

# A Simple Surface Realizer for Filipino \*

Ethel Ong, Stephanie Abella, Lawrence Santos, and Dennis Tiu

Center for Language Technologies, College of Computer Studies  
De La Salle University, Manila, Philippines 1004

ethel.ong@delasalle.ph, stephanie.abella@yahoo.com, lawrencesantos@ymail.com, den\_tiu@yahoo.com

**Abstract.** Surface realizers are used at the final phase of natural language text generation to convert abstract or symbolic representations of information to linguistic forms in a particular human language. Rules of grammar for the target language are applied to produce text that is syntactically, morphologically and orthographically correct. In this paper, we present the development of FilSuRe, a simple surface realizer for Filipino. We also present how the Booklat system was produced by revising the realization phase of a prototype automatic story generator system, Picture Books, to use the API library of FilSuRe in order to generate children's stories in Filipino.

**Keywords:** Surface realization, text generation, story generation, Filipino language.

## 1 Introduction

Text generation systems are computer applications that use theories of artificial intelligence and computational linguistics to automatically produce documents, reports, explanations, help messages, stories, and other kinds of texts. Such systems typically follow a basic three-stage pipeline presented by Dale and Reiter (2000) comprising of content determination, sentence planning, and surface or linguistic realization.

Surface or linguistic realization is a process whereby abstract or symbolic representations of information are transformed into readable text in a target human language. A number of systems that generate text rely on an external surface realizer during their realization phase to form syntactically and morphologically correct sentence structures. SimpleNLG (Venour and Reiter, 2007) is a popular choice as its library of Java functions provides an interface for applications to build phrases and simple sentences, and to perform inflectional morphological operations and orthography to generate grammatically correct and formatted English sentences. It is a grammar-based realizer engine that accepts canned and non-canned input representations and produces an output string in a deterministic fashion (Gatt and Reiter, 2009).

Various systems have utilized simpleNLG in the latter phase of their generation process. The automatic story generators Picture Books (Hong *et al.*, 2009; Ang *et al.*, 2011) used simpleNLG to transform text specifications in the abstract story tree into story text that can be read by young children. The learning tool for spelling and vocabulary, Pun World (Aban *et al.*, 2010), as well as the learning tool for Filipino heritage learners, SalinLahi (Cheng *et al.*, 2009) utilized simpleNLG to perform formatting on the generated feedback before the surface text is displayed in the user interface. The text generator system, Vigan (Chen *et al.*, 2008), used simpleNLG to transform internal descriptions of museum objects into surface text.

Although the functions provided by simpleNLG to produce a sentence in the target language is flexible enough to accept phrases (i.e., noun phrase, verb phrase, prepositional phrase), the structure of a Filipino sentence necessitates the need for a Filipino text realizer that can support the nuances of Filipino grammar rules, specifically those involving word order, generation of markers for nouns, and morphological rules for generating verbs in various tenses.

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In this paper, we present the development of FilSuRe, a simple Filipino surface realizer that was patterned after simpleNLG. It provides a library of Java functions as an interface for applications to generate the correct markers, determiners and inflections of words to build phrases and simple sentences in the Filipino language.

The rest of this paper is organized as follows. Section 2 presents an overview of grammar constructs from the *balarila* or the official grammar of the Filipino language and how this affected the design of FilSuRe. The discussion begins with the types of sentence structures, followed by verbs, nouns, adjectives, and adverbs. Testing of the API through interfacing with an NLG application, the Booklat story generator system, is presented in Section 3. The paper ends with a summary of research findings and further work to improve the library.

## 2 The Development of FilSuRe

The *Filipino Surface Realizer* (FilSuRe) is a library of Java API functions patterned after simpleNLG to support the generation of simple and grammatically correct Filipino declarative sentences. The library can be utilized by NLP applications that require surface realizers in the last phase of their generation phase to produce surface text in Filipino.

Four main functions are provided in the library, namely *PandiwaSpec* to build verb phrases, *PangngalanSpec* to build noun phrases, *PangukolSpec* to build prepositional phrases, and *PangungusapSpec* to build sentences from the different phrases.

### 2.1 Structure of Filipino Sentences

A Filipino sentence (*pangungusap*) is comprised of two main parts, the subject (*simuno*) and the predicate (*panaguri*). These two parts gave rise to two forms of sentence structure, the common (*karaniwan*) structure where the predicate precedes the subject, and the uncommon (*di-karaniwan*) structure where the subject appears before the predicate with the structural marker *ay* appearing between them (De Vos, 2010).

The two sentences below for “*John ate at home*” exemplify these structures. The free-word order nature of the Filipino grammar is seen in sentences (1) and (2), where in (1) the location (*sa bahay*) precedes the actor (*si John*), while in (2) the actor precedes the location.

Karaniwan:

Kumain sa bahay si John. (1)

Kumain si John sa bahay. (2)

Di-karaniwan:

Si John ay kumain sa bahay. (3)

By default, FilSuRe generates sentences using the *karaniwan* structure. This can be explicitly modified to *di-karaniwan* during the instantiation of a new sentence (*PangungusapSpec*). A set of grammar rules composed of thematic roles dictates the structure of the sentence. During realization, the system parses the rule to identify the order and arrangement of the different parts of a sentence. There are currently 14 grammar rules, shown in Figure 1, that are specified using the notation:

*VERB:1;AGTR:1;PATR:1;BENR:0;INSR:0;LOCR:0;TIMR:0;PURR:0;CAUR:0*

The thematic roles are verb, agent (*AGTR*), patient (*PATR*), beneficiary (*BENR*), instrument (*INSR*), location (*LOCR*), time (*TIMR*), purpose (*PURR*), and cause (*CAUR*). The 1 or 0 in the thematic rule indicates whether that thematic role is required or optional, respectively. For example, the rule above can be used to generate sentence (4) for “*John ate an apple*”. Setting the thematic roles *INSR* and *TIMR* to 1 would generate sentence (5) for “*John ate an apple using a fork last night*.”

Kumain (*VERB*) si John (*AGTR*) ng mansanas (*PATR*). (4)

Kumain (*VERB*) si John (*AGTR*) ng mansanas (*PATR*) gamit ang tinidor (*INSTR*) kagabi (*TIMR*). (5)

ruleid	thematicrule
0	VERB:1;AGTR:1;PATR:1;BENR:0;INSR:0;LOCR:0;TIMR:0;PURR:0;CAUR:0
1	VERB:1;PATR:1;AGTR:1;BENR:0;INSR:0;LOCR:0;TIMR:0;PURR:0;CAUR:0
2	AGTR:1;VERB:1;PATR:1;INSR:0;LOCR:0;TIMR:0;PURR:0;CAUR:0
3	VERB:1;AGTR:1;BENR:1;PATR:1;INSR:0;LOCR:0;TIMR:0;PURR:0;CAUR:0
4	VERB:1;PATR:1;AGTR:1;BENR:1;INSR:0;LOCR:0;TIMR:0;PURR:0;CAUR:0
5	BENR:1;VERB:1;AGTR:1;PATR:1;INSR:0;LOCR:0;TIMR:0;PURR:0;CAUR:0
6	VERB:1;AGTR:1;INSR:1;PATR:1;LOCR:0;TIMR:0;PURR:0;CAUR:0
7	VERB:1;PATR:1;AGTR:1;INSR:1;LOCR:0;TIMR:0;PURR:0;CAUR:0
8	INSR:1;VERB:1;AGTR:1;PATR:1;LOCR:0;TIMR:0;PURR:0;CAUR:0
9	VERB:1;AGTR:1;PATR:0;INSR:0;LOCR:1;TIMR:0;PURR:0;CAUR:0
10	VERB:1;LOCR:1;AGTR:1;PATR:0;INSR:0;TIMR:0;PURR:0;CAUR:0
11	AGTR:1;VERB:1;PATR:0;INSR:0;LOCR:1;TIMR:0;PURR:0;CAUR:0
12	VERB:1;AGTR:1;CAUR:1
13	CAUR:1;VERB:1;AGTR:1

Figure 1: Existing Filipino grammar rules defined in FilSuRe.

## 2.2 Filipino Verbs

Affixes are used in Filipino verbs (*pandiwa*) to reflect their tenses. Table 1 shows some affixes and the resulting inflected verbs.

Table 1: Examples of Filipino verbs and their inflections.

Past Tense	-um	<u>U</u> minom (Drank)	<u>Ku</u> main (Ate)
	mag-	<u>Nag</u> -ayos (Fixed)	<u>Nagl</u> uto (Cooked)
	-in	<u>In</u> ayos (Fixed)	<u>Kin</u> ain (Ate)
Present Tense	-um	<u>Umi</u> nom	<u>Kuma</u> kain
	mag-	<u>Nag</u> -ayos	<u>Naglul</u> uto
	-in	<u>Ina</u> ayos	<u>Kina</u> kain
Future Tense		<u>I</u> nom	<u>Ka</u> kain
	mag-	<u>Mag</u> -ayos	<u>Maglul</u> uto
	-in	<u>A</u> ayusin	<u>Kakainin</u>

The affixes are dependent on the focus of the verb that differentiates the grammatical role of the subject of the sentence. These grammatical roles include the actor, object, location, benefactor, instrument and cause. Verbs with the affixes *um* and *mag*, for example, reflect the actor focus or the doer of the action, as exemplified in sentences (6) to (9). In the morphological rules of Filipino, *mag* becomes *nag*, as the case in (8), for present tense. The first syllable of the root word is repeated for present and future tenses, as shown in (8) and (9).

Uminom si Jose ng gatas. (Jose drank milk.) (6)

Kumain si Maria ng mangga. (Maria ate a mango.) (7)

Si Juan ay nag-ayos ng kotse. (Juan is fixing a car.) (8)

Magluluto si Linda ng isda. (Linda will cook fish.) (9)

Verbs with the affix *in* reflect the object focus or the target of the action, for example, in sentences (10) to (12).

Inayos ni Juan ang kotse. (The car was fixed by Juan.) (10)

Kinakain ni Linda ang isda. (The fish is being eaten by Linda.) (11)

Ayusin ni Jose ang pintuan bukas. (The door will be fixed by Jose tomorrow.) (12)

The affix *in* is also used to reflect the benefactive focus or the recipient of the action in (13).

Binigyan ni Juan ng kendi si Maria. (Maria was given a candy by Juan.) (13)

To be able to generate the correct inflection of a verb, FilSuRe maintains a lexicon of verbs in their root form. Each verb entry is associated with the aspect/tense, focus, corresponding affixes (prefix, infix and suffix), and valid grammar rules to generate sentences in the *karaniwan* and *di-karaniwan* structures. The lexicon currently has 84 unique verbs and 865 total verb inflections. To generate an inflection, the affixes are retrieved and concatenated to the root word based on grammar rules for verbs. Table 2 shows sample entries for the verb *alam* (know).

**Table 2:** Sample entries in the verb lexicon of FilSuRe.

wordID	rootWord	aspect	focus	prefix	infix	suffix	karaniwanrule	dikaraniwanrule
1	alam	COM	ACTF	naka			0;1;2	3;4
2	alam	COM	BENF	ipina			5;6;7	
5	alam	PRO	ACTF	naka			0;1;2	3;4
6	alam	PRO	BENF	ipina			5;6;7	
9	alam	CON	ACTF	maka			0;1;2	3;4
10	alam	CON	BENF	ipa			5;6;7	

### 2.3 Filipino Nouns

To create a noun phrase using the *PangngalanSpec* class, the following parameters are needed – the noun itself, its thematic role, classification (i.e., proper or common), grammatical number (singular or plural), and marker type. The classification of the noun must be explicitly specified because FilSuRe does not maintain a database of proper nouns nor does it utilize an external named entity recognizer.

**Table 3:** ANG, NG, and SA markers.

	ANG markers	NG markers	SA markers
Singular-Proper	<b>Si</b> Jose (Jose)	Aso <b>ni</b> Jose (Jose's dog)	Ibinigay <b>kay</b> Jose (Gave to Jose)
Singular-Common	<b>Ang</b> bata (The child)	Aso <b>ng</b> bata (The child's dog)	Ibinigay <b>sa</b> bata (Gave to the child)
Plural-Proper	<b>Sina</b> Jose at Maria (Jose and Maria)	Pagkain <b>nina</b> Jose at Maria (Jose and Maria's food)	Para <b>kina</b> Jose at Maria (For Jose and Maria)
Plural-Common	<b>Ang mga</b> bata (The children)	Pagkain <b>ng mga</b> bata (The children's food)	Para <b>sa mga</b> bata (For the children)

There are three groups of markers or determiners (*pantukoy*) in the Filipino language – *ang*, *ng*, and *sa*. They are further classified according to the number and the commonality of the nouns they are describing. **Ang** markers (*si/sina, ang/ang mga*) introduce the subject of the

sentence. *Ng* markers (*ni/nina*, *ng/ng mga*) show possession of an item by the subject. *Sa* markers (*kay/kina*, *sa/sa mga*) show the target of verbs as well as possession of objects. Table 3 summarizes and provides sample usage of these markers. The marker “*mga*” is the common approach to specifying plural nouns, such as *ang mga bata* (the children).

Markers are generated automatically based on the noun classification, marker type, thematic role, verb focus, and grammatical number, as shown in Table 4.

**Table 4:** Marker type based on the thematic role and the verb focus.

Thematic Role	Verb Focus	Marker Type
Agent	Actor, Locative	Ang
	Benefactive, Causative, Instrument, Object	Ng
Patient	Actor, Locative, Benefactive	Ng
	Object	Ang
	Instrument	Sa
Beneficiary	Benefactive	Ang
	Actor	Sa

## 2.4 Filipino Adjectives

An adjective (*pang-uri*) is connected to the word it describes with the use of the connectives (*pang-angkop*) *na*, *-g*, or *ng*. The adjective may precede or succeed the word it describes. The *pang-angkop na* is used if the first word ends with a consonant other than *n*, such as *mag-aaral na matalino* (student who is smart) and *malinis na paligid* (clean surroundings). The *pang-angkop -g* is used if the first word ends with *n*, such as *bayang maunlad* (nation that is progressive) and *mayamang kultura* (rich culture). The *pang-angkop -ng* is used if the first word ends with a vowel, such as *matalinong mag-aaral* (intelligent student) and *manggang maasim* (mango that is sour).

If a noun phrase has two or more adjectives, FilSuRe adds a comma after every adjective, inserts the connective “*at*” (and) before the last adjective, and applies the rule above on the last adjective that immediately precedes the noun, for example, *masipag, magalang, at masunuring anak* (hardworking, respectful, and obedient child).

If there is an adjective of type *pamilang* (number), then it is placed before all the *panlarawan* (descriptive) adjectives, for example, *limang magalang na bata* (five respectful kids).

Adverbs (*pang-abay*) are concatenated before the verb they describe using a similar set of rules, except for the *pang-angkop na* which is not needed if the adverb ends with a consonant, e.g., *mabilis tumakbo* (ran fast); *mahilig maglaro* (likes to play).

## 3 Using FilSuRe in an NLG Application

To test the API library of FilSuRe, Booklat, a Filipino version of the Picture Books (Hong *et al.*, 2009) story generator system, was developed. Specifically, the realization phase of Picture Books was revised to use FilSuRe as its surface realizer instead of simpleNLG, in order to generate story text in the Filipino language. All other aspects of Picture Books, namely the picture editor for specifying the story elements, the story planner, and the semantic ontology of commonsense knowledge on storytelling were retained. The story planner generates a story plan in the form of an abstract story tree that is forwarded to the surface realizer.

The abstract story tree contains a collection of character goals representing the sequence of actions and events that occur in the story to be generated (Ong, 2010). A character goal represented below comprises the action (verb), an agent and a patient (some characters in the story), an instrument and a target (some objects used in the story). This representation is easily transformed into a declarative sentence.

*CGid(Action:<verb>, Agens:<char>, Patiens:<char>, Target:<obj>, Instrument:<obj>)*

The transformation is straightforward. A *PandiwaSpec* object is instantiated for each character goal in the story tree. Inputs to *PandiwaSpec* come from the action attribute of a character goal which provides the root word of the verb. The focus of the verb is taken from the character goal type. All verbs in Picture Books are in past tense; Booklat retains this convention.

The agent and the patient attributes of a character goal are used as inputs to create noun phrases using the *PangngalanSpec* class. This includes pronouns, which were generated by Picture Books' referring expression generator during realization. A mapping of English to Filipino pronouns is used in Booklat.

### 3.1 Inflection of Verbs

Because Picture Books was designed to specifically use simpleNLG, its character goal is not associated with the focus of the verb. The focus does not affect the inflection of verbs in the English grammar. To compensate for this requirement in Booklat, the default focus was assigned to *actor*, since most sentences in a Picture Books-generated story is declarative in nature where a character performs an action (e.g., “*Rizzy broke the lamp*”) or feels an emotion (e.g., “*Rizzy was scared*”). A special case is sentence (14) which was initially generated as sentence (15) to reflect an actor focus. But the more natural way of stating this is in (16) using the benefactive focus.

Mommy Hannah told Roy to brush teeth. (14)

**Nagsabi si** Nanay Hannah kay Roy na magsipilyo ng ngipin. (15)

**Sinabi ni** Nanay Hannah kay Roy na magsipilyo ng ngipin. (16)

It was determined that the type of the character goal can be used to dictate the focus. Table 5 shows the assigned focus for each of type of character goals and the sample sentences/verb inflections in Filipino.

**Table 5:** Types of character goals and the assigned focus.

Character Goal Type	Focus	Sample Filipino Story Text
Character does something	Actor	Kumain si Roy ng matamis (Roy ate sweets)
Character does not do	Actor	Hindi siya nagsipilyo ng ngipin (He did not brush teeth)
Character wants	Actor	Gusto niya na magsipilyo ng ngipin (Roy wanted to brush teeth)
Character continues doing something	Actor (incorrect)	<b>Tumuloy</b> si Roy sa pagkain ng matamis (Roy continued to eat sweets)
	Object (correct)	<b>Tinuloy</b> ni Roy na kumain ng matamis
Secondary character talks to main character	Actor (incorrect)	<b>Nagsabi</b> si Mommy Hannah kay Roy na ...
	Benefactive (correct)	<b>Sinabi</b> ni Mommy Hannah kay Roy na ...

### 3.2 Lexical Choices

The literal translation of parameters in a character goal as inputs to the different phrases of FilSuRe's API resulted in incorrectly sounding sentences. For example, sentence (17) is generated as (18), which, although syntactically and semantically correct, is not the common and natural way of saying this. Sentence (19) is a better way of expressing what a character is feeling. The same is true for other similar sentences shown in (20) and (21).

He felt hurt. (17)

Nakaramdam siya ng sakit.	(18)
Nasaktan siya.	(19)
Nakaramdam siya ng pagod. → Napagod siya. (He felt tired.)	(20)
Nakaramdam siya ng takot. → Natakot siya. (He felt scared.)	(21)

### 3.3 Prepositional Phrases

FilSuRe provides a *PangukolSpec* class that can be used to create prepositional phrases. A prepositional phrase is specified in the *target* attribute of a character goal. However, the *target* attribute is also used to specify the object of the verb, in which case a *PangngalanSpec* is instantiated for the noun phrase. The comparative character goals are shown in Table 6.

**Table 6:** Character goals with values for the *target* attribute.

Character Goal	Picture Books	Booklat	Picture Books	Booklat
Action	Saw	kita	told	sabi
Agent	she	siya	Mommy Hannah	Nanay Hannah
Patient	null	null	Roy	Roy
Instrument	null	null	null	null
Target	delicious cake	masarap cake	to stay	diyan lang
Target Type	Object	Object	Preposition	Preposition

The prepositions in the *target* attribute of character goals use command verbs. In English, these verbs are set without any inflections. However, in Filipino, infinitive verbs may require inflections. FilSuRe currently only covers verbs that are used in generating declarative sentences. It cannot handle the generation of imperative sentences yet.

### 3.4 Sentence Structure

Sentences are realized using the *PangungusapSpec* after taking the *PandiwaSpec*, *PangnglanSpec* and *PangukolSpec*. The *di-karaniwan* structure is used if the target sentence is any one of the following – story title, setting (day and place where the story takes place), or statement of the rule (or lesson). Examples of these are shown in Table 7. All other character goal types will be realized following the *karaniwan* structure.

**Table 7:** Comparative examples of sentences depicting the title, setting and lesson of the story.

Type	Picture Books Sentence	Booklat Sentence
Title	Roy the chicken learns to brush teeth	Si Roy na manok ay natuto na magsipilyo ng ngipin
Setting	The morning was warm.	Ang umaga ay maalinsangan.
	Roy the chicken was in the dining room.	Si Roy na manok ay nasa silid-kainan.
Lesson	Brushing teeth is fun.	Ito ay Masaya.
	Afterwards, Roy always brushed teeth.	Mula sa araw na iyon, siya ay lagi nagsipilyo ng ngipin.

### 3.5 Other Issues

A Filipino linguist assessed the grammatical correctness of three Booklat stories. These stories were generated from the existing ontology of Picture Books that has been manually populated with 240 relevant concepts and 369 semantic relations, and a lexicon containing 419 words that was populated with corresponding Filipino words. The verb lexicon of FilSuRe has been

manually populated with 84 unique verbs that were identified based on the lexicon of Picture Books. The total number of entries in the verb lexicon is 865 by including the different foci, aspects, affixes and sentence grammar rules. The validation of the narrative content is not of primary concern in Booklat since it retained the story planning algorithm of Picture Books.

Booklat uses an extended lexicon from Picture Books (with an added column for Filipino words). This led to the word-per-word translation during the lexicalization process, resulting in incorrect word usage (22) and missing function word (23) to connect the adjective to the noun that it describes.

Mommy Hannah told Roy to take bath. (22)

*Incorrect:* Sinabi ni Mommy Hannah kay Roy na kuha paliguan.

*Correct:* Sinabi ni Mommy Hannah kay Roy na maligo siya.

She saw the delicious cake. (23)

*Incorrect:* Nakita niya ang masarap keyk.

*Correct:* Nakita niya ang masarap na keyk.

Furthermore, an English word may have multiple counterparts in Filipino. For example, the word “with” can precede a person (24) or an object (25). Depending on these two contexts, the corresponding Filipino word would be “*kasama*” or “*gamit*”, respectively.

He went with Mommy Hannah to the school. (24)

Pumunta siya kasama ni Mommy Hannah sa paaralan.

He ate the cake with a fork. (25)

Kinain niya ang keyk gamit ang tinidor.

#### 4 Conclusion

We have presented an initial work on the development of a simple surface realizer for use by text generation systems to produce text in the Filipino language. A set of API functions is provided, specifically to create verb phrases, noun phrases, prepositional phrases, and sentences in the *karaniwan* and *di-karaniwan* structure.

Verb phrase generation includes the automatic inflection to produce a verb in the correct tense based on user-specified focus and aspect. This is supported by a manually-populated verb lexicon consisting of the root verb and the set of possible affixes. Grammar rules specifying the structure of Filipino sentences can also be associated to a verb in the lexicon.

Noun phrase generation includes the automatic assignment of a correct marker based on user-specified noun classification and thematic role. Inflecting nouns to reflect their number and inflecting adjectives to reflect the plurality of the nouns they describe are currently not supported and instead rely on user inputs.

The accurate realization of a Filipino sentence depends on the correctness of the data in the lexicon and also from the inputs of the user. All grammar construct rules, such as verb inflection, marker generation for nouns, connective generation for adjectives, are currently programmed into FilSuRe. Future work should explore the use of Finite State Morphology (FSM) to allow for greater flexibility and increased performance.

To test the API, the realization phase of the Picture Books automatic story generation system was modified to make calls to FilSuRe instead of simpleNLG. A major problem encountered in the integration is related to insufficient inputs needed by the different API, which are not available in the abstract story tree provided by the story planner to the realization module. Specifically, these are the parameters needed to generate the correct verb inflection. This was addressed by annotating each character goal type with the correct focus, and fixing the aspect to past tense, the way most children’s stories are usually written.



The presence of multiple Filipino lexical choices for a single English word also presented a problem. As in the previous case, this was addressed in the realization phase of Booklat.

A final concern that occurred during the lexicalization process was more of a design decision to extend the lexicon of Picture Books by simply adding a column for the corresponding Filipino word. Future work on Booklat should explore the use of Picture Books' semantic ontology to associate concepts directly with Filipino words.

Because children's stories and other text generation systems may require different kinds of sentences, FilSuRe should be extended to support the generation of imperative, interrogative, and exclamatory sentences.

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