



Categorizing Software Feedback in Current Language Software

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Abstract— Through the integration of the linguistic and computer science perspective of corrective feedback, this paper seeks to examine the forms of feedback present in current CALL software. This paper expounds on the Behaviorist, Cognitivist, and Constructivist learning perspective present in current language learning software.

Keywords—input, language production, Corrective Feedback, adaptability, Computer Assisted Language Learning, feedback

I. INTRODUCTION

Feedback has a variety of meanings, which stem partly from Instructional Design, and are partly related to traditions within the fields of computer science and linguistics. There are many areas between these fields that the perspective on feedback differ and many areas where the perceptions overlap.

This paper seeks to examine these overlapping similarities as well as differences. Based on this analysis, the forms of feedback present in current language learning software systems will be categorized. These categories might be used as the basis for communication between computer specialists and linguists, when it comes to the design of teaching and training systems for language learning.

A. Feedback Definition

When it comes to language learning, feedback is one of the most important instructional elements. In the field of linguistics, feedback is often referred to as Corrective Feedback (CF). CF points out errors in learners' language production and contrasts it with the target language production (Ellis, Loewen & Erlam, 2006).

From a computer science perspective, feedback is examined within a software system and is measured in relation to the level of user awareness the system has. This level awareness is often referred to as "adaptability". Dumsloff (1994) maintains that an adaptive system be flexible in regard to learner's input and development changes (Martens, 2004). One way that a system would display this flexibility is by adapting the feedback to the needs, repeat mistakes, problem solving strategies, and understanding of the content demonstrated in the user's input (Brusilovsky (1998) as referenced in Martens, 2004). Similarly, CF is also seen as highly user/learner centered. The use and form of CF is often changed in relation to a learner's "cultural background, previous and current language learning experiences, or proficiency levels" (Schulz (2001), Gass & Lewis (2007) referenced by Lyster, Saito, & Sato 2013)".

The goal of CF and feedback within a software system are the same- the correction of errors. From a linguistic perspective, there is much deliberation as to how or why error correction is achieved.

B. Feedback Forms

In the field of linguistics, Corrective Feedback can come in one of the following forms (See Table I). Nicholas, Lightbrown & Spada (2001) define Metalinguistic clues as a "direct comment or question related to the well-formedness of the learner's utterance" An example of this would be the CF speaker (teacher, or peer) responding to a learner language production by saying "the noun is masculine not feminine".

In Explicit CF the speaker indicates that the learner's language production is incorrect and gives the correct form. An example of this might be a learner says "at Tuesday" and the CF speaker might say "We wouldn't use "at" but "on Tuesday". Similarly, a Recast is when the CF speaker repeats all or part of the learner's incorrect language production correctly without explicitly saying it is incorrect. An example of this may be a learner saying "Como estas usted?" and the CF speaker saying "esta".

In Explicit CF the speaker indicates that the learner's language production is incorrect and gives the correct form. An example of this might be a learner says "at Tuesday" and the CF speaker would say "We wouldn't say "at" but "on Tuesday". Similarly, a Recast is when the CF speaker repeats all or part of the learner's incorrect language production correctly without explicitly saying it is incorrect. An example of this may be a learner saying "como esta?" and the CF speaker saying "estas".

In Elicitation the CF speaker "elicits a reformulation from the student by asking questions" (Nicholas, Lightbrown & Spada 2001). An example of this would be the CF speaker saying "Wie sagt man "run away" auf Deutsch?". Repetition could be the CF speaker repeating the incorrect language utterance and indicating implicitly the part of the language production that is incorrect. For example, the speaker might say "she go to the store" and change their intonation when they repeat the "go" (Nicholas, Lightbrown & Spada, 2001). In contrast, Russell (2009) describes paralinguistic cues as a "gesture, tone, and facial expression" used to indicate an error in the learners' production". For example, the CF speaker may raise their eyebrow when they hear an error in the learner's language production. A Clarification request would be the CF speaker

using questions like “Sorry, what did you say?” “Pardon?” (Nicholas, Lightbrown & Spada, 2001).

There is much variance among linguistic researchers as to which forms of CF are more implicit or explicit in nature (Yang & Lyster 2010), as well as which forms are classified as “Prompts” or “Reformations” (Lyster & Saito 2010). There is additional debate among linguists as to which CF forms encourages or effects implicit or explicit knowledge (Ellis, Loewen & Erlam, 2006, Russell & Spade, 2006). Finally, there is much debate within the field of linguistics as to which CF forms are more or less effective at achieving the goal of error correction and language acquisition (Ellis, Loewen & Erlam, 2006).

Despite this deliberation among linguists over how and why CF is effective, how CF forms should be classified, and which form is less, least, more or the most effective, there is overwhelming evidence as to the effectiveness of CF in the language acquisition process and error correction (see Ellis, Loewen & Erlam, 2006)

TABLE I.

Forms	Feedback Forms	
	Example	Research
Metalinguistic Clue/Feedback	“the noun “Park” is masculine not feminine”	Ammar & Spada (2006); Ellis (2009); Loewen & Nabei (2007); Ellis, Loewen & Erlam (2006); Yang & Lyster (2010); Lyster, Saito & Sato (2013); Hall (2007); Hernandez & Reyes (2012)
Explicit Correction	“We wouldn’t say “at” but “on Tuesday”	Lyster, Saito & Sato (2013); Hall (2007); Hernandez & Reyes (2012)
Recasts	<u>Learner:</u> Como estas usted? <u>CF-Speaker:</u> “esta”	Ammar & Spada (2006); Ellis (2009); Ellis, Loewen & Erlam (2006); Loewen & Nabei (2007); Yang & Lyster (2010); Lyster, Saito & Sato (2013); Hall (2007); Hernandez & Reyes (2012);
Elicitation	“Wie sagt man “run away” auf Deutsch?”	Yang & Lyster (2010); Lyster, Saito & Sato (2013); Hernandez & Reyes (2012)
Repetition	“She <u>go</u> to the store” *intonation change on “go”	Yang & Lyster (2010); Lyster, Saito & Sato (2013); Hall (2007); Hernandez & Reyes (2012);
Paralinguistic Signal	*raises eyebrow when hears error	Lyster, Saito & Sato (2013); Hernandez & Reyes (2012)
Clarification Request	“Sorry, what did you say?”	Loewen & Nabei (2007); Yang & Lyster (2010); Lyster, Saito & Sato (2013); Hall (2007); Hernandez & Reyes (2012);

Figure 1. Example of CF forms

C. Feedback Delivery

There are many differences between computer science and linguistics as to who delivers feedback. In linguistics CF can either be given to a learner by the teacher/instructor, peer or the learner to themselves. (Hernandez & Reyes 2012). Lyster & Saito & Sato (2013) expound on how the feedback learners receive from their peers “positively correlated with L2 development scores”. In contrast, feedback in the field of computer science field, is given to the user only by the software. Within the field of Computer Assisted Language Learning (CALL) we can see an overlapping of these differences in feedback delivery.

Within modern CALL, there are the categories of Computer Mediated Communication (CMC), Computer Supported Collaborative Learning (CSCL), and Network Based Language Training (NBLT).

CMC connects the user, instructor, content and assessments (Stockwell & Tanaka-Ellis 2012). It is often understood as the use of forums, blogs, emails, Skype or instant messenger programs to connect users (Blake 2011). Overall, CMC is seen as a platform for user-user interaction. In CMC the user can experience feedback from a teacher or peer.

The difference between CSCL and CMC lies in the difference between connecting users over a platform and the collaboration of users over a platform. CSCL is a platform over which users collaborate. In CSCL users receive feedback from peers, teachers, and software systems as well (see Martens, 2004). NBLT is the connection and communication between the computer and user over a local area network. (Chapelle 2001). Feedback within NBLT is primarily by the software. Although some NBLT software have been found to include CMC aspects.

D. Feedback Problems

In both computer science and linguistics there arises many issues as to the effectiveness of feedback.

In the field of linguistics, one issue is the difference of CF use and effects in classroom and laboratory settings (Lyster, Saito & Sato, 2013). Equally, Lochtman (2002) points out how CF forms are dependent on the activities done within a classroom and vary accordingly. Schmidt’s (1990) “noticing principle” argues in favor of CF due to its ability to draw learner’s attention to their learning process. However, Lyster, Saito & Sato (2013) argue that “it is difficult to claim that learning follows noticing or is dependent on noticing” (Mackey, 2006 referenced in Lyster Saito & Sato 2013). The research by Paul Lennon (1991) as to the complexity of defining what constitutes an error in language production also points to further difficulties in CF research. Consequently, Hernandez & Reyes (2012) expound on how the ambiguity or unsystematic nature of CF or a teachers’ use of CF, lead to problems or inconsistencies in the effectiveness of CF. Hall (2007) expands on the concept of ambiguity and inconsistency with her assertion that it is often the teacher, and only the teacher, who decides what language production needs to be corrected or recasted, as well as “what counts as correct or sufficient responses”.

Ellis, Loewen & Erlam (2006) drive the point home with their defense of Carroll's (2001) "autonomous induction theory". This theory argues that CF is only effective when the "the corrective intentions of the feedback are recognized by the learner". Finally, Ellis (2009) expounds on how feedback varies in its consistency and form based on whether the teacher want to focus on fluency or accuracy in language production.

E. Education Frameworks

Behaviorist, Cognitivist and Constructivist learning theories can be found in both linguistic and computer science research in regard to feedback.

Skinner's (1968) research into "drill and practice integrated learning systems" pointed to a "stimulus/response feedback loop" managing the scaffolded content within a software system. The goal of feedback given in these systems was accurate repetition of content by the learner and the use of feedback was to maintain this accuracy (as referenced in Niederhauser & Stoddart, 2001). Egenfeldt-nielsen (2006) further describes how feedback within Behaviorist modeled software systems is based on a system of punishment and reward- punishments for incorrect input and rewards for the correct user input. Consequently, feedback that adheres to this Behaviorist learning model is solely related to the "correctness" of learner/user input.

Behaviorist learning theory within linguistics focuses on the prevention of errors within language production (Bitchener & Ferris, 2012; Ellis, 2009). The selection of a CF form, according to a Behaviorist learning model, focuses on speedily providing "correct responses" (Russell, 2009). However, when it comes to computer science, simple correction and feedback mechanisms, based on the Behavioristic learning theory, are comparably easy to be realized in a computer-based teaching and training setting.

Cognitivist learning theory manifests itself in software systems by the prevalence of scaffolded content that promotes higher order thinking. Interestingly, in computer-based settings, these manifestations often mimic Bloom's (1956) Taxonomy of learning, which is an integral part of linguistics' view of the adaptation of Cognitive learning theory.

Similarly, linguists that adhere to cognitivist learning theories on language acquisition will use CF forms that they believe best "activate internal processes such as attention and rehearsal" (Ellis 2009). These linguists often adhere to the noticing principles of Schmidt (1995) and Long (1996) (As referenced in Lochtman 2002). A great portion of CF research is focused on which form of CF stimulates these cognitive processes (Panova & Lyster (2002); Sheen, (2004); Iwashita, (2003); Mackey, Oliver, & Leeman, (2003); Philp, (2003) referenced in Ellis, Loewen & Erlam, 2006).

Software systems that adhere to constructivist learning theory allow users to discover, manipulate and explore content within the system (Hogle, 1996, referenced in Niederhauser & Stoddart, 2001). One common example of this is the construction of a micro-world within a software

system (Egenfeldt-Nielsen 2006). However, compared to the Behavioristic based approaches, these systems often rely on an expert knowledge base or another form of background knowledge in the computer – and thus, they are not quick and easy to implement in a software system.

In linguistic, those that adhere to constructivist learning theories rely on peer CF in addition to teacher and self CF. They argue that peer CF allow learners to work collaboratively (Lyster, Saito & Sato, 2013). Subsequently, this perception of feedback overlaps with computer science. Clark & Martinez-Garza (2012), describe the constructivist learning theory as being evident in collaborative peer-peer interactions within a software system (referenced in Steinkuehler, Squire, & Barab, 2012).

II. ANALYSIS OF CALL SOFTWARE

With the variation in perspectives of feedback between the fields of computer science and linguistics, we sought to investigate further ways that these perspectives overlap. Since CALL seems to be at the cusp of these two fields, we desired to investigate feedback within these software systems. In the following sections we will expound on the investigation of modern CMC, CSCL, and NBLT software systems and the forms of feedback evident in these systems.

A. Research Questions & Categorizations

With the variation in perspectives of feedback between the fields of computer science and linguistics, we sought to investigate further ways that these perspectives overlap. Since CALL seems to be at the cusp of these two fields, we desired to investigate feedback within these software systems. In the following sections we will expound on the investigation of modern CMC, CSCL, and NBLT software systems and the forms of feedback evident in these systems.

Through a systematic investigation of current CALL programs from various academic and educational sources, a list of 69 software systems was compiled. From this investigation of the software systems we sought to answer the following questions:

1) *What forms of feedback are evident in current language learning software systems?*

2) *How do these feedback forms relate to CF in the field of Linguistics?*

In order to differentiate the forms of feedback evident in the CALL software systems, we first had to divide the feedback based on the system's awareness of the user. We used the labels "No User Awareness" of "User Awareness" to differentiate between software systems that had and didn't have user awareness. We further categorized the software systems with "User Awareness" by determining if the systems' feedback was "immediate" or "accumulated". Then, the CALL software systems were analyzed further to determine what specific forms of feedback were found in each of these categories.

The following section expounds on the forms of feedback found in the CALL software systems including their categorizations. Additionally, it provides an

explanation of evidences of CF within these software systems.

B. No User Awareness Categorization

The first forms of feedback we analyzed were instances within software systems with “No User Awareness”. These feedback forms required no action or input from the user. Overall, 40.58% of the software systems had no awareness of the user. It should be understood that only 8.70% of the software had no user awareness whatsoever. The remaining percentage had aspects of the software system that had user awareness AND aspects of the software system that did not.

Of the 69 software systems investigated, 26.09% gave “Translations” as a feedback form. Here, the system provided a translation of a word, phrase, or sentence without requiring user action. These translations often came with a pronunciation of the word, phrase, or sentence or a sound clip that played without user action within the system. In total, one third of the systems received a label of “Audio”.

Additionally, 11.59% had “Explanations”. Often these explanations were related to grammar rules, cultural differences, or idioms. In several cases they appeared in the context of a CMC system and were posted or discussed user-to-user. See Table II for examples of each form of feedback found in the software systems.

TABLE II.

User Awareness	Feedback Examples	
Immediate	Example	Software
Explanation	* clicks answer 	<i>Rocket Languages</i>
Translation	*clicks on “ist”, 	<i>Mondly</i>
Audio	*clicks audio icon 	<i>Transparent Languages</i>
Hints	“he r _ e _ y drinks vodka”	<i>Exceller</i>
Answers		<i>LinguaLeo</i>
Accumulated		
Goal		<i>Drops</i>
Progress		<i>Memrise</i>
Knowledge		<i>Rosetta Stone</i>
Leaderboard		<i>DuoLingo</i>

User Awareness	Feedback Examples	
Immediate	Example	Software
No User Awareness	Feedback Examples	
Explanation	“Generally Eastern Turks are more conservative ...when saying goodbye to	<i>Hands on Turkish</i>
Translation		<i>Babble</i>
Audio	*Music plays if user answered incorrectly	<i>Cant Wait to Learn</i>

Figure 2. Examples of CF within CALL Software

C. User Awareness: Immediate Categorization

Of the software systems analyzed, 91.30% had awareness of the user. Software system’s feedback characterized as “Immediate” required user input before the feedback was given. Of the software systems investigated, 79.71% gave immediate feedback to the users.

In total, 37.68% of the systems investigated had “Explanations”, 21.74% had forms of “Audio” Feedback and 5.80% had instances of “Translation” immediate feedback within software systems with user awareness. Within these examples of “Explanation” feedback we found Metalinguistic clues/feedback, Explicit CF, and Recasts. We additionally found these instances of Metalinguistic clues, Explicit CF and Recasts in systems with “no user awareness” explanations that occurred in CMC systems. In these cases, it was not the system that provided these forms of CF but other users. The “Audio” feedback was often a recording of a dialogue or a pronunciation of a word, phrase or sentence. In some cases, the “Audio” feedback entailed the system playing a sound on the user’s completion of a set of exercises or in response to the “correctness” of the user’s input. The cases where the software system used sounds to indicate a user’s incorrect input could be compared with the implicit corrective feedback forms of Paralinguistic Signals or Elicitations.

Further examples of “Immediate” feedback present in the software system were “Hints”. These were instances where the system gave clues to the answer. These closer resembled Explicit Feedback and Elicitation CF forms though there is no direct correlation. Here the user is made explicitly aware of what in the sentence is correct or incorrect. Then they are given an additional chance(s) to recast their input. Only 4.35% of the software systems gave hints.

The last form of feedback that were “Answers”. This was any instance that the software provided specific feedback on the correctness of the user’s input in an exercise or activity. Overall, 79.71% of the software systems gave feedback in regard to user’s answers.

D. User Awareness: Accumulated Categorization

Feedback that was given in response to the user’s input over a period of time was deemed as “Accumulated”. Of the software systems investigated, 69.57% gave feedback on user’s accumulated input.

One common form of “Accumulated” feedback was a “goal”. These goals were often set by the user or software system and pertained to using the software system a certain amount of time per week or day. Only 17.39% of software systems investigated had options to or set goals for users.

A similar feedback form was identified as “progress”. Here, the system gave feedback in relation to the user’s input over the course of a unit, exercises set, level, since their initial login. A majority of the software systems-65.22%, gave feedback in regard to user’s progress.

The next form of feedback related to the user’s “knowledge”. Here, the software system kept track of how much of the user’s input was correct or incorrect in a set of exercises or how many vocabulary words the user had practiced within the system. Only 31.88% of the software systems investigated tracked user “knowledge”.

The final “Accumulated” feedback form found in the software systems was in relation to a “Leaderboard”. Only 7.25% of the software systems investigated had a leaderboard. Sometimes the systems ranked the user in relation to their frequency of use or accuracy of their input within the system. In some instances, the leaderboard was only among peers the user invited or selected. In other instances, the system ranked the user in relation to all users of the software systems.

III. CONCLUSION

Generally offering a clear analysis and categorization of combined approaches might help to bridge this gap between the needs of linguists and computer scientists. Additionally, it will help and support the designing and development of appropriate and goal-oriented CALL. Moreover, clear categorization leads to a basis for evaluating the efficiency of one CALL system compared to another.

In this paper we demonstrated one of many instances where linguistic perspectives on Corrective Feedback overlaps with computer science’ perceptions on feedback systems. Furthermore, we offered a categorization of these aspects.

In this paper we also explored the forms of feedback found in current CALL software systems. More research is needed as to what other areas, in terms of feedback, the fields of linguistics and computer science overlap. Additionally, we identified some forms of CF present in these software systems. Further evaluation of these CF forms that occur in current language learning software is needed. Including, a discussion of the use of metalinguistic clues, Explicit CF, repetitions, clarification requests, paralinguistic signals, elicitation and recasts. Further research is also needed as to which forms of CF in current language software are more effective or have a greater effect on language acquisition and/or error correction.

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