Automatic Correction of Adverb Placement Errors for CALL

Marie Garnier*

Equipe Cultures Anglo-Saxonnes, Université Toulouse Le Mirail, Toulouse, France
Institut de Recherche en Informatique de Toulouse, Université Paul Sabatier, Toulouse, France

Abstract. According to recent studies, there is a persistence of adverb placement errors in the written productions of francophone learners and users of English at an intermediate to advanced level. In this paper, we present strategies for the automatic detection and correction of errors in the placement of manner adverbs, using linguistic-based natural language processing (NLP) techniques in the <TextCoop> platform. Feedback messages are generated as a complement to corrections. We use grammatical information as well as the results of grammaticality judgement tests performed by native English speakers in order to predict correct positions for manner adverbs used as verb phrase (VP) modifiers or clause adjuncts. Detection and correction strategies are based on detection patterns and rewriting rules. The system has a precision of 87.23%, and a recall of 79.61% on a corpus of learner productions and emails. We discuss these results and present the limits of the system. Finally, we introduce the protocol used for the generation of feedback messages.

Keywords: adverb placement, grammar checking, error patterns, corrective feedback.

1. Background

The canonical positions of adverbs in English, especially when used as modifiers in the verb phrase or adjuncts in the clause, overlap only partially with the canonical positions of adverbs in French. Such partial overlap may give rise to syntactic transfer in francophone learners and users of English. According to Osborne (2008), there is indeed a persistence of adverb placement errors in the productions of English learners at the post-intermediate level, especially among those whose native languages accept Verb-Adverb-Object structures, like French. These conclusions are confirmed by the analysis of errors in our corpus, which is composed of 100,000 words of texts written by users of English with L1 French, and includes scientific productions, emails and learner productions at B2-C1 level from the *International Corpus of Learner English*

* Contact author: garnier@irit.fr

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v. 2 (Granger, Dagneaux, Meunier, & Paquot, 2009). Adverb placement errors are the fourth most frequent error type in our corpus. Errors concerning the placement of manner adverbs in modifier or adjunct function account for 40% of adverb placement errors. A survey of existing grammar checkers for English revealed that adverb placement is one of the blind spots of such systems, whether created for commercial or research purposes.

The aim of the research presented in this paper is to design strategies for the automatic detection and correction of adverb placement errors produced by francophone learners and users of English at an intermediate to advanced level (i.e., *CEFRL*[*] levels B2-C1). We focus on manner adverbs used as modifiers in the verb phrase or adjuncts in the clause. Adverb placement errors are automatically detected and corrected using linguistic-based NLP techniques in the framework of <TextCoop> (Saint-Dizier, 2011), a logic-based platform for language processing implemented in Prolog.

2. Correcting adverb placement errors using linguistic-based techniques

2.1. Predicting correct adverb placement

In a previous article (Garnier, 2012), we highlighted the fact that adverb placement was governed by a variety of factors, including the meaning and scope of the adverb and the syntactic structure of the VP or clause. There is a lack of precise and synthetic rules about adverb placement, by the own admission of the authors of authoritative works on grammar or adverbs (Guimier, 1988; Huddleston & Pullum, 2002; Quirk, Greenbaum, Leech, & Svartvik, 1985).

As a way to gain more insight into adverb placement in specific configurations, we asked three native English speakers to complete a grammaticality judgment test comprising 56 sentences organized in 13 sets illustrating a range of different possible positions for a manner adverb. English speakers were asked to decide whether the position of a manner adverb in a sentence seemed correct, grammatically correct but unnatural, or incorrect. They were also asked to identify the best position among the 3 to 5 propositions. Semantic variation in the adverb and the sentences was kept to a minimum. Complete agreement between the three English speakers was reached in only 36 % of cases; however, there was agreement as to the best position for the adverb in 69 % of cases.

2.2. Implementation of detection and correction strategies

The system is based on detection patterns and rewriting rules written in Prolog. We designed 22 detection patterns, each of which is associated with 1 to 3 different rewriting rules to enable the system to issue several propositions when there is more

* Common European Framework of Reference for Languages

than one possible correction. Table 1 presents a schematized example of a pattern and its associated rewriting rules.

Table 1. Schematized representation of a pattern and rewriting rules

Error	**Carefully* she opened the window.
Detection pattern	ADV NP1 (AUX) (AUX) VLEX (PREP) NP2
Rewriting rules	1. Adv / [comma] / NP1 / (Aux) / (Aux) / Vlex / (Prep) / NP2 2. NP1 / (Aux) / (Aux) / Adv / Vlex / (Prep) / NP2 3. NP1 / (Aux) / (Aux) / Vlex / (Prep) / NP2 / Adv
Corrected sentence	1. *Carefully*, she opened the window. 2. She *carefully* opened the window. 3. She opened the window *carefully*.

Each pattern is designed to describe as many syntactic configurations as possible, such as the presence of auxiliaries and prepositions, or the use of adverbs in non-finite sentences. Specific patterns have also been created in order to accommodate for modifications that influence adverb placement, such as modifications of the main adverb with very, too, and more (e.g., *She carefully opened the window* vs. **She more carefully opened the window*), and the presence of a long noun phrase (NP) after the lexical verb (e.g., *She carefully opened the window that she had repaired the day before* vs. **She opened the window that she had repaired the day before carefully*). As can be seen from the example given in Table 1, the system also deals with errors linked to an unnatural use of punctuation.

3. Evaluation

3.1. Results of testing

The system was first evaluated on an 80,000-word corpus of well-formed English composed of British and American online newspaper articles, British and American blog posts, and scientific publications from English native speakers. The rate of false positives was inferior to 4%, with most false positives being due to terms belonging to several grammatical categories (e.g., *purchase*, n. vs *purchase*, v.), which is a frequent issue when dealing with the English language. When such false positives are not taken into account, the rate falls to 1.5%.

Next, the system was evaluated on a modified 10,000-word corpus of English learner productions and emails written by English users. One of the challenges of researching new methods for automatic grammar checking is the lack of usable learner/user productions with the appropriate proportion of errors to make evaluation both significant and manageable (Foster & Andersen, 2009). In order to overcome this problem, we asked a francophone English user to introduce manner adverbs in existing English learner productions, producing correct and incorrect sentences.

For the first correction proposed, the system has a precision of 87.23% and a recall of 79.61%. When a second correction is proposed, the precision for this proposition is only of 70.15% (recall is irrelevant in this case).

The patterns and rewriting rules that deal with default configurations (i.e., adverb without modification by another adverb, in a finite sentence with an object NP of less than 5 words) are used in 83% of all cases. Among "default" patterns, the pattern dealing with Verb-Adverb-Object errors is used in 48% of all cases.

3.2. Limits of the system

A study of the causes for non-detection, incorrect propositions or false positives shows that the system is still limited by the number of syntactic configurations that it can recognize. Embedded clauses and verb phrases with more than one complement are common issues that can be solved by the extension of the number of configurations described in the patterns. Reducing false positives and incorrect propositions that result from homonymy and semantic incompatibility (e.g., **They are convinced of their righteousness blindly*) is a much more challenging task that requires a specific in-depth study.

Since patterns rely on the description of segments of text, the system is also limited by the fact that the sentences it processes need to be mostly grammatical. However, this is a minor problem when dealing with intermediate to advanced francophone learner/user productions. In addition, patterns use syntactic categories (e.g., adverb, verb, preposition) instead of actual words, which allows for a margin of errors in the input text, such as number or subject-verb agreement, ungrammatical choice of auxiliary, or ungrammatical passive and aspectual constructions.

4. Feedback messages

The grammar-checking strategies presented in this paper are designed to be part of a CALL system enabling intermediate to advanced learners and users of English to benefit from grammatical information about their errors. Previous studies on the use of corrective feedback in CALL have shown that meta-linguistic feedback combined with highlighting have positive effects on uptake and learning (Heift, 2004; Heift & Schulze, 2007). We have designed a protocol for creating feedback messages that integrates these feedback types. It is based on a study of the feedback offered by existing grammar checkers and includes the five following steps (Garnier, 2011):

- **Error marking:** error is highlighted;
- **Error diagnosis:** possible mention of error type, description of the erroneous segment, information as to the nature and/or causes of the error;
- **Meta-linguistic feedback:** exposition of the relevant grammar/style rules;
- **Remediation:** instructions enabling the user to successfully correct the segment;
- **Illustrations:** examples of the correct use the grammar/style rules in question.

This protocol is portable to other error types. Feedback messages are written in the user's native language, i.e., French, and can be adapted to the profile of the user. For

example, learners receive the entire feedback message without the correction from the system in order to elicit self-correction, while users wishing to have more information about the different possibilities for correction can limit the feedback to steps 1 and 2. The implementation and evaluation of this step in the project is ongoing.

5. Conclusion

This paper has highlighted the various aspects that make correcting adverb placement errors both relevant and difficult. We have shown that the use of linguistic methods for automatic detection and correction relying on detection patterns and rewriting rules can yield satisfactory results at an intermediate stage, providing that the model used for patterns and rules is based on a synthesis of sound linguistic information. A protocol for the generation of corrective feedback messages has also been proposed, and awaits implementation and testing. Further research will look into the application of the same methods to the correction of errors linked to the use of nouns in modifier functions in noun phrases.

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