



# **ViaVoice™ Speech Developer's Tools Guide**

Printed in the USA

**Note:**

Before using this information and the product it supports, be sure to read the general information under Appendix A "Notices".

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## About This Document

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This document provides detailed information on developing Linux™ speech-aware applications using the IBM ViaVoice™ Software Developer's Kit (SDK) for Linux and the IBM Speech Manager API (SMAPI) interface set. This document is prepared in Portable Document Format (PDF) to provide the advantages of text search and cross-reference hyperlinking and is viewable with the Adobe Acrobat Reader v.3.x. We recommend that you print all or part of this guide for quick reference.

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## Who Should Read This Document

Read this document if you are a programmer interested in writing Linux speech-aware applications that use ViaVoice for speech and are built using the IBM SMAPI interface set.

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## Related Publications

Refer to the following publications included with this version for additional programming, reference, and design information:

- *SMAPI Reference*



# SMAPI Grammar Development and Test Tools

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The ViaVoice SDK provides three command-line tools that can assist you as you design, test, and debug grammars. These tools can be used in conjunction with the SMAPI Grammar Compiler, Dictionary Builder of SMAPI, and the SMAPI Grammar Test Tool to verify the behavior of your grammars. These tools are:

- `fsgenum`
- `fsgprint`
- `fsgtest`

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## **fsgenum**

The `fsgenum` tool is used to generate the sentences accepted by a grammar. These generated sentences can be used as test scripts for the grammar or as a reference for what the grammar will accept. The command line parameters for `fsgenum` control how the sentences for the grammar will be generated. `Fsgenum` can enumerate all the sentences accepted from a compiled grammar (FSG) to standard output. The command-line options specified below determine which sentences are generated. This tool can be used to produce test scripts for “live” grammar testing. The syntax of `fsgenum` is:

```
fsgenum [-r N | -R N | -f] [-a] [-p] [-l N] file.fsg
```

The parameters are:

**-r N**

Generates N random sets of sentences from the grammar. The same set of random sentences are always generated each time the command is executed with this option. The sentences are chosen in accordance with the probability that is assigned to them by the grammar.

**-R N**

Generates N a new random set of sentences from the grammar. A different set of random sentences is generated each time the command is executed with this option.

**-f**

Generates a complete set of sentences acceptable by the grammar. For some grammars, this set might be very large.

**Note:**

If none of the preceding options is specified, `fsgenum` will enumerate one sentence representing each possible state sequence in the FSG file.

- a**  
Displays the annotations associated with each enumerated sentence in the format `word:annotation`.
- p**  
Displays the probability associated with each enumerated sentence.
- l N**  
Specifies how many times loops (repetition operators) are expanded in the enumeration. For example, with `-l 3` specified, the production `"very+"` generates “very,” “very very,” and “very very very” in the enumeration, while `"very*"` generates "", “very,” and “very very.” The default value for `N` is 2.

**file.fsg**

Specifies the FSG file containing the grammar to enumerate.

The following example enumerates 10 different, random sentences from the grammar `mygram.fsg` and shows the probability associated with each sentence:

```
fsgenum -R 10 -p mygram.fsg
```



---

## **fsgprint**

The fsgprint tool prints a state-by-state description of a compiled grammar (FSG), with annotations and arc probabilities. This tool is used primarily for diagnostic purposes. The syntax of fsgprint is:

```
fsgprint [-v] file.fsg
```

The parameters are:

**-v**

Prints additional information about the contents of the FSG.

**file.fsg**

Specifies the FSG containing the grammar to print.

The following example prints the contents of the grammar mygram.fsg:

```
fsgprint mygram.fsg
```

---

## **fsgtest**

The fsgtest tool accepts test sentences from standard input and, for each sentence, prints to standard output an indication of whether the sentence is accepted by the grammar. This tool is used to verify the expected behavior of a grammar. The syntax of fsgtest is:

```
fsgtest [-t] [-a] [-p] file.fsg
```

The parameters are:

**-t**

Prints to standard output translations of sentences read from standard input.

**-a**

Shows the annotations associated with each sentence in the format word:annotation.

**-p**

Shows the probability assigned by the grammar to each sentence.

A probability of "\*\*\*\*\*" indicates that the grammar does not accept the sentence. If -p is not specified, fsgtest prints each input sentence that is accepted by the grammar to standard output.

Any sentence that is rejected by the grammar is printed to standard output preceded by an asterisk "\*".

**file.fsg**

Specifies the FSG containing the grammar to test.

The following example tests whether the sentence “what time is it” is accepted by the grammar mygram.fsg and shows the probability associated with that sentence:

```
fsgtest -p mygram.fsg
what time is it
```

You can use **Ctrl+C** or **Ctrl+Z** to end the session.

You might also want to create a file that contains all of the sentences you want to test. You can then redirect standard input to this file. In the following example, the file test.txt is used as input to fsgtest:

```
fsgtest <test.txt mygram.fsg
```

---

After you define your vocabulary, compile the grammar (if necessary), and create a dictionary of pronunciations for your vocabulary, you need to test it and the pronunciations to verify that all the words and phrases can be recognized by ViaVoice. The SMAPI Grammar Test Tool allows you to do this before you've written or modified your own application. If ViaVoice cannot recognize selected words or phrases, you might need to modify your vocabulary or the pronunciations of the words or phrases to resolve the problems.

The SMAPI Grammar Test Tool takes compiled grammar (FSG) files as input. It also supports command vocabularies; that is, you can specify word list (WDL) files as input, too. In addition, you can define dynamic command vocabularies and external lists from within the SMAPI Grammar Test Tool.

When testing your vocabulary, you should test both in-vocabulary and out-of-vocabulary words and phrases. If you have more than one vocabulary for your application, you should test each of the vocabularies separately, and then test them together.

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## Accessing the SMAPI Grammar Test Tool

From the ViaVoice SDK folder, under TOOLS, click SMAPI Grammar Test Tool. The SMAPI Grammar Test Tool main window appears.

You can also start the SMAPI Grammar Test Tool from the command line by typing:

```
gramtest
```

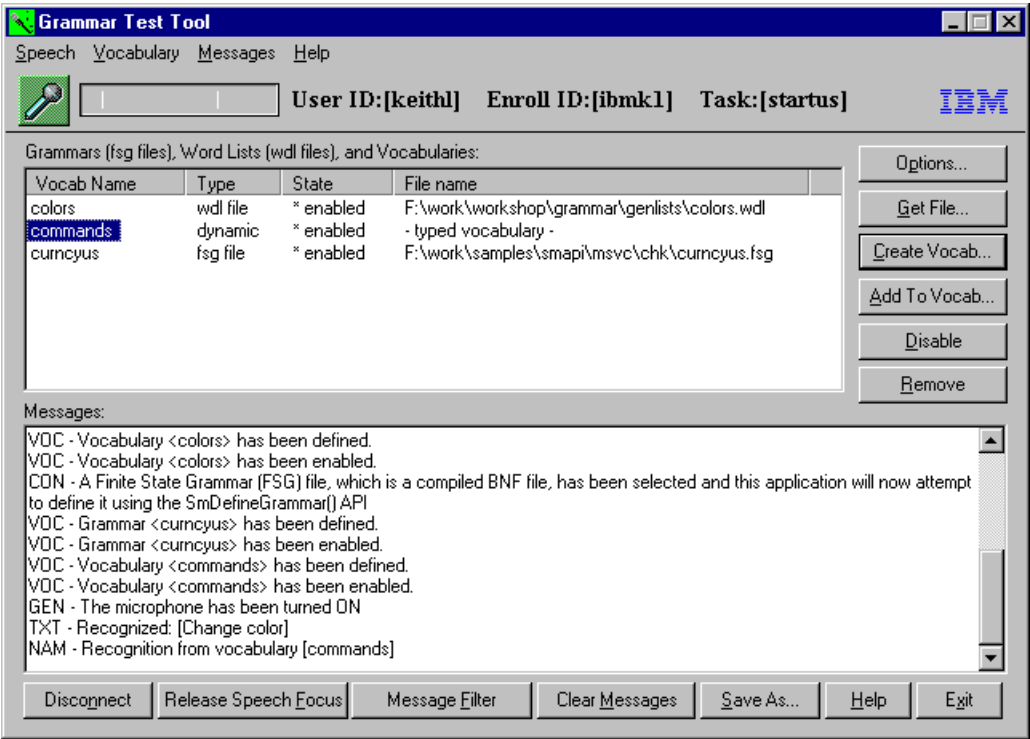


Figure 1. SMAPI Grammar Test Tool

This window shows the grammars you have selected to test in the Grammars (fsg files), Word lists (wdl files), and Vocabularies area. In the Messages area, you see informational and error messages, including messages that tell you whether the engine recognized what you said.

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## Using the Test Tool

With the Tool, you can:

- Select word lists, SAPI grammars, and vocabularies to test
- Test word lists, SAPI grammars, and vocabularies
- Filter, display, and save informational and error messages
- Create a dynamic vocabulary or external list
- Add words and phrases to a dynamic vocabulary or external list
- Change the active user ID, enroll ID, or task
- Disconnect from and reconnect to the speech recognition engine
- Request or release speech focus

## Selecting Word Lists, SAPI Grammars, and Vocabularies to Test

You use the Tool to test SAPI grammars, word lists, dynamic vocabularies, and external lists. You can test multiple vocabularies of different types at the same time. The list of vocabularies available to test are shown in the Grammars (fsg files), Word lists (wdl files), and Vocabularies area.

To select a grammar (FSG) or word list (WDL) to test:

1. Click the Get File button.
2. Choose the file(s) you want to test. Click Open.
3. You will see the name of the file(s) you selected in the list of vocabularies to be tested.

To include a dynamic vocabulary or external list in the list of vocabularies to be tested, you must first create the vocabulary. Once it is created, it will be available for testing. Note that when you exit the SAPI Grammar Test Tool, a dynamic vocabulary is lost, unless you saved the contents to a word list (WDL) file.

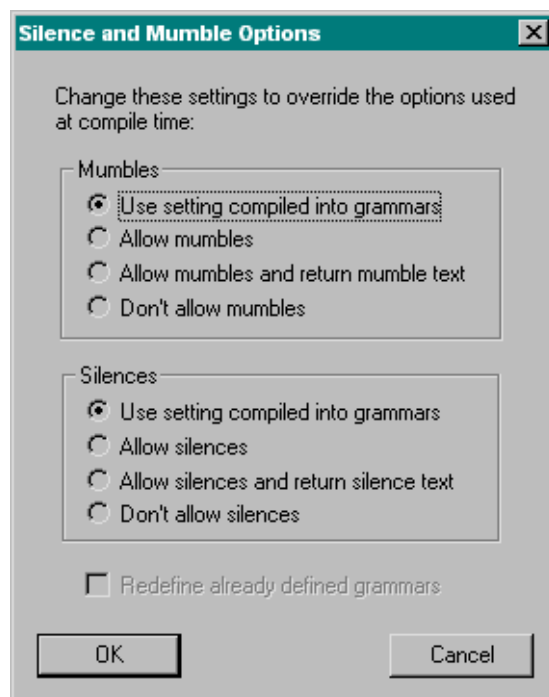
For each vocabulary in the list, you will see its type (fsg, wdl, or dynamic), whether it is enabled or disabled, and the full path name to the file. (For dynamic vocabularies, there is no path name, so you see an informational message that it is a typed vocabulary.)

When a vocabulary is enabled, it is used by the speech recognition engine when recognizing words and phrases. You can temporarily disable a vocabulary (that is, remove it from the set of vocabularies that the engine actually uses to recognize words but keep it in the list of vocabularies available to test) by first selecting the vocabulary and clicking Disable. You can later re-enable the vocabulary by selecting the vocabulary name and clicking Enable. (Note: The Disable and Enable buttons work as a toggle. The Disable button is available only when an enabled vocabulary is selected, and the Enable button is available only when a disabled vocabulary is selected.)

To remove a vocabulary from the list of vocabularies available to test, select the vocabulary name and click Remove. The vocabulary is removed from the list. When you remove a dynamic vocabulary, the contents of the vocabulary are lost.

**Notes:**

- SMAPI Grammars and vocabularies are automatically enabled by the Tool when they are defined (that is, when you get the file or you create the vocabulary.) You can choose not to have the Tool automatically enable SMAPI grammars and vocabularies. To do this, select Vocabulary from the menu, and then deselect Automatic Enable on Get or Create. Any SMAPI grammars and vocabularies that you subsequently select will be defined, but not enabled, by the Tool.
- When a grammar is compiled, you can specify whether to allow (or not allow) silence and/or mumbles between the words of a phrase. When the Tool defines a grammar, it uses the options compiled into the grammars by default. However, you can override the silence and mumble options set at compile time with the Tool. To do this, select Vocabulary from the menu, and then select Silence and Mumble Options. For a description of these compiler options, refer to Chapter 4, “SMAPI Grammar Compiler” on page 67



**Figure 2. Silence and Mumble Options**

Choose the options with which you would like to test your grammars. Click OK. Any grammars that you subsequently select will be defined with these new options. (You can redefine grammars that are already in the vocabulary list by selecting *Redefine already defined grammars*.) By varying the silence and mumble options, you can determine the optimum settings for your SMAPI grammars.

## Testing Word Lists, SMAPI Grammars, and Vocabularies

Once you have selected the word lists, SMAPI grammars, and vocabularies you would like to test, you are ready to begin testing. To test speech vocabularies:

1. Turn the microphone on by clicking the microphone button.
2. Speak every word or phrase in the vocabulary, one at a time.

As you say a word or phrase, a message appears in the Messages area, telling you whether the word or phrase was recognized by the engine. For example, if the word you said is recognized, you will see a message like “TXT - Recognized [word].”

The speech recognition engine can return three types of recognition results: recognized, rejection, or substitution. For example, the word “orange” is in one of the vocabularies available to the speech recognition engine. If the engine recognizes the word “orange” when it is spoken, you will see the following message:

TXT - Recognized [orange]

Rejections occur when you say a word that is in one of the vocabularies, but is not recognized by the engine. A rejection can also occur if you say a word that is not in any of the enabled vocabularies. In these cases, you will see the following message:

TXT - Recognized ?? [different word]

The “??” indicate that the speech recognition engine rejected the utterance, with the word in brackets being the engine's closest guess.

Substitution occurs if the engine recognizes a word, but it is not the word you said (the speech recognition engine substitutes another word for the word you said). In this case, you should see a message like:

TXT - Recognized [different word]

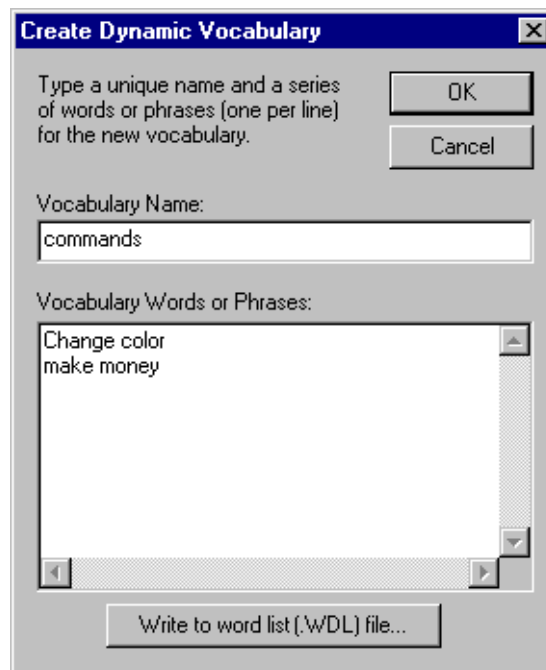
For tips on interpreting and handling these types of messages, refer to “Interpreting and Handling the Results” on page 22.



## Creating a Dynamic Vocabulary or External List

With the Tool, you can define a vocabulary “on the fly” as you're testing it. This is how you specify a dynamic command vocabulary or external list to be tested. It is also a useful way of testing alternative words and phrases for an existing vocabulary. To define a dynamic vocabulary, follow these steps:

1. Click the Create Dynamic button.



**Figure 3. Create Dynamic Vocabulary**

2. The Create Dynamic Vocabulary window appears. Type a name for your dynamic vocabulary in the Vocabulary Name field. This name must be unique.
3. Enter all of the words and phrases for this vocabulary in the Vocabulary Words or Phrase field. Use one word or phrase per line.
4. When you're done, click OK. You will see the name of the vocabulary in the list of vocabularies to be tested. Its type will be dynamic.

**Notes:**

- You can optionally save a dynamic vocabulary as a word list (WDL) file. To do this, click the Write to word list (.WDL) file... button.
- The Tool interprets more than one word on the same line of a WDL file as a phrase to be recognized, rather than as individual words to be recognized. For example, the line:

`open file`

indicates that the phrase “open file” is to be recognized, rather than the individual words “open” and “file.” The Tool recognizes phrases even if pronunciations exist only for the individual words in a phrase. Developers are encouraged to create dictionary files with the Dictionary Builder for all of the words and phrases in their applications before testing with the Tool. This ensures the best recognition performance for all words and phrases.

- If you are defining an external list, you must name it exactly as it is specified in the grammar that refers to it.

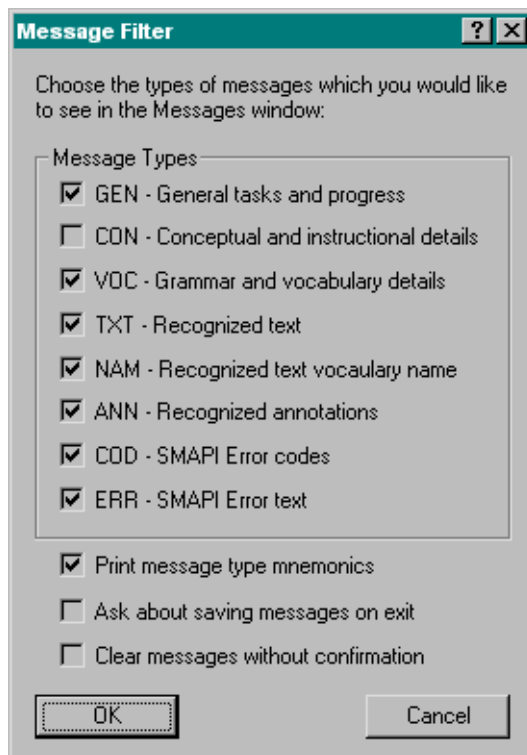
## **Adding Words or Phrases to a Dynamic Vocabulary or External List**

To add words or phrases to a dynamic vocabulary or external list:

1. Select the vocabulary to which you want to add a word or phrase. (It must have a type of dynamic.)
2. Click the Add to Vocab button.
3. Enter the words and phrases for this vocabulary in the Vocabulary Words or Phrases field. Use one word or phrase per line.
4. When you are done, click OK.

## Displaying Informational and Error Messages

The Messages area of the Tool displays a variety of informational and error messages that can help you as you test your vocabularies. You can choose the amount and type of information to be displayed in the Messages area by clicking the Message Filter button.



**Figure 4. Message Filter**

The types of messages that can be displayed are:

- General (such as connecting and disconnecting from the speech recognition engine, requesting and releasing speech focus, and errors in vocabulary definition)
- Conceptual and instructional (detailed information about what is happening, such as “Attempting to connect to ViaVoice” and “Checking connect status”)
- Vocabulary details (when vocabularies are defined, enabled, disabled, undefined, or removed)
- Recognized Text (the actual text that was recognized by the engine)
- Vocabulary name (the name of the vocabulary in which the recognized text was found)
- Annotations (any text or numeric annotations associated with the recognized text)
- SMAPI error codes
- SMAPI error text

By default, all message types except “Conceptual and Instructional” are selected. Experiment with displaying different combinations of messages to determine which are most useful to you.

### **Hint:**

You might want to display “Conceptual and Instructional” messages if this is the first time you are using the Tool, or if you are new to developing SMAPI applications using ViaVoice.

### **Notes:**

- Each message can be prefaced with its type (such as “TXT” or “ANN”). You can turn this feature on or off by selecting the Print message type mnemonics button. (This feature is on by default.)
- You can also save any messages that are in the Messages area to a file. When you exit the Tool, you will be asked if you want to do this. To turn this feature on or off, select the Ask about saving messages on exit button. (This feature is off by default.)
- You can clear the information in the Messages area by clicking Clear messages from the main Tool window. If there is a significant amount of text to clear, you will be asked to confirm that you want to clear the Messages area. To turn this feature off, select the Clear messages without confirmation button. (This feature is off by default.)
- You can edit the information in the Messages area. For example, you might want to annotate the information with notes to yourself to clarify the results of your testing. Any text that you add to the Messages area is saved along with the messages produced by the Tool, if you choose to save the messages information.

## Changing the Active User ID, Enroll ID, or Task

The Tool displays the active user ID, enroll ID, and task. You might need to vary these settings to fully test your vocabularies. To change any of these settings, click the Options button. The ViaVoice Options in Control Panel is displayed.

It is important to test grammars under a variety of conditions, including variations in recognition sensitivity, recognition performance, users, and enrollments.

### **Note:**

Changing certain settings (such as user ID) will cause the engine to send an `SM_REQUEST_DETACH` to all speech-aware applications. The Tool honors this request by disconnecting. You will need to reconnect to the speech recognition engine after changing the user ID.

## Disconnecting from and Reconnecting to the Speech Engine

The Tool automatically connects to the speech recognition engine when it starts. You can explicitly disconnect from the speech recognition engine. This allows testing across repeated program executions (simulated by disconnecting and reconnecting) without interrupting a test session. It is also convenient for testing interactions (coexistence) with other speech-aware applications. To disconnect from the speech recognition engine:

1. Click the Disconnect button.
2. If any vocabularies appear in the vocabulary list, they will be undefined and removed from the list. Click OK to continue or Cancel to stop the disconnect.
3. If you click OK, the Tool is disconnected from the speech recognition engine, the vocabularies are undefined and removed, and the microphone, Get File, Create Dynamic, Add to Vocab, Enable/Disable, Remove, and Get Speech Focus buttons are disabled.

To reconnect to the speech recognition engine:

1. Click Connect.
2. The microphone, Get File, Create Dynamic, Add to Vocab, Enable/Disable, Remove, and Get Speech Focus buttons are now available.

3. You will need to select the vocabularies you want to test again.

The Disconnect and Connect buttons work as a toggle. If the Tool is connected to the speech recognition engine, the Disconnect button is available. If the Tool is not connected to the speech recognition engine, the Connect button is available.

## Requesting or Releasing Speech Focus

With the Tool, you can explicitly request or release speech focus. This is useful for testing interactions (coexistence) with other speech-aware applications. To release speech focus, click the Release Speech Focus button. To request speech focus, click the Request Speech Focus button.

The Get Speech Focus and Release Speech Focus buttons work as a toggle. If the Tool has speech focus, the Release Speech Focus button is available. If another speech-aware application has speech focus (or the Tool has released speech focus), the Get Speech Focus button is available.

---

## Interpreting and Handling the Results

The following examples illustrate how you might interpret and handle some of the more common results that you might encounter when testing your vocabulary. This is not a complete list, nor is there a prescribed approach to testing and verifying your vocabulary and its associated pronunciations. However, this section is meant to provide some insight into the testing process, and it should guide you in determining when you need to change your vocabulary and when you need to change or add a pronunciation to fix a problem.

- You experience frequent misrecognitions of a short phrase. For example, you defined the word “blue” in your vocabulary to select the color blue. When you test it using the Grammar Test utility, it is consistently misrecognized as “new.” You probably need to provide a longer alternative; for example, you might want to define “choose blue” or “new color blue.”
- You defined the phrases “Add gray pen” and “Add green pen” in your vocabulary. You find that “Add gray pen” is consistently misrecognized as “Add green pen” (“green” is substituted for “gray”). Look at the pronunciations for “gray” and “green.” You might need to provide an alternative pronunciation for “gray” using the Dictionary Builder.

- You have defined two functions, “Add <color>” and “Get <color>,” which do two very different things (they are not synonyms). However, when you say “Add blue,” it is frequently recognized as “Get blue.” You might want to reword one of the phrases; for example, change “Get blue” to “Mix blue.”

---

## Tips for Using the Tool

This section describes some hints and tips for using the Tool:

- If your application supports multiple vocabularies, you need to test each one separately first, and then test them together.
- Test your vocabulary with a reasonable population of users. This should help you identify if there are words that are consistently misrecognized over a number of users; if there are, you might need to change the word or phrase or add multiple pronunciations. You should test your vocabulary against a variety of factors, including people with accents, males and females, people who speak the language natively and those who speak it as their secondary language, and users who have enrolled and those who have not enrolled.
- Test “out-of-vocabulary” words and phrases as well as those that are in your vocabulary. For example, you might want to test things that users might say when they are interrupted and forget to turn the microphone off (such as “Good morning” and “Hello”). The goal of testing out-of-vocabulary words and phrases is to ensure that ViaVoice is not inadvertently recognizing these out-of-vocabulary words and causing functions to be performed that the user did not specify. For more information on how the engine accepts or rejects utterances, refer to “Acceptance or Rejection of Utterances” on page 39.
- Remember that testing your vocabulary is an iterative process. As you make changes to your vocabulary or the pronunciations, you should go back and retest the entire vocabulary to verify that all of the words and phrases in the vocabulary can still be recognized.
- Use word list files (WDL) for large dynamic vocabularies. This provides you with a mechanism for editing the vocabulary, as well as enabling easier input to the Dictionary Builder and the Tool.
- You can edit the information in the Messages area. Whatever text you add or change in the Messages area is saved along with the messages produced by the Tool. This can be used, for example, to add notes to yourself to clarify the results of your testing.





---

This chapter describes the **VtGeneratePronunciations** API, which is included with the ViaVoice SDK to enable the unlimited vocabulary capability for SMAPI applications. **VtGeneratePronunciations** is provided as a separate DLL (UVOCAB.DLL) which must be included with any application that uses the function.

**Note:**

The unlimited vocabulary capability uses the SAPI interface to the text-to-speech engine. As a result, SMAPI applications that incorporate the **VtGeneratePronunciations** call must also include the Microsoft Speech API (SAPI) redistributable files for this function to work. These files are available from Microsoft.

For more information on the unlimited vocabulary capability, refer to the SMAPI Developer's Guide.

---

## VtGeneratePronunciations

**Purpose**

**VtGeneratePronunciations** adds pronunciations for words returned by **SmDefineVocab** and **SmDefineGrammar** that do not have pronunciations in the engine. The baseform pronunciations that **VtGeneratePronunciation** builds are obtained from the text-to-speech engine dictionaries, and are placed in the engine's temporary pronunciation pools.

This function returns TRUE if pronunciations for all words in the list are added to the engine. It returns FALSE if one or more words failed in phonetization or in being added to the engine. With a return code of FALSE, an application can reissue **SmDefineVocab** or **SmDefineGrammar** to obtain the list of words that could not be added, if required.

The following restriction applies when calling **VtGeneratePronunciations**:

- The speech recognition engine must be halted.

### Notes:

4. **SmDefineGrammar** always fails on one or more missing words. **SmDefineVocab** will succeed, even if all words are missing. An application will need to undefine a dynamic vocabulary before reissuing the **SmDefineVocab** call to find the list of failed phonetizations.
5. Users of this function should adhere to the rules and restrictions that COM places on outgoing calls while handling messages from another process. In particular, this function should not be called from a message handler while handling a `SendMessage` that was generated by another process.

### Syntax

```
BOOL VtGeneratePronunciations (SmSesId session_id, unsigned long nmissing,  
SM_VOCWORD *missing);
```

### Parameters

`session_id`

input - An open SMAPI session ID, returned by **SmSesOpen**.

Note: Applications using **SmOpen** do not have explicit access to the session ID; in this case, specify a default value of 0.

`nmissing`

input - The number of words missing pronunciations, returned by **SmGetVocWords**. Limited to `SM_MAX_VOCWORDS`.

`missing`

input - The pointer to an array of `SM_VOCWORDS`, returned by **SmGetVocWords**.

### Return Values

`TRUE` - If all words are added to the engine.

`FALSE` - If one or more words failed in phonetization or in being added to the engine.

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