

# TBTA Tutorial Lesson 8: Pronoun and Switch Reference Rules

(video: [TBTA-8A Pronoun Generation](#))

## 8.0 Introduction

In this lesson we're going to focus on the process of generating pronouns. There are no pronouns in the semantic representations because each language has its own set of rules for determining where and when pronouns should be used. The semantic representations do include a feature called Person with values such as First, Second, Third, 'First & Second,' etc., but those features are on nouns rather than pronouns. English speakers will realize all nouns marked as First Person and Second Person with pronouns, but that isn't universal; some languages prefer to use titles or names rather than pronouns.

Generating pronouns in TBTA is a two step process: 1) identify nominals that should be realized with pronouns, and 2) supply the appropriate surface forms for the pronouns. Switch reference morphemes are added to the texts using a similar two step process, but this tutorial won't discuss switch reference morphemes. If you're working in a language that uses a switch reference system and you'd like more information, please contact the instructor.

## 8.1 Pronoun Identification and Spellout Rules

As was mentioned above, the first step in generating pronouns is to identify which nominals should be realized with pronouns. Go to Clauses 1:70 which produces *After John walked, he read a book*. Link AFTER-A to *after*. If you click the Generate button now, you'll see *John read a book after John walked*. Let's begin by adding a feature and writing the necessary rules to position the adverbial clause at the beginning of the sentence. In English, some adverbial clauses precede the main clause (e.g., *If Mary reads that book, John will read this book.*), and some adverbial clauses follow the main clause (e.g., *John passed the test by studying hard.*). So let's define a new feature for propositions called 'Adverbial Clause Position.' To define this feature, go to the Lexicon and Grammar Development screen and click the button labeled 'Feature Set' in the lower right corner of the screen. This feature will be for clauses, and Clauses was selected in the dropdown on the left by default. In the dropdown on the right, select 'Spare 12.' All of the features called 'Spare' are available for you to use, and you should generally use the last available spares in case future releases of TBTA need to use some of the early spares. Click the button labeled 'Edit Feature's Name,' and change the name from 'Spare 12' to 'Adverbial Clause Position.' Then enter two values into the table below the row containing Unspecified: 'PrePosed' and 'PostPosed.' The Feature Set dialog should now look like the one shown in Figure 8-1.

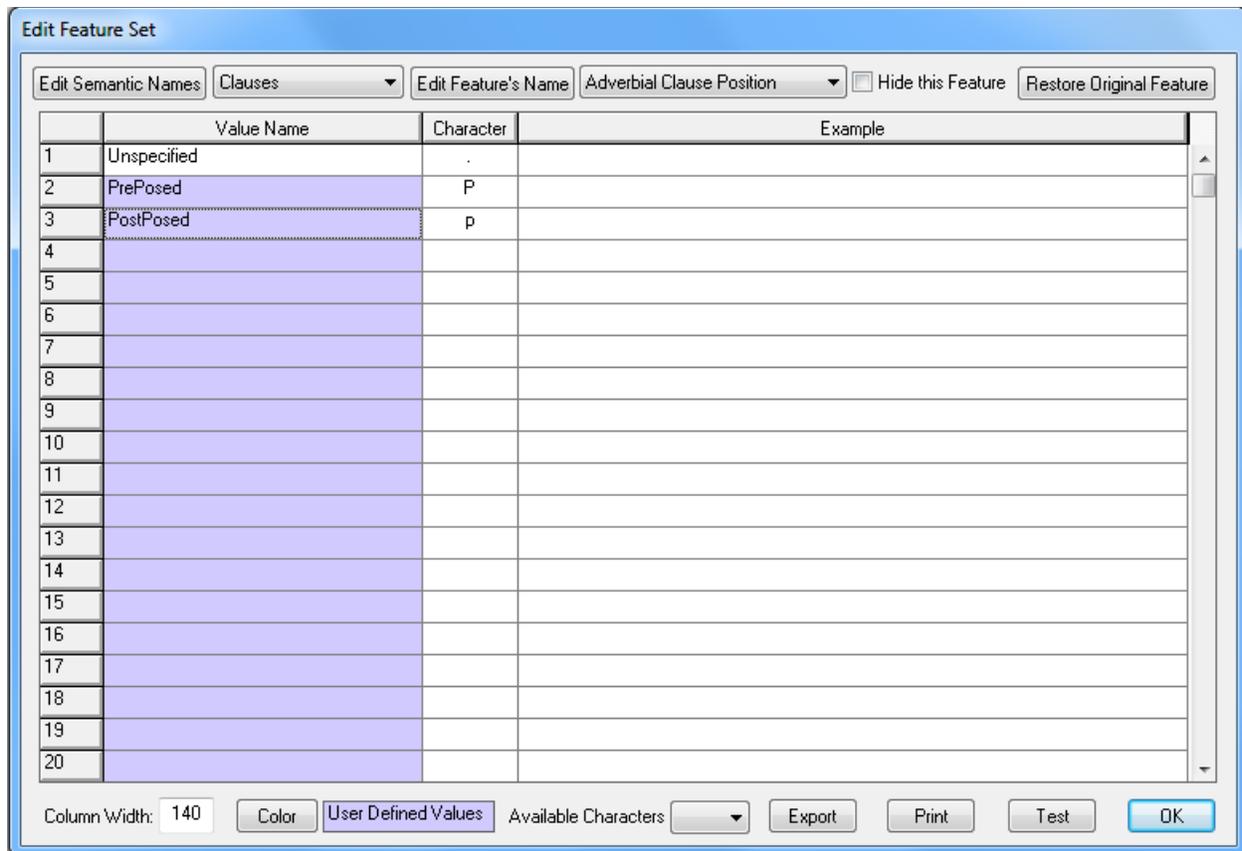


Figure 8-1. Feature Set Dialog with Feature for Adverbial Clauses

After you've defined the feature, we need to write a rule that will set this feature. Usually we would write a Structural Adjustment rule to set this feature, but since we haven't yet discussed those rules in these tutorials, we'll write a Feature Copying and Setting rule. We want to write a rule that will set this feature to PrePosed whenever the preposition *after* occurs in an adverbial clause. To do this, open the 'Feature Copying and Setting Rules' node in the grammar tree, and double click on Clauses. You'll be prompted to enter a group name, so enter something like **Adverbial Clauses**. Then double click on the group name, and you'll see a new Feature Copying and Setting rule. For 'Type of Rule,' select 'Feature Setting.' Click on the button labeled 'Insert Word,' and you'll see that it remains highlighted indicating that you're ready to insert a word. Click on the input structure somewhere between the opening and closing clause boundaries, and you'll see a dialog asking you to select a Syntactic Category. Select Adpositions, and then select *after* from the lower dropdown. Then click OK, and you'll see *after* inserted into the input structure. Now click the radio button labeled 'Output Structure,' and you'll see the input structure copied down into the output structure. Click on the button labeled Features, and you'll see that it remains highlighted indicating that you're ready to specify features. Click on the opening clause boundary in the output structure, and you'll see a dialog listing all of the features for clauses. Scroll to the right and you'll see the new feature that you just defined in the dialog shown in Figure 8-1. We want adverbial clauses that contain *after* to be pre-posed, so select the value PrePosed and click OK. Enter a name for this rule such as **Some adverbial clauses**

are **PrePosed**, others are **PostPosed** (we'll need to come back later and modify this rule to include some postposed adverbial clauses). Assign this rule to the grammar topic called 'Adverbial Clauses.' Your rule should now look like the one shown in Figure 8-2.

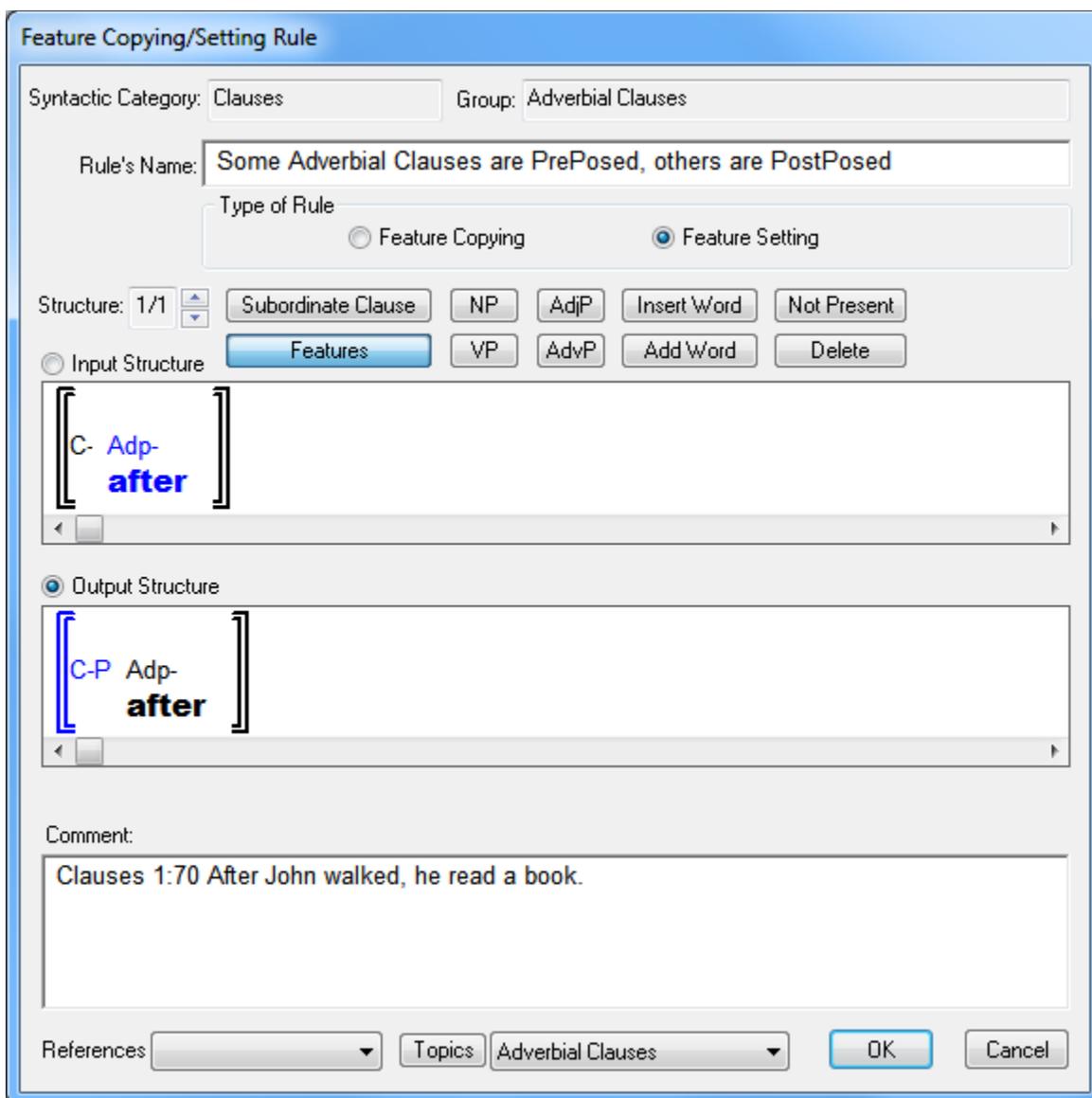


Figure 8-2. Feature Setting Rule for Post-Posed Adverbial Clauses

Close this dialog and click the Generate button. You'll still see *John read a book after John walked*, but if you rest the cursor on the opening adverbial clause boundary, you'll see that the feature called 'Adverbial Clause Position' has been set to PrePosed.

Now let's modify our clause PSR so that adverbial clauses marked as PrePosed are positioned before the main clause. Open your first clause PSR, and insert a new constituent called Clauses. Specify that the clause has a Type value of 'Event Modifier' (this is the semantic equivalent of 'adverbial clause'), and an 'Adverbial Clause Position' value of PrePosed. For the constituent's name, enter something like **PrePosed**

**Adverbial Clauses.** You'll then see this constituent inserted at the top of the rule, and you can leave it there. Click the OK button, and generate this verse again. You'll now see *After John walked John read a book*. We're almost ready to begin generating the pronoun, but first let's insert a comma into adverbial clauses that are marked as PrePosed.

Use Grammar Wizard to write a spellout rule that will add a comma to clauses. Remember that all punctuation marks are initially treated as words in TBTA, so this spellout rule will add a word to clauses. The word's tag should be **comma**, and you'll need to enter a new group such as **Adverbial Clauses**. Click the Features button on the spellout rule dialog, and specify that the clause's Type must be 'Event Modifier,' and the 'Adverbial Clause Position' must be PrePosed. Assign this rule to the grammar topic called 'Adverbial Clauses.' Your finished rule should look like the one shown in Figure 8-3.

The screenshot shows the 'Spellout Rule' dialog box with the following configuration:

- Syntactic Category: Clauses
- Group: Adverbial Clauses
- Rule's Name: Add word ,comma to PrePosed Adverbial Clauses
- Status:  On
- Type of Rule:  Simple,  Table,  Morphophonemic,  Form Selection,  Phrase Builder
- Features: Clause Type = Event Modifier, Clause Adverbial Clause Position = PrePosed
- New Word: ,
- Word's Tag: comma
- Comment: Clauses 1:70 After John walked, he read a book.
- References: [Dropdown]
- Topics: Adverbial Clauses
- Buttons: OK, Cancel

Figure 8-3. Spellout Rule that adds a comma to PrePosed Adverbial Clauses

Close this rule, and you'll be prompted to edit your clause PSR to position this comma appropriately. Say Yes, and drag 'comma' down the list so that it precedes 'Question Mark.' After you've saved the clause PSR, click the Generate button, and you'll see *After John walked , John read a book.* Use Grammar Wizard to write a Find/Replace rule that will remove the space before the comma. This rule will be very similar to the rules that remove spaces before periods and question marks. Now when you generate this verse, you'll see *After John walked, John read a book.* Now we're ready to work on the pronouns.

Open the 'Pronoun and Switch Reference Rules' node, and you'll see that there are two types of rules: 1) Identification Rules and 2) Spellout Rules. Enter a new group called **Pronouns** into the Identification Rules by double clicking on the 'Identification Rules' node. Then double click on that group name, and you'll be prompted to select a semantic category. All pronoun rules are based on nouns, so select Nouns in the dropdown. You'll now see an empty Pronoun and Switch Reference rule. These rules use the same dialog as the Constituent Movement rules which were discussed in a previous tutorial. However, Grammar Wizard isn't able to build any pronoun identification rules for us, so we'll need to build the input and output structures ourselves. Let's begin by building an input structure that looks like the one shown in Figure 8-4.

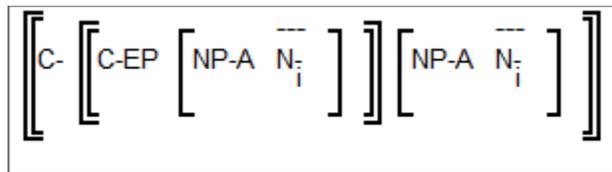


Figure 8-4. Input Structure for a Pronoun Identification Rule

In the input structure notice that both nouns are subscripted with an 'i'; this indicates that they both have the same List Index value. If you rest the cursor on the two occurrences of JOHN-A in Clauses 1:70, you'll see that both of them have a List Index value of 1. This tells us that they refer to the same referent, and in English we can realize the second one with a pronoun. To build the input structure shown above, click on the button labeled 'Subordinate Clause,' and then click in the input structure somewhere between the two sentence brackets. You'll then see the opening boundary for the subordinate clause inserted into the sentence. Then click again between the subordinate clause opening boundary and the main clause closing boundary. You'll then see the subordinate clause's closing boundary inserted into the structure. Now click on the button labeled 'Noun Phrase,' and insert a NP into the subordinate clause, and another NP in the main clause after the subordinate clause. You can insert these NPs in the same way that you inserted the subordinate clause. After you've inserted the two NPs, click the button labeled 'Insert Word,' and click inside one of the NPs. You'll then be prompted to select a syntactic category, so select Nouns. We want this rule to apply to all nouns, so leave the lower dropdown on that dialog blank, and click OK. Then insert another noun into the other NP. Now we need to specify the features, so click the Features button. Then click on the opening subordinate clause boundary, and specify that it must have a Type value of 'Event Modifier,' and an 'Adverbial Clause Position' value of PrePosed. Then specify that both NPs must have a 'Semantic Role'

value of Agent. Finally we need to set the indices on the two nouns, so click the button labeled ‘Set Nominal Indices,’ and then click on a noun in the input structure. Select ‘i’ from the dropdown, and click OK. Repeat this process for the other nominal. Your input structure should now look like the one shown in Figure 8-4.

After completing the input structure, click the radio button labeled ‘Output Structure.’ You’ll then see the input structure copied to the output structure. In the output structure all we need to do is set the ‘Surface Realization’ value of the nominal in the main clause’s agent NP to ‘Unambiguous Pronoun.’ Give this rule an appropriate name such as **When a PrePosed Adverbial Clause has the same Subject Nominal as the Main Clause, set the Nominal in the Main Clause to Unambiguous Pronoun.** Assign this rule to the grammar topic called Pronouns. Your completed rule should look like the one shown below in Figure 8-5.

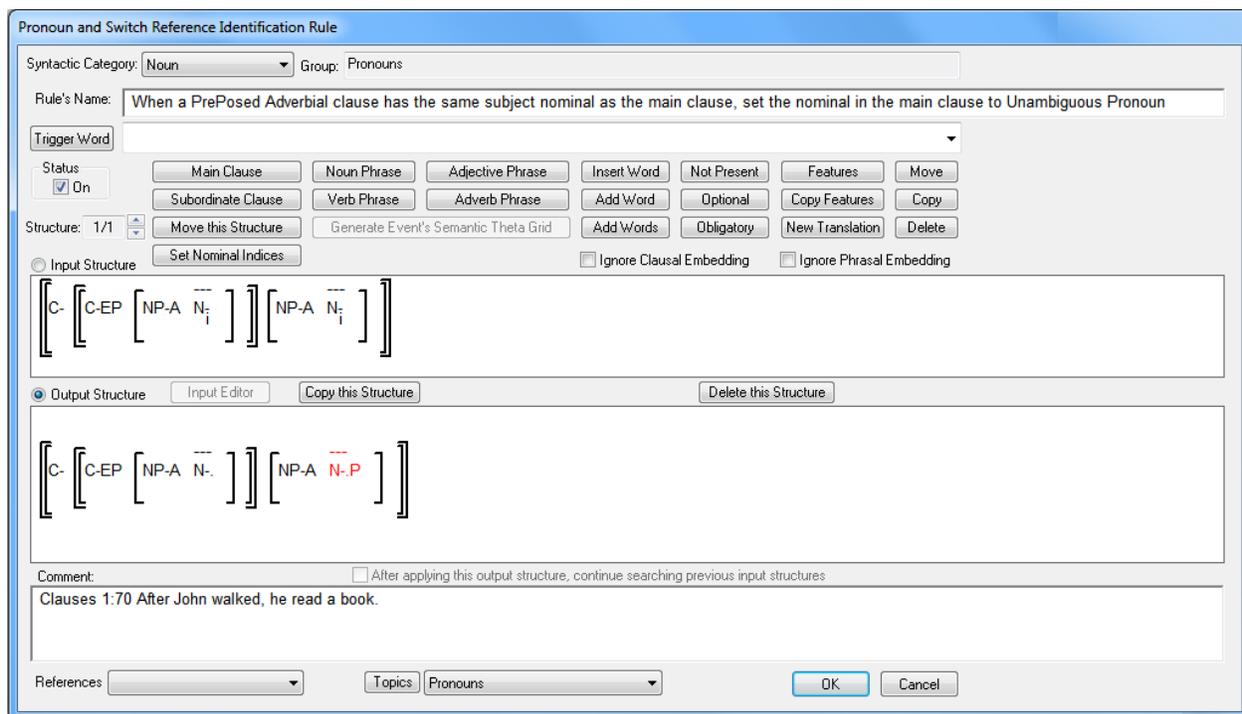


Figure 8-5. Pronoun Identification Rule for PrePosed Adverbial Clauses

Close this rule by clicking the OK button, and then click the Generate button. You’ll still see *After John walked, John read a book*, but if you rest the cursor on JOHN-A in the main clause, you’ll see that its ‘Surface Realization’ value has been set to ‘Unambiguous Pronoun.’ Now we’re ready to write a pronoun spellout rule that will examine that feature and generate the proper surface form.

In order to write a spellout rule for pronouns, expand the node called Pronoun and Switch Reference Rules, and then expand the node called Spellout Rules. In the Spellout Rules node you’ll see two syntactic categories: Nouns and Verbs. The node for nouns is used for pronoun rules, and the node for verbs is used for switch reference rules. We want to write a rule for pronouns, so double click on the Nouns node and enter a new group called **Pronouns**. Then double click on that group name and you’ll see an empty Pronoun Spellout rule. The Pronoun Spellout rules are identical to the

spellout rules that we discussed in an earlier tutorial, so we'll be able to set up tables for our pronouns just like we set up tables in the earlier tutorial. For the rule Type, select Table, and for the 'Type of Modification,' select 'New Translation' because we want these rules to replace the target language noun with a pronoun. For the 'Layer Name,' enter **Personal Pronouns** (later we'll need to add more layers to handle possessive pronouns, reflexive pronouns, reciprocal pronouns, locative pronouns, relative pronouns, etc.). A table showing English personal pronouns is shown below in Table 8-1.

	Singular Subject	Plural Subject	Singular Non-Subject	Plural Non-Subject
First Person	I	we	me	us
Second Person	you	you	you	you
Third Person Masculine	he	they	him	them
Third Person Feminine	she	they	her	them
Third Person Neuter	it	they	it	them

Table 8-1. English Personal Pronouns

Build a table rule that looks like the table shown above, but since we haven't yet generated grammatical relations from semantic roles, use Agent and non-Agent rather than Subject and non-Subject. Remember that to specify something like non-Agent, you should right click on the Agent cell; you'll then see that checkbox highlighted in red indicating that that value will not be included. Be sure to specify in the upper left corner of the table that the noun's 'Surface Realization' value must be 'Unambiguous Pronoun.' Your final rule should look like the one shown in Figure 8-6.

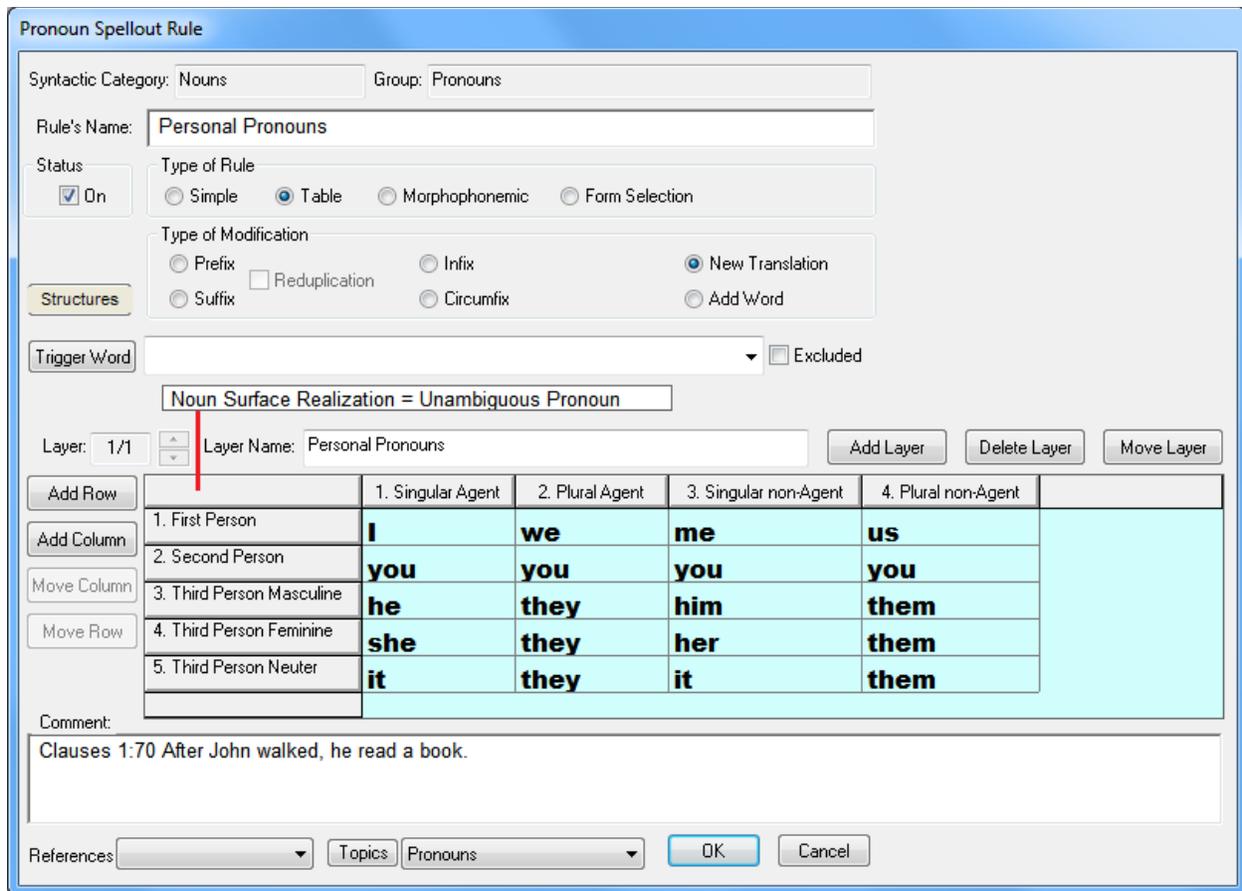


Figure 8-6. Pronoun Spellout Rule for Personal Pronouns

After saving the rule shown above, click the Generate button. This time you'll see *After John walked, he read a book*. If you rest the cursor on *he* in the semantic representation window, you'll see in the popup that *John* was changed to *he* by the pronoun spellout rule, layer 1, row 3, column 1.

Now go to Clauses 1:69 which produces *Before John walked, he read a book*. In order to generate the pronoun in this verse, all we need to do is add *before* to the Feature Setting rule that marks adverbial clauses as preposed. Open that Feature Setting rule, and click the button labeled 'Add Word.' Then click on the adposition in the input structure, and select *before* in the dropdown. Then close the word selection dialog and rest the cursor on the adposition in the input structure. The popup will show you that both *after* and *before* are now included in that adposition. Only one adposition can be displayed in the input structure, so you'll only see *after* in the input structure, but when you rest the cursor on the adposition, you'll see a list of all the included adpositions. Now generate this verse and you'll see *Before John walked, he read a book*.

Now go to Clauses 1:68 which produces *When John walks, he sings*. Link WHEN-A to *when* and SING-A to *sing*. Add *when* to the list of prepositions in the Feature Setting rule, and then click the Generate button. You'll see *When John walks, he sings*.

Now let's work on some other pronouns. Go to Pronouns 1:1 which produces *I saw Mary*. If you rest the cursor on the features under JOHN-A, you'll see that Person

is First, but 'Surface Realization' is 'Not Applicable.' Our spellout rule only applies to nouns that have a 'Surface Realization' value of 'Unambiguous Pronoun,' so if you generate this verse now, you'll see *John saw Mary*. In English whenever Person is First or Second, we want to set 'Surface Realization' to 'Unambiguous Pronoun.' There's a rule in the Grammar Library that does this, so open the Grammar Library, open the node labeled 'Common Transfer Rules,' and find the rule called 'Set Surface Realization of First and Second Person pronouns to Unambiguous Pronoun.' Then open the node called 'Complex Concept Insertion Rules and Library Rules' at the top of the grammar tree, and find the group called 'Common Transfer Rules Copied from the Library.' Drag the rule from the library to this group. Then rest the cursor on the features below JOHN-A (you don't need to click the Generate button) and you'll see that the 'Surface Realization' feature is now set to 'Unambiguous Pronoun.' If you generate this verse now, you'll see *I saw Mary*. You can now generate most of the verses between Pronouns 1:1 and Pronouns 1:20 and see the proper results. There will be issues in a few verses such as Pronouns 1:5 because we haven't yet dealt with the Person value of 'First & Second.' In order to generate all of these verses, select Generator in the main menu, and then select 'Generate Text.' Click on the button labeled Text in the upper left corner, and select Pronouns 1:1 to Pronouns 1:20. Then click the Generate button and you'll see the results.

Now let's work on reflexive pronouns. Go to Pronouns 1:21 which produces *I saw myself*. Rest the cursor on the features under SEE-A, and you'll see that Reflexivity is set to Reflexive. In order to generate reflexive pronouns, we need to add a new value to the 'Surface Realization' feature for nouns, so go back to the Lexicon and Grammar Development screen, and click the button labeled 'Feature Set.' Select Nouns in the dropdown on the left, and 'Surface Realization' in the dropdown on the right. Then add a new value called 'Reflexive Pronoun' in the row below 'Unambiguous Pronoun.' Now we need to write a pronoun identification rule that will look for a verb with a Reflexivity value of Reflexive and two nominals that have the same List Index value. When that situation is found, the rule will set the second nominal's 'Surface Realization' value to 'Reflexive Pronoun.' Expand the node for pronoun identification rules in the grammar tree, and then double click on the group called Pronouns. You'll see a new pronoun identification rule. We need to build the structure that's shown below in Figure 8-7.

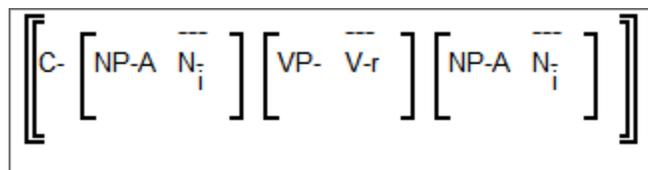


Figure 8-7. Input Structure for Reflexive Pronoun Identification Rule

Build that input structure just like you built the input structure for the other pronoun identification rule. Be sure to specify that the first NP has a 'Semantic Role' value of Agent, and the second NP has a 'Sematic Role' value of not-Agent. Set the verb's Reflexivity to Reflexive, and assign both nominals an index value of 'i'. After building this input structure, click the radio button labeled 'Output Structure.' Now we need to set the 'Surface Realization' feature on the nominal in the second NP to 'Reflexive Pronoun,' so click the button labeled Features, and then click on the noun in the second

NP in the output structure. Select the value 'Reflexive Pronoun' and click OK. Enter a name for this rule such as **Identify Reflexive Pronouns**, and assign this rule to the grammar topic called Pronouns. Your finished rule should look like the one shown in Figure 8-8.

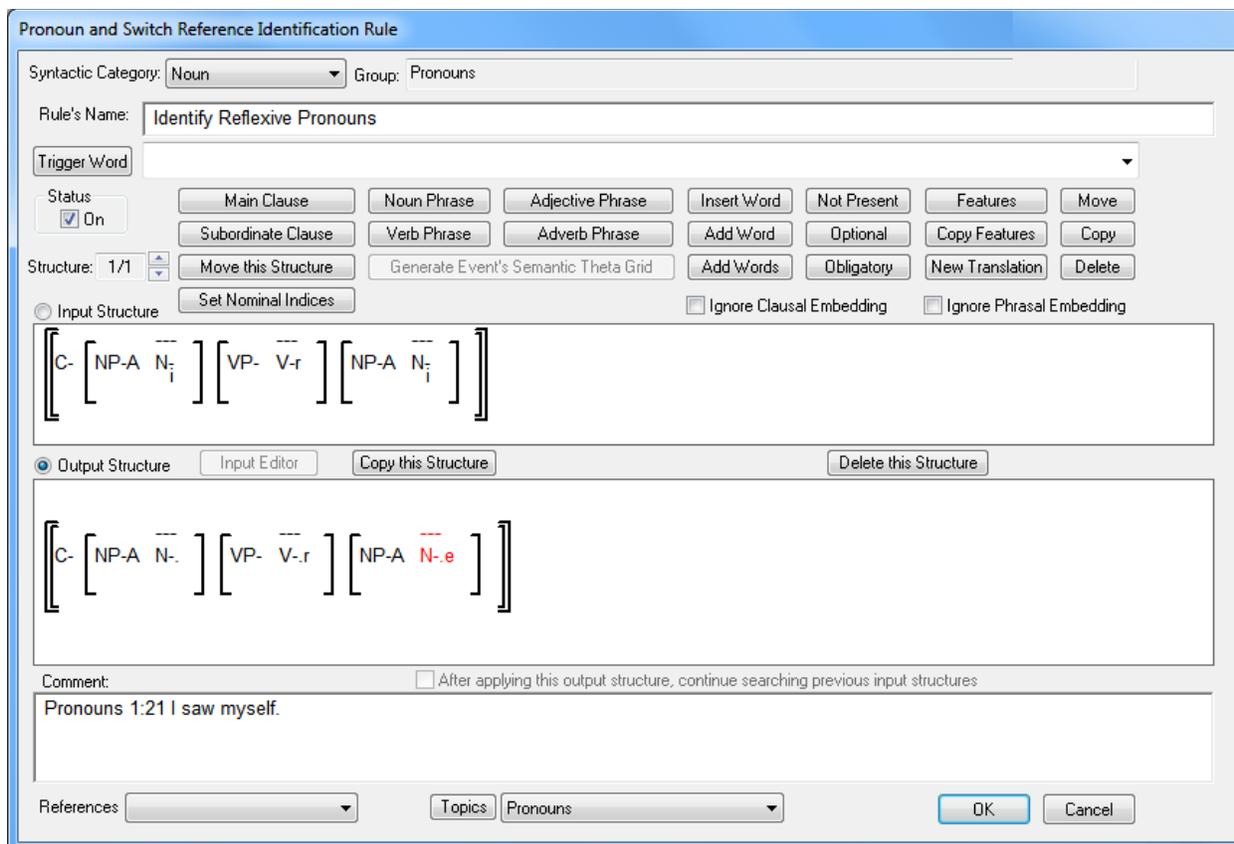


Figure 8-8. Reflexive Pronoun Identification Rule

Save this rule and click the Generate button. You'll see *I saw John*, and if you rest your cursor on the features under JOHN, you'll see that the 'Surface Realization' value is 'Reflexive Pronoun.'

Now we need to generate the proper surface form for this reflexive pronoun, so open the pronoun spellout rule that you wrote earlier in this tutorial (the one shown in Figure 8-6). Let's add another layer to this table rule to include our reflexive pronouns. Click the button labeled 'Add Layer,' and you'll see a new layer added to the rule. For the Layer Name, enter **Reflexive Pronouns**. In the upper left corner of the table, specify that this layer only applies to nouns with a 'Surface Realization' value of 'Reflexive Pronoun.' The second layer of this table should look like that shown in Figure 8-9 below.

**Pronoun Spellout Rule**

Syntactic Category: Nouns      Group: Pronouns

Rule's Name: Personal and Reflexive Pronouns

Status:  On

Type of Rule:  Simple  Table  Morphophonemic  Form Selection

Type of Modification:  Prefix  Reduplication  Infix  New Translation  Suffix  Circumfix  Add Word

Structures

Trigger Word:   Excluded

Noun Surface Realization = Reflexive Pronoun

Layer: 2/2      Layer Name: Reflexive Pronouns      Add Layer      Delete Layer      Move Layer

	1. Singular	2. Plural
1. First Person	<b>myself</b>	<b>ourselves</b>
2. Second Person	<b>yourself</b>	<b>yourselves</b>
3. Third Person Masculine	<b>himself</b>	<b>themselves</b>
4. Third Person Feminine	<b>herself</b>	<b>themselves</b>
5. Third Person Neuter	<b>itself</b>	<b>themselves</b>

Comment:

References:  Topics: Pronouns      OK      Cancel

Figure 8-9. Pronoun Spellout Rule that includes Reflexive Pronouns

After you've finished building the second layer of this table, modify the rule's name so that it includes Reflexive Pronouns. Then save this rule and click the Generate button. This time you'll see *I saw myself*. Go to the generate text screen again, and this time generate Pronouns 1:21 through 1:30. Again there will be some verses that aren't generated correctly because we haven't dealt with Person values such as 'First & Second,' but most of the verses will be generated correctly.

In order to generate possessive pronouns, locative pronouns, relative pronouns, etc., we need to use tools that are in the transfer grammar, but we haven't yet learned how to use those tools. Therefore those types of pronouns will have to wait.

## 8.2 Conclusions

This tutorial described the two step process of generating pronouns. The first step consists of identifying which nouns can be replaced with pronouns, and the second step consists of inserting the proper pronouns into the text. The noun feature called 'Surface Realization' is used throughout this process. The vast majority of the nouns in the semantic representations have a 'Surface Realization' value of 'Not Applicable.' There are a few cases (e.g., John 1:1 *In the beginning was the Word, and the Word was with God, and the Word was God.*) in the semantic representations where a noun's 'Surface Realization' value is set to 'Always a Noun,' and for those nouns you need to consider

very carefully whether or not you should generate a pronoun. But the vast majority of the nouns have a 'Surface Realization' value of 'Not Applicable,' and you can write rules that will change that value to 'Unambiguous Pronoun' wherever it's appropriate in your language. Then you can write rules to generate the appropriate surface forms of the pronouns.

This tutorial is the last tutorial that discusses TBTA's synthesizing grammar. You're now familiar with TBTA's ontology, the semantic representations, the lexicon, all of the types of rules in the synthesizing grammar, and the grammar tools. The remaining tutorials will describe the types of rules that are used in TBTA's transfer grammar.