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# Handling Native and Non-Native Language Transfer in CALL: Theory and Practice

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## 1. Introduction

Not all errors made by language learners are the result of overgeneralisation of target language forms, or erroneous 'guessing' on the part of the learner. Some errors are due to (conscious or unconscious) transfer from another language. Cross-linguistic influence can in some cases be unfavourable, resulting in negative transfer, and in other cases facilitative, i.e. transfer will result in the correct form being produced in the target language. Transfer from native languages has been well documented (see Odlin, 1989 for an overview). However in some circumstances transfer may arise as a result of reference to other *foreign* languages known by a student. This non-native transfer has in general received much less attention from researchers. Examples of transfer are provided by Rivers (1983), who identified the influence of other languages in her learning of Spanish as a foreign language. This influence came not only from her native English, but also to varying degrees from four other previously learnt foreign languages (French, German, Italian and Latin). Transfer was in some cases a result of conscious attempts to facilitate acquisition through comparison with these other languages, and sometimes occurred without deliberate contemplation. Singleton (1987) describes a learner whose transfer into French came more often from his non-native Spanish than from his native English. Similarly, Kellerman (1977) noted the effect of his non-native German on his early use of Dutch, and later, the occasional interference of Dutch in his French. The present author experienced lexical and word order influence from intermediate $L_2$ Spanish to beginner-level $L_3$ Portuguese, and also $L_3$ Portuguese lexical influence in $L_2$ Spanish. The direction of transfer depended on which of the languages had recently been studied or used most frequently (i.e. the language more commonly used at the time tended to affect the one used less frequently). A similar situation occurred with non-native Arabic to

Spanish, and Spanish to Arabic lexical influence. More general examples of non-native transfer include a greater tendency towards $L_2$ English transfer to $L_3$ French, than for transfer from the $L_1$ Igbo to the French of Nigerians (Ahukanna, Lund & Gentile, 1981), and the appearance of English word order in the Swedish and German of some Finns (Ringbom, 1987). We conclude that on occasions transfer may be more likely to occur from another foreign language than from the learner's native tongue. Odlin (1989: 27) offers the following working definition:

> "Transfer is the influence resulting from similarities and differences between the target language and any other language that has been previously (and perhaps imperfectly) acquired."

The obvious (and only) method of competently dealing with the question of transfer in the intelligent computer assisted language learning (ICALL) environment is to include in a language learning system representations of other languages known by students. This information will then be available for the diagnosis of transfer errors, and may also promote learning through positive comparison, by indicating similarities between the target and other languages.

However, approaches to the development of CALL programs have not generally been able to support issues connected with transfer of the kind discussed here. Many CALL programs are still of either the simple linear or branching types, which leave little room for the consideration of cross-linguistic influence. Hypertext applications are now becoming much more common in language learning, but although these do generally allow greater flexibility, this flexibility tends to be more in the navigation of material than in the contemplation of issues such as transfer. The same could be said of most multimedia applications. What these programs lack is an ability to *reason about* the target language, which can only be achieved through separating the teaching approach from the actual material, i.e. designing the system to contain information about the target language and information about teaching strategies, such that these two types of knowledge will be independent of each other. Thus the material to be learnt in a session need not be bound to a particular teaching approach. Once this is accomplished it becomes easier to also incorporate into this framework 'outside influences' such as the possibility of transfer from other languages.

The ICALL system presented in this paper contrasts with traditional CALL programs in the following manner:

1. It maintains a model of each individual student's knowledge and misconceptions concerning the target language, which it is then able to compare with the separate expert model of the domain - to determine whether a student's input is

correct. If this input is faulty, the models are used to help identify the cause of the problem.

2. These target language rules and the student model can also be compared with independent representations of the equivalent rules of other languages in order to account for language transfer.
3. As the above elements all form separate modules, the teaching or presentation of material is not irretrievably linked to the knowledge to be acquired. This is the typical position of an intelligent learning environment; as stated above, it is this independence of components which allows the system to reason about the knowledge it contains, and hence contribute to the description 'intelligent'.
4. The system goes even further by enabling the student to request explicit comparisons of languages and descriptions of his own use of transfer from his various languages as he feels appropriate. More importantly, this system also allows the student to inspect the system's inferences about his use of transfer and his performance in general, and to suggest modifications to this information if he feels that the representations held inaccurately reflect the situation. This improves the system's ability to adapt to the student, while also increasing learner awareness.

Although the system focused on in this paper also deals with several other issues which can affect second language acquisition (overgeneralisation of target language rules, acquisition order of target rules, language awareness and learning strategies - see Bull, 1994a), it is this issue of language transfer which will be concentrated on here. In the remainder of this paper the theoretical aspect of transfer will be further assessed to justify its consideration in CALL in general, and in this implementation in particular. There will then follow a description of other systems dealing with transfer and a discussion of shortcomings, returning finally to our system, Mr. Collins: a system which was designed as a result of research findings in the area. (The name Mr. Collins actually refers to the student model component of the system. For simplicity, in this paper the name is used to refer to the system as a whole.)

## 2. The Case of $L_1$ - English, $L_2$ - Spanish and $L_3$ - Portuguese

Mr. Collins is intended primarily as a research vehicle to determine guidelines for the production of intelligent learning environments which are able to take account of real learning issues. Therefore the actual target language chosen to illustrate this approach is less relevant than the fact that language learning theories are used in the system; it is the testing of these theories in the ICALL environment (concentrating in

this paper on the issue of language transfer) which is the important factor. It is for this reason that the target language has not been not introduced earlier. It now becomes relevant, as we move on to introduce theoretical support for the manner in which transfer is handled in Mr. Collins.

The target language of Mr. Collins (in its present state) is European Portuguese; the area of Portuguese considered is that of clitic pronouns. Although this is a very restricted focus it is useful, as these pronouns are problematic for many students. It is the placement of pronouns which is most likely to be affected by transfer (see Bull, 1994b for examples of non-transfer errors). For the sake of simplification, in the discussion to follow we will concentrate on the example of a native English speaker learning Portuguese after having previously learnt Spanish.

Azevedo (1978) states that due to their knowledge of Spanish as a foreign language, students in the U.S. often exhibit transfer from $L_2$ Spanish in their $L_3$ Portuguese. Azevedo encourages direct comparison between Spanish and Portuguese in the teaching of Portuguese, to help reduce negative interference and to promote positive transfer. Similarly, Chandler (1958) urges those familiar with Spanish to investigate Portuguese through Spanish, offering explicit comparisons of orthographic variations.

As stated above, the area of Portuguese currently implemented in Mr. Collins is clitic pronouns. The rules for pronoun placement are as follows (from Benson, 1989; 1990):

1a. The clitic pronoun is *post-verbal* in:
- affirmative, declarative main clauses
- yes/no questions

The same occurs in English, the reverse in Spanish.

1b. The clitic pronoun is *post-verbal* with:
- gerunds
- infinitives
- positive imperatives

The same occurs in both English and Spanish.

2. The clitic pronoun is *pre-verbal* in:
- negatives
- open questions
- after certain adverbial phrases (e.g. ‘já’, ‘logo’)
- embedded clauses

The same occurs in Spanish, the reverse in English.

3. The clitic pronoun is *between:*

   auxiliary and past participle

   This is different from both English and Spanish.

4. The clitic pronoun becomes an *infix* between the infinitive stem and verb ending in:

   future tense

   conditional tense

   This is different from both English and Spanish.

Benson's work is very relevant to our discussion, as she aims to identify the extent of $L_1$ (English) and $L_2$ (Spanish) transfer to $L_3$ (Portuguese). That part of Mr. Collins which is concerned with transfer was designed based partly on the above rules of pronoun placement. Benson (1990) predicts that with the first rule (1a), negative transfer from Spanish would be possible, resulting in pre-verbal placement of the clitic pronoun. Correct placement could be due to positive transfer from English *or* target rule acquisition. In the case of rule 2, Benson explains correct pronoun placement with reference to target rule acquisition *or* positive transfer from Spanish, and incorrect placement could be a result of faulty analogy with English. (Incorrect placement could, of course, also occur as a result of inappropriate overgeneralisation.) Rules 1b, 3 and 4 do not permit the same possibilities for the comparison of transfer from English and Spanish, though they do not interfere with data from the other rules. Mr. Collins handles transfer (and overgeneralisation or correct production) of all the above rules except for the case of gerunds.

In her study, Benson (1989) suggests that Spanish (as $L_2$) might be responsible for a greater proportion of the answers to her test questions than English ($L_1$) - regardless of whether the responses were correct or incorrect. (These test questions were 1. grammaticality judgement questions; 2. insertion of given pronouns into the correct position in a sentence.) Benson identifies three groups of students: 11 who scored 100%, and may therefore have fully acquired and automatized the rules concerned and, if so, were not relying on their knowledge of another language at all; 9 who had correct responses where the rules of Spanish and Portuguese are identical, but who responded incorrectly where these rules differed (and reference to English would have been facilitative); 7 students who relied primarily on English (with 100% accuracy where English coincides with Portuguese and Spanish does not, and only 60% accuracy where the Spanish rule matches Portuguese, but English does not). This could suggest that different students used different transfer strategies, though Benson was unable to seek explanations of this as the tasks were performed

anonymously. Nevertheless she suggests the following possible variables: level of proficiency; attitude; aptitude and perception of similarities; interplay of the above and other factors. Whatever the reasons accounting for such differences in the occurrence of transfer, the fact that these differences are observed amongst students is sufficient to justify Mr. Collins' concern with this phenomenon. Indeed, use of the system by students of Portuguese with $L_1$ English and $L_2$ Spanish may help to resolve this uncertainty (at least in the cases of level of $L_2$ proficiency and perception of similarity of languages - see next section).

We will now review Benson's results based on a separate, but similar study carried out by the author. The study was based on 47 undergraduates' completion of four mixed pronoun placement exercises spread across five weeks (multiple choice, translation and sentence transformation tasks). These students were all beginners in Portuguese. Nearly all learners involved were native speakers of English; the few exceptions had a high degree of fluency in English. Not all learners knew Spanish, however a large majority had some knowledge. Because this second study was larger (i.e. more students + greater number of questions per student), and there were more opportunities for students to make errors, there were only two students out of the 47 who exhibited no difficulties at all with pronoun placement. Sixteen learners made placement errors fairly equally in Portuguese rules coinciding with those of either English or Spanish. Seventeen tended to complete sentences correctly in cases where the Portuguese and Spanish rules are identical, and made more errors in sentences where English coincides with Portuguese, but Spanish does not. For 9 students the reverse was true (i.e. they generally performed better in sentences where English resembles Portuguese). In 3 cases it was not possible to determine the source of an error, as these were all confined to sentences in which the Spanish and English rules are identical.

This overall result clearly matches that noted by Benson - i.e. with many students *$L_2$ Spanish may have more influence on the acquisition of this aspect of Portuguese than $L_1$ English.* This is even more striking when it is remembered that several of the learners in this study did not know Spanish, and thus biased the results towards English. However, this possibility is not intended as a claim, but is merely speculation; errors and correct sentences may also be the result of some other phenomenon (e.g. inappropriate or successful overgeneralisation of other Portuguese rules, or acquisition of the target rule). Nevertheless, it is likely that some of the recorded cases were actually due to positive or negative transfer.

## 3. Profiling the Learner's Language Background in Mr. Collins

English is the native language of most of the 47 students whose language production was studied in order to provide information for the construction of the system and, as seen above, about one fifth of these students may have been influenced primarily by English in cases of transfer. As these students are considered typical of undergraduate learners of Portuguese in Britain, English is therefore an obvious choice for inclusion in Mr. Collins. We saw in the previous sections the importance of also considering languages other than the learner's mother tongue as potential sources of transfer. Subsequent questioning of 20 of the 47 students discovered Spanish and French to be the main languages consciously referred to when learning Portuguese (Bull, Pain & Brna, 1994); hence also the inclusion of these languages in Mr. Collins. (Note that Spanish and French were referred to more frequently than English, despite the fact that most learners were native speakers of English, having Spanish and/or French as *foreign* languages. This complements the findings of the previous section.) Catalan is also represented in Mr. Collins, as the rules for pronoun placement are identical to the Spanish rules. This will enable more effective evaluation of the system if it can be tested with bilingual Spanish/Catalan students, as the rules of both native languages, which are strong candidates as potential sources of transfer, coincide.

The basic information regarding a learner's language background is obtained at the start of a student's first interaction with the system. During this initial interaction, a learner profile is constructed which can be consulted and updated during future sessions. The learner profile is composed in the following manner: the student is offered a menu from which he is requested to identify his native language(s). There follows a second menu requesting the selection of other languages known. As transfer may occur from any of these languages, it is essential that the system is able to identify the correct source of a transfer error (i.e. it must attribute any difficulty to the correct base language). Therefore further information about the learner's background languages must be obtained in order to support this identification of the appropriate language(s) from which transfer may occur.

There are two factors considered here; firstly, a learner's *proficiency* in each of his background languages. Ringbom (1983) suggests proficiency to be a determinant affecting the extent of transfer; a student is more likely to transfer from a language in which he has a higher degree of fluency. The learner is therefore asked to indicate

his proficiency in the foreign languages concerned, e.g. beginner, advanced, etc. Secondly the student is requested to state his assessment of the *language distance* between each of the languages he knows and the target Portuguese, i.e. his perception of the degree of similarity between these languages: Kellerman (1977) states that languages perceived to resemble the target are more likely to be sources of transfer. These two issues of proficiency and perception of language distance are considered together when the system is trying to identify the cause of transfer-related difficulties, or seeking to prompt positive transfer: the various native and foreign language parsers are ordered according to a principle of 'most proficient and most similarly perceived language first' i.e. the system considers the most likely sources of transfer first. As an example, imagine a native English speaker provides the information to the initial learner profile that he feels Portuguese and English to be quite distant from each other. He then informs the system that he knows Spanish to a high degree of fluency, and perceives Spanish and Portuguese as similar languages. In such a case, in later interactions the system would look for evidence of transfer from Spanish before checking English - the similarity factor here overrides the dominance of transfer from the $L_1$, as the learner's ability in the similar $L_2$ is above a certain threshold. (Of course, if later interactions were to demonstrate that for this learner *English* had greater influence, the system would adapt its strategy accordingly.) As French and Catalan are not known, these languages would be excluded from participation in all interactions in this example.

There are other issues which could be involved in transfer. Examples include: markedness, proficiency in the target language, beliefs about how best to learn a language, or the recency of learning a language from which cross-linguistic influence may occur. Such questions are outside the scope of this system but will be considered should the two issues of proficiency in background languages, and perceived language distance, later prove inadequate predictors of the source of transfer in this context. Yet other possibilities include transfer of aspects of the learner's current 'inaccurate' target language interlanguage, and also divergent interlanguages of other foreign languages. These 'non-expert rules' are also not dealt with in the current version of Mr. Collins. Indeed, although this phenomenon may occur, there is a danger that discussion of transfer of 'inaccurate rules' from within one language, or from one language to another, could ultimately be confusing for the learner.

## 4. Related Work: Approaches to transfer taken by other ICALL systems

It was stated in the introduction that most CALL programs are unable to deal with cross-linguistic influence. Nevertheless, the existence of language transfer has been considered and incorporated into the design of a number of ICALL systems: examples include the Automated German Tutor (Weischedel, Voge & James, 1978); Intelligent Language Tutoring System (Schwind, 1990). However these systems are limited as they have no separate representation of background languages, and therefore require all transfer errors to be anticipated.

Some ICALL systems do contain models of the $L_1$, e.g. Catt and Hirst's Scripsi (1990) and Schuster's VP2 (1986). However VP2 has no model of the learner beyond the rules of the native language, and therefore is only able to detect errors from this source, and Scripsi deals only with errors of overgeneralisation and transfer from the $L_1$. Wang and Garigliano's (1992) system also includes a model of the native language. Their system is based on the belief that translation exercises are one of the most powerful methods of minimising negative language transfer. While this is possibly true, as translation will reduce the student's avoidance of structures of which he is unsure, this approach must be used with caution as it could lead to greater dependency on a general translation strategy, a strategy which is less efficient for communication due to its reliance on the $L_1$. The VP2 system is also based on translation exercises.

In common with the second group of intelligent systems discussed above, Mr. Collins does not require prior anticipation of all possible transfer errors, as rules of other languages are also explicitly represented in the system. However, an advantage of Mr. Collins over these systems is its ability to take account of more than one background language simultaneously. Although Scripsi can be adapted for either French or Chinese learners of English, it does not appear that both languages can be taken into account as possible sources of transfer for an individual learner. Similarly, for VP2 it is claimed that the model of a learner's mother tongue could very easily be substituted by a different language as the native language, should the system be further developed. Again there appears to be no consideration of multiple background languages as the sources of transfer for a single learner. Wang and Garigliano's system also relies on only one language being the origin of errors. The authors justified their approach through the study of empirical data which revealed transfer to be the source of the majority of errors made by their students of Chinese. However transfer was defined as "the influence of the students' mother tongue". It may be that in this case English really is the only source of transfer for these learners or, if not, transfer from other languages is minimal, but it is not clear whether the possibility of transfer from other foreign languages has been considered. In systems

such as those of Weischedel et al and Schwind, which do not contain separate models of the $L_1$, a similar approach of 'native language only' is taken.

We are not trying to claim that the above systems cannot be useful. In many cases the $L_1$ *will* be the dominant source of transfer, and systems such as the above are designed to overcome this problem. However, there is evidence that other $L_2$s can also be a significant source of cross-linguistic influence. In some cases $L_2$ transfer may be more frequent, or may co-exist with $L_1$ transfer. Thus, the above systems may have restricted their efficiency.

## 5. Transfer and the Advantages of Mr. Collins

The significance of transfer in language learning should be clear. Having identified this, and having demonstrated possible shortcomings of existing approaches, the advantages of effective handling of transfer in CALL can be illustrated. This will be done with reference to Mr. Collins. As argued throughout this paper, it is not only the learner's native language which can be the source of (positive or negative) transfer, but also other foreign languages known. In order to account for cross-linguistic influence, in addition to the target Portuguese Mr. Collins also models learners' background languages. The advantages of this approach can be seen in the following examples. Let us return to our case of the native English speaker with a knowledge of Spanish. Imagine this learner has entered the following Portuguese sentence into the system: * *O empregado o trouxe.* The correct word order for this sentence would be: *O empregado trouxe-o* ('The employee brought it'). This type of error occurred quite frequently amongst the 47 students whose performance was studied by the author (see section 2), particularly in the earlier stages of learning. Because Mr. Collins is able to detect possible cases of transfer by using the equivalent rules of other languages in parsing the target Portuguese, it is able to recognise that although this error of pronoun placement may be due to incorrect overgeneralisation of another Portuguese rule, it may instead be due to transfer from $L_2$ Spanish, as the pronoun would occur pre-verbally in this context in Spanish. (The $L_1$ English is clearly not involved, as transfer of English word order would have resulted in correct production in Portuguese.) Thus a powerful feature of this system is that in addition to $L_1$ transfer, *Mr. Collins is able to consider the possibility of transfer from non-native languages* as a potential influence on performance in the target language. (However, it is not claimed that transfer will be the only cause of difficulties.)

A similar example, but one involving transfer from the $L_1$ English, and where the system can use the $L_2$ Spanish positively to help the student, is the following sentence entered by the learner: * *O patrão viu o empregado que trouxe-o.* The correct form of this sentence would be: *O patrão viu o empregado que o trouxe.* ('The boss saw the employee who brought it.') As with the previous example, this error may have occurred as a result of overgeneralisation of another Portuguese rule (probably that applicable in positive main clause statements, e.g. *O empregado trouxe-o*), or it may have been due to transfer from the $L_1$ English (where the pronoun would also occur in post-verbal position). In addition to challenging the student to investigate the problem himself, or explaining the error by stating explicitly that pronouns are pre-verbal in relative clauses, or offering sufficient examples for the student to infer the rule, a further option is available to Mr. Collins. This is to look at other languages with which the student is familiar and use these as a basis for positive comparison. In this case the learner knows Spanish, so the system may point out that the rule for pronoun placement in relative clauses is identical in Spanish and Portuguese. Thus the system is not only able to detect errors which may be based on transfer, but it is also equipped to *prompt positive transfer from whichever language is most appropriate* for a particular student, where this would be beneficial as an additional coaching option.

Furthermore, as the system contains this information about a student's background languages and use of transfer, the information is available for student consultation if the learner wishes to investigate the matter; i.e. *the learner is also able to take the initiative.* (Indeed, if the student disagrees with the system's assessment of his performance or its identification of the cause of an error, he is able to argue with the system - see Bull & Pain, 1995.) Examples of the type of transfer information available about an individual include:

1. an explanation of which of a learner's languages is most likely to be the source of transfer
2. a description of the sentences in which transfer has appeared, together with the language from which transfer occurred in each case
3. a comparison of sentences in which transfer occurred with sentences where it did not
4. a statistical summary of the frequency of transfer from each language
5. a description of likely transfer problems (based on previous performance and learning strategies used)
6. a general description of possible transfer (positive and negative), i.e. explicit comparison of rules of different languages

7. system suggestions of where a student may improve his performance through the use of positive transfer.

As stated previously, the current implementation of Mr. Collins is in a restricted domain, and is intended as an *example* of a system which incorporates theoretical knowledge about language transfer to aid learners in their acquisition of a foreign language. (This does not, of course, prevent the system from being useful and usable.) The system can be used as the basis for the design of other systems with similar concerns; there are many other cases where it would be useful to consider multiple background languages as potential sources of transfer. For example, an obvious area to consider in different languages is the lexicon, as lexical influence appears to be the most common type of non-native cross-linguistic influence (Ringbom, 1987). Another possibility for our case of $L_1$ English, $L_2$ Spanish and $L_3$ Portuguese is the differing contrast between *ser* and *estar* in Spanish and Portuguese (Benson, 1989; 1990). A similar example for other languages is comparison between the use of English *do/make,* German *tun/machen* and Dutch *doen/maken* (described in Nehls, 1991). Word order difficulties may arise, for example across some Germanic languages (e.g. Platzack (1986) illustrates some differences in the ordering of the infinitival marker, infinitival verb and sentence adverbial in infinitival phrases in Scandinavian languages, and also describes similarities and differences of word order in normal subordinate clauses between German and Dutch, which differ from Danish, Norwegian and Swedish, which, in turn, differ from English and Icelandic). Although the simple existence of such similarities and differences neither guarantees transfer, nor implies that transfer will be probable, it is nevertheless possible that a knowledge of some combination of these languages could influence a student, and could also be used by an ICALL system to help a student in his learning of a further language from this group.

## 6. Summary and Conclusion

This paper has emphasised the importance of transfer in second language acquisition; moreover it has highlighted the role played by other foreign languages in addition to the learner's native language. Attempts to deal with transfer in various ICALL systems were discussed, concluding with a description of the advantages of Mr. Collins, a system which is unusual due to its ability to handle transfer from more than one background language.

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