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# Transformational Generative Grammar for Various Types of Bengali Sentences

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## Abstract

In this paper, we analyze the syntax of various types of Bengali sentences and design transformational generative grammar rules for them. Designing machine-processable grammars to recognize and generate various types of Bengali sentences is an important step and prerequisite to develop Bengali natural language applications. However, although few works for designing grammars are found, they mainly deal with on assertive sentences. Besides, those grammars are phrase structure grammars and can only work on strictly formal sentences. Many natural language sentences cannot be parsed using only such grammars. In this paper, we design a transformational generative grammar which, in conjunction with phrase structure grammar, is used to generate or recognize other types of Bengali sentences. It is applicable for many usable sentences that cannot be parsed using only phrase structure grammars.

**Keywords:** Deep Structure, Surface Structure, Phrase Structure Grammar, Transformational Generative Grammar.

## 1. Introduction

There are several types of sentences in Bengali, e.g., Assertive, Interrogative, Imperative, Optative, Conditional, Dubitative and Interjective [1]. Each type of sentences has different *surface structure* (SS), i.e., real/usable form, although their syntactic structures, called the *deep structures* (DSs) [2, 3, 4, 6, 12, 13], are same. In order to generate or recognize a natural language sentence by a computer, its syntactic structure must be identified. In addition, grammars are necessary to map the syntactic structure to its surface form. Syntactic quantity of a sentence is represented using Phrase Structure Grammar (PSG) [2, 3, 4, 5, 6, 12, 13] while the surface form is represented using Transformational Generative Grammar (TGG) [2, 3, 4, 6, 12, 13].

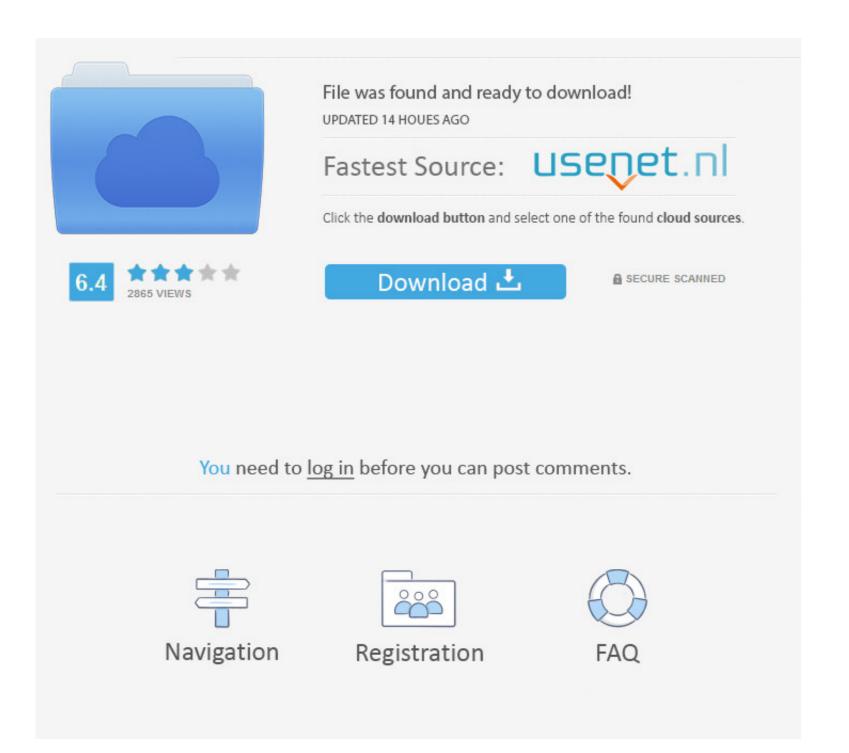
PSGs use *phrase structure rules* (PSRs) [2, 3, 4, 6, 12, 13] to generate the DS of a sentence. However, a DS may not be a usable form. All sentences of a language cannot be generated using only PSGs. The usable form of a sentence, i.e., SS, can be generated using the special type of grammar TGG. The rules used in TGG are called *transformational rules* (TRs) [2, 3, 4, 6, 12, 13]. For example, the Bengali interrogative sentence (surface form) বাংলা ভাষা কি আমদের অনেক কিছু দেয়নি? can not be generated using the PSG only. However, in addition to PSG, if we use TGG, it is possible to generate such sentences. The PSG can generate the DS বাংলা ভাষা আমদের অনেক কিছু দিয়েছে only. From this DS, TRs can generate the interrogative sentence, i.e., the SS, বাংলা ভাষা কি আমদের অনেক কিছু দেয়নি?.

All most all the research works on Bengali syntax analysis consider assertive sentences only [5, 7, 8, 9, 10, 11]. No significant work has been done on other type of sentences except the preliminary analysis in our previous work [6]. The scope of this paper is to design TRs to generate or to recognize various types of Bengali sentences. Although there are five types of sentences in Bengali, we limit our discussion only on the mostly used types of sentences, i.e., assertive, interrogative and imperative sentences. In Bengali, there are simple, complex and compound sentences. Although purely simple sentences do not dominate a language, they are the building blocks of other types of sentences. Therefore, we consider simple sentences only in this paper.

The paper is organized as follows. In section 2, we design the grammar rules, specially the TRs, to generate the SSs from DSs for various types of sentences. Section 3 presents an algorithm for the reverse process, i.e., to generate the DSs from the SSs. In section 4, we present a discussion on our work. Finally, section 5 concludes our work.

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