described. It is important to emphasise here that although the system will respond to all student enquiries, it will itself only initiate interaction about learning strategies if the student is not performing well on the language task.

As a starting point, the system determines from the learner profile or previous interactions which strategies the learner tends to use. (The learner profile is constructed by the student and system at the start of the student's first interaction (see Bull, Pain & Brna, 1995). Learning strategies are then traced as they are used (described in Bull, Pain & Brna, 1993).) The system then compares this strategy information to the O'Malley and Chamot (1990) three group classification (metacognitive, cognitive and social), to see how broad the learner's strategy use is. For a learner who wishes to broaden his use of learning strategies, but does not have any specific suggestions of his own, the following route is used:

1. A student who uses no cognitive strategies will first be introduced to those in the sub-category of NOTING.
2. A student who uses no metacognitive strategies will first be introduced to self-monitoring and/or self evaluation. This is particularly relevant if he already uses some of the strategies from the category ACTIVELY SEEKING INFORMATION.
3. A student who uses no social strategies will be introduced to questioning if his general use of learning strategies is quite broad. If the learner does not have a broad range of strategies, the system will instead try to build on those strategies already used (as described below in Figure 6).

It can be seen that it is considered important for a student to be aware of a variety of different types of strategy (though strategy use will depend partly on the individual). The choices of starting point, as described above, are explained as follows. These explanations are in terms of the further categorisation of O'Malley and Chamot's (1990) classification, as presented previously in Figure 5.
1. Cognitive learning strategies are the largest group. A learner who does not use any of these strategies\textsuperscript{15} is therefore likely to have a very low overall incidence of useful strategy use. Therefore the strategies to be suggested here must be simple to comprehend. (More complicated approaches can be left for future interactions.) The NOTING (note taking/summarization) strategies are the most obvious, as this concept is very ordinary.

2. All three metacognitive learning strategies are found in the category ASSESSING PERFORMANCE/APPROACH. It is easier to introduce the idea of the SELF ASSESSMENT strategies (self-monitoring and self-evaluation) to a student who does not use a great many learning strategies, than it is to introduce organizational planning of strategies. (If a learner does not use many different strategies, it may be less obvious how he should organise them.) It is probably also more important to initially encourage SELF ASSESSMENT than strategy planning to a student who uses a variety of strategies (but which does not include any metacognitive strategies). Strategy planning can be introduced later.

3. The social strategy of questioning is useful, and it is particularly appropriate to introduce this if a learner already uses a variety of (metacognitive and cognitive) learning strategies. Cooperation, although also useful, is harder to conceptualise as it is a two way process, and it is therefore easier to leave this until the strategy of questioning is familiar. However, if a learner uses only a limited set of strategies, it is considered more useful to build directly from those already used, as the idea of learning strategies is clearly not obvious to the student. Such a student is likely to be more receptive to a more obvious elaboration of his present approach. Questioning (and cooperation) can be introduced later, as appropriate.

The following illustrates the next stage: the system's discouragement of the more negative strategies.\textsuperscript{16} Again, this will occur only if the learner has no specific request.

1. A student who uses translation will be encouraged to substitute the strategies in WORKING IT OUT (deduction

\textsuperscript{15} This is an unlikely situation, but must be allowed for.

\textsuperscript{16} 'Negative' strategies must be included in the system and be visible to the learner if the system is to try to discourage the use of such strategies.
and inferencing), if he already uses other INFORMATION SEEKING strategies. Otherwise he will be introduced to the idea of transfer, if this is new to him.

2. A student who uses the strategy of substitution will be encouraged to use deduction or inferencing instead. If he does not wish to try either of these, the system will suggest transfer.

Figure 6 illustrates the next stages of the introduction of explanation of, and encouragement of use of learning strategies. This occurs unless the learner requests discussion of a particular strategy or set of strategies. Strategies are presented and described depending partly on those strategies already used successfully by the student. Thus, although the sequence described would be the ideal sequence for some students, others may start at a different point in the list (moving later to those higher in the list). Recall that this order is simply to provide the system with heuristics to guide its strategy selection in cases where the student does not offer suggestions of his own.

Figure 6 should be read as follows: A student who uses deduction will first be introduced to the strategy of inferencing, if this is not already used. However, if the student explicitly states that he does not (currently) wish to consider inferencing (or if he already uses inferencing), the system will instead try to introduce resourcing or the strategies in ASKING/DISCUSSING. Should the student wish to try none of these, but still be eager to find out more about learning strategies, the system will search down the list until it reaches the next strategy (on the left hand side of the figure) which the student already uses, and which contains at least one suggestion (on the right hand side) which the student does not use and has not vetoed. If the first case (for deduction) has already been passed through completely, either the student is now aware of, and maybe uses these strategies, or has decided not to consider them at the present time. Therefore the system will not try to introduce the next groups: those leading from inferencing, questioning, cooperation and resourcing. It will here move on to suggest transfer, as this leads on from WORKING IT OUT, which contains deduction, (a strategy which is used, as can be seen from the beginning of the description of this example).

There are other issues which are also taken into account in addition to the 'closeness' of learning strategies.
Figure 6. Moving between learning strategies
The student is encouraged to inform the system about things he feels he has difficulty with. For example, a student who says he thinks *too much* in terms of a background language, or demonstrates such behaviour, is directed towards the Portuguese-focused strategies. A student who considers himself bad at self-assessment, or demonstrates this by having belief measures consistently incompatible to those of the system (see Bull & Pain, 1995), is encouraged to compare his input directly with information in the expert domain model. A student who claims he forgets easily, encounters the suggestion that he should make (more) notes. A student who feels he uses dictionaries far too frequently is directed towards trying inferencing for word meanings.

Students are also encouraged to state which previous language learning experiences were good and bad for them. This information can then be matched to appropriate learning strategies. For example, a student who does not like grammar would work more from examples. A student who likes grammar and structure is offered explicit rules. A student who dislikes a too communicative bias could also be offered explicit rules. A student who dislikes teacher dominance is directed towards resourcing and questioning. A student who likes having an expert teacher available to verify information or answer questions could question the system. Note that questioning is suggested for a student who dislikes teacher dominance as well as for a student who prefers the availability of an expert teacher. In the latter case the student is questioning the system in its role of expert. In the former case the student views the system more in terms of a resource. Although effectively these are identical behaviours, the perspectives differ.

In the previous sections we have been considering how the system is able to suggest appropriate strategies to a particular student. It should be noted that in this system, although learning strategies can be presented and discussed, there is no attempt to *directly* teach the use of learning strategies. This may not always be desirable, and is an issue for further research. The aim here is to raise learner awareness of the range of strategies available, and to encourage a learner to reflect on what may work best for him as an individual. The next section describes the manner in which the system is able to take account of students' views about what might work for them.
9. Discussion of learning strategy use: In addition to viewing information about learning strategy use, students may also discuss their use of learning strategies. The example in Figure 7 is a discussion about strategies a particular student might try. This discussion may occur after system prompting, or a student request for interaction about learning strategies.

system:
As you already use deduction efficiently, you might like to try a complementary strategy: inferencing.
Do you wish to try inferencing, or find out more about this strategy?
  - try inferencing
  - no
  - find out more
  - no ( & comment)
  - (cancel)

student (selects):
find out more

system:
Deduction is based on rules
e.g. from the rule 'the pronoun is pre-verbal in negative clauses' you know that the pronoun must be placed before the verb in this context.
Inferencing is similar, but you use examples rather than explicit rules
e.g. from the example sentence 'Não os compre' you can INFER that the pronoun must be placed before the verb in this context.
You may find inferencing useful (in addition to deduction), or you may prefer to stay only with deduction, as these two strategies are not equally suited to all learners.
Do you wish to try inferencing?
  - yes
  - no
  - no ( & comment)
  - (cancel)

student (selects):
no ( & comment)

system:
Please select one of the following:
  - this does not feel right FOR ME
  - this does not feel right FOR ME
    ( & comment)
  - I would prefer to try another strategy
  - I would prefer to try another strategy
    ( & comment)
  - I would like to come back to this later
  - I would like to come back
    to this later ( & comment)
  - none of the above
  - (cancel)

student (selects):
this does not feel right FOR ME ( & comment)

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17 This is a hypothetical interaction based on the current implementation.
Figure 7. Example discussion about future learning strategy use

In this example the system suggests that since the student can already use deduction, he could also consider inferencing. This strategy has been suggested due to the link between learning from rules and learning from examples. However, it is also acknowledged that some people prefer only one of these approaches. Recall here that new strategies are suggested based on a principle of ‘ease of introduction and comprehension on the part of the student’. This is particularly important when learners are unused to the notion of learning strategies. Therefore, although a student may feel that inferencing is inappropriate for him, he is able to make an informed decision, as he understands the purpose of the strategy. The current student is such a learner, and explains that for him, rules are the
most: important thing. The system now knows not to try to reintroduce inferencing (as it would have done, had the student indicated that he currently did not feel confident enough to use this strategy). Other students at this point may be eager to try this alternative approach, as it is familiar in the sense that the mechanism of 'working it out' is similar to what they already do, but it provides an additional perspective. After suggesting that the student try inferencing, the next step (as can be seen from Figure 6) is to offer resourcing, or the strategies in ASKING/DISCUSSING (i.e., questioning and cooperation). This student already uses questioning, therefore the system offers only resourcing and cooperation. The student selects to attempt more resourcing.19

10. Summary and conclusion: This paper commenced with a review of recent literature on language learning strategies. Some of this literature is concerned with describing strategies used by students, and some concerns programmes to increase awareness of the range of strategies available. The two extreme positions are: the belief that so called 'good strategies' should be taught to all learners, and the contrasting belief that students perform best if allowed to follow their own styles. The position here is that student preferences and current approaches should be taken into account, but the trial of new strategies should also be encouraged if the student wishes, particularly if he has a very narrow strategy focus, or is performing badly on the language task. The aim is to develop greater awareness of the range of strategies available, and to help students discover strategies which will benefit them. Thus student choice remains central.

Few CALL programs incorporate information about language learning strategies, however a small number which do were described. Although these tend to be more restricted than Mr. Collins in their treatment of learning strategies, some use learning strategies to good effect. For example, although ArtCheck (Sentance, 1993) deals with only two distinct approaches to learning, it does adapt its explanations according to the student's

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18 By offering this additional information the student is also cooperating with the system despite having vetoed the system's initial choice. The student's action here was valid, as shown in his explanation. The system's record of the student's cooperation will therefore be incremented.

19 See Bull and Smith (1993) for a further example — focusing on cooperation, and for a discussion of negotiation of, and reflection about learning strategy use.
preferred approach. *MetaText* (Gillespie & Gray, 1992) is not adaptive, but its strength is in the fostering of useful skills. This illustrates the benefits of even a more limited view of learning strategies in CALL.

A deeper consideration of learning strategy use is also possible. Systems such as the above are aimed more at helping learners through specific tasks or areas of language (e.g., *ArtCheck* is concerned with English article usage, and *MetaText* with translation). The main difference between this type of system and *Mr. Collins* is that the primary aim of *Mr. Collins* is not acquisition of the domain information or high performance on a particular task (though this is, of course, also important). The main aim here is to increase awareness of language and approaches to learning in such a way that these skills can then also be used in other aspects of language learning.20 Thus, like *ArtCheck*, *Mr. Collins* will present explanations using rules or examples or both, depending on the student’s preferences. Similarly, like *MetaText* it enables note-taking and encourages the development of resourcing skills. However, because the aims of *Mr. Collins* are different from those of the above systems, the treatment of learning strategies must be broader. Fourteen strategies are handled in relative detail; *Mr. Collins* is able to interact knowledgeably21 about learning strategies in general, and to provide advice appropriate to an individual. It also seeks to promote student reflection about learning strategy use through *discussion*. Discussion occurs in menu format and is therefore limited, but the options available are designed to provoke students into thinking.

The manner in which interaction about language learning strategies occurs in *Mr. Collins* has been described to illustrate the feasibility of this type of implementation. Although a full evaluation of the system is not yet complete, initial results indicate that students will be willing to interact on the subject of learning strategies (Bull, Pain & Brna, 1993). Bull and Pain (1995) show that, in general, students are likely to welcome explicit interaction

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20 One of the claims for *MetaText* is that it should also foster more general language learning skills, however this is not the primary aim, and there is no explicit treatment of this process. *Mr. Collins* deals with a wider range of learning strategies, and aims specifically to promote learner reflection on their use and potential use of these strategies.

21 Based on declarative statements about similarities between strategies, and strategies appropriate for students with different learning preferences.
about their knowledge and learning. This was a small-scale evaluation which applied to discussion of learner beliefs about their proficiency rather than their use of learning strategies, but the form of interaction is identical, and, as with learning strategies, discussion is aimed at the promotion of reflection.

As a reminder of the role of learning strategies in the system, as stated previously the learning strategy component is activated only if the student specifically requests information, or if the system judges the student to be performing 'inadequately'. Thus, although it has an important function in the system it is not the sole, nor even the major component. Furthermore, the student's choices are considered by the system to be more important than its own recommendations, as students will inevitably have valid intuitions about the types of approach which suit them. The system's role is that of increasing awareness and offering advice. However, there is no definitive set of strategies considered ideal for all learners. It cannot be assumed that a particular strategy will necessarily be beneficial for a particular student. The student, through interaction about learning strategies, should become more aware of the approaches most beneficial to himself.

Even though this is a more thorough consideration of learning strategies than can be found in most other language systems, this is still only a first step. Other issues could also be considered for this type of system, for example: might it be possible to predict strategy preferences with sufficient accuracy, based on a learner's general beliefs about language learning? Might there be a 'natural order' in which strategies could be introduced? (See Chesterfield & Chesterfield, 1985). Could information about the student be used to predict strategy use? Oxford (1993) summarises the following possible variables on learning strategy selection: motivation, gender, cultural background, type of task, learning style, age and stage of L2 acquisition. However it is not clear whether students would actually welcome interaction on some of these issues, e.g., cultural background, gender. Another question is whether the interface, interaction, or presentation of information from various sources could be usefully varied depending on which learning strategies are preferred by a student, or, if such aspects were to be varied, whether this would work better based on direct student choice rather than system inference from learning strategy use. Another interesting future direction could be for the system to explicitly model to students the use of the learning strategies it discusses. A further
useful consideration would be more explicit interaction about the relevance of the different strategies for different language tasks.

A final aim of the system is to collect information obtained from students' use of the system; this information can then be made available to those researching learning strategy use. Extensive data on individual strategy use, typical strategy groupings, and the success of introduction of new strategies depending on those already used, can be very easily collected as the system records all strategy use, and also strategy choice and rejection by students. Clearly such information could also be usefully employed to refine future versions of this, and other systems. Thus, while the system aims to enhance students' awareness and learning, it is also a research tool observing what students do.

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