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# The Role of Corrective Feedback in Second Language Learning: New Research Possibilities by Combining CALL and Speech Technology

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## Abstract

The role of corrective feedback (CF) is debated in second language acquisition (SLA). It has not been unequivocally shown that CF is effective in SLA, in particular not in the case of on-line processing, as in oral second language (L2) proficiency. This might be because, to date, it has not been feasible to create appropriate research conditions. We claim that these problems can be alleviated by resorting to a computer assisted language learning (CALL) environment in which learners receive CF individually, on spoken output. Learner output is analyzed using automatic speech recognition (ASR). In the project FASOP (Feedback on Syntax in Oral Proficiency) we intend to use an ASR-based CALL system to generate different types of CF and to test their effectiveness. The central question in this project is whether CF on syntax contributes to the development of oral proficiency when it is provided under near-optimal conditions.

**Index Terms:** corrective feedback, speech technology, second language acquisition, CALL

## 1. Introduction

The recent developments in the field of language and speech technology have led to a growing interest in developing more advanced CALL systems that can offer opportunities for language learning beyond the language classroom [1]. In developing such systems, not only the technological options and possibilities need to be considered, but also the lessons learned from many years of research in SLA [2,3] need to be taken into account. Thanks to initiatives such as ‘Speech and Language Technology in Education’ (SLaTE, [www.sigslate.org](http://www.sigslate.org)), CALICO (<https://www.calico.org/>), etc., cross-fertilization between the two fields is gaining ground. In prevalence, the exchange of information goes from SLA to CALL, in the sense that SLA expertise informs the development of CALL systems. However, an equally important form of cross-fertilization would be to implement CALL systems to advance research in SLA.

In this paper we present such a form of interaction by implementing CF in a CALL system to test its role and effectiveness in SLA. First, we provide a review of the numerous studies that have addressed the topic of corrective feedback in SLA (section 2). In section 3 we summarize the main problems that still need to be solved to gain insight into the role of corrective feedback. In section 4 we explain how a CALL system can offer new possibilities of studying the effect of corrective feedback in SLA, and in section 5 we propose a new approach to investigate CF that makes use of an ASR-based CALL system to enable research under near-optimal conditions.

## 2. The role of corrective feedback in second language acquisition

The role of CF is disputed in SLA [4, 5]. In first language acquisition (FLA), CF does not seem to play a significant role. Children successfully acquire their first language (L1) through social interaction, and seemingly without conscious effort. Language acquisition, therefore, is argued to be a process that takes place implicitly while receiving language input.

In line with this view, SLA has been taken to proceed in similar fashion. Krashen’s [4] influential Input Hypothesis proposed implicit learning from exposure to comprehensible input was sufficient for fully acquiring an L2. Moreover, he argued that consciously processed language input, such as explicit instruction or CF, would not increase L2 proficiency. As a result, CF was considered to be irrelevant for SLA.

Krashen assumed that implicitly and explicitly learned language knowledge remain separate (the no-interface position). However, other researchers claimed that explicit knowledge can influence, or transform into, implicit knowledge (weak or strong interface position). According to this view, CF may be effective in adult L2 learning.

Currently, there is a renewed interest in the effect of form-focused instruction and CF on language acquisition. A reason is that the level of ultimate L2 attainment varies enormously between learners in all contexts [6], suggesting that implicit learning from language input is insufficient. For successful adult SLA, it may be necessary to consciously learn certain features of the target language, for instance through CF. So far, however, it proves difficult to assess the effect of CF on language acquisition. Below we discuss the important issues in SLA on CF.

### 2.1. Input

In early childhood, it is unlikely that cognitive development is sufficient for conscious language processing, thus acquisition of the L1 must be largely an unconscious process [7]. The role of conscious processing in FLA is therefore likely to be marginal. If SLA is assumed to function in the same way as FLA, then interaction and language input should be sufficient for learning an L2.

However, empirical evidence suggests that language input alone is not sufficient (e.g., [8]). Adult L2 learners often do not reach full mastery of the target language, despite sufficient language input (full immersion in L2 surroundings) and motivation (e.g., [6]). This may be caused by biological factors, social factors, interference with the previously acquired L1 [9], or a combination of all three. Apparently, for adult L2 learners, exposure to the target language does not automatically lead to full acquisition of the L2: at varying points, their interlanguage stops developing. Comprehensible language input alone is not enough for successful adult SLA.

## 2.2. Output

As a reaction to Krashen's emphasis on input, several SLA researchers pointed to the importance of output in SLA. Relevant in this respect is Swain's output hypothesis [8] which emphasizes the role of output in L2 learning. Producing output plays a direct role in enhancing fluency by turning declarative knowledge (knowing that) into procedural knowledge (knowing how) [10]. The functions of producing output can be: noticing 'gaps' in L2 knowledge, hypothesis testing, activating metalinguistic awareness, and enhancing fluency. In other words, producing language output can have a substantial role in transforming explicit knowledge into implicit knowledge.

## 2.3. Noticing

Schmidt's [11] 'noticing hypothesis' underlines that awareness of discrepancies between the learner's output and the L2 is necessary for the acquisition of a specific linguistic item. For instance, some features of the target language (e.g., grammatical functors) may be greatly reduced in the speech of native speakers and may be hardly perceptible for L2 learners, or may be non-salient because they are semantically redundant [12], causing learners to miss them in their input. It is presumable that some features are not noticed by speakers who are communicatively driven. In interaction, for example, the interlocutor may only break the flow of conversation to correct an error if he/she does not understand the meaning of the speaker. Since exposure to L2 will not automatically guarantee this kind of awareness, CF must come into play to bring learners to focus on language-specific and individual problems and (indirectly) stimulate them to attempt self-improvement [13,14].

## 2.4. Corrective feedback

The limitations of naturalistic approaches to SLA and the renewed emphasis on the role of awareness in SLA spawned numerous studies on the effectiveness of different forms of CF (e.g., [15, 16, 17]). On the whole these studies indicate that (1) corrective feedback, from either teachers, peers, or native speakers, triggers adult learners to notice the discrepancies between their output and the L2 [13], that (2) CF is more effective for SLA than language input alone, and that (3) explicit feedback may be more effective than implicit feedback. This was found both in interaction [15], and in classroom and laboratory studies [16]. However, due to many variable factors that may or may not determine the outcome of adult SLA, it has proven to be very difficult to draw firm conclusions about effectiveness of teaching methods [16]. Variability between studies and uncontrollable variables within studies weaken the conclusions, and the separate studies are difficult to combine to collectively point to one conclusion. Major difficulties are variability among learners, manner of providing CF, setting, and methods of determining CF effectiveness. In the following subsections, we look at these variables more closely.

## 2.5. Types of corrective feedback

Corrective feedback can be broadly defined as responses to learner utterances that contain an error. Different types of feedback presumably have a different impact on the acquisition process. Lyster & Ranta [17] distinguish six types in their often-cited classroom observation study:

1. *Explicit feedback*: teacher provides the correct form and clearly indicates that what the student said was incorrect.
2. *Recasts*: the teacher's reformulation of all or part of a student's utterance, minus the error.
3. *Clarification requests*: question indicating that the utterance has been misunderstood or ill-formed and that a repetition or reformulation is required.
4. *Metalinguistic feedback* contains either comments, information, or questions related to the well-formedness of the student's utterance, without explicitly providing the correct form.
5. *Elicitation*: teachers try to elicit the correct form by asking for completion of a sentence, or asking questions, or asking for a reformulation.
6. *Repetition*: the teacher's repetition, in isolation, of the erroneous utterance.

Types (2) and (6) give feedback implicitly, it is up to the learner to notice that an error was made, the other types are explicit in indicating that an error occurred. The interpretation of the distinction is related to the setting of the feedback, e.g., an implicit recast may be argued to be explicit in formal classroom settings [18]. Additionally, intonation and visual cues accompanying CF delivery should be taken into account.

In analyses of CF in the classroom, recasts turned out to be by far the most frequent technique for error correction [14, 17, 18], especially in communicative contexts, because they cause less learner anxiety and do not disrupt the flow of communication. However, because they are so discrete, recasts may go unnoticed [19].

Clarification requests, metalinguistic clues and elicitation, are so-called negotiation of form techniques, collectively called prompts. They indicate that an error was made without providing the correct form. These feedback moves are considered to be effective because they induce learners to reprocess their output, and to produce "pushed output" [8, 10], but have been criticized because they would contribute to explicit linguistic knowledge and not to competence, as will be explained in section 2.7.

Although the numerous studies on types of feedback and learner uptake have produced mixed results [16], there are indications that explicit CF is more effective than implicit, potentially ambiguous CF [20], that CF does not work when it is erratic and inconsistent [21], that CF should be intensive [22], that it should be appropriate to learners' readiness [23], and that it should provide opportunities for self-repair and modified output because these induce learners to revise their hypotheses about the target language [13, 14, 17]. In general, it is extremely hard to meet these conditions in natural interactions or in classroom situations.

## 2.6. How to measure effectiveness of CF for acquisition

In classroom observation studies, learners' reactions to feedback have often been used as indicators of CF effectiveness: uptake, intake, and repair. Since the learner reacts to the feedback, it is assumed that he or she has consciously noticed it. However, the learner may not have noticed the error, but simply repeat the teacher, or, a learner may not respond, while understanding the error (see [18] for a discussion).

As a result, many experimental studies resort to comparing pre- and post-test scores. A problem with these tests is that they have to be very carefully designed to address specifically implicit or explicit knowledge. For instance, as [24] notes, several studies investigating the effectiveness of implicit

versus explicit feedback used the kinds of tests that favoured the use of explicit knowledge. Since implicit knowledge is said to underlie language proficiency, CF effectiveness should be measured for impact on implicit knowledge. Moreover, delayed post-tests are needed to determine whether the effect of CF is durable.

## 2.7. Explicit and implicit learning

In cognitive psychology, it is found that implicitly learned knowledge is stored in a different area of the brain than explicitly learned knowledge [5]. Implicit knowledge underlies language proficiency, since it is automatized and allows for rapid processing; explicit knowledge, on the other hand, is knowledge that learners are aware of and is available through controlled processing [7]. Consciously learned knowledge does not apply to online processing of language, but only reflectively, if time and working memory are available. To raise L2 proficiency, therefore, language learning should aim to increase a learner's implicit language knowledge.

Several researchers maintain that consciously learned, explicit knowledge can be converted into implicit knowledge (e.g., [5]). If learners' attention is explicitly directed to features of the L2, this knowledge will first be stored as explicit knowledge, but may under specific circumstances become implicit knowledge, for instance by applying explicit knowledge in production [10]. This view is based on evidence from skill-acquisition research, where explicit, declarative knowledge of a skill is converted to implicit, procedural knowledge through practice [25]. The relevance of skill-acquisition theory for L2 learning is suggested in [26]. In this fashion, it can be argued that providing learners with explicit instruction and CF can increase their level of L2 proficiency.

## 3. Necessary conditions for CF research in SLA

In the previous sections we have reviewed the issues that make it difficult to draw firm conclusions on the role of corrective feedback in SLA. From the findings presented above, several characteristics that are necessary for effective CF stand out. For a learner, CF must be unambiguous, understandable, detectable, and short: this implies that learner proficiency level and literacy level must be taken into account. Preferably, what is needed is individualized attention to the learner, consistent focus on one type of error at a time over a period of time, intensive treatment, and consideration of the learners' developmental readiness.

In classroom settings, it is very difficult to realize these demands. Moreover, teacher's CF is said to be generally inconsistent, ambiguous, arbitrary, and idiosyncratic [27]. When groups are under study, it is difficult to determine what each learner is paying attention to, or picking up, during instruction. For this reason, it is difficult to argue that classroom observation studies give much insight into the effectiveness of CF. In addition, feedback can be expected to be most effective in individualized settings, where individual variation can be taken into account.

When testing for CF effect, it must be certain that implicit knowledge is targeted. In several studies, pre- and post-tests favoured the use of explicit knowledge [24]. Therefore, a research paradigm should be adopted in which the use of explicit knowledge is minimized.

To recapitulate, it has not been convincingly shown that CF is effective in SLA, in particular not in on-line processing

like oral L2 learning. The evidence accumulated so far suggests that this might be because it has hitherto not been possible to create appropriate conditions to offer CF that is systematic, consistent, intensive, and clear enough to be perceived as such, that takes account of developmental level and learning style, and that provides opportunities for self-repair and modified output [28].

## 4. Improving research conditions using CALL systems

The problems in the CF research mentioned above could be partly alleviated by resorting to a CALL environment where CF is provided individually. To date, different CALL systems have been used for SLA experiments (see e.g., [29]), and for studying the role of CF in particular (e.g., [30,31]).

CALL systems offer several advantages for research on CF. Learners interact one-on-one with the system, allowing it to provide immediate, clearly defined, consistent feedback on all learner utterances. The CALL system engages learners more intensely, and can motivate them to achieve a 'perfect score'. Additionally, scores on tasks and developmental progress can be logged by the computer. This gives the possibility of optimizing the program to learner preferences or developmental readiness. For research purposes, all data, such as learner output, and reaction times in response to tasks can be logged and analyzed.

In general, the CALL systems used so far use written input, even if they investigate oral skills [32, 33]. But writing is assumed to employ explicit L2 knowledge, while to address implicit knowledge it is necessary to study on-line performance as in speaking. The difficulties in non-native ASR [34] might have hampered the development of CALL systems that can handle L2 speech. However, recent advances in ASR and insights into SLA suggest new possibilities of applying ASR in CALL systems to the benefit of SLA research. An advantage of using a CALL system that makes use of ASR is that it is possible to analyze spoken output from the learner and to provide appropriate feedback on-line. This is particularly interesting because it allows minimizing the use of explicit knowledge.

## 5. An ASR-based system for studying the effect of CF on oral proficiency

In the project FASOP (Feedback on Acquisition of Syntax in Oral Proficiency) we aim at meeting the criteria of optimal CF research. The CALL system used employs ASR to analyze learner output and to provide systematic, clear, consistent, CF on syntax in oral performance. The learners engage individually in dialogues with a virtual language tutor, receive CF on incorrect utterances and can provide modified output. Crucially, the learners must provide spoken answers. By using an ASR system that is trained on non-native speech, and constraining learner output, the L2 utterances can be recognized with high precision. The FASOP project will make use of technology that is being developed in the project 'Development and Integration of Speech technology into Courseware for language learning', (DISCO) [35].

Various experiments are envisaged in which the effect of different feedback moves is investigated: a) prompts (in the form of metalinguistic clues) and b) explicit and c) implicit recasts (see section 2.5 above). In addition, the system can adapt to the learner and choose the feedback form that appears to be more beneficial.

All learner-system interactions are logged to enable analyzing the learners' reactions to CF. In addition, pre- and post-tests are envisaged to study the effect of the CF received in our CALL system on speaking performance in normal, human interaction. Performance of a test group and a control group will be judged by human raters and compared. A delayed post-test will make it possible to establish whether the effect of CF holds and is conducive to actual learning.

The approach chosen in this project indicates how CALL and SLaTE can offer new opportunities for SLA research. In turn, new insights in SLA can inform the development of better CALL systems and SLaTE. In this way a virtuous circle can be established in which these fields profit from each other and lead to increased knowledge and better language learning systems.

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