

Speech Recognition software in SQA Assessments



Speech Recognition in SQA Assessments

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Introduction

Speech recognition software has been commercially available for many years (since the mid '90s) and is now in reasonably common use. Speech recognition software converts speech into typed text or computer commands, and should not be confused with 'text-to-speech' software which converts digital text into synthetic speech, spoken out by a computer. Speech recognition software is an alternative to typing and using the mouse; text-to-speech software is an alternative or support to reading text on the computer screen.

Nuance, the developers of Dragon NaturallySpeaking (one of the most common speech recognition programs), claim that users of speech recognition software can write three times faster than most people can type¹ and so the technology is potentially of interest to all computer users. However, this claim does not take into account time needed for planning, thinking, reviewing, correcting errors and editing text and 'real' writing speeds may be considerably slower, depending on the user and the task.

Speech recognition potentially offers particular benefits for learners with additional support needs. For example, students with physical disabilities who cannot handwrite or type may be able to dictate text and control the computer, while writers with dyspraxia or dyslexia who have handwriting or spelling difficulties can use speech recognition to overcome the mechanics of the writing process.

Given that many pupils have writing difficulties and use scribes in examinations (SQA received 14,313 requests for use of a scribe in 2010), an obvious question to ask is whether speech recognition can offer an alternative method of support.

This report reviews four speech recognition programs and considers how they might be used in SQA assessments. The packages reviewed are:

- Dragon NaturallySpeaking 11 Home and Premium;
- Windows 7 speech recognition;
- WordQ + SpeakQ.

We chose to investigate Windows versions of the programs because the vast majority of computers in secondary schools in Scotland are Windows PCs. Note however that Dragon is also available for Apple Macs.

This report is not intended to give a comprehensive comparison of each program, but rather to focus on the aspects of the software that are particularly relevant for candidates with additional support needs sitting SQA examinations, such as:

¹ <http://www.nuance.com/for-business/by-product/dragon/index.htm>

- Can you dictate into commonly used word processors, such as Microsoft Word?
- Can you dictate into the SQA Digital Question Papers?
- Can voice be used to interact and control Digital Question Papers?
- How easy is it to train the program to recognise your voice?
- How easy is it to correct mis-recognised words?
- Can you play back your dictation to help review and proof-reading?
- Can you use text-to-speech to read back your dictated text?

Use of speech recognition in SQA external assessments

SQA have received requests for permission to use speech recognition software in examinations and the project team contacted centres which had either enquired or requested permission in 2009 and 2010 to investigate:

- why the candidate wanted to use speech recognition and in which subjects;
- the speech recognition program used;
- whether the candidate actually used the speech recognition in the examination;
- their views on the use of speech recognition.

Of the nine enquiries or requests for use of speech recognition in 2009 and 2010, it seems that none of the pupils actually used the software in an examination:

- three of the nine pupils did use the software at home, but not in exams;
- three of the enquiries were in relation to use of text-to-speech software (for example, PDFaloud and ZoomText) as opposed to speech recognition;
- the details of the enquiries or requests in the other three schools is not clear.

Summary

The accuracy and reliability of speech recognition software has improved considerably in recent years and all the programs tested were functional and seemed effective when dictating into a word processor.

Windows speech recognition is **not** functional for dictating into SQA digital question papers, and so we do not recommend it for use in examinations unless the candidate is only intending to dictate into a word processor.

Dragon NaturallySpeaking is the most well known speech recognition program and can be used to dictate into both digital question papers and to a word processor. It is probably the most accurate, is relatively easy to train and use and gives voice control over formatting and over the computer in general. Dragon has text-to-speech for reading back the dictated text, and the Premium version can also play back a recording of the dictation to help with finding and correcting errors. For single user copies, Dragon NaturallySpeaking Premium is available with an educational discount (£68) and the 100-user Professional school license at £895 would seem to be relatively good value for schools who wish to make the software available to a large number of pupils.

WordQ + SpeakQ is specifically designed for users who have difficulties with literacy. It uses the Windows speech recognition system, but accessed using a different, simpler interface. It has text-to-speech to help get through the training process; it can read back each phrase as it is dictated; it has text-to-speech for proof-reading; and it provides word prediction. SpeakQ can be used to dictate into SQA digital papers and also to word processors. WordQ + SpeakQ is arguably simpler to use than Dragon and the integrated text-to-speech and word prediction does make it a more attractive option for writers with reading and writing difficulties. WordQ + SpeakQ requires use of the keyboard and so it is not suitable for users who wish to control the computer completely by voice. A single user license for WordQ + SpeakQ is £199 and a site licence is £1995.

Technically, both Dragon NaturallySpeaking and SpeakQ can be used to access SQA digital question papers and assessments.

Speech recognition software may have considerable potential to enable some candidates to work independently and to rely less on scribes, and we suggest that user trials should be undertaken to investigate which candidates might benefit from the software and to develop guidelines for good practice.

Program Comparison

	Dragon NaturallySpeaking Home	Dragon NaturallySpeaking Premium Education	Windows 7	WordQ + SpeakQ
Cost	£60 single user (includes microphone)	£68 single user (includes microphone) £499 (5 user Professional version school licence; microphones not supplied) £895 (100 user Professional version school licence; microphones not supplied)	Free with Windows 7 (microphones not supplied)	£199 single user (microphone not supplied) £1995 site licence (microphones not supplied)
Minimum system requirements	1 GHz Pentium/AMD or 1.6 GHz Atom; 512 Kb cache; 2.5 GB hard disc space; 1 GB RAM (Windows XP)	1 GHz Pentium/AMD or 1.6 GHz Atom; 512 Kb cache; 2.5 GB hard disc space; 1 GB RAM (Windows XP)	1 GHz processor; 16 GB hard disc space; 1 GB RAM. Windows 7.	1 GHz processor; 200 MB hard disc space; 1 GB RAM. Windows XP / Vista / 7.
Recommended system requirements	1.8 GHz Pentium/AMD; 2 MB cache; 2.5 GB hard disc space; 2 GB RAM (Windows XP)	1.8 GHz Pentium/AMD; 2 MB cache; 2.5 GB hard disc space; 2 GB RAM (Windows XP)	1 GHz processor; 16 GB hard disc space; 1 GB RAM; Windows 7.	1 GHz processor; 200 MB hard disc space; 1 GB RAM. Windows XP / Vista / 7.
Training	Optional but highly recommended. Involves reading about 700 words. A range of texts including some for children.	Optional but highly recommended. Involves reading about 700 words. A range of texts including some for children.	Optional but highly recommended. Fairly complex sentences.	Optional but highly recommended. Simple texts, small phrases and speech prompting make training easier for users with reading difficulties. Involves reading 800 – 1,000 words.

Speech Recognition Software in SQA Assessments

	Dragon NaturallySpeaking Home	Dragon NaturallySpeaking Premium Education	Windows 7	WordQ + SpeakQ
Dictation into word processor	Easy – turn on the microphone and talk. You can dictate either a few words at a time, or complete sentences.	Easy – turn on the microphone and talk. You can dictate either a few words at a time, or complete sentences.	Easy – turn on the microphone and talk. You can dictate either a few words at a time, or complete sentences.	Easy – turn on the microphone and talk. Two modes: Speak and Select lets you dictate and check a word or a few words at a time; Speak Continuously lets you dictate more text and then correct afterwards. The writer can use speech recognition alongside word prediction.
How can you correct errors in a word processor?	Click on the error and press '-' to open the Correction Box, or say <i>Correct <that></i> .	Click on the error and press '-' to open the Correction Box, or say <i>Correct <that></i> .	Say <i>Correct <that></i>	Select and re-dictate or press ESC to correct the last dictation.
Can you dictate into a Digital Question Paper?	Yes	Yes. Limitations compared with dictating to a word processor are: Read Back text-to-speech does not work; Play Back to play back the dictation does not work.	Yes, but the results are not consistent and recognition is much less accurate than when dictating into a word processor. A 'Dictation Box' often appears first and this can add to complexity.	Yes.
How can you correct recognition errors in a digital paper?	a) Select text by keyboard or voice and then re-dictate or re-type. b) When dictating directly into an answer box, the last phrase spoken can be	Select text by keyboard or voice and then re-dictate or re-type. When dictating directly into an answer box, the last phrase spoken can be corrected. The Dragon Dictation Box can	Not possible.	Select text by keyboard or voice and then re-dictate or re-type. When dictating directly into an answer box, press ESC to correct the last phrase spoken.

Speech Recognition Software in SQA Assessments

	Dragon NaturallySpeaking Home	Dragon NaturallySpeaking Premium Education	Windows 7	WordQ + SpeakQ
	corrected. c) The Dragon Dictation Box can be used to dictate and correct before transfer to the answer box.	be used to dictate and correct before transfer to the answer box.		
Can you read the question from the digital paper with the program's own text-to-speech?	No: Dragon Home does not have text-to-speech.	No: Dragon's Read Back does not work with the PDF question paper.	No. It doesn't have one.	Yes
Can you read your dictated answer with the program's own text-to-speech?	No: Dragon Home does not have text-to-speech.	Not in an answer box in the digital paper; yes from the Dragon Dictation Box or from Word.	No.	Yes
Can you use another TTS tool such as PDFaloud to read back dictated text?	Yes	Yes	Yes	Yes
Can you play back what you dictated?	No.	Not in an answer box; yes from the Dragon Dictation Box or from Word.	No	No

Speech Recognition Software in SQA Assessments

	Dragon NaturallySpeaking Home	Dragon NaturallySpeaking Premium Education	Windows 7	WordQ + SpeakQ
Can you answer 'tick box' questions by voice?	Yes – say <i>Click Enter</i>	Yes – say <i>Click Enter</i>	Yes – say <i>Click Enter</i>	Not reliably
Can you use voice to move between answer boxes?	Yes – say <i>Press Tab Key</i>	Yes – say <i>Press Tab Key</i>	Yes – say <i>Tab</i>	Not reliably
Can you use voice to navigate the question paper?	Yes: basic functions e.g. page up and page down; switch between PDF question paper and word processor.	Yes: basic functions e.g. page up and page down; switch between PDF question paper and word processor.	Yes – anything clickable, including Home, End, PageUp/Down, switch between question paper and word processor/	No
Web site	http://www.nuance.co.uk	http://www.nuance.co.uk	http://windows.microsoft.com/en-US/windows7/Set-up-Speech-Recognition	http://www.goqsoftware.com/

Dragon NaturallySpeaking 11

Dragon 11 is the latest version of the well-established NaturallySpeaking program and is available in Home, Premium and Professional versions. NaturallySpeaking is sold in mainstream computer shops and the discounted education versions are available from educational software specialists such as [Pugh](#) or [dyslexic.com](#).

All versions have broadly similar features² in that:

- they can recognise speech and convert it into text;
- mis-recognised words can be corrected using keyboard or voice;
- the user can dictate directly into common applications such as Microsoft Word, OpenOffice Writer, PowerPoint, Excel and Outlook;
- the user can 'click by voice' to operate menus, dialogue boxes and control the mouse;
- the user can read back text using Dragon's text-to-speech facility (only in some applications).

The main additional features provided with Premium that are lacking in the Home version are:

- Premium can play back a recording of the speech so the user can compare it with the text to check for accuracy;
- a facility to transcribe recordings from digital recorders;
- import/export of user profiles and custom word lists (particularly useful for copying user profiles between computers).

The Professional versions also have:

- 'enterprise' profile management so that user voice profiles can be stored on a network in order that learners can use the software on multiple networked computers;
- 'Deferred correction' so that dictated text can be played back and corrected at a later date.

All boxed single user versions are supplied with a headset microphone; the site licence versions are not. Each pupil using speech recognition should have their own personal

² <http://www.nuance.com/for-individuals/by-product/dragon-for-pc/index.htm>

microphone headset designed for speech recognition³. These cost from £20 for a basic wired device like the Andrea NC-185, to around £100 for a wireless Bluetooth microphone such as the Sennheiser BW900. Trial or demo versions of Naturally Speaking are not available, which is unfortunate as it means users cannot try the software to find out if it works for them before purchase.

The Nuance web site has video tutorials, FAQs, user guides and manuals and also examples of how it can be used in educational contexts⁴.

Networks

Dragon Home and Premium are intended for personal use and so would typically be installed on a student's own personal laptop. They could be installed on a networked computer provided that the machine can be configured to access the C: drive, because this is where Dragon stores the user voice profiles. In the assessment context, the candidate would require to use the PC on which the software was installed: it would not be possible to use it on other networked computers. It would be possible to back up the user profile and then copy it to another computer.

Dragon NaturallySpeaking Professional is available for enterprise installations and the advantage of this version is that users can access the software and their voice profiles on different computers in the school. Another potential advantage is that the candidate's dictation can be saved as synchronised audio with text dictated into the word processor (but not a digital paper) so that there is the possibility of 'deferred correction', i.e. a transcriber can listen to the recording while reading the text and make corrections.

Pricing ex VAT

Dragon NaturallySpeaking 11 Home single user	£60
Dragon NaturallySpeaking 11 Premium Education single user	£68
Dragon NaturallySpeaking 11 Professional single user	£237
Dragon NaturallySpeaking 11 Professional 5 School site licence (no headsets)	£499
Dragon NaturallySpeaking 11 Professional 100 School site licence (no headsets)	£895
Speak and See Suite Education Version single user. (Speak and See combines Dragon NaturallySpeaking Preferred 10 (the previous version) with a set of reading and study support tools from Claro software: text-to-speech, screen magnifier, on-screen reading ruler and colour overlays.)	£85

³ <http://support.nuance.com/compatibility/>

⁴ <http://www.nuance.com/for-business/by-industry/education/dragon-education-solutions/index.htm>

Training

Nuance suggest that Dragon NaturallySpeaking can be used without training it to the user's voice, but in our experience, it is definitely worth going through at least the initial training process. With Dragon, this involves reading a text of around 700 words; Dragon uses the recording to develop a voice model for the user. There is a choice of up to ten texts, some of which are aimed at younger children. When creating a voice model, Dragon uses the age of the writer (13 or under; 14-21; 22-54; or 55+) to adapt the profile. The presence of the '13 or under' option suggests that Dragon 11 may work more successfully with younger users than previous versions.

There are two methods of tackling the training: 'Show Text with Prompting' where the text is shown on screen in 'chunks' to be read by the user; and 'Show text without prompting' for 'special reading needs' where the text is shown on screen or printed for reading at the user's own pace.

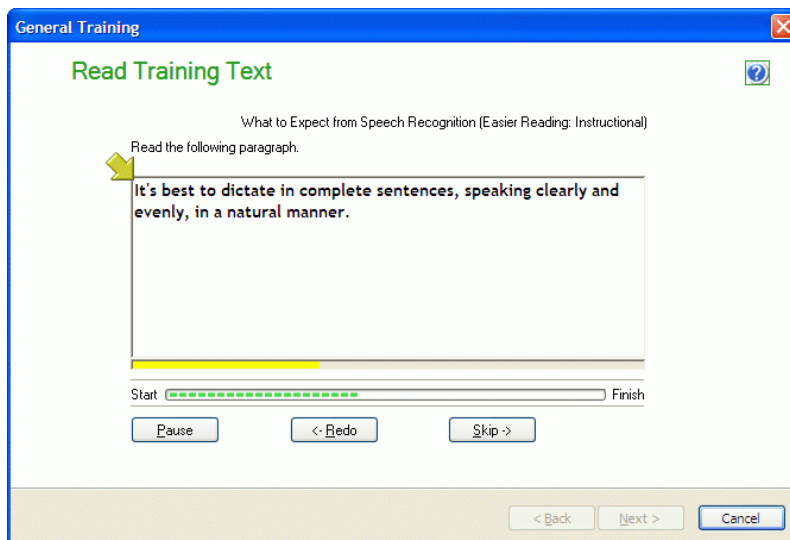
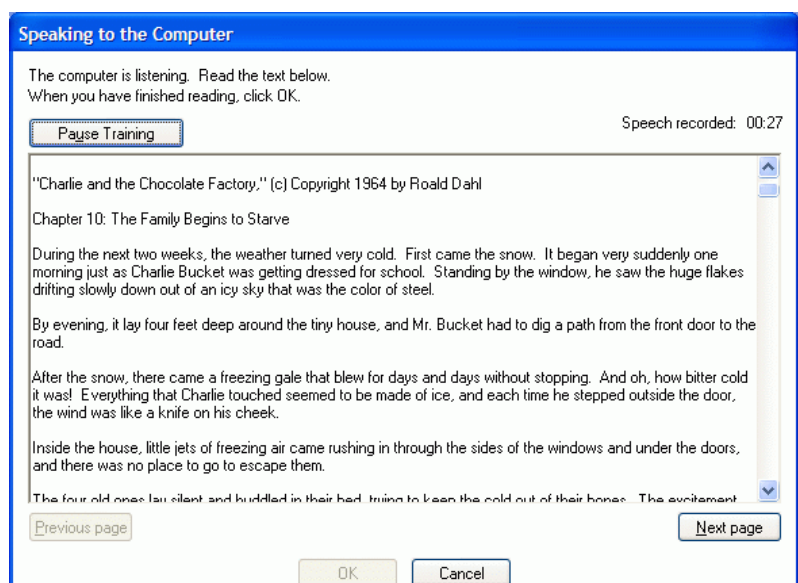


Figure 2: Training Dragon with prompts

Figure 1: and without prompts



A reasonably fluent reader will complete the training in around 5 minutes. Dragon then takes a few minutes to create the voice model.

Following initial training, Dragon offers to analyse existing documents and emails in order to adapt the voice model further to the user's writing style. This is worth doing as it improves accuracy. Dragon cannot analyse PDF files and so the text from digital papers would have to be extracted and saved as, for example, plain text, before analysis.

Dragon recognises a huge vocabulary of words and so the vast majority of the words to be dictated will be known, although there may be some technical or scientific words which are not in the dictionary. Note that new word lists can be imported into Dragon Premium, so that, potentially, a custom word list could be created for particular examinations and then uploaded to a candidate's computer.

Dictation into word processors

Dragon works with most standard word processors such as Microsoft Word, OpenOffice Writer and WordPerfect. We (adult speakers who have all used speech recognition before) tested dictation into Microsoft Word 2003 and 2007, and found it to be straightforward and accurate.

Text can be dictated quickly and easily into the word processor; mis-recognised words corrected with keyboard or voice; text can be selected, edited and formatted by voice; the user can navigate around the document by voice; and menu commands and functions can be accessed by voice.

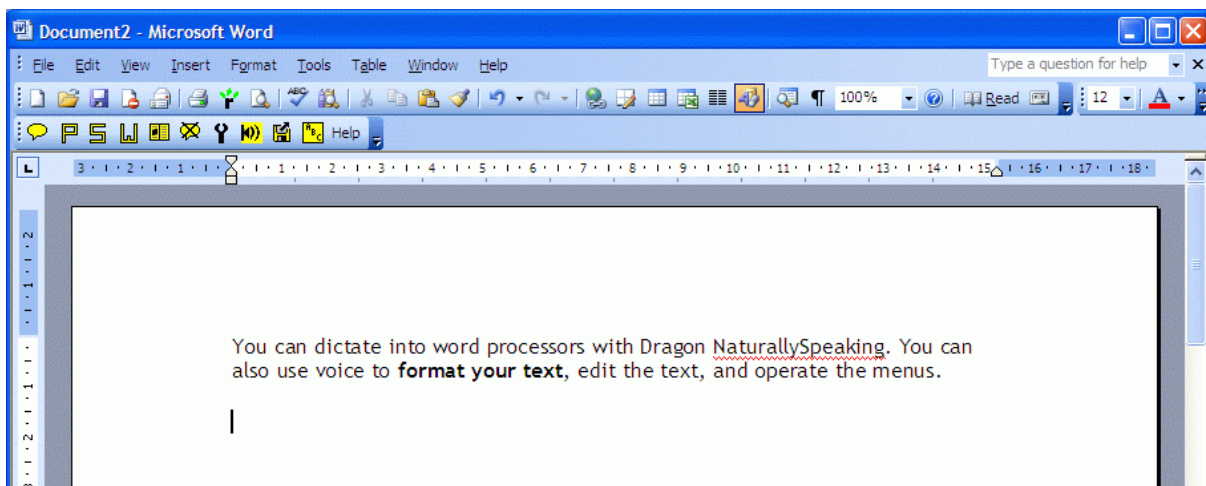


Figure 3: Dictating into Microsoft Word

There are several ways to correct misrecognised text. One is to select the word or phrase (either by mouse, keyboard or voice, e.g. *Select <error>*) and then dictate again, or type over with the keyboard. However, although this corrects the text, it does not help Dragon improve its accuracy and so Nuance recommend that errors are corrected using Dragon's

correction tools which teach the program not to make the same mistake again. The Dragon Correction window can be brought up with the keyboard or by voice (e.g. *Correct <that>*, Figure 4).

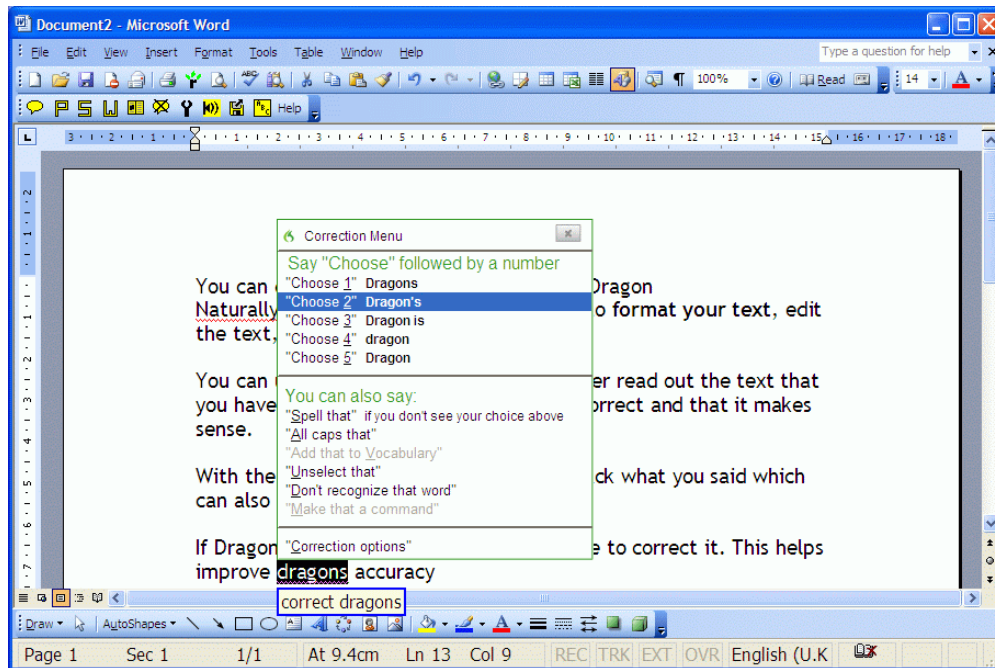


Figure 4: Correcting errors with Dragon

Read Back

Dragon Premium (not Home) has a 'Read Back' text-to-speech facility whereby you can select text using voice, keyboard or mouse, and then have it spoken back by the computer. Note that the Read Back facility works with programs like Microsoft Word, for example, but it does not work with the PDF digital papers. Using text-to-speech can be helpful to check for mis-recognised words and also for general proof-reading. The Read Back facility does not highlight the text as it reads unlike other text-to-speech tools such as WordTalk, PDFaloud or Read and Write Gold.

Play Back

Dragon Premium also has a playback facility for playing back a recording of the dictation, to help the user correct mistakes.

Dictation into SQA Digital Question Papers

Dictating directly into a Question Paper answer box

Dragon can be used to dictate directly into a Digital Question paper. A slight irritation is that the first letter dictated (unless the word is a proper noun) is typed in lower case.

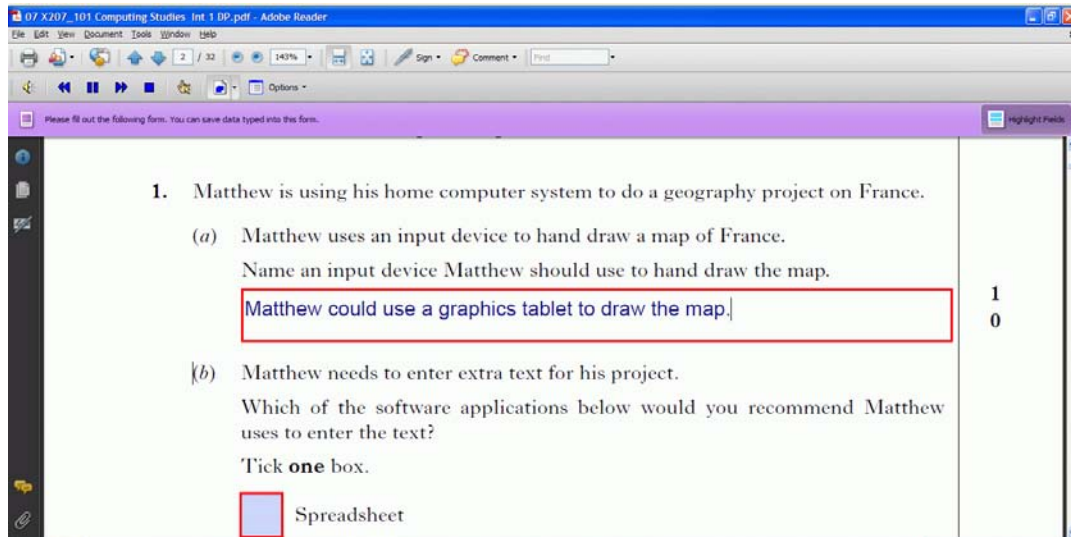


Figure 5: Dictating directly into an answer box

The user can correct mis-recognised words, but only within the last sentence or phrase dictated. If the last sentence or phrase contains an error, the user can say *Correct That* to correct the whole phrase, or *Correct <word>* to correct a single word within the phrase.

However, if the user dictates a response that is two or three sentences, pausing between each, and Dragon does not recognise a word in the first sentence, *Correct <word>* does not work. Similarly, the candidate cannot correct a word in an answer dictated into a previous answer box.

However, not being able to correct earlier recognition errors in an answer box may not be a significant disadvantage. In an examination context we would expect the candidate to be an experienced user of speech recognition and therefore have a well-trained voice profile with good accuracy, so that there should be little need to correct errors or train it during the assessment. In addition, in an examination, the user is likely to be more interested in concentrating on the questions and answers than on improving Dragon's accuracy, and so is likely to find it quicker to simply select the mis-recognised text and dictate it again. The candidate would say *Select [word or phrase]* to highlight a word or phrase, and then dictate it again. Selecting and then dictating again is quicker than using the correction mechanism and so we expect that most candidates would use this approach in the assessment context. However, if the student's approach is to provide partial answers to questions, using them as briefing notes to return to and expand on later, it would be important to ensure that any recognition errors are fixed before moving to the next answer box.

Dragon's **Read Back** facility (text-to-speech) does not work for reading back either dictated text in the answer box or text in the PDF question paper. (PDFaloud or another text reader could be used for this purpose.)

Similarly, Dragon's **Play Back**, where the user can play back the recording of what was dictated, does not work for text dictated directly into an answer box in the PDF.

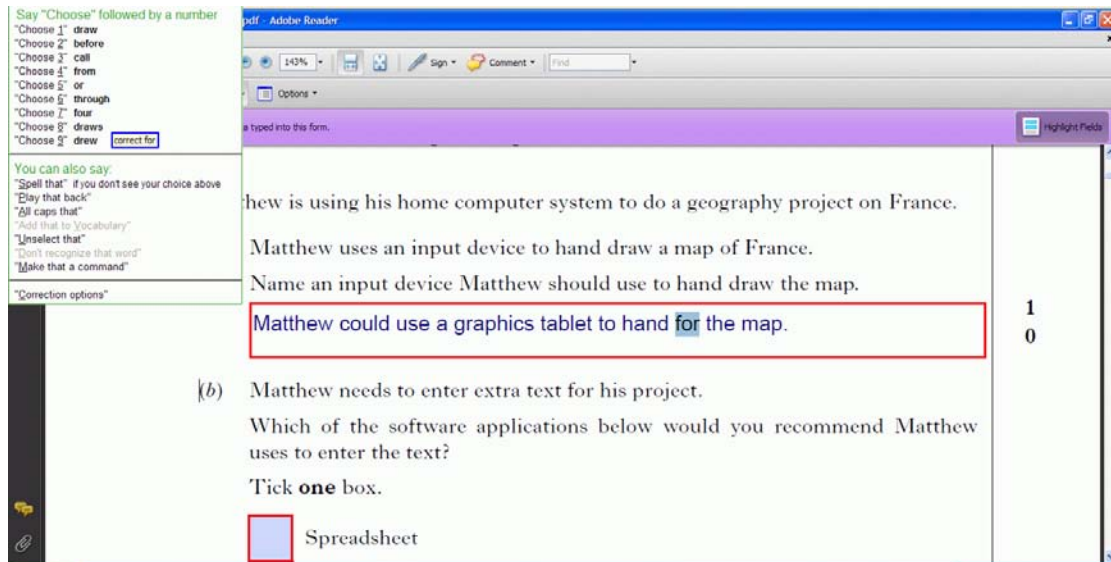


Figure 6: Correcting a mis-recognised word, by voice or keyboard

Using the Dictation Box

As an alternative to dictating directly into the answer boxes, the user can dictate into Dragon's Dictation Box (say *Show Dictation Box*) and then transfer the dictated text to the answer box. The advantage of this is that mis-recognitions can be corrected, and the candidate can use the Read Back and Play Back tools to check the dictated text.

The disadvantage of the Dictation Box is that it takes up screen space and may obscure the question paper (Figure 7). We found it best to choose the 'Anchor' setting and then position the Dictation Box in the corner of the screen otherwise it would follow the cursor and cover up part of the question.

Navigation by voice

The candidate can use voice (*Tab* or *Press Tab*) to navigate between answer boxes. 'Tick boxes' can be answered by saying *Enter*, *Click Enter* or *Press Enter key*. The user can say commands such as *Page Up*, *Page Down*, *Go to Start* and *Go to end* to navigate around the paper. It is not possible to say *Go to page X* or *Go to question Y*.

The candidate can use voice to switch applications: for example from the PDF question paper, to Microsoft Word, by saying *Switch to Microsoft Word*. The candidate can select text (manually, with the mouse or keyboard) from the question paper, then use voice to say

Copy That, switch to Word, and then *Paste That*, to copy and paste text from the question paper to the word processor.

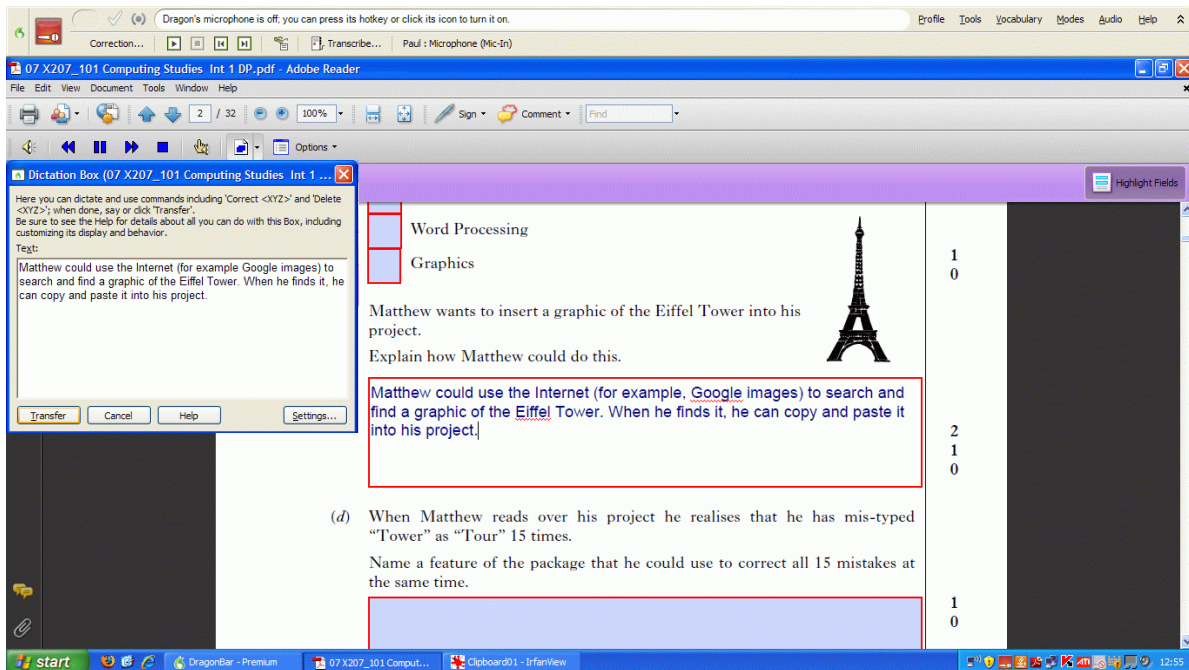


Figure 7: Using the Dictation Box to dictate into a Digital Question Paper

Summary

Dragon 11 is an accurate and effective speech recognition tool, provided it is used on a reasonably recent computer with sufficient memory and a fast processor (see Program Comparison). Dictating into Microsoft Word or another word processor is straightforward. Using Dragon to dictate into a Digital Question Paper is also quite easy. Although there are some limitations when dictating directly into an answer box in a digital paper, we think that the majority of candidates with writing difficulties or dyslexia would not find these problematic in the assessment situation. In an exam, most candidates will be concentrating on the question and so should not be concerned with correcting errors: they are better off selecting any mis-recognised text and dictating it again with slightly greater care. Likewise, although it would be helpful if Dragon's Read Back facility worked to read out dictated text from the answer box, PDFaloud or another tool can be used instead. Lastly, there is the option of using the Dictation Box if the candidate does want to use correction, Read Back and Play Back.

Although the program works well technically, further user trials are recommended to investigate which facilities and options would actually be most appropriate in the assessment context, and to research the practical issues around using Dragon to support candidates with literacy difficulties in SQA assessments.

Windows 7 Speech Recognition

Windows 7 comes with its own inbuilt speech recognition system, and so there is no additional software to buy and install.

Windows Speech Recognition is not zero cost, however: each pupil using speech recognition will require their own personal high quality speech recognition microphone costing from £20.

Windows speech recognition voice profiles are set up within each user's own Windows User Account. Each user account can allow a different voice user file to be built up through training and use. It does mean that, if there are two users, it is vital they do not use the same voice User Account, as each will overwrite the other.

Networks

Because Windows 7 Speech Recognition is part of the operating system a pupil will normally use it on a single identified laptop or desktop. We understand it is possible to transfer Windows 7 Speech Recognition profiles between computers using an [additional program](#). Clearly, this would not be practical to try the first time during an exam and procedures would need to be in place in the school or other assessment centre if this were to work.

Training

Starting the program is simple. **Start > Control Panels⁵ > Speech Recognition**. From the "Speech Recognition" control panel you can: Start speech recognition; Set up the microphone; Take the speech tutorial; or Train the computer to better understand you (Figure 8).

Setting up the microphone is straightforward, with the computer prompting you to read a short sentence back (the pupil can say anything as it is just to check sound levels). In theory you could at this point just start using Speech Recognition but we would not recommend it. We would certainly advise taking at least the tutorial.

The built-in tutorial is there to get started and, for best results, it is really important that this is followed. The program works without it but there is one very good reason why even experienced speech recognition users should take the tutorial: as you go through exercises, being introduced to the basic commands and practising, the software is at the same time adapting to your voice. Each section of the tutorial completed helps it to learn and adapt to your style of speech.

⁵ Access to Control Panels will require the pupil to be 'allowed' to do so. Some network managed systems limit access to Control Panels. It will therefore be important that the pupil does have access. This could for example be stored under the pupil's log-in preferences.

To see this through we would recommend the pupil is supported, especially if he or she has a reading difficulty and not just a writing difficulty. In most cases the short phrases and chunked phrases make it easier to read in short bursts, saying or clicking 'Next' between screens. Sometimes it can disturb the flow but in ways that is intentional to allow the software to adapt to how you might speak.

After completing training you have the option of continuing to 'Train your computer to better understand you'. This is optional but as we wanted to give the best chance to the computer's speech recognition we continued with the training. The training does involve more complex and varied sentence and word structures, and again we would highly recommend support is given to pupils with reading difficulties who consider this option.

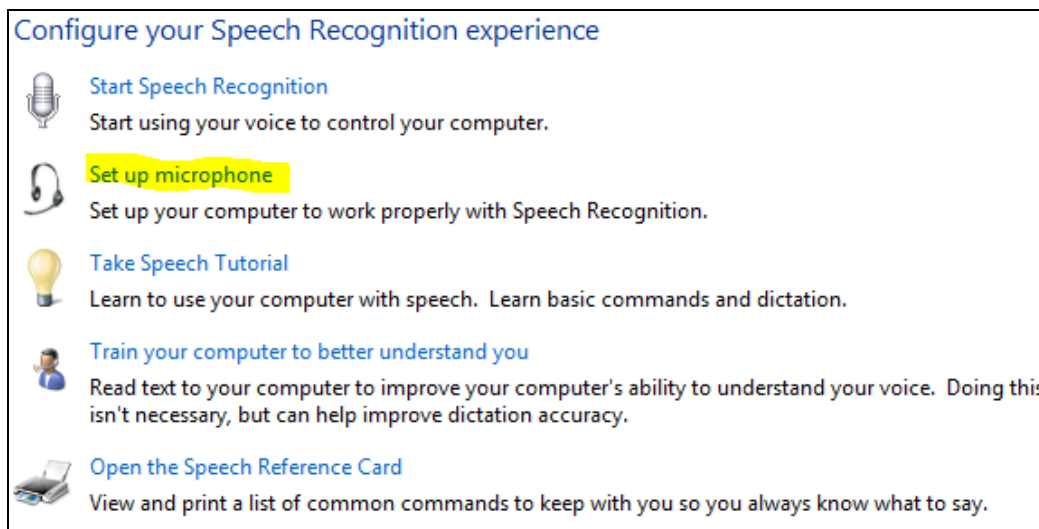


Figure 8 Setting up Windows 7 Speech recognition

Using both the tutorial and the training is a satisfying experience. Both are well structured with opportunities to do exercises which are carefully staged and built up gradually. Experience in using the Quick Reference Card is given so that by the end of the tutorial the most used and useful functions are well established. A word of caution: it is very easy to get confused about whether the speech recognition is on or off – sometimes the little dialog can be misleading.

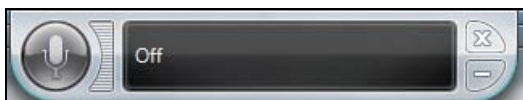


Figure 9 Dialog box to Start and Stop speech recognition.

Dictation into word processors

We used Windows 7 speech recognition to type into NotePad, WordPad and Microsoft Word 2007.

NotePad and WordPad were used only during the Tutorial and Training sessions. For testing purposes Microsoft Word was used. The paragraph below was dictated directly into Microsoft Word:

Dictated, uncorrected text:

*On several **locations** the answer box was highlighted, text was recognized **open bracket** and dialogue box opened with insert highlighted **close bracket** but no text was available in the answer box to insert,*

Corrected text:

*On several **occasions** the answer box was highlighted, text was recognized [and dialogue box opened with insert highlighted] but no text was available in the answer box to insert,*

The example below shows text to speech recognised with one error.

During stage by the bacteria rapidly increased before.

Figure 10 Text recognised in MS Word document.

If a pupil is using a word processor to answer a paper then Windows 7 would be a possibility although we regard NaturallySpeaking or SpeakQ as preferable.

Dictation into SQA Digital Question Papers

Dictating directly into a Question Paper answer box

Windows speech recognition was tested by dictating directly into an SQA digital question papers following training via the tutorial and two additional training sessions. The initial results were poor (Table 1).

Table 1: Results of dictating into a digital paper with Windows SR

SQA Answer Box	Text spoken	Text entered by Windows Speech Recognition
Full Name of Centre	<i>University of Edinburgh</i>	i) No response ii) No response iii) Showed Number grid selected followed by 'a' preventing it being deleted. iv) Ditto – no response. v) Minimised window vi) Minimised window.
First Name	<i>Stuart</i>	Stuart
Surname	<i>Aitken</i>	Gave up after 12 attempts.
Tabbing between cells	<i>TAB</i>	Worked reliably
Q1a.	<i>The cells in the columns would have to be formatted</i>	L:WB [see Figure 11]

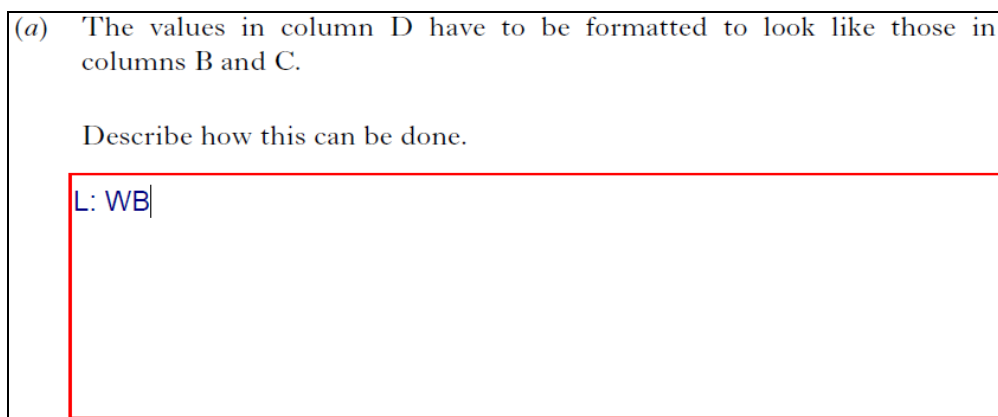


Figure 11 Actual text entered into SQA Exam Paper

Several more attempts were made including using the Dictation box (see below), and many attempts at spelling before finally obtaining the result shown in Figure 12.

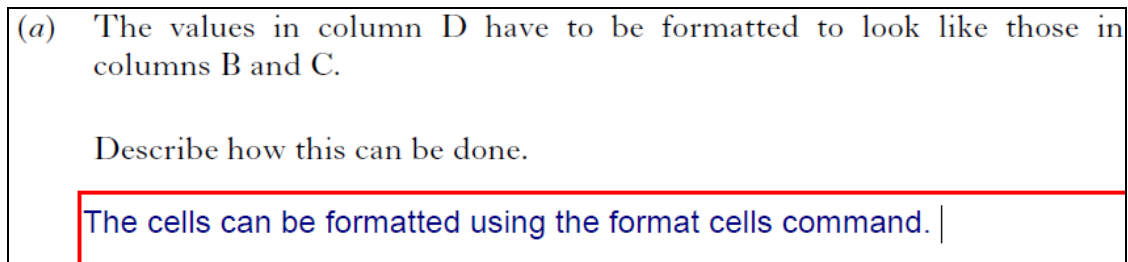


Figure 12 Text to speech directly into PDF exam paper (result after several attempts)

Several attempts at dictating answers resulted in the 'Insert' dictation dialog box appearing. This allows the spoken text to be checked, revised for errors and then inserted into an application. In practice this was difficult to use because it would overlap the question, move its position depending on the location of text and often did not increase the accuracy of speech recognised. On a couple of occasions the answer box was highlighted, an Insert dictation box opened, which then did not accept spoken text, resulting in there being no text to insert.

Using the Dictation Box

If the application does not recognise the text spoken, the program displays a Dictation Box. Text can be dictated, corrections made and the corrected text then inserted into the application.

The Dictation Box popped up more frequently in non-Microsoft applications such as Adobe Reader, which is used to access the SQA digital question papers. On several occasions the answer box was selected and text dictated into the Dictation Box but the box obscured the answer, as shown in Figure 13.

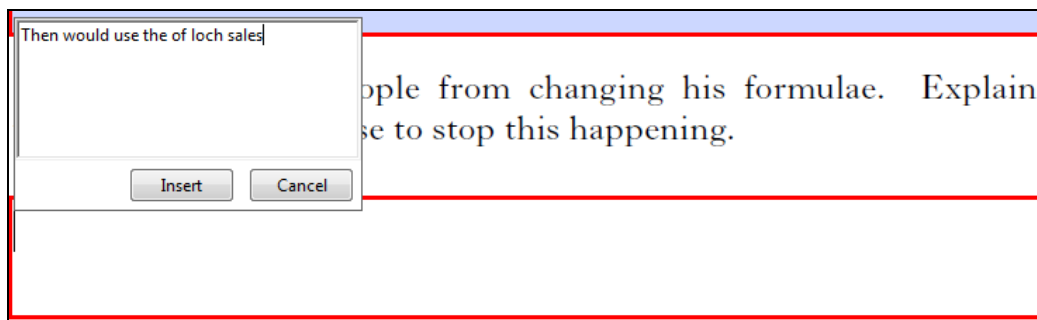


Figure 13 Dictation Box overlapping question and answer box.

Figure 14 shows a third attempt a) before correction and b) after correction.

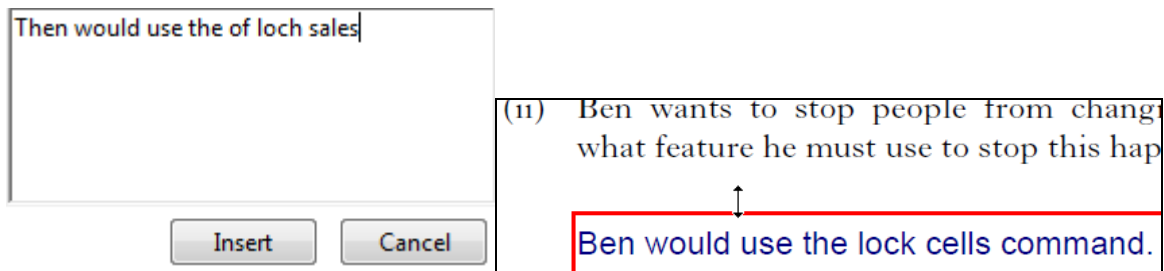


Figure 14 a) Uncorrected text and b) Corrected text.

On several occasions the application appeared to recognise the text spoken but it did not appear in the Dictation Box, so there was no answer to insert. The accompanying Insert dialog box can be confusing because it opens at different parts of the page often obscuring the question.

Navigation by voice

Saying *TAB* to move between answer boxes worked well and consistently.

Windows 7 speech recognition can recognise a number of commands. *Go to start of sentence, Go to end of paragraph, Select word, Select all, Go to word, Delete that, Delete next paragraph* are all available and self-evident. They worked consistently across a range of settings.

Comma, Colon, Backslash, At sign, Question mark, Exclamation mark, Paragraph sign, Degree sign, are some of the many punctuation and special characters available.

The user can open and close folders, select files, Double Click and Right Click. Navigating the computer – saying *Start Excel, Switch to Explorer, Double click English Exam* – all worked well.

You can speak almost any text visible on the screen, for examples Menu names, filenames and dialogue boxes. Windows speech recognition works well with these. Switching between programs is straightforward; indeed *Switch to WordPad / Switch to NotePad* are two of the earliest commands introduced. Opening files, selecting files and double clicking are all consistent using voice commands. You can press individual keys on the keyboard using the commands *Press a; Press capital b; Press Ctrl plus a*. For these you can use the phonetic alphabet as in ‘press alpha’ etc. Some keyboard keys can be recognised directly – *Delete; Enter; Page Up; Page down; Home End; Tab*.

If you are not sure what command to use – say to open a folder window - you can say *Show Numbers*. The current window or desktop is overlaid by blue rectangles with transparent numbers (sometimes too transparent). Each represents a clickable object. Say the number and the computer clicks for you. This approach can be a powerful way to home in on the desired area of the screen but is potentially confusing. As the numbers are just opaque enough to obscure what is underneath, it is easy to lose track of the task.

If the area of the screen does not contain an object to select but an action is required (e.g. to draw a box round an area), a useful command is *Mousegrid*. A numbered grid appears and by repeating this command, a progressively smaller area of the screen can be selected by saying *Click 9* (or whatever number of the square). The item can then be selected and dragged.

Summary

Windows 7 speech recognition is provided free with the operating system. It appears to provide reliable voice control over computer commands, and is reasonably accurate when dictating into Microsoft Word and text editors.

The tutorial is helpful and it is quick to get up and running, although some pupils will need support. The tutorial uses the exercises to adapt to the user's voice. Additional training of Windows 7 speech recognition is highly recommended although the text used for training is more complex.

The speech recognition dialog box – controlled by *Start listening* and *Stop Listening* or by clicking On/Off – is unobtrusive and offers helpful hints that can be ignored if preferred.

However, Windows speech recognition is not usable for dictating directly into the PDF question papers and so is not recommended for candidates who wish to use speech recognition with SQA digital papers.

WordQ + SpeakQ v3

WordQ + SpeakQ is a speech recognition program designed specifically for people with literacy difficulties. WordQ provides text-to-speech and word prediction, while SpeakQ adds speech recognition. To use SpeakQ you need WordQ installed first.

SpeakQ uses the Microsoft's own speech recognition facility (Windows XP, Vista or 7) but modifies the operation and interface so that it is more suited to users who have difficulties with reading, writing or spelling.

Specifically, WordQ + SpeakQ provides:

- simplified training with speech prompting, for users with difficulty reading the training text;
- speech feedback of text immediately after it is dictated;
- text-to-speech;
- integration with word prediction;
- discrete or continuous dictation.

For this exercise we tested SpeakQ on Windows XP and Windows Vista.

Pricing ex VAT (from [AssistiveITSolutions](http://www.assistiveitsolutions.com/)⁶)

WordQ + SpeakQ single user	£199
WordQ + SpeakQ site licence	£1995

A free 30 day trial version can be downloaded from <http://www.gogsoftware.com/uk/>. This provides an opportunity to try the program and in particular to see whether the user can successfully use speech recognition without committing to significant expenditure on the software.

Networks

The user's voice files can either be stored on the standalone computer or on a network server so that SpeakQ can be used on different computers. See <http://faq.gogsoftware.com/> for details.

⁶ <http://www.assistiveitsolutions.com/>

Training

Training SpeakQ involves reading several passages of text totalling about 800 to 1,000 words, or about 15 minutes of speech. There are two methods of training: using the standard Microsoft speech recognition procedure (which is quickest for users who can read fluently), or using the SpeakQ training facility which has prompts to assist a user with a reading difficulty.

SpeakQ training offers thirteen different training texts at three levels of reading ability: Beginner, Intermediate and Advanced. SpeakQ recommend reading at least three full texts and most of the texts are split into two parts to make it easier. The training texts are written for children and young people or you can use your own texts.

The SpeakQ training process is designed for users with reading or literacy difficulties and so each phrase is displayed on screen in large Comic Sans font, and read out by the computer. The user then repeats the phrase and if it is correctly recognised, it appears in the window underneath. Compared with other speech recognition programs, users with reading difficulties should find it easier to read the short passages with this speech support, and it is reassuring to see the recognised text displayed as you talk. If the text is not recognised, the computer reads the phrase again. If the user has difficulty with a particular word or phrase, it can be skipped.



Figure 15: SpeakQ training: the computer reads the sentence and the user repeats it

Dictation into word processors

SpeakQ has two dictation methods: Speak and Select and Speak Continuously.

Speak and select

Speak and Select combines speech recognition with the WordQ word prediction: the user dictates a single word or a short phrase and then SpeakQ offers a list of possible words or phrases in a prediction box. The most likely word or phrase is read back automatically by the computer, and you can hear the others by pressing the arrow keys to go up and down the list.

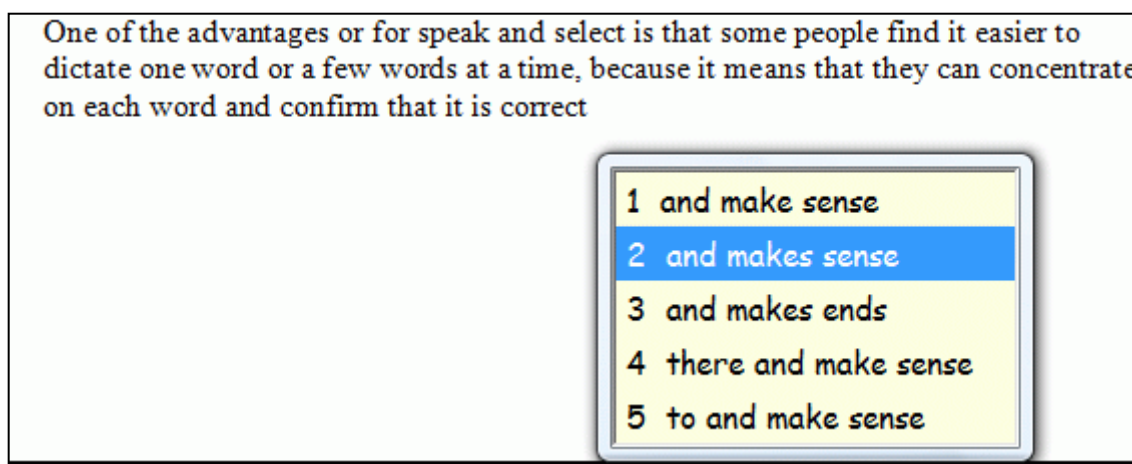


Figure 16: Dictating with Speak and Select

One of the advantages of Speak and Select is that some people find it easier to dictate one word or a few words at a time, because it means that they can concentrate on each word or phrase and confirm that it is correct and makes sense. As you speak each word or short phrase, it is spoken back by the computer and displayed at the top of the prediction window: if it is correct, you hit '1' on the keyboard and it is typed into the word processor. If the correct word or phrase is lower down the list you hit the corresponding number on the keyboard or click with the mouse to select it. If you cannot see the correct word or phrase in the list you can dictate it again or start typing it – or both.

The combination of dictating short phrases with speech feedback and word prediction may help some learners to engage with the writing process more effectively and to spot and correct errors more successfully than dictating a large quantity of text and then going back over it to correct it .

When dictating with Speak and Select, punctuation and corrections to mis-recognised text must be typed manually with the keyboard.

There are no commands to edit or format text or to control the computer.

Speak Continuously

With Speak Continuously, the user is recommended to dictate short phrases, which are then typed into the word processor. Each phrase is spoken back by the computer as it is typed which can be very helpful to confirm that the text is correct, to identify errors, and also to check vocabulary and grammar. You can use a combination of speech and word prediction at the same time, which can be helpful, particularly when correcting errors. With Speak Continuously you can dictate common punctuation including . , ! : ; ? and ! (although the full stop must be dictated as *Period*).

Speak Continuously cannot be used to edit or format text, or to control the word processor or computer by voice.

In general, the experience of dictating with WordQ+SpeakQ is quite different from Dragon or the standard Windows speech recognition. It is simple to use and the speech feedback and correction and word prediction options mean that it may well be more usable for many students with literacy difficulties.

Speech feedback

WordQ + SpeakQ has a speech feedback facility which can read back each word as it is dictated or typed or selected from the prediction list. There are two British English and two American English voices supplied with the program, and the reading speed can be adjusted. WordQ + SpeakQ can also use other SAPI 5 voices installed on your computer, such as Heather, the Scottish voice⁷. (Note that one of the American voices supplied with WordQ is also called Heather.)

⁷ Available free for Scottish schools from www.TheScottishVoice.org.uk

Dictation into SQA Digital Question Papers

SpeakQ can be used to dictate directly into a digital question paper and it seems to work well. One good feature is that the dictated text is spoken back by the computer as it is typed into the answer box. However, when a full stop is typed, the sentence is not spoken back.

The word prediction feature can also be used to type or to correct errors or to edit the answer.

The SpeakQ 'Read' button can be used to read out both questions and also dictated answers – select the text to be read and then click the **Read** button.

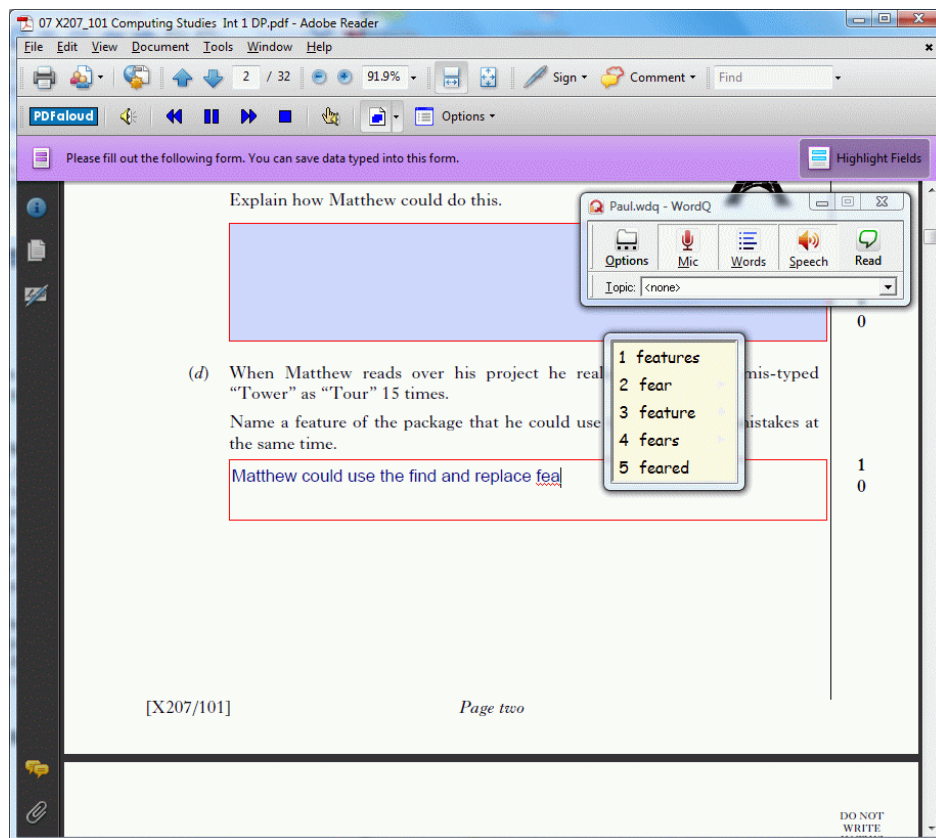


Figure 17: Dictating into a digital paper with SpeakQ *Speak and Select*

Corrections are made by either typing over the error or by pressing the ESC key to 'undo' the last dictated phrase and speaking it again. The word prediction, in conjunction with the speech, can be used to correct errors.

Navigation by voice

It is possible to say *Tab* and *Tab key* to move between answer boxes but this seemed to be fairly unreliable and difficult to control.

SpeakQ is designed for dictating text and it does not give any means of navigating around the paper by voice or swapping between the digital paper and a word processor.

Summary

WordQ + SpeakQ is specifically designed for people with literacy difficulties and integrates speech recognition, speech feedback, and word prediction well.

Users with significant reading difficulties are likely to find the training process easier than Dragon or the standard Windows speech recognition.

The recognition accuracy seemed good enough for use in an examination (on a Windows Vista computer using the Microsoft Speech Recognizer 8.0 for Windows (English UK)) although we did not carry out standardised testing. It is likely that the recognition accuracy will not be as good as Dragon Naturally Speaking.

SpeakQ is simpler to use than Dragon, and has fewer facilities, and for some users this is an advantage. It also has facilities that can help with the process of composing, dictating, checking and editing text. The dictated text can be read back by the computer as soon as it is dictated, which can be reassuring that it has been correctly recognised and also helpful for identifying mis-recognised words and for the writer to check vocabulary and grammar. The integrated word prediction can help ensure that errors can be corrected accurately.

SpeakQ can be used to dictate directly into the digital papers and also into word processors such as Microsoft Word.

The SpeakQ Read facility can be used to read questions from the digital paper and also dictated answers, and text dictated into a word processor.

SpeakQ is not a 'hands-free' program – it is designed for writers who can use the keyboard, and so it is not suitable for writers who need hands-free control of the computer.

Further information

Dragon Naturally Speaking

Dragon NaturallySpeaking, <http://www.nuance.co.uk>

Dragon NaturallySpeaking in education,
<http://www.nuance.co.uk/industries/education/dictation/>

Windows Speech Recognition

Windows speech recognition, <http://windows.microsoft.com/en-US/windows7/Set-up-Speech-Recognition>

WordQ + SpeakQ 3

WordQ + SpeakQ <http://www.gogsoftware.com/> ;
<http://assistiveitsolutions.com/wordq/pressrelease.html>

SpeakQ for WordQ. <http://www.spectronicsinoz.com/product/speakq-for-wordq-3>

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CALL Scotland website <http://www.adapteddigitalexams.org.uk/Home/>

SQA Assessment Arrangements website <http://www.sqa.org.uk/assessmentarrangements>

SQA (2008) Adapted Digital Question Papers: User Guide November 2008. <http://www.sqa.org.uk/assessmentarrangements>

Nisbet, P.D. (2010) SQA Digital Papers 2010 Report. CALL Scotland. <http://www.adapteddigitalexams.org.uk/Downloads/Reports/>

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Speech Recognition in SQA Assessments

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