CALL Scotland

Accessing SQA Digital Question Papers with Text to Speech Software

THE UNIVERSITY of EDINBURGH

CALL Scotland

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Accessing SQA Digital Question Papers with Text to Speech Software

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Introduction

Some candidates use SQA Digital Question Papers (DQP) because they can employ text-to-speech (TTS) software to read the questions and thereby address difficulties with reading the paper due to for example dyslexia or visual impairment. It is therefore important to ensure that the technology can read the text accurately, and that candidates can understand it.

This will be even more important for assessment of the new National Literacy Units because use of a human reader will not be regarded as a reasonable adjustment where reading is being explicitly assessed, whereas use of a computer reader will.

The number of candidates or examinations where TTS is used is not recorded directly by SQA, but feedback from schools suggests that between 40% and 56% of presenting centres that request Digital Question Papers use TTS[1].

In 2012, SQA conducted a survey of centres that used Digital Question papers, and 51 (29%) out of 173 centres responded. TTS was used in 35 (51%) of the 51 centres that responded, and by 4.3 candidates per centre, on average. If this is representative of all the centres that used DQP, then TTS will have been used in 88 centres by 379 candidates, or 28.5% of the total number of candidates that used DQP.

Research and feedback from schools since digital papers were first piloted in 2006 has identified three concerns with text-to-speech software for accessing SQA Digital Question Papers.

1. The quality and intelligibility of the computer voice.

2. Accuracy of pronunciation: some words and terms are not pronounced correctly.

3. On occasion text cannot be read out by TTS because the text on the paper is an image, not selectable, readable text.

Improvements have been made across all three of these areas since the DQP were introduced. This paper summarises the progress made and presents the results of analysis of the use of text-to-speech software for the 2012 papers.

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[1] Nisbet, P.D. (2013) SQA Digital Question Papers 2012 Report.

Text-to-speech software

The TTS system for accessing a DQP is composed of four separate software components:

- the digital question paper (in this case, a PDF file);

- the application used to open the file (usually, Adobe Reader);

- the text or screen reader (the application that enables the user to select the text to be read);

- the computer voice(s), such as Cereproc Heather or Stuart.

Digital Question Paper in PDF, opened with Adobe Reader →

Text reader copies the text and sends it to…. →
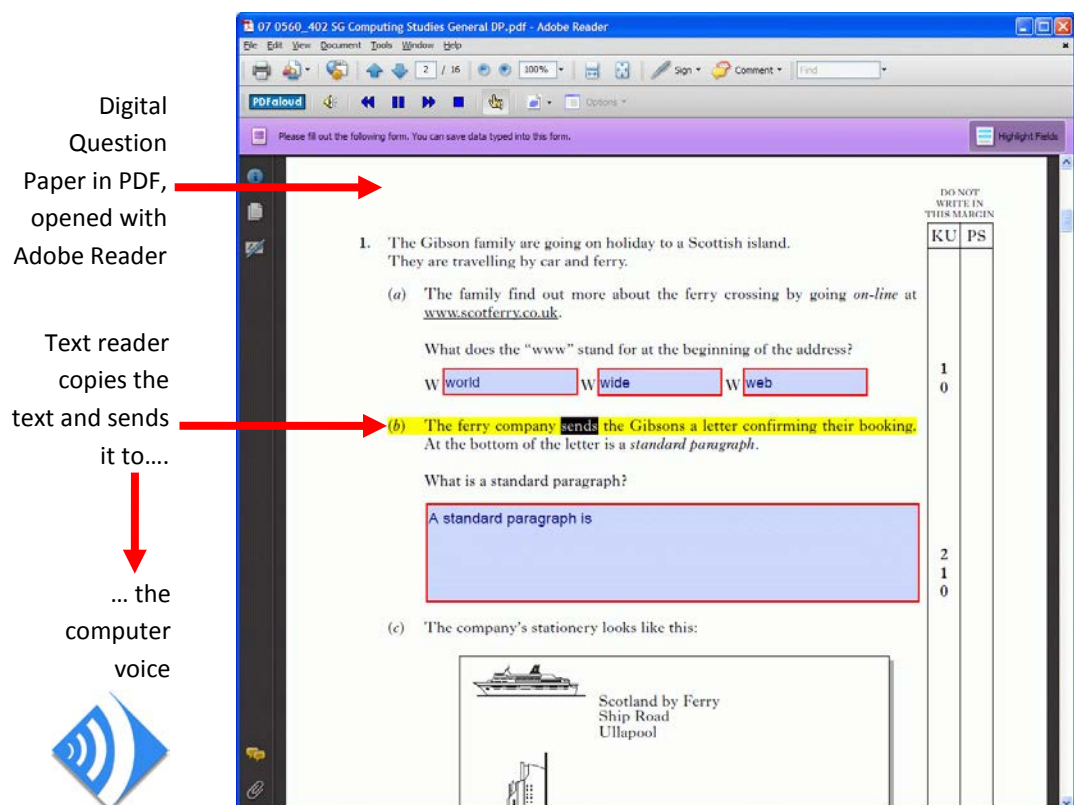
… the computer voice

The computer voice is technically independent of the text reader, although many text readers are sold bundled with high quality voices. The most common text readers used for DQPs are:

- PDFaloud 3/Read and Write. PDFaloud is a simple and effective text reader but from November 2011 it has only been available as a component of Read and Write Gold, which is relatively expensive. In addition, the original version of PDFaloud does not work with the latest versions of Adobe Reader, and so it is becoming less popular.

- Read Out Loud. This is built-in to Adobe Reader for Windows and provides basic TTS.

- Ivona MiniReader. This is a simple, free text reader that works well for reading DQPs.

Voice quality

When DQP were first trialled in 2004, some students and staff felt TTS was useful but "many of the students commented that the synthetic voice was of poor quality and was difficult to understand" (Nisbet et al, 2004 p.4). At that time, the voices available in schools were relatively 'robotic' with American accents. High quality voices were available for purchase, but only with American or 'received-pronunciation' British English accents.

In 2008, CALL Scotland obtained funding from the Scottish Government to licence 'Heather', a high quality computer voice with a Scottish accent, from Cereproc, for use across Scottish schools. This was followed with further funding to develop a male voice and 'Stuart' was made available in September 2011. Both voices can be downloaded free of charge from CALL Scotland's web site at http://www.thescottishvoice.org.uk/Home/.

Anecdotal feedback and comments from students and staff suggest that the Scottish voices improve the intelligibility and acceptance of TTS for DQP. Every year, following the examination diet, SQA staff survey staff in schools that used the DQP, and the absence of negative comments regarding voice quality and intelligibility suggests that both are satisfactory. However, an absence of negative feedback does not necessarily mean that the technology meets the needs for all students in all subjects: for example, some students may choose not to use TTS in the exam, and instead opt for a human reader, and staff are unlikely to feed back in these situations. Therefore more detailed research is required to investigate the effectiveness of TTS in assessments.

Accuracy and pronunciation

In addition to the surveys, each year CALL and SQA run a Focus Group meeting with centres that have used digital papers, and a reasonably common criticism from staff is with regard to mispronunciation by the Scottish voices. For example:

Text to speech doesn't read every word accurately, 1928 would be read as one thousand nine hundred and twenty-eight. Words are mispronounced, in particular names and places, which can affect the smooth reading of longer passages. Words containing an apostrophe are not read correctly. (Nisbet, 2010, p. 16)

Two options for improving the pronunciation of the computer voices were identified:

1. If the **text reader** has a 'pronunciation dictionary', then mis-pronunciations and corrected pronunciations can be added to the dictionary. The advantage here is that school staff and users can correct the pronunciation quickly. The disadvantage with this approach is that different text readers have different dictionaries, and some readers do not have a pronunciation dictionary at all.
2. Improve the pronunciation of the **computer voice** itself. The advantage of this approach is that the pronunciation will be improved for all text readers that use the voice.

Survey of 2011 papers

CALL carried out a survey of SQA 2011 Standard Grade General and Higher papers to identify words and terms that were not pronounced accurately by the Heather and Stuart voices. It was not practical to listen to every word of every paper (there were 69 papers, 927 pages and 108,664 words) and so the author used his experience and knowledge of TTS to skim read the papers and only test words which were likely to be mispronounced. A total of 259 words or terms were identified as mis-pronounced. The list was passed to the developers of the Scottish Voices at CereProc who created new versions of the Scottish voices, with corrected pronunciation. Most of the mispronunciations could be resolved, but some could not. For example:

- The thirty mathematical or Greek characters in the list (such as πr^2, $a^2+b^2=c^2$, Δ etc) could not be spoken out as 'pi', 'squared' or 'delta' unless a different character encoding in the paper was employed.

- Some terms are ambiguous and so could not be normalised (e.g. is m/s metres per second or miles per second; St. Vincent St.; Ω could be 'ohm' or 'omega'; etc).

Appendix 1 lists the papers checked and words identified.

CereProc software engineers were able to make use of context to determine the correct pronunciation of some words and terms: for example, the two versions of the word 'read' in

'*I read a book last week and today will read another*' are correctly pronounced; while '2 kg' is spoken as '2 kilograms' whereas 'kg' is spoken as 'kay gee'.

Survey of 2012 papers

The same exercise was then carried out for the 2012 Standard Grade General and Higher papers. This time, only 49 mispronunciations were found (from 85 papers, 1,117 pages with 126,541 words). In addition, the names of all the elements in the periodic table were also checked and another 13 mispronounced words were found. Appendix 2 lists the papers checked and words identified.

Table 1 compares the number of mispronunciations in 2011 and 2012. We have removed the Greek, mathematical or scientific terms from the comparison in order to focus only on words, which gives a more accurate comparison, and therefore we note 229 mispronounced words in 2011. The comparison suggests that the accuracy of the text-to-speech for reading the 2012 papers has improved as a result of the improvements in the voice.

The accuracy of this test method cannot be guaranteed, because the author skim-read each paper and used experience to identify and then test words which were likely to be mis-pronounced, and so some errors may not have been identified. However, the tests do suggest that the process is reasonably effective for first identifying and then correcting errors.

Table 1: 2011 and 2012 mispronunciations

	Number of mispronunciations	Number of papers	Number of pages	Number of words	Average errors/paper
2011 papers	229	69	927	108,664	0.3
2012 papers	49	85	1117	126,541	0.6

Unreadable text elements

The third criticism of text-to-speech software for reading digital question papers was that some text elements were not readable using the software. For example, map labels in Geography papers, drawings of invoices, menus or spreadsheet extracts might look like text, but are images rather than selectable text, which cannot be read out by the computer. The analysis of the 2011 papers also revealed that the 2011 Standard Grade Graphic Communication papers could not be read at all with text to speech (Appendix 1: 2011 TTS test results).

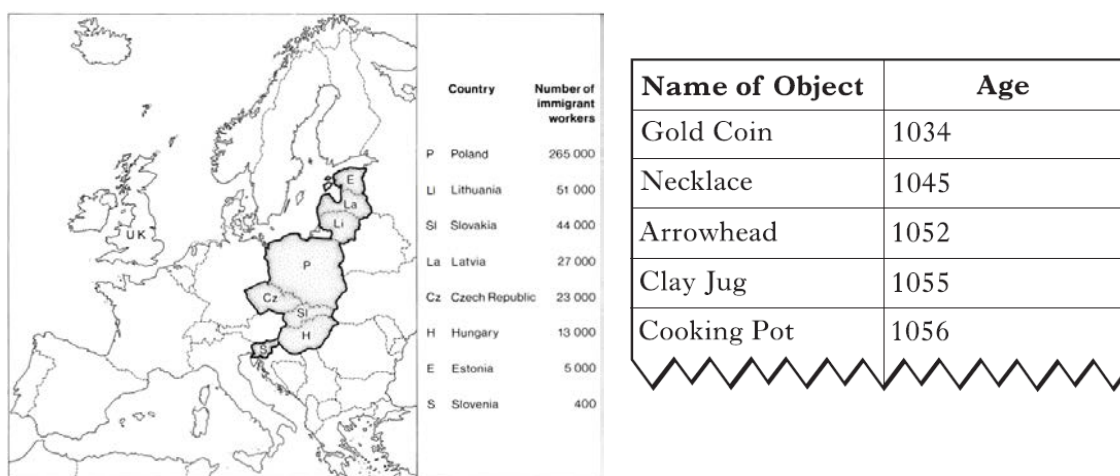The screen shots below give examples of unreadable text on a map and a table.

Figure 1: Unreadable text in a 2008 Intermediate 1 Geography map and a 2007 Intermediate 1 Computing Studies table

This discussion does beg questions about whether it is necessary or appropriate for a candidate to be able to use text-to-speech software to read the text items in order to answer the question: does TTS actually help candidates with reading difficulties to access these papers; and is unsupported reading and understanding a component part of the assessment, in which case does the use of TTS therefore give an unfair advantage?

Discussion with teaching and SQA staff at the annual Focus Group meetings indicated that for the majority of papers and candidates with reading difficulties:

- use of TTS to read text elements that contained information necessary to answer the question *was* desirable, and;
- use of TTS was *not* felt to give an unfair advantage.

Since papers were first offered generally in 2008, the SQA desktop publishing team has taken steps to avoid use of text elements that are not readable with TTS, through for

example using text boxes and re-creating tables and elements, rather than cutting and pasting images.

In order to determine the type and nature of any text elements that cannot be read with TTS at the current time, the 2012 Standard Grade General, Intermediate 1 and 2 and Higher papers were reviewed and the results are given in Appendix 2: 2012 TTS test results. Most of the text elements in most of the 2012 papers were readable and the incidence of unreadable items appears to be lower than for example in 2008 (although a similar exercise would have to be carried out on the 2008 papers to confirm this). Note also that the 2012 Graphic Communication paper <u>could</u> be read using TTS, whereas the papers for previous years could not.

The unreadable text elements that were found in the 2012 papers are given below. The main concerns are with images of handwritten memos and letters in the Administration and Information Systems papers that have to be typed up, some of which could present a barrier to candidates with reading difficulties.

Paper	Example of unreadable element	Comment
Intermediate 1 Administration, pp. 4, 8, 12		The handwritten memo shown cannot be read with TTS. However, since the instructions for this and the other questions are repeated as readable text, this should not be a problem for candidates. On p.12, however, there is an image of a handwritten letter which has to be typed up and which cannot be read with TTS, so this image could be a barrier.

Intermediate 2 Administration Paper 2, p.9	**TASK 3** *Marks* *Using the information below, prepare a letter to be sent by post to thank all of our senior fundraisers. This is the result of the search in task 2. Use the files **ALTCWP** and **ALTCLOGO**.* *Print one copy of the letter showing the merge fields and one copy to any one senior fundraiser for my signature.* *Janet* Dear _____ (Insert the Club logo in the letterhead) Loyalty and Fundraising We would like to take this opportunity to thank you for (↑loyal) renewing your membership. You have been a (↑member) since (*) and we hope that you will continue your membership for years to come! (* insert merge field to show year) You are a valued fundraiser - we want to thank you for your <u>commitment</u> (and) <u>efforts</u>. TRS We are very pleased with the fundraising figures and would like to ask our members how they would prefer the funds to be spent. Please use the tear off slip below to indicate your preference and return to me before the end of June. Yours _____ - (bold) ALEVIEW LAWN TENNIS CLUB (italics) Preferred Development - <u>please circle as appropriate</u> 2 LS { Floodlights / Speedserve and ball machine / Re-surfacing Name_____ Date_____ The results of our consultation will be discussed at the AGM next month. ← (move this sentence to become paragraph 3) **15** *[END OF QUESTION PAPER]*	The handwritten letter shown cannot be read with TTS. Candidates need to be able to read this to answer the question, and so this image could be a barrier, unless the text is already provided in the ALTCWP file that is given to the candidate.

Higher Administration Paper 2, p.5	3. Complete and print the Information Leaflet that will be issued to the Danish farmers when they visit Scotland next month.
	     The leaflet must fit on 4 pages. All text on pages 2 and 3 should be fully justified.
	
	     Page 1 – Title page with the logo and the text below.
	
	FARMERS' MARKETS } SIZE 24
	MAKE SURE IT'S THE REAL THING
	
	The definition of a Scottish Farmers' Market is a market in which farmers, growers and producers from throughout Scotland sell their produce direct
	(np) to the public. [All foods/products sold should have been grown, reared, caught, brewed, pickled, baked, smoked or made/prepared by the producer. } SIZE 18
		The handwritten text shown cannot be read with TTS. Candidates need to be able to read this to answer the question, and so this image could be a barrier.

Intermediate 2 Geography Paper p.10	4. (continued) *Marks* **Diagram Q4B: River Nile Management Project** "The best way to protect and manage water is by close international cooperation between all the countries within the river basin—bringing together all interests upstream and downstream." Egyptian government spokesperson (b) Study Diagram Q4B. For this **or** any other river management project you have studied: (i) describe the social, economic and environmental benefits; **6** (ii) suggest possible disadvantages of the project. **4** **(15)**	The map labels are not readable with TTS. However, being able to read text is not essential to answer the question and so this is unlikely to be a barrier.
Intermediate 2 Information Systems p.6		The text is this image is not readable, but it is probably not required to answer the question, which is: While creating the logo, Amy finds the following information screen useful. State the name given to this type of information screen.
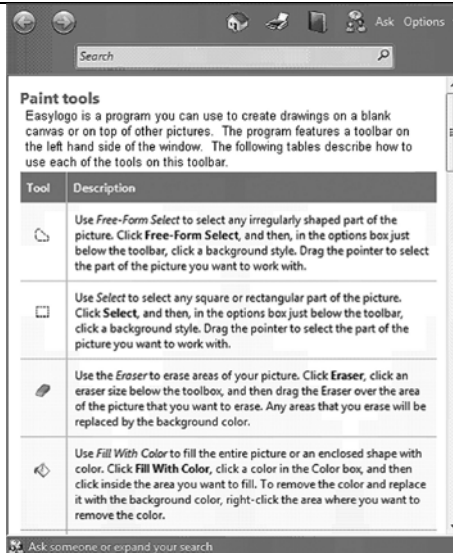
Higher Geography Paper 2, p.6	**Question 3: River Basin Management** Marks (a) *"The Zambezi river basin extends into 8 southern African countries. It is one of the most heavily dammed rivers in Africa."* Study Map Q3 and Tables Q3A and Q3B. **Describe** and **explain** why there is a need for water management within the Zambezi river basin. 12 (b) **Describe** and **explain** the physical and human factors which should be considered when selecting the site for any major dam and its associated reservoir. 14 (c) **Describe** and **account for** the social, economic and environmental benefits **and** adverse consequences of a named water control project in Africa **or** Asia **or** North America. 24 (50) **Map Q3: Zambezi River Basin** 	8 horizontal labels on this map on p.6 are readable; 5 (2 x Zambezi, Malawi, Mozambique, Indian Ocean) are not. It is unlikely that this would present a barrier because the candidate is likely to be able to deduce the location of the river from the information provided.
Higher Information Systems p.8	**SECTION II (continued)** Marks 14. *Presentation* and *Availability* are two characteristics that can affect the quality of information. Below is a review of an act in a local talent show which was published in the local paper, the Northbank Daily Echo. The review was written by the father of one of the band members. The table below shows an evaluation of the review using presentation and availability. | Characteristic	Comment
---	---
Presentation	The appearance of the graphic, "China Cats", is poor and would have been improved with the use of a photograph of the band.
Availability	The availability is poor as the Northbank Daily Echo is a local paper, not available nationally. | Complete a similar table for **four** other suitable characteristics. 8	The text of the review is not readable with TTS. The candidate would need to be able to read the review in order to answer the question and so this could present a barrier.
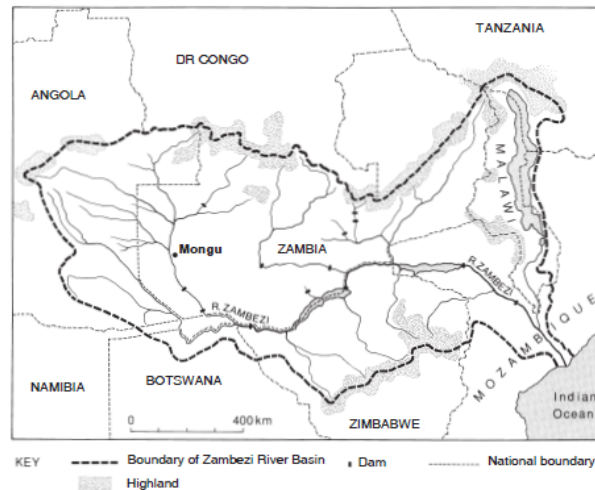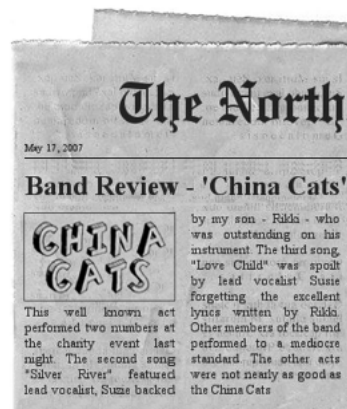
| Higher Geography Paper 2, p.10 | Question 4 – continued

Map Q4C: Site and Situation of Melbourne
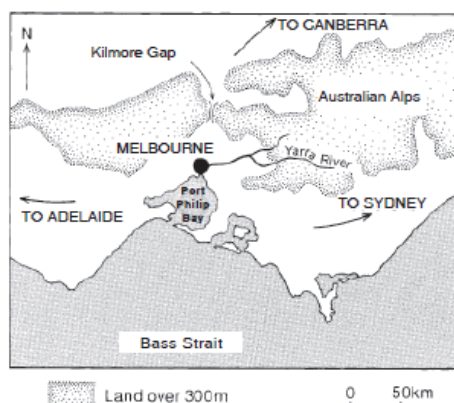
Map Q4D: New Melbourne Urban Growth Boundary
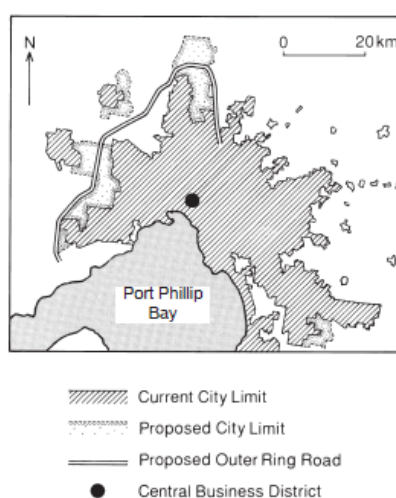
 | Most of the labels on the maps are readable. The keys are not but this should not present a barrier for candidates for Map Q4C.

Question 4c is: "Study Map Q4D on *Page ten*. Referring to Melbourne **or** any named city you have studied in a Developed Country: (i) **explain** the problems caused by urban sprawl; (ii) **suggest ways** in which these problems may be resolved."

Although the key does carry information about the city limits etc, the question is wide enough that it is not essential to read it and so most candidates would not be disadvantaged. |

Making map labels and keys readable with TTS is relatively straightforward where the text is horizontal and involves inserting text boxes on top of the image.

Making the images of handwritten memos and letters readable is more problematic. It is possible to add 'Alt Text' descriptions to images, but the text can only be read by screen readers (i.e. software such as Jaws, NVDA or the built-in Read Out Loud when used to read the whole page) designed for blind or severely visually impaired users. The Alt Text cannot be read by the text readers (such as PDFaloud, MiniReader, or Read Out Loud when clicking on text or the image) used by dyslexic candidates who can see, which comprise the largest group of candidates with reading difficulties. Adding Alt Text to images does therefore not address the problem.

The only way to tackle these elements is to provide a readable text equivalent, either as separate text, or to use a suitable 'handwriting font' to create the elements themselves (Figure 2).

FARMERS' MARKETS

MAKE SURE IT'S THE REAL THING } SIZE 24

np The definition of a Scottish Farmers' Market is a market in which farmers, growers and producers from throughout Scotland sell their produce direct to the public. [All foods/products sold should have been grown, reared, caught, brewed, pickled, baked, smoke } SIZE 18
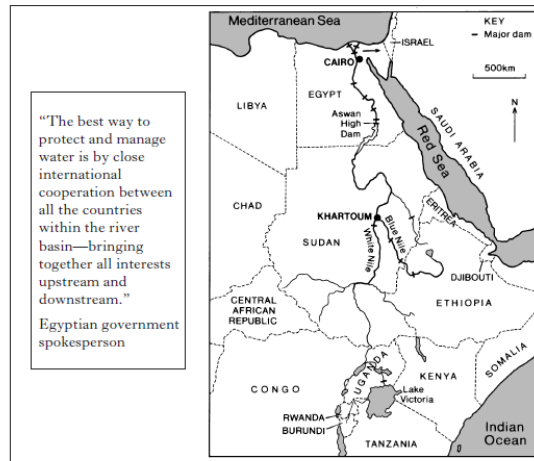
FARMERS MARKETS

MAKE SURE IT'S THE REAL THING [Size 24]

The definition of a Scottish Farmer's Market is a market in which farmers, growers and producers from throughout Scotland sell their produce direct to the public. [All foods should have been grown, reared, caught, brewed, pickled, baked, smoked or made/prepared by the producer. [Size 18]

Figure 2: Original image and readable text in a 'handwriting' font

References

Nisbet, P.D., Aitken, S., Shearer, N. (2004) *Trial of External Papers in Accessible PDF for Candidates with Additional Support Needs.* Project Report to Scottish Qualifications Authority. CALL Centre, University of Edinburgh. http://www.adapteddigitalexams.org.uk/Downloads/Reports/

Nisbet, P.D. (2010) SQA Digital Papers 2010 Report. Submitted to Scottish Qualifications Authority. December 2010. CALL Scotland. http://www.AdaptedDigitalExams.org.uk

Appendix 1: 2011 TTS test results

The 2011 Standard Grade General and Higher papers were tested using PDFaloud and Ivona Minireader.

Test method:
- Look for words which were likely to be mis-pronounced, on the basis of experience.
- Test the word with PDFaloud (single word) with Stuart
- Test the word with MiniReader with Heather
- Where necessary, check pronunciation using http://www.howjsay.com/

The mispronounced words are arranged in tables alphabetically. Words marked 'OK' are terms which sound acceptable, but they are included here because they were previously identified by other staff. (They may have been picked up using an earlier version of Heather or Stuart.)

Miscellaneous

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
°C	OK	degrees Celsius	OK	degrees Celsius
Auchiltibuie		Ach ill tibuie		Ach ill tibuie
MA		M A		M A
St Andrews		Saint Andrews		Saint Andrews
Fn		short-hand for "footnote"] (fn).....some other voices do say "footnote"		short-hand for "footnote"] (fn).....some other voices do say "footnote"
πr2		Pi r squared		Pi r squared
Ii		two		two
Iii		three		three
Iv		four		four
÷		Divided by	OK	
^{2} code 00B2		squared		squared
^{3} code 00B3		cubed		cubed
× code 00D7		times		times
· code 00B7		Point		point
√ code 00D6		Square root		Square root
A code 0041		Alpha		Alpha
B code 0042		Beta		Beta
Δ code 0043		delta		delta
E code 0044		epsilon		epsilon
Φ code 0046		phi		theta
Γ code 0047		Gamma		

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
Η code 0048		eta		
Ι code 0049		iota		
ϑ code 004A				
Κ code 004B		kappa		
Λ code 004C		lambda		
Μ code 004D		Mu		
Ν code 004E		Nu		
Ο code 004F		Omnicron		
Π code 0050		Pi		
Θ code 0051		Theta		
Ρ code 0052		Rho		
Σ code 0053		Sigma		
Τ code 0054		Tau		
Υ code 0055		Upsilon		
Ω code 0057		Omega		
Ξ code 0058		Xi		
Ψ code 0059		Psi		
Ζ code 005A		Zeta		

A

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
AD	OK	Ay D.		Ay D.
abiotic		aebiotic		aebiotic
aka		Ay kay ay		Ay kay ay
allele	OK	al eel		al eel
alleles		al eels		al eels
Allied		Stress not quite correct		Stress not quite correct
Andre		on Dray		on Dray
Ammonium		Says 'amminium'	OK	
Amperes		Amp ers		Amp ers
And/or		And or	OK	
Anglais		Ong glay		Ong glay
anodising		Annodising	OK	
anointed	OK	anointted		anointted
arable	OK	ahrabble		ahrabble
arginine		arjinine		arjinine
Arizona		Says 'Ae rizona'		Says 'erizona'
asthma		Ass thma		Ass thma
attitudes	OK	atti tudes		atti tudes
avogadro		ah vo gad roe		ah vo gad roe
Auchtertool		Och ter tool		Och ter tool

autoimmune		Auto immune		Auto immune

B

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
babygro	OK	baby grow		baby grow
baritone	OK	barit tone		barit tone
barium		Gargles!	OK	
baroque		barock		barock
Biosphere		Says bi osphere		Says bi osphere
Bitumen		Bit u men	OK	
boolean	OK			bulean
BSI		B S I		B S I
Butyne		Bew tyne		Bew tyne

C

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
capillary		Cap illary		Cap illary
cappella		ca pella		ca pella
Categorical		Says 'categarical' not 'categorical'		Says 'categarical' not 'categorical'
Centauri		Cent aw rie		Cent aw rie
ceu		cell		cell
Chloride		Rising intonation? Says 'aw' instead of 'oh'		Says 'aw' instead of 'oh'
chloromethane		Chloro meethane		Chloro meethane
clarsach		Clars ach		Clars ach
Cm^3		Cubic centimeters		Cubic centimeters
coli	OK	coh lie		coh lie
copper(II)	OK	copper two		copper two
Coulomb		coolomb		coolomb
covalent	OK	coveilent		coveilent
Cycloalkane		Cyclo alkane		Cyclo alkane
cycloalkene		Cyclo alkene		Cyclo alkene

D

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
decelerates		Dee selerates		Dee selerates
Deforestation		dee forest aetion		dee forest aetion
defragmenter	OK	deef rag menter		deef rag menter
dénouement		Dénouemong		Dénouemong
Diatomic		Doesn't say the 'a'	OK	

Dietary		Di eh tary	OK	
Dilute		Should be die lute	OK	
Diode		Says two words – die ode – should be one word		Says two words – die ode – should be one word
DIY		D i y		
donatello	OK	donnatello	OK	donnatello
Drs		Doctors		Doctors
duodenum		Duoh dean um		Duoh dean um

E

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
electronegativities		Electro negativities		Electro negativities
endonuclease	OK		OK	endonucle ays
enthalpy		enthlpy	OK	enthlpy
enzyme	OK		OK	enz I'm
enzymes	OK		OK	enz eye mms
entrepreneurial		ontreprenewerial		ontreprenewerial
ephemera		eff emerra		eff emerra
escherichia		Should be esher ick iah		Should be esher ick iah
estuaries	OK	estchuries	OK	estchuries
Etiolation		Eetiolation		Eetiolation
Ethane		Eath aine		Eath aine
ethyne	OK		OK	
Euthyphro		Euthy phro		Euthy phro

F

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
falsehood	OK	false hood	OK	false hood
ferroxyl	OK	fer ox ill	OK	fer ox ill
Fertile		Fer tile		Fer tile
Fife		Wrong 'i'	OK	
flaccid	OK	flacid	OK	flacid
flowchart		flow chart		flow chart
foosball	OK	foos ball	OK	foos ball
fructose		Frooc tose		Frooc tose

G

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
galactosidase		galacto side ays		galacto side ays
Ghanaian		Ghan a an		Ghan a an

gibberellic		jibberellic		jibberellic
glaciated		Glace iated		Glace iated
glomeruli	OK	glomb err you lie		glomb err you lie
glucagon	OK	gluca gone	OK	gluca gone
glutamine		glutameen		glutameen
Glycolysis		Gly cawlysis		Gly cawlysis
gratuitous		grat u ittus		grat u ittus

H

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
haemophilia		heemophilia		heemophilia
haemophiliac		heemophiliac		heemophiliac
hydrochloric		Hydro chloric		Hydro chloric
hypochlorite		Hypo chlorite		Hypo chlorite
hypothalamus		Hypo thalamus		Hypo thalamus
hypothesis	OK	hypothisis	OK	hypothisis
HTML			OK	
Hz		Hertz		hertz

I

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
ii		two		two
iii		three		three
iv		four		four
inheritance		Says 'e' as 'a'		Says 'e' as 'a'
injustice	OK	in just is	OK	in just is
intellect	OK	intell ecked	OK	intell ecked
Inverurie		Inverewerie		Inverewerie
Irvine	OK	irvin	OK	irvin
isoleucine		Isoluseen		Isoluseen

J

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound

K

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
Kcals		Kilo calories		Kilo calories
Klinostat		Klynostat		Klynostat

km		Kilometre		Kilometre
/km		Per Kilometre		Per Kilometre
Kg		Kilogram		Kilogram
/kg		Per Kilogram		Per Kilogram
kW		kilowatt		kilowatt
Kwh		Kilowatt hours		Kilowatt hours
kJ		kilojoules		kilojoules
kΩ		kill-ohm		kill-ohm

L

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
Labelling		Label ing		Label ling
Laziness		Says lz e ness	OK	
lead		led		led
leucine		leuceen		leuceen
lobotomy		Lo bot omie		Lo bot omie

M

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
maltose		Malt ose		Malt ose
medici	OK	medeechi	OK	medeechi
Metres/second		Metres per second		Metres per second
Mg		Milligrams		Milligrams
m/s		Metres per second		Metres per second
medieval		Med ieval		Med ieval
Mentieth		Menteeth		Menteeth
methionine		Metheye o neen		Metheye o neen
mitochondria	OK	my tow con dree-ah	OK	my tow con dree-ah
Molecule		Says 'mahlicule'	OK	
Mol/l		moles per litre		moles per litre
monarchy	OK	monnarcy	OK	monnarcy
Morayshire		Moray shire		Moray shire
moveable	OK	move abble	OK	move abble
MRSA		Em arr ess a		Em arr ess a
musique		museek	OK	museek
/min		Per minute		Per minute

N

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
Nazi		Says 'narzi'	OK	
Neptune		Nep tune	OK	Nep tune

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
noradrenaline		Nor adrenaline	OK	noradrenaline
nucleolus	OK		OK	

O

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
Omelette		ommlette		ommlette
Ω		ohm		ohm

P

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
peccadilloes		pecca dill oes	OK	pecca dillos
penalises		penal eyes is	OK	penal eyes is
pepsin		pep sin	OK	pep sin
periodontitis		Perrio don titis		Perri odon tie tis
phenylalanine	OK	fenil alla neen	OK	fenil alla neen
phenylephrine		Fenil efreen		Fenil efreen
phenylketonuria	OK	fenil key tone urea	OK	fenil key tone urea
phenylpyruvic	OK	fenil pie ruvic	OK	fenil pie ruvic
philosophical		Philosawphical		Philosawphical
Photolysis		Phote awlysis		Phote awlysis
Phototropism		Photo tropism		Photo tropism
Pilate		Peyelit		Peyelit
Poland		Po land	OK	Poland
polymerisation		polymer eye zation	OK	polymer eye zation
popish		pope ish	OK	pope ish
portraiture		portraitcher		portraitcher
Prescribed		'pre' not 'prea'		'pre' not 'prea'
propanoate		Propan o ate		Propan o ate
Provost		prawvist		prawvist
Psalm		sahm		sahm

Q

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
quadrats		Quad rats		Quad rats

R

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
referential	OK		OK	
residue		Says 'residoo'		Says 'residoo'

ribosomes		R eye bo not ribo		R eye bo not ribo
ritornello	OK	ritor nello	OK	ritor nello
RNA		R N A		R N A
Rubato	OK	Rue baahto		Rue baahto
RuBP		are you bee pee		are you bee pee

S

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
scenarios		Should be 'seen ar i o'	OK	
scenarios		Should be 'seen ar i o'	OK	
scone		scawn		scawn
Scone		Scune		Scune
serine		Serr een		Serr een
Ski		skee	OK	
Slovakia		Slov akia		Slov akia
SO2		ess oh 2		ess oh 2
soliloquy		Solillo kway		Solillo kway
Sonata		Son ahta		Son ahta
Soprano		sawprano		sawprahno
Solder		Sold er		Sold er
Spirogyra		Spyro gyra		Spyro gyra
St		saint		saint
stabilises	OK	stable eyes is	OK	stable eyes is
sterile		Sterr ile		sterr isle
stolen		sto len	OK	sto len
Stonehaven		Stone haven		Stone haven
Strathearn		Strath earn		Strath earn
sulphuric		Sulf u ric		Sulf u ric

T

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
Taleban		Says 'toleban'		Says 'toleban'
threonine		Threoneen		Threoneen
tournament		toornament		toornament
towelling		Towel ing		Towel ing
transpiration	OK	transpir ay shin	OK	transpir ay shin
tRNA		T R N A		T R N A
Tsarist	OK	Zarrist	OK	Zarrist
tyrosine		tyroseen		tyroseen

U

Mispronounced	Stuart	How it should sound	Heather	How it should sound

written word				
UHT		U H T		U H T
unfair	OK	un fair	OK	un fair
UNICODE	OK	uni code	OK	uni code
unidirectional	OK	uni directional	OK	uni directional
unreactive		Says 'un reek tive'		Says 'un reek tive'
urbanisation	OK	urban isation	OK	urban isation
Urease		Your ee aise		Your ee aise
urine	OK	you rine	OK	you rin
usability	OK	use ability	OK	use ability

V

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
vacuole			OK	
vacuoles			OK	
Vasoconstriction		Vaso constriction		Vaso constriction
vasodilation		Vaso dilation		Vaso dilation
Velodrome		Velo drome		Velo drome
Versailles			OK	
Vishnu		Vish noo		Vish noo
vitamin		Vittamin		Vittamin
volksgemeinschaft	OK	volksg em ein shaft	OK	volksg em ein shaft
Voltmeter		Volt meter		Volt meter

W

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
wynds		Should say 'wine ds'	OK	wineds
Wildebeest		Willdebeest		Willdebeest

X

Y

Mispronounced written word	Stuart	How it should sound	Heather	How it should sound
Yoghurt		Says yog hurt		Says yog hurt

Z

2011 Standard Grade General papers reviewed

Paper	Page count	Notes
SG G Accountancy and Finance 2011	4	
SG G Chemistry 2011	32	
SG G Biology 2011	32	
SG G Computing Studies 2011	16	
SG G Craft and Design 2011	12	
SG G Drama 2011	12	
SG G English Question 2011	8	
SG G English Reading text 2011	4	
SG G French Listening 2011	4	
SG G French Reading 2011	12	
SG G Geography 2011	20	Can't read map labels
SG Graphic Communication 2011	12	Text can't be read with TTS – just hisses – can be selected –copying and pasting text just gives this: _____
SG G History 2011	20	
SG G Home Economics 2011	20	
SG G Latin Interpretation 2011	4	
SG G Latin translation 2011	2	
SG G Maths Paper 1 2011	12	Various codes not spoken
SG G Maths Paper 2 2011	20	
SG G Modern Studies 2011	24	
SG G Music Section II 2011	8	
SG G Music Section II 2011	8	
SG G Physical education 2011	20	
SG G Physics 2011	29	
SG G Religious Studies 2011	24	
SG G Science 2011	24	
SG G Social and Vocational Skills 2011	16	
SG G Spanish Listening 2011	8	
SG G Spanish Reading 2011	12	
SG G Technological Studies 2011	16	

2011 Higher Papers reviewed

Paper (Higher 2011)	Page count	Notes
RMPS Paper 1	8	
RMPS Paper 2	8	
Accounting	16	
Administration Paper 1	5	
Administration Paper 2	4	
Biology	49	

Business Management	8	
Chemistry	43	
Computing	24	
Drama Answer book	4	
Early Education and Childcare Paper 1	4	
Early Education and Childcare Paper 2	4	
English close reading questions	4	
English close reading text	6	
English critical essay	8	
French Listening Writing	4	
French reading and directed writing	5	
Geography Paper 1	12	
Geography Paper 2	16	
Graphic Communication	14	Text can't be read with TTS – just hisses – can be selected –copyig and pasting text just gives this: _____
Health and food technology	8	
History paper 1	8	
History paper 2	12	
Human Biology	42	
Information Systems	24	
Lifestyle and Consumer Technology	8	
Mathematics Paper 1	16	
Mathematics Paper 2	8	
Media studies	4	
Modern Studies Paper 1	4	
Modern Studies Paper 2	4	
Music	18	
Philosophy	8	
Physical Education	8	
Physics	30	
Product design	12	
Psychology	8	
Sociology	4	
Technological Studies	16	
Technological Studies	4	

Appendix 2: 2012 TTS test results

Papers and documents tested for mis-pronunciations and unreadable text elements:

- 2012 Standard Grade General
- 2012 Higher
- Periodic table of elements

Test method:
- Look for words which were likely to be mis-pronounced, on the basis of experience.
- Test the word with MiniReader with Heather (version 3.0.3)
- Where necessary, check pronunciation using http://www.howjsay.com/

Papers tested for unreadable elements:

- 2012 Intermediate 1 and Intermediate 2.

2012 mispronunciations

Mispronounced written word	Comment	How it should sound
(i)		1
(ii)		2
(iii)		3
(iv)		4
(v)		5
¤500 (euros)	DTP problem rather than the voice	€ is spoken correctly
≤		less than or equal to
14·6 − 3·21 + 5·3	Decimal point and minus sign are not spoken	
ABC		Ae B C
AD		Ae, D.
Androclus		Andro clus
anti-aliasing		Anti ale iasing
appoggiatura		apo jer tura
arpeggio		Ar peggio
astatine		ahstatine
bolognese		bolognase
Bracadale		Brackadail
BSi		B S I
BSI		B S I
burgh		burrugh
Caesium		ceesium
Chaconne		shaconne
chorale		coral

concertino		Con certino
Cyclops	Strange intonation	Cyc lops
cytosine		cytoseen
Duchenne's		Dooshenn's
Einsteinium		einesteinium
ensemble		on somble
Fuchsia		fooshia
GUI		G U I
Hippomenes	Wrong 'o' sound	
Keswick		Kesick
Kincardine		Kincardin
Lutetium		looteeshum
medieval		Med ieval
Molybdenum		molibdenuum
Neodymium		Neo dymmium
neural		newral
neurones		new rones
neutrinos		New treen ose
omnivore	Hesitates before 'ore'	omni vore
oscilloscope		osilloscope
ostrich	Strange intonation	
patio	Breaks up the syllables	
Praseodymium		Praisio dymium
Prosciutto		Pro shutio
Qur'an		Caw rann
Rhenium		rheenium
risotto		Risawtto
Roentgenium		Rentjenium
Ruthenium		rutheenium
scherzo		scertzo
Seaborgium		Seebohrg ium
teapots	teapits	tea pots
Technetium		techneeshium
trypsinogen		trypsinojen
X	Sometimes spoken as '10', should be 'x' for an equation: suggest saying (x) as 10, otherwise x as x	
Ytterbium		itter bium

Graham Leary at CereProc reported that all of these errors could be addressed with the exception of:
- 'GUI' which is more often pronounced 'gooey' rather than 'G U I';
- 'neutrinos' and 'patios' which sound slightly strange due to technical factors that cannot be overcome.

Standard Grade General 2012 Papers checked

Paper	Page count	Word count	Notes
FGC_English-FGC_Writing_2012	14	800	
SFGC_Drama_Stimulus-Paper_2012	5	200	
SG_Accounting-and-Finance_Document-Pack_2012	4	150	
SG_Accounting-and-Finance_QP_2012	16	920	
SG_Admin_All_2012	20	1000	
SG_Biology_all_2012	32	2851	
SG_Bus-Management_all_2012	16	1135	
SG_Chemistry_all_2012	28	2704	
SG_Classical-Studies_all_2012	17	1229	
SG_Computing-Studies_All_2012	16	1669	
SG_Craft-and-Design_all_2012	16	1490	
SG_Drama_all_2012	11	743	
SG_English_Questions_2012	8	763	
SG_English_Text_2012	5	1368	
SG_French_Listening_2012	8	724	
SG_French_Reading_2012	13	1269	
SG_Geography_all_2012	20	1477	
SG_German_Listening_2012	8	719	
SG_German_Reading_2012	12	1045	
SG_Graphic-Comm_all_2012	12	1122	
SG_History_all_2012	24	4774	
SG_Home-Economics_All_2012	24	1664	
SG_Italian_Listening_2012	8	610	
SG_Italian_Reading_2012	12	1203	
SG_Latin_Interpretation_2012	4	491	
SG_Latin_Translation_2012	2	266	
SG_Maths_Paper1_2012	11	804	
SG_Maths_Paper2_2012	20	1126	
SG_Modern-Studies_all_2012	24	3265	
SG_Music_Section-I_2012	11	922	
SG_Music_Section-II_2012	8	594	
SG_PE_all_2012	20	1717	
SG_Physics_all_2012	28	2742	
SG_Religious-Studies_all_2012	20	974	
SG_Science_all_2012	24	2460	
SG_Soc-and-Voc-Skills_all_2012	16	1524	figure on p1 should be a table
SG_Spanish_Listening_2012	8	640	
SG_Spanish_Reading_2012	12	1388	
SG_Technological-Studies_all_2012	16	1399	

Higher 2012 Papers checked

2012 Higher Papers	Page count	Word count	Notes
H_Accounting_all_2012	16	2691	
H_Administration_Paper-1_2012	4	664	
H_Administration_Paper-2_2012	8	850	handwritten text cannot be read out
H_Art-and-Design_all_2012	16		Paper is secured to prevent copying or TTS (because it is a past paper available publicly that contains images)
H_Classical-Studies_all_2012	8	1832	
H_Computing_all_2012	28	4584	
H_Drama_Answer-book_2012	64	7232	
H_Early-Education-and-childcare_Paper-1_2012	4	333	
H_Early-Education-and-childcare_Paper-2_2012	4	408	
H_Economics_all_2012	8	1268	
H_English_Close-Reading_2012	6	972	
H_English_Critical-Essay_2012	8	1456	
H_English_Questions_2012	4	816	
H_Fashion-and-Textile-Technology_all_2012	8	674	
H_French_Listening-Writing_2012	4	569	
H_French_Reading-Directed-Writing_2012	5	1167	
H_Geography_Paper-1_2012	12	1066	
H_Geography_Paper-2_2012	16	2122	5 texts on map, text and map key not readable
H_German_Listening-Writing_2012	4	593	
H_German_Reading-Direct-Writing_2012	5	1165	
H_Graphic-Comm_all_2012	15	1455	
H_Health-and-Food-Technology_all_2012	8	843	
H_History_Paper-1_2012	8	998	
H_History_Paper-2_2012	12	5223	
H_Human-Biology_all_2012	41	4814	
H_Information-Systems_all_2012	28	4052	Copy of band review in newspaper not readable
H_Maths_Paper-1_2012	12	1811	

H_Maths_Paper-2_2012	8	692	
H_Media-Studies_2012	4	888	
H_MER_all_2012	32	3599	
H_Modern-Studies_Paper-1_2012	4	449	
H_Modern-Studies_Paper-2_2012	10	1724	
H_Music_all_2012	18	1805	
H_Philosophy_all_2012	8	992	
H_Physical-Education_all_2012	8	732	
H_Physics_datasheet_2012(Revised)	2	344	
H_Physics_QP_2012(Revised)	24	4544	
H_Product-Design_all_2012	9	815	
H_Professional-Cookery_all_2012	4	541	
H_Psychology_all_2012	7	846	
H_RMPS_Paper-1_2012	8	1156	
H_RMPS_Paper-2_2012	8	1030	
H_Sociology_all_2012	4	447	
H_Spanish_Listening-Writing_2012	4	547	
H_Spanish_Reading-Direct-Writing_2012	6	1217	
H_Tech-Studies_all_2012	20	2574	

Intermediate 1 2012 papers checked (for unreadable text)

Paper	Notes
Int1_Administration_QP_2012-DQP-SpellcheckOn	4 handwritten memos could not be read with TTS
Int1_Administration_Worksheet_2012-DQP-SpellcheckOn	
Int1_Biology_all_2012-DQP-SpellcheckOn	
Int1_Business-Management_all_2012-DQP-spellcheckon	
Int1_Care_all_2012-DQP-SpellcheckOn	
Int1_Chemistry_all_2012-DQP-Spellcheckon	
Int1_Computing-Studies_All_2012-DQP-spellcheckon	
Int1_Drama_all_2012-DQP-spellcheckon	
Int1_English_Close-Reading_2012-DQP-spellcheckon	
Int1_English_Critical-Essay_2012-DQP-spellcheckon	
Int1_French_Listening_2012-DQP-spellcheckon	
Int1_French_Reading_2012-DQP-spellcheckon	
Int1_French_Writing_2012-DQP-spellcheckon	
Int1_Geography_all_2012-DQP-SpellcheckOn	
Int1_Geology_all_2012-DQP-SpellcheckON	
Int1_German_Listening_2012-DQP-SpellcheckOn	
Int1_German_Reading_2012-DQP-SpellcheckOn	
Int1_Graphic-Comm_all_2012-DQP-SpellcheckOn	
Int1_Mathematics-1-2-3_Paper-1-non-calculator_2012-	

DQP-SpellcheckON	
Int1_Mathematics-1-2-3_Paper-2_2012-DQP-SpellcheckOn	
Int1_Mathematics-1-2-Apps_Paper-1-non-calculator_2012-DQP-spellcheckon	
Int1_Mathematics-1-2-Apps_Paper-2_2012-DQP-spellcheckon	
Int1_Media-Studies_all_2012-DQP-Spellcheckon	
Int1_Modern-Studies_all_2012-DQP-SpellcheckOn	
Int1_Music_all_2012-DQP-Spellcheckon	
Int1_PE_all_2012-DQP-Spellcheckon	
Int1_Physics_all_2012-DQP-SpellcheckOn	
Int1_Psychology_all_2012-DQP-Spellcheckon	
Int1_RMPS_all_2012-DQP-Spellcheckon	
Int1_Spanish_Listening_2012-DQP-SpecllcheckOn	
Int1_Spanish_Reading_2012-DQP-SpecllcheckOn	
Int1_Spanish_Writing_2012-DQP-SpecllcheckOn	
Int1_Travel-and-Tourism_all_2012-DQP-SpellcheckOn	

Intermediate 2 2012 papers checked (for unreadable text)

Int 2_Modern-Studies_all_2012-DQP-SpellcheckOn	
Int 2_PE_all_2012-DQP-SpellcheckOn	
Int 2_Psychology_all_2012-DQP-SpellcheckON	
Int2_Accounting_QP_2012-DQP-Spellcheckon	
Int2_Accounting_Worksheet_2012-DQP-spellcheckon	
Int2_Administration_Paper-1_2012-DQP-SpellcheckOn	
Int2_Administration_Paper-2_2012-DQP-SpellcheckOn	1 handwritten note
Int2_Art-and-Design_All_2012-DQP-SpellcheckOn	
Int2_Biology_all_2012-DQP-SpellcheckOn	
Int2_Business-Management_all_2012-DQP-SpellcheckOn	
Int2_Care_all_2012-DQP-spellcheckon	
Int2_Chemistry_all_2012-DQP-SpellcheckOn	
Int2_Computing_all_2012-DQP-SpellcheckOn	
Int2_Drama_all_2012-DQP-SpellcheckOn	
Int2_Drama_Dramatic-Extracts_2012-DQP-SpellcheckOn	
Int2_Economics_all_2012-DQP-Spellcheckon	
Int2_English_Close-Reading_2012-DQP-SpellcheckOn.pdf	
Int2_English_Critical-Essay_2012-DQP-SpellcheckOn	
Int2_Fashion-and-Textile-Technology_all_2012-DQP-Spellcheckon	
Int2_French_Listening_2012-DQP-SpellcheckOn	
Int2_French_Reading_2012-DQP-SpellcheckOn	
Int2_French_Writing_2012-DQP-SpellcheckOn	
Int2_Geography_QP_2012-DQP-SpellcheckOn	1 map with unreadable labels

Int2_Geography_Worksheet_2012-DQP-SpellcheckOn	
Int2_German_Listening_2012-DQP-SpellcheckON	
Int2_German_Reading_2012-DQP-SpellcheckON	
Int2_German_Writing_2012-DQP-SpellcheckON	
Int2_Graphic-Comm_all_2012-DQP-SpellcheckOn	
Int2_History_all_2012-DQP-Spellcheckon	
Int2_Info-Systems_all_2012-DQP-SpellcheckOn	1 screen shot with unreadable text.
Int2_Managing-Environmental-Resources_all_2012-DQP-Spellcheckon	
Int2_Mathematics-1-2-3_Paper-1-non-calculator_2012-DQP-spellcheckon	
Int2_Mathematics-1-2-3_Paper-2_2012-DQP-spellcheckon	
Int2_Mathematics-1-2-Applications_Paper-1-non-calculator_2012-DQP-spellcheckOn	
Int2_Media-Studies_all_2012-DQP-SpellcheckOn	
Int2_Music_all_2012-DQP-SpellcheckOn	
Int2_Physics_all_2012-DQP-Spellcheckon	
Int2_Product-Design_all_2012-DQP-SpellcheckOn	
Int2_Professional-Cookery_all_2012-DQP-Spellcheckon	
Int2_RMPS_all_2012-DQP-Spellcheckon	
Int2_Sociology_all_2012-DQP-spellcheckon	
Int2_Spanish_Listening_2012-DQP-SpellcheckOn (1)	
Int2_Spanish_Reading_2012-DQP-SpellcheckOn	
Int2_Spanish_Writing_2012-DQP-SpellcheckOn	
Int2_Technological-Studies_2012-DQP-spellcheckon	
Int2_Travel-and-Tourism_all_2012-DQP-SpellcheckOn	

Accessing SQA Digital Question Papers with Text to Speech Software

Paul Nisbet