

# TBTA Tutorial

## Lesson 10: Beginning a New Language Project

### 1.0 Introduction

Congratulations! You've finished learning how to use TBTA's grammar. I know that learning to use TBTA hasn't been easy, but I guarantee that this project will save you many years of work. Hopefully by now you have a pretty good understanding of each type of rule in the descriptive grammar. You should also be familiar with most of the capabilities of the transfer rules. By carefully and creatively combining the capabilities of the transfer rules, you'll be able to restructure the semantic representations into a new underlying representation that is appropriate for your target language. Then as you develop your lexicon and descriptive grammar, you'll be able to generate text in your language that is easily understandable, grammatically perfect, and semantically equivalent to the source texts.

This tutorial is going to walk you through the startup process for a new language project. A tool called Grammar Builder has been added to TBTA to make the initial development of your target grammar much easier. This tool takes advantage of the fact that, despite their many differences, languages actually have a great deal in common with one another. For example, there are many common operations performed by transfer rules that will be required by many different languages. These transfer rules have been written for you; all you need to do is activate the ones that are relevant for your language. These transfer rules are called text preprocessors because they're applied to the semantic representations even before you see the representations displayed in the Lexicon and Grammar Development screen. This tutorial will also describe how to use a library of common transfer rules that has been developed. If a rule in the library is appropriate for your language, all you have to do is drag it from the library into your grammar. So this library of common transfer rules and Grammar Builder will save you many hours of work as you develop your grammar.

### 2.0 Grammar Builder

To see the Grammar Builder dialog, go to the Lexicon and Grammar Development screen and click on the Setup button in the upper right corner. In the lower left corner of the Setup dialog is a button labeled Grammar Builder. Click on that button and you'll see the Grammar Builder dialog. Open the dropdown at the top of this dialog and you'll see that there are eight steps to help you build your grammar. In this lesson we'll walk through these eight steps in sequence. But before we look at these steps, let's first start a new language project.

Begin by going to Utilities, Select / Add / Edit a Target Language. Click on the button labeled New Target Language, and enter a name for the language

such as **My Final Tutorial**. You'll see a progress dialog indicating that TBTA is building a case frame adjustment rule for each event in the ontology. You'll then be prompted to select a font; choose Arial Black. Answer Yes when asked if you want to use the Roman Alphabet. You'll then be asked to select the phonetic features that are relevant to your language; go ahead and select all of them. You'll then see the alphabetic sequence dialog. Click the button labeled Capital Letters and enter those just as you did before in an earlier tutorial. Then go to the Lexicon and Grammar Development screen, click the Setup button, and then click the Grammar Builder button. We'll now walk through the eight steps.

### Step 1: Feature Adjustments

In the Grammar Builder dialog, open the dropdown and select 'Step 1: Feature Adjustments'. The feature adjustments dialog has three sections: 1) hiding features in the semantic representations that aren't relevant to your language, 2) collapsing feature values in the semantic representations that aren't relevant to your language, and 3) adding new features that are relevant to your language. Right now the button labeled Hide Features is depressed indicating that you're ready to specify which features in the semantic representations should be hidden because they're irrelevant to your language. This dialog is shown below in figure 1.

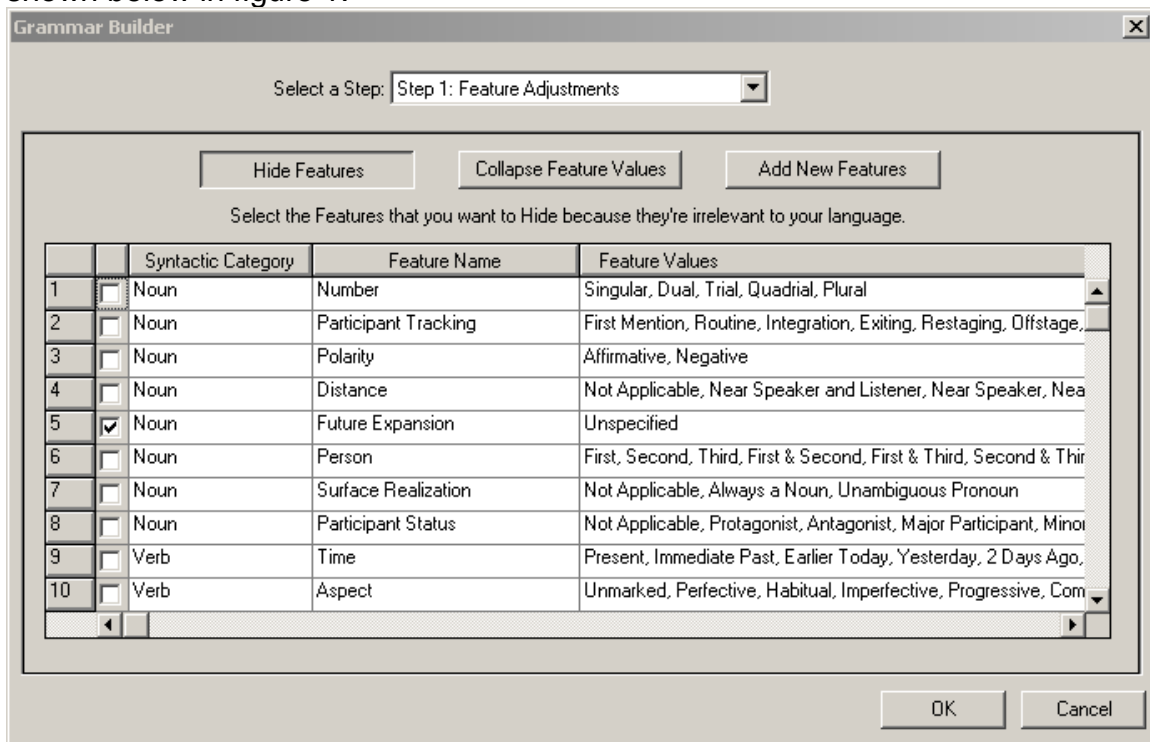


Figure 1. Grammar Builder - Feature Adjustments - Hide Features

In this dialog you'll see each of the syntactic categories with their features and feature values. If you rest the cursor on any row in the final column, a popup will show you all of the values associated with that particular feature. You should look at each of the features listed in this dialog and decide which ones aren't

relevant to your language. For each feature that isn't relevant, check the box in the leftmost column. Then that feature won't be displayed in the semantic representations and it won't appear anywhere in your grammar. For example, the last feature for nouns is called Participant Status. Rest the cursor on its Feature Values cell and look at the values listed in the popup. If your language doesn't mark the protagonist or antagonist, and if it doesn't distinguish the major and minor participants, props or locations, then you should hide this feature. Check the box at the left end of this row and that feature will be hidden the next time you look at the semantic representation of a verse. If you decide later that this feature is relevant to your language, you may always come back and uncheck the box. Scroll down and look at the features for clauses. Some of those features are already checked so they'll be hidden. If your language uses a system of honorifics in direct speech, then you should unhide Direct Quote 1 and Direct Quote 2. Those two features indicate who is talking to whom and are used only in direct quotes. Carefully consider every feature listed in this dialog and hide the features that are irrelevant to your language.

Now click on the button labeled Collapse Feature Values. The dialog will change as shown below in figure 2.

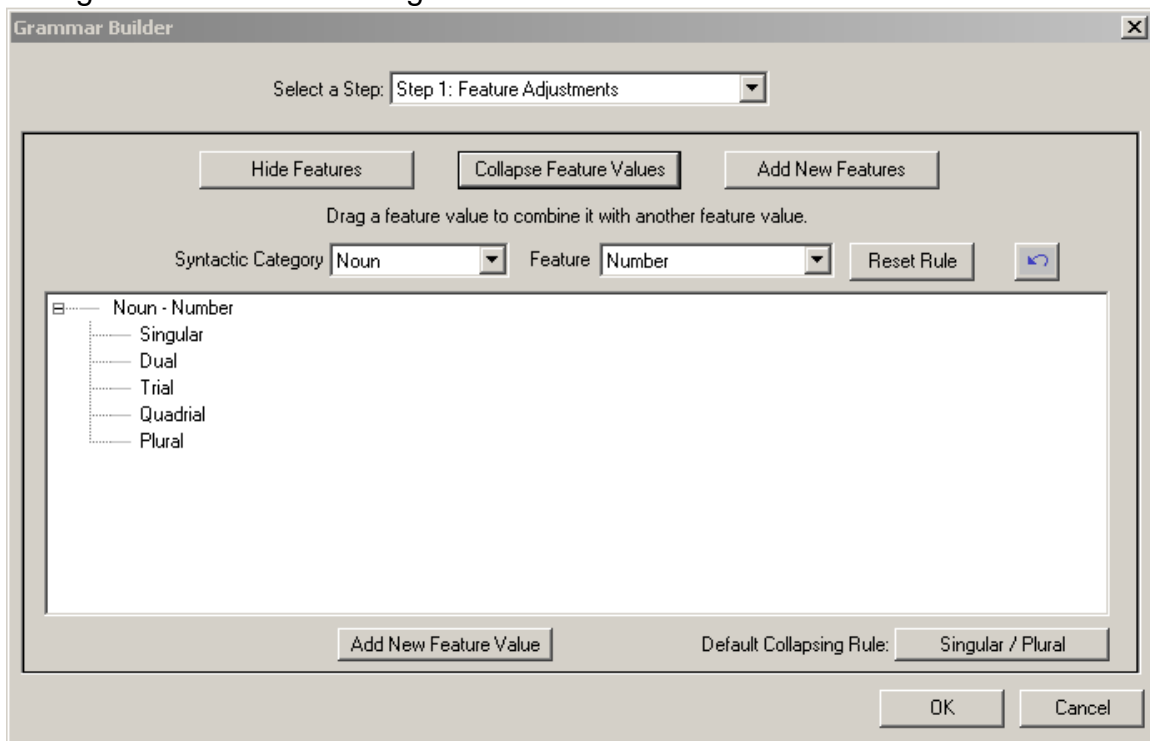


Figure 2. Grammar Builder - Feature Adjustments - Collapse Feature Values

In a previous tutorial you wrote a transfer rule that collapsed the noun Number values Dual, Trial and Quadrial to Plural. You wrote another rule that collapsed verb Time values. Since every language will require some feature collapsing, this dialog eliminates the need for you to write those transfer rules. Before you do any feature collapsing, close this dialog by clicking the OK button, and go to Ruth 1:3. Rest the cursor on the features under SON and you'll see that the

Number value is Dual. Now expand the Spellout Rules node in the grammar tree and double click on Nouns. You'll be prompted to enter a group name; enter **Test**. Now double click on the group name and you'll see an empty spellout rule template. Click on the button labeled Features and you'll see the standard features for Nouns. Notice that the Number column contains Singular, Dual, Trial, Quadrial and Plural. Cancel this rule and go back to the Grammar Builder dialog, Collapse Feature Values. Click on Dual and then drag it down to Plural. Similarly drag Trial and Quadrial down to Plural. By dragging these values down to plural, you've written a rule that collapses Dual, Trial and Quadrial to Plural just like your transfer rule in an earlier tutorial. Close the Grammar Builder dialog and Setup dialog, and rest the cursor on SON in the semantic representation again. You'll see that the Number value is now Plural rather than Dual. The feature collapsing rules are applied to the semantic representations even before they're displayed in this large window. So now in the semantic representations you'll only see Singular and Plural for noun Number. Open another spellout rule dialog for nouns and click the Features button. Now the Number column contains only Singular and Plural. From now on the only values you'll see for noun Number are Singular and Plural. This also applies to any feature copying rule that copies noun Number. For example, if you write a feature copying rule that copies noun Number from all Subject nouns to the verb, TBTA will find all of the Subject NPs, add their Number values together, and then apply this collapsing rule to the result. In general Singular plus Singular is Dual, but if you collapsed Dual to Plural, then Singular plus Singular will become Plural.

Go back to the Collapsing Feature Values dialog. Now click the button in the upper right corner labeled Reset Rule. You'll see all of the values listed separately again. Look in the lower right corner and you'll see a button labeled Default Collapsing Rule and the button's label is Singular / Plural. For some features there's a default button to save you some time. Click that button and you'll see Dual, Trial and Quadrial collapsed to Plural. Click the Reset Rule button again and then drag Quadrial to Plural. Then click on the button in the upper right corner with the blue Undo arrow. You'll then see that Quadrial is no longer collapsed to Plural. This Undo button will always undo the last feature value in the rule.

In the Syntactic Category dropdown in the upper left corner select Verb. Suppose your language only distinguishes Past, Present and Future tenses. Remember that when you wrote a transfer rule to accomplish this task, you had to add the values Past and Future because those values aren't in the semantic representations. Here you can click on the button in the lower left corner labeled Add New Feature Value. Enter **Past** into the dialog and you'll see it appear at the top of the list. Repeat this process and enter **Future**. Now you can drag all of the past tense values to Past and all of the future tense values to Future. Now click the button labeled Reset Rule. You'll see the feature values displayed separately and Past and Future will no longer be in the list. Click the default collapsing rule button which is now labeled Past / Present / Future.

Now select Noun in the left dropdown. Go through each feature in each syntactic category and collapse the values that aren't relevant to your language.

Features that are good candidates for collapsing are noun Number, Participant Tracking, Distance, Person, and verb Time. Add as many new values to these features as you want. The goal here is to modify the feature system so that it contains values that are relevant to your language. For example, when linguists write grammars for English, they generally don't refer to Participant Tracking when discussing nouns. Instead they refer to nouns as being either 'Definite Referential' or 'Indefinite Referential'. So you could add those two values to Participant Tracking, and then collapse the values under Participant Tracking to those two new entries.

After you've finished the feature collapsing process, click the Add New Features button in the upper right corner. The Grammar Builder dialog will change as shown below in figure 3.

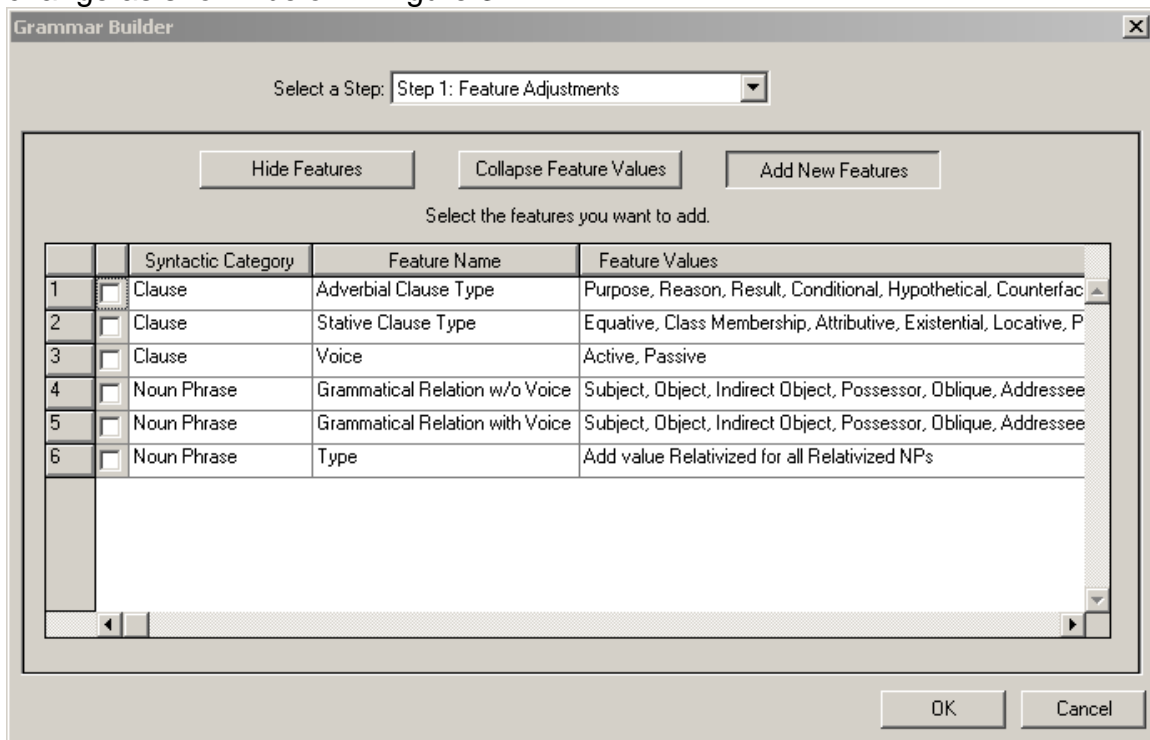


Figure 3. Grammar Builder - Feature Adjustments - Add New Features

This dialog lets you add some very common and useful features to the semantic representations. Before you check any of these features, close this dialog and go to Clauses 1:74. Rest the cursor on the subordinate proposition's features. You'll see that the Clause Type is Event Modifier (adverbial clause), but there's no feature indicating the type of event modifier. In the subordinate clause you see the concept BECAUSE, so you know this is a Reason adverbial, but right now there's no feature on the clause indicating this. Rest the cursor on the NP features and you'll see that they aren't marked for Grammatical Relations. Now go back to Grammar Builder – Add New Features. Check the boxes for Adverbial Clause Type, Stative Clause Type, Voice and Grammatical Relation with Voice. Also check the last box which identifies all of the relativized NPs. Close this dialog and go look at Clauses 1:74 again. Now the event modifying

proposition is tagged as a Reason adverbial clause and the NPs are now marked for grammatical relations. Writing your grammar will be much easier if you add these features that distinguish the various types of adverbial clauses, the various types of stative clauses, voice, and grammatical relations. Go back to this dialog and click in the last column for any of these features. You'll see the transfer rule that accomplishes that particular task. The transfer rules that generate grammatical relations from semantic roles, adverbial clause types from adpositions, stative clause types from lexical senses of BE, etc., have all been written for you. All you need to do is activate the ones that are relevant to your language. You're able to edit these transfer rules if you want to, but you really shouldn't change these rules unless it's necessary. But keep in mind that they are available for you to edit if your language requires it.

## Step 2: Structural Adjustments

In the dropdown at the top of the Grammar Builder dialog select the second step: 'Structural Adjustments'. The dialog will now appear as shown below in figure 4.

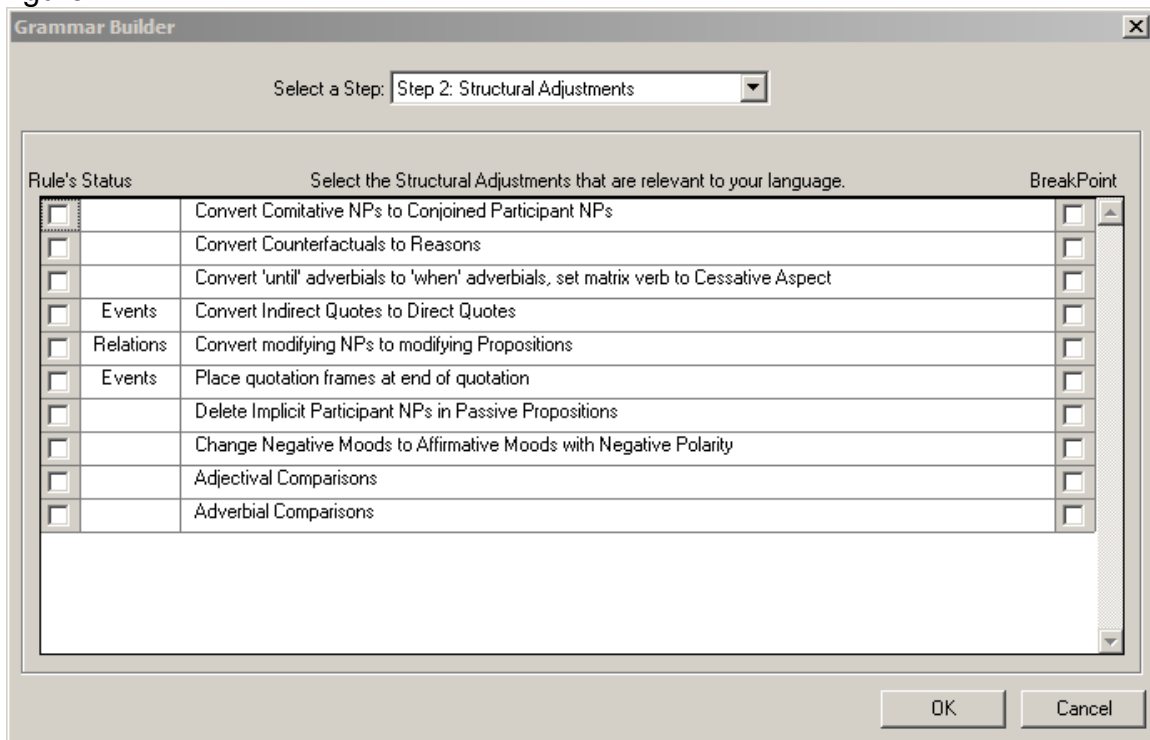


Figure 4. Grammar Builder – Structural Adjustments

This dialog contains many common structural adjustments that will be used by a variety of languages. Structural adjustments are accomplished by transfer rules just like the ones you wrote in the previous two tutorials. The changes made by the rules in this dialog are common changes that will be required by many different languages. If you rest your cursor on the name of a particular structural adjustment, you'll see a popup showing an example of that adjustment and a reference where you can see that adjustment applied. For example, close this

dialog and go to Clauses 1:83. Rest the cursor on the subordinate clause's features and you'll see that it's a Counterfactual - assuming you added the Adverbial Clause Type feature described in the previous section. Also notice that this subordinate clause begins with the adposition IF-D. This clause generates *If Mary had read that book, John would have read this book*. However, not all languages have a method of forming counterfactual clauses; some languages form the semantic equivalent by using a reason clause rather than a counterfactual. If your language would use a reason adverbial rather than a counterfactual, go back to the Structural Adjustments dialog and check the box for Convert Counterfactuals to Reasons. Now close Grammar Builder and look at Clauses 1:83 again. You'll see that the Adverbial Clause Type is now Reason because it contains the adposition BECAUSE-A rather than IF-D. Notice also that the Polarity of the two verbs has been changed. So this structural adjustment was executed even before the verse was displayed in the semantic representation window. This verse will now generate *Because Mary didn't read that book, John didn't read this book*. By activating this particular text preprocessor, all counterfactual propositions in the semantic representations will be automatically converted to reason propositions. This will be very useful if your language doesn't use counterfactuals. Keep in mind that all of the rules you activate in Grammar Builder are executed before the verse is displayed in the semantic representation window.

Go back to the Structural Adjustments dialog and click in the last column on Convert Counterfactuals to Reasons. You'll see the transfer rule that accomplishes this change; notice that four structures are used in the rule to handle all of the possible verb polarity combinations. As was mentioned before, you're able to edit these transfer rules, but that's not recommended. For another example, the first structural adjustment is called Convert Comitative NPs to Conjoined Participant NPs. The popup shows you that this preprocessor will convert *John walked with Mary* to *John and Mary walked*. This particular adjustment will be used by many Papuan languages. Go to Noun Phrases 1:9 and you'll see the semantic representation for *John walked with Mary*. Now go back and activate that structural adjustment preprocessor by checking the box. When you look at the semantic representation for Noun Phrases 1:9 again, you'll see that the NP that previously contained *with Mary* now contains *and Mary*, and its semantic role has been changed to Participant. If you rest the cursor under the features for that NP, you'll see a popup explaining what the rule did. Go back and turn the preprocessor off by unchecking the box, and then come look at the verse again. You'll see that the verse is back to its standard representation.

For some of these structural adjustment preprocessors you need to specify which concepts will trigger them. For example, rest the cursor on the preprocessor called Convert Modifying NPs to Modifying Propositions. The popup shows you that this rule converts something like *The man in that house read a book* to *The man who is in that house read a book*. English permits its speakers to freely modify nouns with prepositional phrases, so the semantic representations include these constructions. But not all languages permit this type of modification. Therefore in those languages the modifying prepositional

phrases will have to be converted to relative clauses. Close the Grammar Builder dialog and go to Noun Phrases 1:19. You'll see that MAN is modified by the noun phrase IN-A HOUSE. Now go back to Grammar Builder and click on the cell labeled Relations (prepositions). Scroll the upper grid down until you see IN-A. Click on IN-A and then click on the button below the grid labeled 'vv'. You'll see IN-A moved from the top grid down to the lower grid indicating that this preposition will now trigger this rule. If you inadvertently move a preposition down to the lower grid, simply click on it in the lower grid and then click the button labeled '^'. You'll then see that preposition moved back to the upper grid. After you have IN-A moved to the lower grid, click the OK button and then make sure this preprocessor is activated by checking its box. Then close Grammar Builder and look at Noun Phrases 1:19 again. You'll see that MAN is now modified by a restrictive relative clause. As you work through the source texts you'll probably discover other modifying prepositional phrases that need to be converted to relative clauses. You may always go back to Grammar Builder and add or remove triggering concepts for the preprocessors.

### Step 3: Styles of Direct Speech

Some languages have different styles of speech depending upon the respective status of the speaker and listener. For example, a language may use one set of personal pronouns to indicate respect, and another set of pronouns may be used to indicate familiarity. If your language distinguishes different styles of direct speech, then you'll want to use this feature. This feature lists all of the general categories of speakers and listeners that occur in direct speech situations in the semantic representations. If you want to use this feature, you should first make sure that Direct Quote 1, 2 and 3 aren't hidden (Grammar Builder – Feature Adjustments – Hide Features). At this dialog you'll first need to enter the generic categories of direct speech styles in your language. For example, suppose your language has three categories: Formal Speech, Standard Speech and Familiar Speech. Click the button at the top labeled Add New Style of Direct Speech. Enter **Formal** into the dialog and you'll see it appear at the top of the list. Repeat this process with **Standard** and **Familiar**. Before you begin dragging speech situations to these new values, close this dialog and go to Ruth 1:8. You'll see a direct quote in which Naomi is speaking to her two daughters-in-law. Rest the cursor on the subordinate patient proposition and then the two independent propositions that are direct quotes. In all three cases you'll see that Direct Quote 1 is set to 'Mother to Grown Daughter'. You'll also see that Direct Speech Style is currently Unspecified. Now go back to Grammar Builder and drag 'Mother to Grown Daughter' to Familiar. Begin by scrolling down until you see 'Mother to Grown Daughter'. Then left click on it and drag it to the top of the window. When the mouse gets to the top of the tree, hold it still for a second and then you'll see the tree begin scrolling upward. Continue to hold your mouse still until the tree has scrolled all the way to the top and you can then highlight Familiar. At that point release your left mouse button and you'll see 'Mother to Grown Daughter' follow Familiar. Your dialog should now appear as shown below in figure 5.

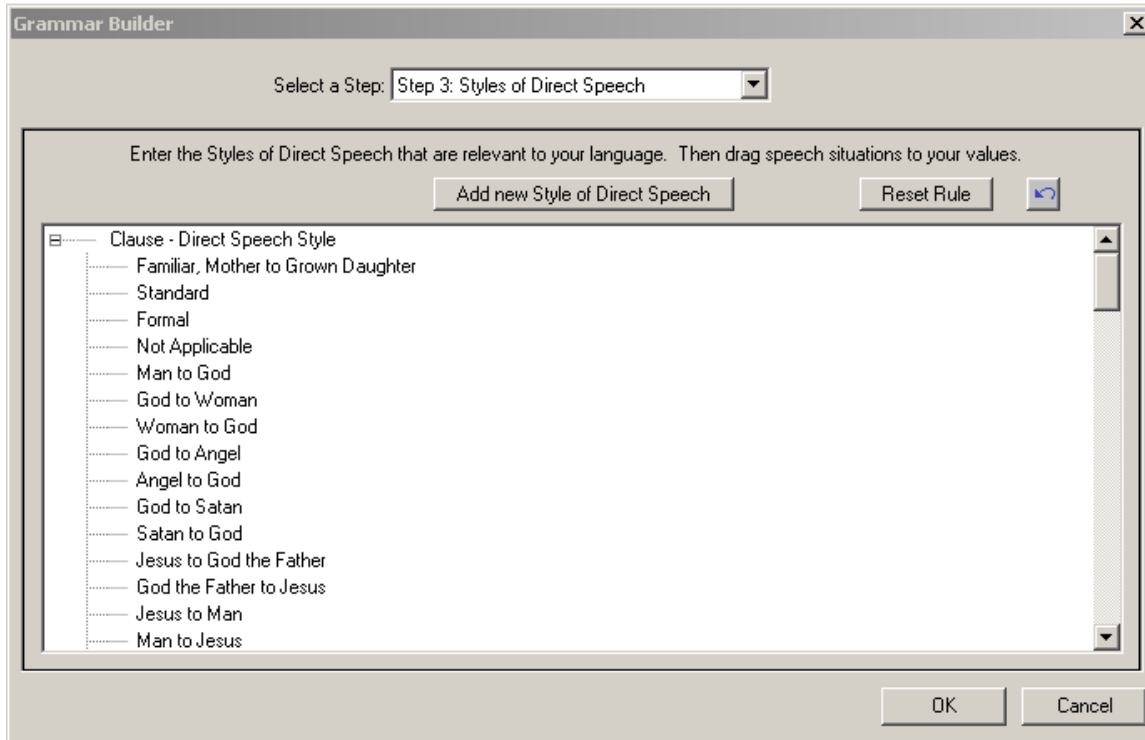


Figure 5. Grammar Builder – Styles of Direct Speech

Look at Ruth 1:8 again and you'll see that 'Direct Speech Style' is now Familiar in all three propositions. You may now go back and drag each of the speaking situations to the appropriate generic category. After you've completed this process, you can write rules that will be triggered by specific styles of speech. For example, one table spellout rule might provide all of the personal pronouns when the Direct Speech Style is Familiar. Another table spellout rule will contain all of the personal pronouns when Direct Speech Style is Formal. Yet another table spellout rule will supply the personal pronouns when Direct Speech Style is Not Applicable.

#### Step 4: Complex Concept Expansion Rules

*This section of the software is not yet complete. For this section, please switch to the English database that was provided with your installation kit. Go to Utilities, Select / Add / Edit a Target Language. Open the dropdown at the top and select English. After you've finished reading this section, please repeat this process to return to the language database that you're using for this final tutorial. At the current time, expansion rules have been written only for BETRAY-A and FORGIVE-A.*

As was discussed in the first tutorial, there are three general categories of events in the ontology: 1) Primitives as identified by Natural Semantic Metalanguage theorists, 2) Molecules, and 3) Complex Events. The molecules are considered semantically more complex than the primitives but semantically simpler than the complex lexemes. According to NSM, every language will have a lexical or morphological equivalent for each of the primitives. Languages are

statistically more likely to have good lexical equivalents for the molecules than they are for the complex events. In fact languages aren't very likely to have good lexicalized equivalents for the complex concepts. Therefore many of the complex concepts will probably require some restructuring in order to accommodate your language. That is the purpose of these complex concept expansion rules. These rules will expand each complex concept in terms of the molecules and primitives. For example, FORGIVE is a complex concept that has been lexicalized in English. Many other languages won't have a single lexical equivalent for this concept. If that's the case, you may want to activate the expansion rule for FORGIVE. Begin by going to Matthew 6:12. This verse has two occurrences of FORGIVE-A and they're highlighted in red<sup>1</sup>. Push the Generate button and you'll see that this verse produces *Forgive us for our sins like we forgive the people that sin against us*. Now go back to Grammar Builder, Complex Concept Expansion Rules, and scroll down to FORGIVE-A. Rest your cursor on FORGIVE and the popup will show you that this rule will change every instance of 'X FORGIVE Y (FOR Z)' in the semantic representations to 'X treat Y kindly and not punish Y (for Z)'. Notice that the events TREAT and PUNISH are semantic molecules so your language is much more likely to have lexical equivalents for these two events than it is for FORGIVE. Activate this complex concept expansion rule by checking the box next to FORGIVE. Now go back and look at Matt. 6:12 again. You'll see that the complex event FORGIVE no longer appears in the verse. Instead the propositions have been restructured and the concept FORGIVE has been expressed using semantic molecules. The verse will now generate *Treat us kindly and do not punish us for our sins like we treat the people that sin against us kindly and do not punish them*.

Go back to Grammar Builder and do a right click on FORGIVE. You'll see the transfer rule that performs the changes. As always you may edit these expansion rules, but that isn't recommended. Deactivate this expansion rule, close Grammar Builder, and look at Matt. 6:12 again. You'll see that the verse is back to its original representation. Rest the cursor on either occurrence of FORGIVE-A and do a right click. The popup menu will include an option labeled 'Activate this Complex Concept's Expansion Rule'. Select this option and you'll again see the verse restructured so that FORGIVE-A no longer appears in the verse. To deactivate the rule, you need to go back to Grammar Builder and uncheck the box.

*Please be sure to switch back to your final tutorial database now so that you don't inadvertently affect the English database.*

## Step 5: Automatic Rule Development

This section of Grammar Builder is a little different from the other sections of Grammar Builder. All of the other sections contain prewritten rules that you activate if they're applicable to your language. This section of Grammar Builder doesn't contain any prewritten rules. Instead this section helps you write lexical

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<sup>1</sup> You may change the color of the complex concepts by going to the Setup dialog and clicking on the red square labeled Complex Concepts. You may then select any color that you like. You may also display the primitives and the molecules in any color that you like.

and grammar spellout rules. This section will walk you through the feature system for four of the syntactic categories: nouns, verbs, adjectives and adverbs. For each feature value you'll be prompted to enter a stem and a sample of text from your language. TBTA will then compare the stem with the sample, and then propose a spellout rule. You'll then decide whether or not the rule is correct. Right now Grammar Builder should appear as shown below in figure 6.

The screenshot shows a dialog box titled "Grammar Builder" with a close button (X) in the top right corner. At the top, there is a dropdown menu labeled "Select a Step:" with "Step 5: Automatic Rule Development" selected. Below this, there are three more dropdown menus: "Syntactic Category:" with "Nouns" selected, "Feature:" with "Number" selected, and "Feature Value:" with "Singular" selected. Underneath these are two input fields: "Stem" and "Singular", both containing the text "rock". Below these is a "Sample sentence:" field containing "John saw a rock.". At the bottom, there are two empty "Target:" input fields and a "Suggest Rule" button. In the bottom right corner, there are "OK" and "Cancel" buttons.

Figure 6. Grammar Builder – Automatic Rule Development

At the top of this dialog you see three dropdowns. The first dropdown contains the four syntactic categories mentioned above. The second dropdown contains a subset of the features associated with the syntactic category that is currently selected in the first dropdown. The last dropdown contains all of the feature values in the selected feature. It's important that you collapse as many feature values as possible before you walk through this process. Feature collapsing was described above in Grammar Builder – Feature Adjustments – Collapse Feature Values. If you haven't completed the collapsing process, you should do that now.

In the automatic rule development dialog you're prompted to enter two samples of text. The first prompt is asking you to enter any noun stem from your language; the second prompt is asking you to enter the singular form of that stem. Grammar Builder will always show you samples from English; you may choose the same nouns that are suggested, or you may choose completely different nouns. Right now it's asking you to enter a noun stem such as *rock*, and then to enter the singular form of that stem. In English we'd enter *rock* as the stem and *rock* as the singular form because singular English nouns are equivalent to the stems. So enter ***rock*** and ***rock*** and click the Suggest Rule button. TBTA will then compare the first string with the second string to determine the differences.

In this case there are no differences, so you'll see a message indicating that no rule is necessary. You'll then be prompted to enter a noun stem and the plural form of that noun (assuming you collapsed Dual, Trial and Quadrial to Plural). Enter **rock** and **rocks** and then click the Suggest Rule button. TBTA will then suggest a rule that adds the suffix –s to the stem in order to generate the plural form. Note that as you enter target text into Grammar Builder, you should always ignore all morphophonemics. TBTA will enter the noun stem into the lexicon, and then it will enter the rule into either the lexicon or the grammar. The guideline used here is that if the second string is formed by adding a prefix, suffix or infix to the first string, then the rule will be put into the lexicon. If the second string is formed by adding a separate word to the first string, then the rule will be put into the grammar. The reason for this is because when a language adds prefixes, suffixes or infixes, there are generally many suppletive forms. By putting these forms into the lexicon, all the suppletive forms may be entered directly into the table. When a language adds a separate word for a particular operation, there are generally very few if any irregular forms. Therefore rules that add words will be put into the grammar rather than the lexicon. When you write your own rules, you should follow this same guideline when deciding whether a particular spellout rule should be put in the lexicon or in the grammar. You may close Grammar Builder now and go look at your nouns in the lexicon. You'll see the particular noun that you entered, and if you look at the Forms, you'll see that Plural has been added. If you look at the Form Rules, you'll see the rule that Grammar Builder just suggested.

Go back to Grammar Builder and click the Suggest Rule button without entering any text in order to step past the Singular and Plural noun forms. You'll then see that Grammar Builder is asking you to enter a noun stem and the equivalent when that stem is first mentioned in a discourse. In English we'd enter **rock** and **a rock**. Push the Suggest Rule button and TBTA will suggest a rule. Again all you need to do is push the OK button to save the rule. Since this rule adds a word rather than an affix, this rule will be put into the grammar rather than the lexicon. So TBTA will add a new group for noun spellout rules, insert this rule into that group, and then check your first NP phrase structure rule. You'll be prompted to edit that phrase structure rule like you were in previous tutorials. Grammar Builder will then move to the next noun feature value and prompt you for text. Continue walking through this process until you've answered all of the prompts. You can always edit any suggested rule before you accept it. Note that Grammar Builder is currently not able to consolidate similar simple spellout rules into a single table rule. After you've finished this process, it's your responsibility to go back and consolidate as many rules as possible. Also note that Grammar Builder is unable to determine whether or not a simple spellout rule is actually adequate for the task. When prompted for Completive aspect, you could enter *walk* and *finish walking*. Grammar Builder would then suggest a rule that adds the word *finish* to the gerund. But, as you already know from a previous tutorial, this solution is inaccurate because *finish* is now the grammatical verb that gets marked for tense and mood, and *walk* becomes a semantic verb. Therefore a simple spellout rule can't possibly handle English completive aspect.

Grammar Builder has no way of knowing this, so it's your responsibility for making sure that it doesn't suggest inadequate or inaccurate rules. In other words, you shouldn't blindly let Grammar Builder suggest rules, and you shouldn't necessarily accept all of the rules that Grammar Builder proposes. When you're prompted with a situation that can't be handled by a spellout rule such as Completeive aspect in English, just click the Suggest Rule button without entering any text. TBTA will then move to the next feature value. When Grammar Builder suggests a rule, inspect it carefully before accepting it. You can always come back later and edit the rules, but try to make sure the rule is appropriate and completely correct before you save it.

### Step 6: Relative Clauses

Relative clauses have been studied in great detail by many different linguists and they've observed common patterns throughout the world's languages. In particular they've observed four different encoding strategies and a relativization hierarchy. Not all languages have relative clauses; some languages form the semantic equivalent with topical clauses. If your language uses topical clauses rather than relative clauses, this section of Grammar Builder will not be applicable to your language. But if your language does use relative clauses and grammatical relations, this section will save you some work.

Before using this section, go back to Grammar Builder – Feature Adjustments – Add New Features. Make sure that you've activated the Grammatical Relation with Voice feature and the Type feature for noun phrases that identifies all relativized NPs. Then come back to the relative clause section of Grammar Builder. For each grammatical relation you're able to select a particular strategy. Before selecting any strategies, close Grammar Builder and go to Clauses 1:25. Verify that the NP containing MAN in the relative clause has been tagged as Relativized and its Grammatical Relation is Subject. If this isn't the case, go back and activate those two features described earlier in this paragraph. Now go back to Grammar Builder – Relative Clauses and for Subject select Gap. Also check the Relativizer box for Subject and enter *that* as the Relativizer. Close Grammar Builder by clicking OK and you'll see in the semantic representation that the question marks below MAN have been eliminated in the relative clause. The gap strategy will leave the source noun and its features in the relative clause, but it will eliminate the target word. In the relative clause you'll also see that the Relativizer *that* has been inserted at the end of the relative clause. Your clause phrase structure rule will determine where the Relativizer will ultimately be positioned. Now go to Clauses 1:26 which has a relativized object NP. Rest your cursor on the features under MAN in the relative clause and notice that its Surface Realization is Not Applicable. Go back to Grammar Builder – Relative Clauses and in the Object row select the Pronoun Retention strategy. Click OK and look at Clauses 1:26 again. Now the Surface Realization feature under MAN is Unambiguous Pronoun. Go to Clauses 1:28 which has a relativized indirect object. Notice that the Surface Realization for MAN in the relative clause is again Not Applicable. Go back to the relative clause section of Grammar Builder and for Indirect Objects select Relative

Pronoun. Click OK to close Grammar Builder and then look at the features under MAN again. Now the Surface Realization feature is set to Relative Pronoun. You may now write spellout rules for nouns that will be triggered whenever the Surface Realization feature is set to Relative Pronoun. You've now seen all of the strategies that have been included in Grammar Builder. You may use as many or as few of these strategies as are applicable to your language. If none of these strategies fit your language, then you can always write your own transfer rules to handle relative clauses.

#### Step 7: Collocation Correction Rules

*This section of the software hasn't yet been developed.*

#### Step 8: Discourse Options

*This section of the software hasn't yet been developed.*

### **3.0 Library of Common Transfer Rules**

Another tool in TBTA that will make your grammar development much easier is a library of common transfer rules. Go to the Lexicon and Grammar Development screen and click on Transfer Rules in the grammar tree. Then do a right click on Transfer Rules. You'll see a second grammar tree appear to the right of the original grammar tree. This second grammar tree contains a library of common transfer rules that have been written for you and organized by topics. You may look at the rules in this library in the usual way – double click on a rule's name in the library tree. If a rule in the library is relevant to your language, you simply drag its name from the library to your regular grammar tree. You may then drop the rule into any group of transfer rules in your grammar tree. You should spend some time looking at each of the rules in the library to determine which are relevant to your language. When you want to close the library, click on Transfer Rules in the standard grammar tree, and then right click. You'll then see the library disappear.

### **4.0 Notes on Grammar Topics**

As you develop your target grammar, you should enter many notes and comments into your rules. At the time when you're writing a particular rule, the purpose of the rule will always seem obvious. However, when you look at the rule a month later, you may not be able to remember why you originally entered that rule. So you should always enter at least one example into the comment for each rule. Later when you edit a rule and change something in it, you should indicate in the comment why you changed the rule. For example, suppose you edit a rule so that it no longer applies in a particular environment. You should then indicate in the comment why you don't want that rule to apply in that environment.

As you're building your grammar, you should also build a set of notes for each topic in your grammar. On the main toolbar is a button labeled Target

Notes. When you click on that button a new dialog will appear. Click on the button labeled New Topic, and enter something like **Relative Clauses**. You may then enter notes relevant to relative clauses into that text box. You should develop a set of notes for relative clauses, complement clauses, adverbial clauses, aspects, moods, and any other topic that you deal with in your grammar. Later those notes will be very helpful when you're trying to remember why you wrote the rules that you did.

## 5.0 Conclusion

You've now completed the TBTA tutorials. The next step is to begin working through the Grammar Introduction. It's highly recommended that you first work through the Grammar Introduction in English. By developing an English lexicon and grammar first, you'll become more familiar with the rules and how TBTA operates. But as you're developing your English grammar and lexicon, you should certainly be thinking about how to handle the various constructions in your target language.

You should now go to Utilities, Select / Add / Edit a Target Language and click the New Target Language button. Begin your new language project just as you have several times in these tutorials. Then select Generator, Lexicon and Grammar Development in the main menu. Click the yellow Analysis Notes button in the lower right corner. When you see the Analysis Notes dialog, check the box in the lower left corner labeled 'Automatically display the Analysis Notes when working in the Grammar Introduction'. By checking that box, TBTA will automatically display the helpful notes whenever you begin working on a new verse. The Analysis Notes button will be yellow whenever the currently selected verse has helpful notes that you should read before you begin working on that verse. Most of the verses in the Grammar Introduction have helpful notes that you should consult. Those notes will walk you through the process of developing your target grammar.