Getting Started with the Tonalities music analysis software

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Overview

This software is part of a larger project that lays stress on the multiplicity of tonal systems in music, focusing particularly on Western music of the late 19th and early 20th centuries. It allows you to analyse passages of music in terms of differing tonal systems that may be configured to a high level of detail from a range of supplied options.

To use the software effectively, it is important to have an understand of the basic concepts of the underlying theory, above all:

- segmentation
- prolonging gamut
- connective gamut
- the distinction between spelled and unspelled matches of chords and gamuts
- the distinction between functional and inclusive chords and gamuts

These concepts are explained briefly in what follows, but it is not the purpose of the guide to present the music theory component of the Tonalities project in full.

The remainder of this user guide also assumes you are familiar to some extent with Microsoft Windows and Microsoft Excel. The software has been developed in Excel 97 and will not run under earlier versions (though it seems to run under later versions up to and including Excel 2002 – the version supplied in Office XP). I have run it under Windows 98 and Windows Me, though not Windows NT, 2000 or XP.

Installing the software

If the software has been pre-installed, please skip this section.

The Tonalities software is supplied as an Add-In to Microsoft® Excel, running under Microsoft® Windows®. An Add-In is a special worksheet, normally containing program modules written in Visual Basic® for Applications (VBA). Once installed within Excel, it is loaded automatically each time Excel runs.

If you choose to install Tonalities, you do so at your own risk. My recommendation for a standard installation is as follows. First, set up a folder within My Documents, called Tonalities. Next, copy the file Tonalities.xla to the folder you have just set up. Then, open Microsoft Excel, and from the Tools menu select Add-Ins. This opens a dialog, normally showing some Add-In programs supplied by Microsoft or a third party. If any of these are checked, then they are already installed.

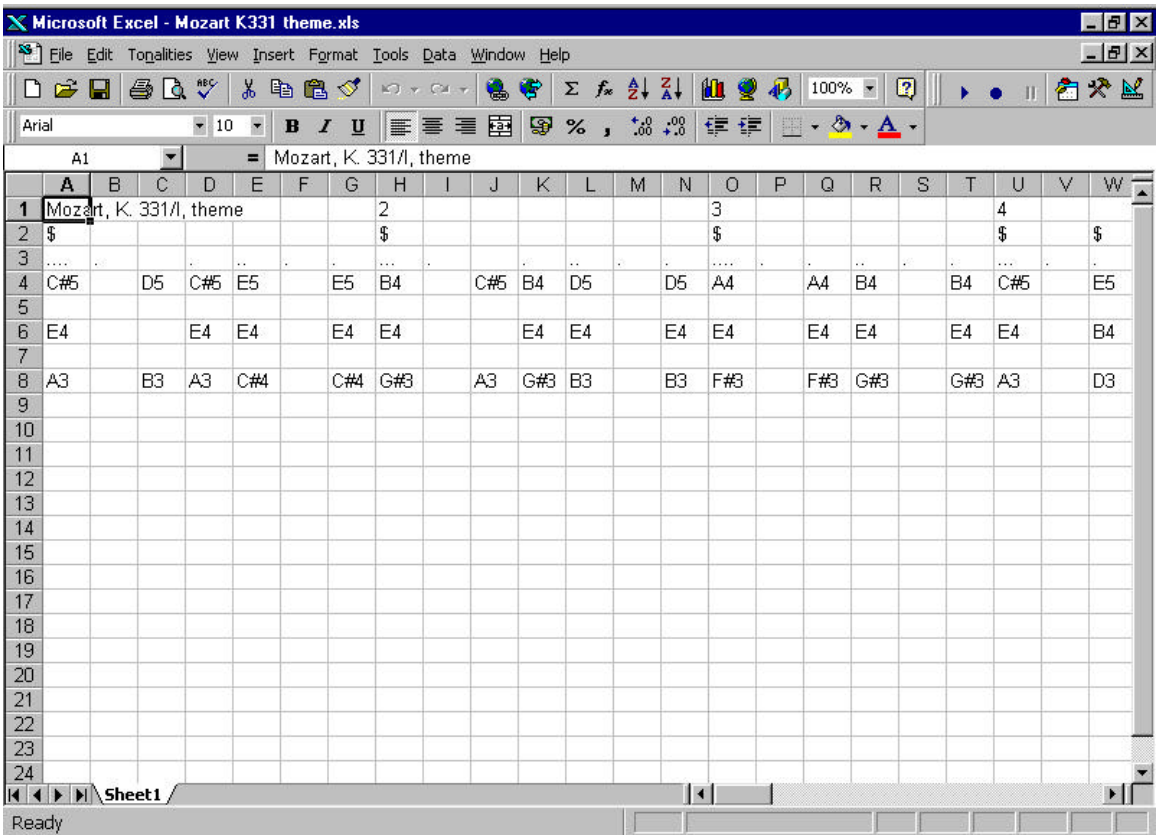
In the Add-Ins dialog, select Browse. This brings up the usual Windows navigable file dialog. Use this to get to the Tonalities.xla file and click on OK. This gets you back to the Add-Ins dialog: make sure that Tonalities has been added to the Add-Ins list and has a check-mark against it, then click OK again. At this point you will be returned to Excel and the Tonalities Add-In should load. If your computer is slow this may take a while. I don't recommend using Tonalities unless you have at least 64Mb RAM and your processor runs at 300Mhz or more.

Now that Tonalities has been installed as an Add-In, it will be loaded each time Excel starts up. If you have also been supplied with music data files, you may wish to copy these to your Tonalities folder as well.

Music data files

Because the Tonalities software is written as an Add-In to Microsoft Excel, when you run Tonalities you also have all the power of an industry-leading spreadsheet application at your fingertips. Opening and saving files, printing, formatting and so on, can be done with normal Excel commands.

The music data files used by Tonalities are simply Excel spreadsheets that present music data in a form that Tonalities can understand. If you open one of the files supplied with Tonalities, you will see the required format, which uses a number of familiar conventions. The screen shot (p. 2) shows the file containing the theme from the first movement of Mozart's keyboard Sonata, K. 331. If you have a



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1	Mozart, K. 331/I, theme							2							3						4		
2	$							$							$						$		$
3	....	.		.	..	.	.	...	.		.	..	.	.	....	.	.	..	.	.	...	.	.
4	C#5		D5	C#5	E5		E5	B4		C#5	B4	D5		D5	A4		A4	B4		B4	C#5		E5
5																							
6	E4			E4	E4		E4	E4			E4	E4		E4	E4		E4	E4		E4	E4		B4
7																							
8	A3		B3	A3	C#4		C#4	G#3		A3	G#3	B3		B3	F#3		F#3	G#3		G#3	A3		D3
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computer to hand then I suggest you open this file and refer to it 'live' when necessary. Not all of the theme is shown here, just bars 1–3 and part of bar 4 (the bar numbers are in row 1 – these are not required by Tonalities but I generally like to put them in to aid readability). The top-left cell (A1) contains a name that identifies this extract; it is defined as a Name in Excel and gives easy access to a large range of cells – in this case the whole extract. (If you use the Data Entry Assistant – which is not covered in this guide – then Tonalities makes this process easy, so that you don't really need to be familiar with Excel Name definitions and how they work. The same applies with the supplied music data files, all of which have been already set up in this way for the sake of convenience.)

In row 2 Tonalities expects the cells to contain $, $*, or nothing at all. The $ sign is used to mark the beginning of each segment for analysis. In the K. 331 theme, to begin with the segments correspond to the barring. (Generally speaking, each segment corresponds in scope to a foreground prolongation in Schenkerian analysis.) Where $* appears instead of $ (see, for example the supplied file of the Chopin E minor Prelude) this instructs Tonalities to ignore note spelling, i.e. to treat C# and Db as equivalent, etc.

Row 3 contains data showing metric stress, using a notation that should be self-explanatory to those familiar with Cooper and Meyer's *The Rhythmic Structure of Music*, Lerdahl and Jackendoff's *A Generative Theory of Tonal Music*, or indeed many other studies of rhythm in music. Up to four dots can be used; the more dots the greater the metric stress that Tonalities will assign to the pitches vertically below. Although it's not strictly necessary for the single-dot level to indicate a constant pulse, Tonalities will interpret things this way when calculating relative durations. When subdivisions of the one-dot level are needed, as for example they are to show the dotted rhythm that recurs in this Mozart theme, Tonalities counts these subdivisions and interprets them as being equal. For example, column B has a single dot, and the next metric stress is shown two columns later, in column D. Tonalities will therefore assign equal duration to columns B and C, each of which will be given half the duration value of a normal one-dot column – the stress, of course, will apply to column B, because it has the dot.

The rows below the segmentation data row and the metric data row contain data about pitches. I hope it's self-explanatory that a note name appears where a note begins. It is best by far to use as many rows as you need to, to match the voice-leading in the score. If a voice stops sounding, then the dash (minus sign) is

used to show where this happens. You can see this at the end of bar 8 in the Mozart extract, where there's a quaver rest in all parts.

So that pitches can be entered without the use of a music font, the hash sign (#) is used for sharp, a lower-case b for flat; x is used for double sharp and bb for double flat; if you want a natural then use n – but it's important to realise that Tonalities requires an accidental to be supplied with every note that needs one, because it doesn't 'know' about bar lines or key signatures. This means that it isn't ever really necessary to use n for natural, because a note name without an accidental will always be understood as a natural; however, I prefer to use n occasionally to improve readability in chromatic passages.

Middle C is C4, and C5 is an octave higher. One important difference from some pitch-notation conventions is that the number designates the absolute pitch rather than being interpreted in conjunction with the letter name. Thus B#4 is the same sounding pitch as middle C (C4); Cb4 is the same sounding pitch as B4, which is nearly an octave above middle C. Registers 0–9 are available.

I suggest you spend a few minutes looking through some of the supplied music data files so as to get used to the notation Tonalities uses. One additional symbol you may see is the underscore character, which precedes a note tied over from a previous note. The note/tied-note combination may include an enharmonic change of notation (such as F#4 … _Gb4).

Each of the supplied music data files contains only one music worksheet, though in some cases the sheet contains several extracts. In principle, however, any number of extracts can be contained in a music data file, on any number of worksheets.

Log sheet

Each music data file also contains a log sheet, which is maintained by Tonalities. The log sheet records analytical reports and/or additional details that let you see how Tonalities has dealt with the analysis of each segment in an extract. The log sheet is only made visible when it contains information.

The log sheet is simply an Excel worksheet (called Tonalities log) which forms part of the music data file, but you are advised not to edit it yourself, other than to use the Page Setup command for printing. (Tonalities provides ways of exporting the log sheet for use as a separate file by Excel or Microsoft Word.)

When you use a command from the Tonalities menu, a log sheet is added to the active workbook if it doesn't already contain one, because Tonalities naturally enough assumes that you are working with music data. For this reason, it's inadvisable to use the Tonalities menu in Excel when you are working with a 'normal' Excel workbook.

The Tonalities menu

Tonalities inserts its own menu into Excel – it normally appears to the right of the Edit menu. All the commands relating to Tonalities are found here. The Tonalities menu items are as follows:

- Analyse Selection
- Options
- Language Settings…
- Import…
- Export…
- Generate Report…
- Data Entry Assistant…
- Transpose Selection
- Export Log Sheet
- Clear Log Sheet

If you are new to Tonalities, you need at first only get to grips with the menu items explained in this guide, which are Analyse Selection, Options, Language Settings…, and Clear Log Sheet.

Each time you use Tonalities, on the first occasion you try to access a command from the Tonalities menu you will be presented with a security screen. This reminds you that use of the Tonalities software should at present not take place without my permission. You are asked to type in your name or other ID in order to proceed. There is a "guest" ID which gives access on a time-limited basis. Use of the software is entirely at your own risk.

Analyse Selection command

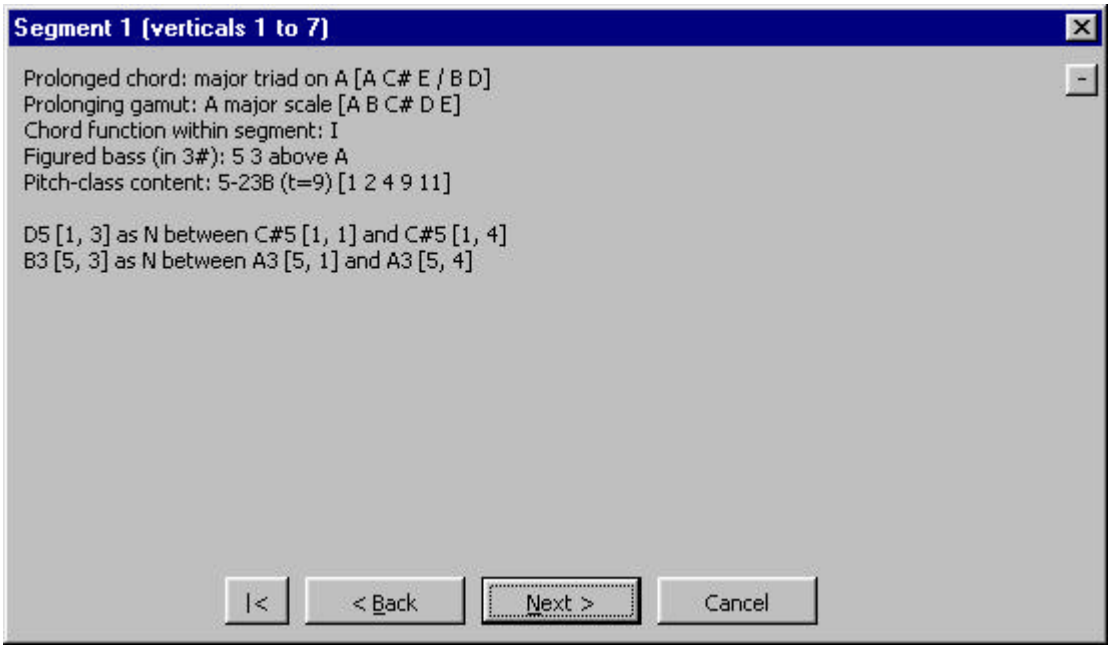
This is the focal command of the software, in that it instructs the software to undertake and report an analysis. However, it is important to have the music data *selected* (in the normal Excel sense) before using this command.

In principle, a selection in Excel comprises a range of cells. (Chart objects, etc., may also be selected, but that need not concern us here.) A rectangular block of cells may be selected, or a single cell. In addition, by making a selection, then holding the Ctrl key and making another selection (etc.), you can make a compound selection comprising discontiguous blocks and/or cells.

Importantly for Tonalities, as described above in the section on music data files, a Name may be assigned to a range of cells. Tonalities uses this feature of Excel to allow you to access an entire music extract by selecting the single cell containing the text of its name. By convention, this identifying text is placed at the top-left of the extract.

If the extract has been set up in this way, the simplest way to use the Analyse Selection command is to click in the cell containing the identifier and then to choose Analyse Selection from the Tonalities menu. Otherwise – or if you wish to analyse only part of a Named extract – you should select the appropriate rectangular range(s) before invoking the Analyse Selection command.

You may Ctrl-click on a succession of identifier cells to analyse several extracts as a single contiguous musical passage. It is important to Ctrl-click the identifiers in the correct running order.



Invoking the Analyse Selection command brings up the **analysis report window**, which is like a dialog in that it has buttons, etc., but remains firmly under the control of Tonalities whilst analysis is taking place. It is used to step through the analysis of the segments, and to report the analysis of each segment in turn. The segment-by-segment sequence is preceded by a summary of the assessment Tonalities has made of the Language Settings applying to this analysis, and is followed by a summary of the analysis itself.

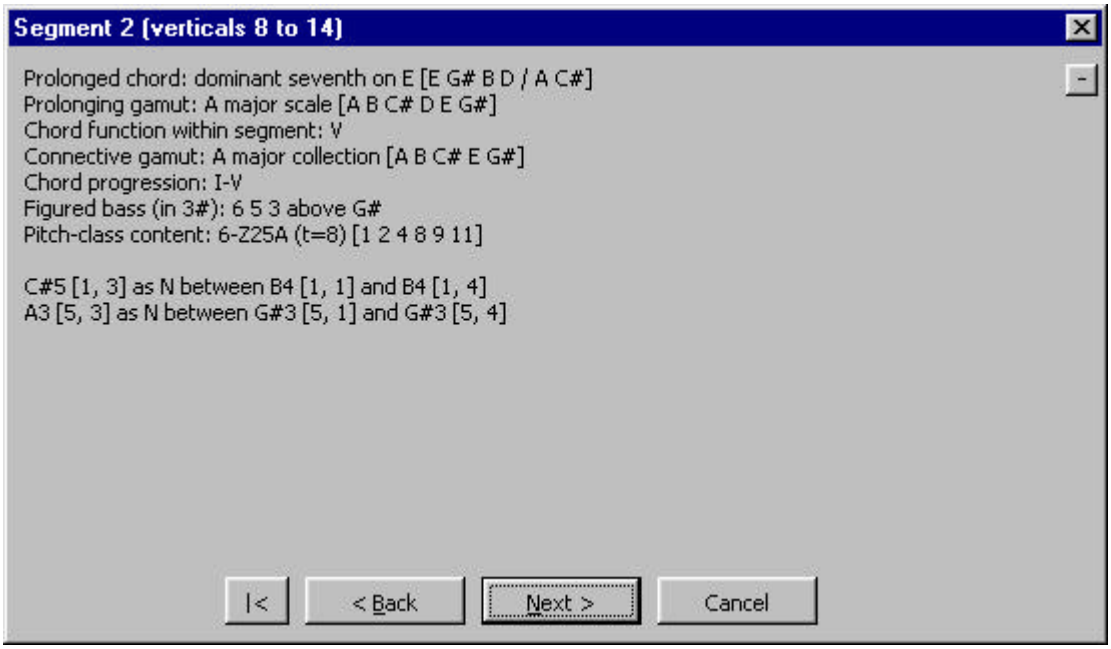
The buttons at the foot of the report window are rather like those found in a ‘wizard’. The leftmost button takes you back to the opening screen, like an instant rewind. (The small rectangular button at top-right collapses the window into an abbreviated form; the sequence of reports is then navigable by left- and right-arrow buttons, and the ‘collapse’ button becomes an ‘expand’ button. Generally I prefer to keep the report window expanded.)

Moving on from the settings summary report brings you to the analytical report on the first segment. The screenshot (above) shows this for the Mozart K. 331 theme. When Tonalities analyses a segment, it matches the pitch content and texture of the segment to as many viable chords and gamuts as it can, assigning a weight (between 0.000 and 1.000) to each one. Then, it pairs each possible chord with each

possible gamut – a chord/gamut pair is called a prolongation – and assigns a weight to each of these. Next, it filters the list of possible prolongations by applying a range of tests, comparisons and preferences, until it is left with the single best prolongation (or a few equal-best prolongations), which it then reports. The **Prolonged chord** and the **Prolonging gamut** are the components of the reportable chord/gamut pair. After the name of each, in square brackets, Tonalities lists the note-classes within the segment that are found in the chord or gamut – and if appropriate, after a forward slash (/), the notes that lie outside it. In the first segment of the Mozart, all five note-classes (A, B, C#, D and E) lie within the A major scale, whereas A, C# and E are within the A major chord and B and D are not.

It is important to be clear that the prolonging gamut is not an identification of 'key'. It applies only within the segment, and reflects the motions between chord notes and non-chord notes. In fact, Tonalities does make efforts to maintain some consistency of prolonging gamut as the analytical process continues, but it will not strive to do so in the face of other, more compelling evidence. Similarly, the **Chord function within segment** is exactly what it says – a within-segment relationship, rather than a judgement in relation to some sort of 'key' that applies in a notional larger context. Tonalities does, however, maintain an estimate of an applicable key signature, as a context for the **Figured bass** analysis. In order to reinforce the point that many of its judgements are based on criteria such as set membership, inclusion and exclusion, the **Pitch-class content** of the segment is reported, using Tn set-class names and pc integer notation.

Below these initial items comes a report on the **dissonance analysis** that Tonalities undertakes. This is a focal stage of the process of prolongation filtering, and is generally the point at which 'non-starters' are weeded out. This report serves to relate every non-chord note to one or more chord notes. The numbers in square brackets after the note names are grid references (in the form: row number, column number) to the pitch data within the segment. In the first segment of the K. 331 theme, for example, the non-chord note D5 is found in the first row of pitch data, in the third column. Tonalities analyses this note as part of a complete neighbour-note configuration, bounded by C#5 on either side.



While you've been reading this report, Tonalities has been busy analysing the next segment. Provided it has finished the analysis, you can click on the Next button to move forward. This process continues until you reach the final segment, at which point clicking the Next button will take you to a summary of the whole analysis, set out in a way that allows you to compare the musical objects found with the Language Settings you have used (as explained later in this guide). If there is a significant mismatch, Tonalities may intervene and suggest the extent of the changes you may wish to consider. Generally speaking, working with Tonalities is an iterative process – after entering the music data, you gradually refine the Language Settings until the analysis satisfies you.

Analytical reports on segments other than the first include information about how the segment-to-segment transition has been analysed. The screenshot (above) shows the report on the second segment of the Mozart theme. Two new report lines have been added, showing the **Connective gamut** and the **Chord progression**. Once again, neither of these should be confused with conventional judgements of key, because they have specific meanings here.

Tonalities assesses segment-to-segment transitions primarily as links between one chord and the next. The definition of each chord-type identifies a three-note subset of the chord that is used for this purpose. To analyse the transition between two chords, the aggregate of their two connective subsets is calculated, and a gamut is found that includes this aggregate. (If all else fails, the chromatic collection will do.) Then, the motion between the two chord roots is given a weighting (again, between 0.000 and 1.000), according to the associations of that gamut. For example, root motion up a perfect fourth scores well if the connective gamut is major or minor, but not if it's the octatonic collection. Various procedures are followed in order to arrive at the 'best' connective gamut for reporting purposes, if more than one is possible.

The root movement between functional chords is reported as a **Chord progression** if the connective gamut and both chords are functional – as they are in the Mozart case. If Tonalities can't report a genuine progression in this way, then it tries to report the **Root movement** in relation to the prolonging gamut from one or other of the segments; sometimes it may invoke the functional association(s) of a non-functional gamut (e.g. the association of the acoustic collection with dominant-quality chords). When assessing the connective subsets in relation to a non-functional gamut, Tonalities looks at the number of common tones between the two sets, and may report this – or, if the sets themselves meet certain criteria, it will report the motion as a **Trichord distance**, in terms of the group-cycles familiar from Neo-Riemannian theory.

Tonalities is prepared to look for diminished-fifth substitutions and other more extreme examples of function substitution, depending on how far the Language Settings depart from the default 'common-practice' configuration. In general, it will report a root movement where it can. In analysing the extract from Debussy's *Prélude à l'après-midi d'un faune*, given in one of the supplied music data files, there is at one point a chord progression which Tonalities reports convincingly as bVI–V, despite the fact that neither of the prolonging gamuts, nor the connective gamut, is functional.

Options commands

There are three commands grouped together in a submenu accessed through Options:

- Analyse Whole Selection At Once
- Log Prolongation Filtering
- Log Analytical Reports

Each of these is either selected or deselected as shown by the presence or absence of a tick that appears by the submenu item. Log Analytical Reports is selected by default, whilst the others are deselected. The options operate independently of each other – that is, selecting one doesn't automatically deselect anything else, or vice versa. These options apply when the Analyse Selection command is used.

Analyse Whole Selection At Once instructs Tonalities to traverse through all the selected segments in turn, instead of waiting for the user to click the Next button in the analysis report window from time to time. Once Tonalities has reached the final report to be shown, you can use the navigation buttons at the bottom of the analysis report window to study the analysis that has been done.

This option is useful if you have a slow PC, because you can set Tonalities going on a long extract and deal with something else instead of constantly watching the screen. If on the other hand you have a fast PC, it is fun to watch Tonalities blister through the segments one after the other.

Log Prolongation Filtering instructs Tonalities to place entries on the log sheet that record decisions taken by the software when reducing the number of possible prolongations (chord/gamut pairs) down to the one (or few) it prefers. The value of logging prolongation filtering for the typical user is that, when you are surprised that an analysis you have thought of for a segment doesn't actually come through the filtering process, you can see at which stage it has fallen by the wayside.

Log Analytical Reports is set by default and simply copies to the log sheet the information given on-screen in the analytical report window. In practice there is little point in deselecting this option, as you can clear the log sheet at any time (see below), e.g. before saving a data file, if you want to save disk space.

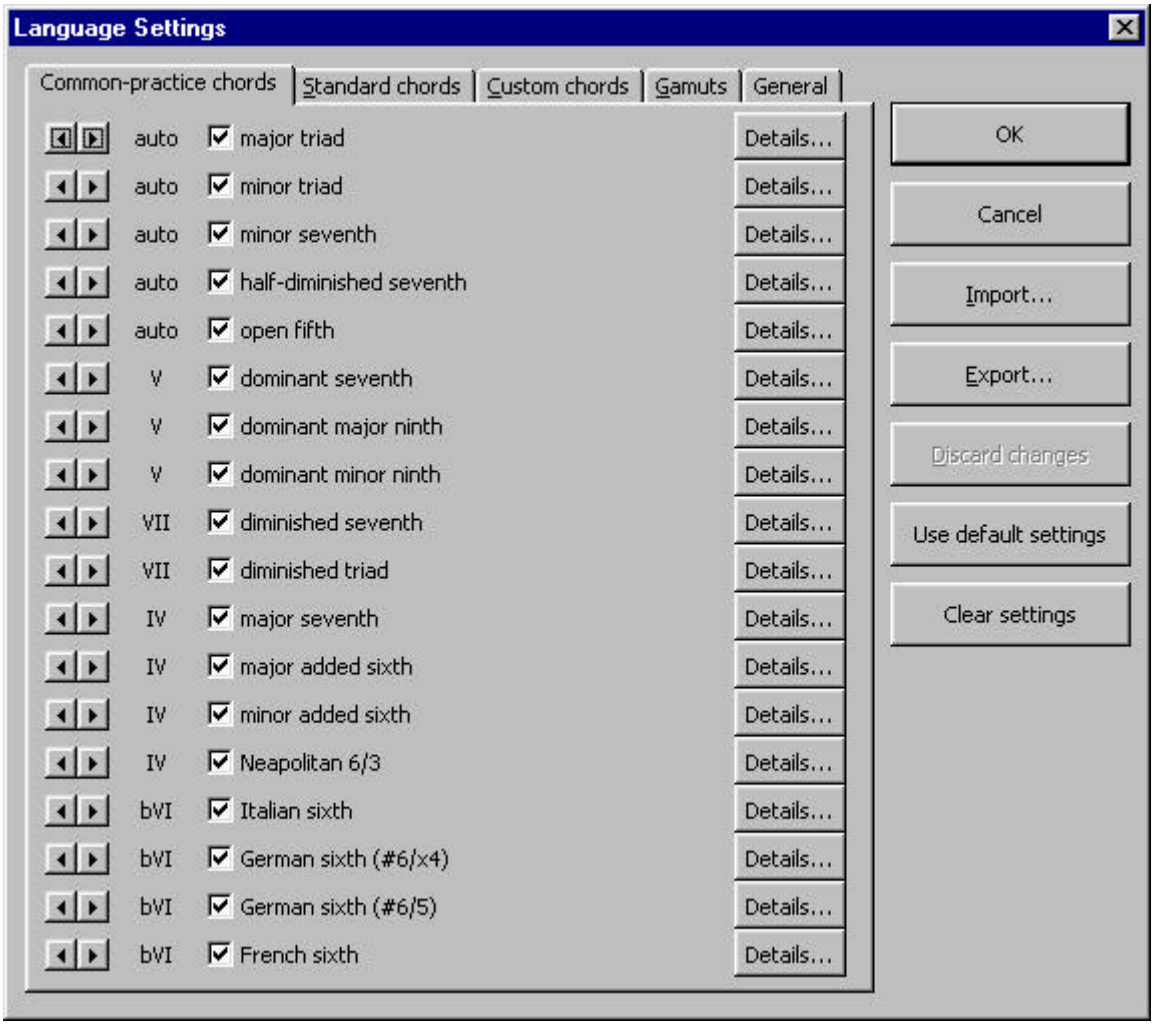
Clear Log Sheet command

This command simply tells Tonalities to clear the log sheet (Tonalities log) of all entries. The log sheet is also made invisible, as it contains no data.

Tonalities will ask you if you would like to have it clear the log sheet before starting an analysis, if the log sheet goes beyond a certain size. This is because maintaining a large log sheet can cause the software to run slower. On fast PCs this may be of little consequence.

Language Settings dialog

It is worth spending some time getting to know this dialog before going making any serious use of the Tonalities software, as it embodies the aim of the project to allow subtly different tonal systems to be defined in theory and applied in analysis.



When you have a music data file open, select the Language Settings command from the Tonalities menu. This brings up the dialog as shown in the screen shot (above). As you can see, the dialog has five tabs, so it is really five dialogs in one. If you alter some settings and then change your mind about it, you can use the **Discard changes** button to get the original settings back; there is also a **Cancel** button. Don't worry about the **Import…** and **Export…** buttons for the time being.

The **Common-practice chords** page of the dialog allows you to choose which of 18 common-practice chord-types you wish Tonalities to allow itself to recognise in your music data. For example, if you deselect the major triad, Tonalities won't recognise any major triads. By default, when you set up a new

music data file, all of these chord-types are selected. There's generally no harm in leaving them selected when dealing with music that obviously moves beyond so-called common-practice tonality, but I find that some of them can get in the way. Generally the first casualties are the Neapolitan 6/3 and the Italian sixth, but there are some tonal styles that seem to use few if any common-practice chord-types (late Scriabin, for example).

As well as selecting or deselecting individual chord-types, you can adjust their default functionality, using the controls that have left and right arrows (Microsoft calls these 'spin buttons'). If you want to try this, I suggest you start with, say, the dominant seventh. As you click on the arrows you'll find that the functions move by fifth, ranging through bII, bVI, bIII, bVII, IV, I, V, II, VI, III, VII and #IV. The left arrow takes you flatwards and the right arrow takes you sharpwards. To the 'right' of #IV you'll find 'incl': if you select this setting, it tells Tonalities not to assign any functionality to the chord-type at all, but instead to treat it as 'inclusive'. To understand what this is about it's necessary to go into a little more detail about what 'function' actually means in Tonalities' terms.

As we have seen, when it analyses a segment Tonalities looks within the segment for chords and gamuts (scales, modes, etc.) that it can recognise, giving a weighting value to each one. Then, it pairs each chord with each gamut, a chord/gamut pair being referred to as a prolongation, and assigns a value to each pairing. By various means the list of prolongations is filtered down to a final analysis, which it then reports. In this scheme of things, the concept of chord function comes into play when a chord and gamut are paired. The word 'function' is used to describe a relationship, between the root of the chord and the tonic of the gamut, that merits a particular additional weighting. So, given that the default function for the dominant seventh chord is V, a prolongation that pairs the dominant seventh on G with a C major/minor scale, for example, will add significantly to the weight given to that prolongation. Matching the default functionality of a chord-type generates the greatest weight, which is why it's worth making this default function adjustable. (For example, in some styles the major added sixth and major seventh chord-types seem to me to have more the quality of I than of IV.)

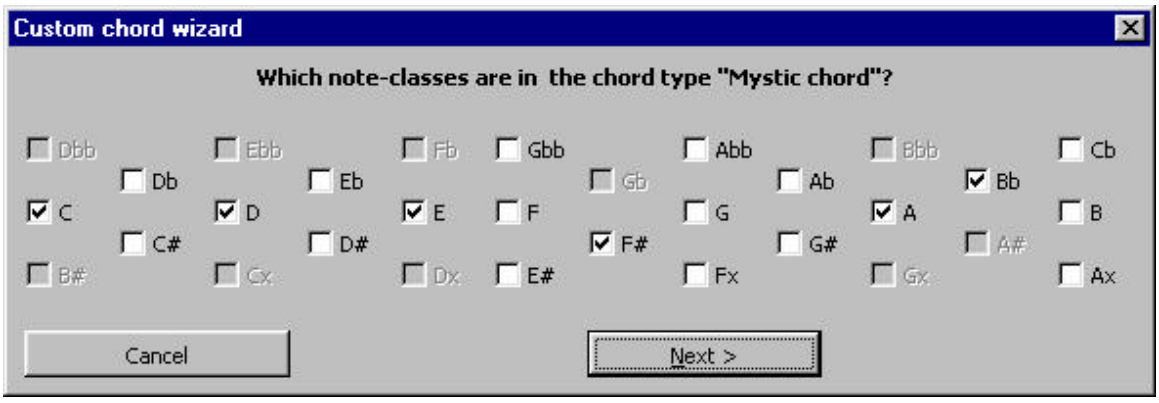
If a chord-type is 'inclusive', then the additional weighting that can come with functionality isn't available, but elsewhere in the Tonalities system, as the list of possible prolongations is filtered, there will be more emphasis given to inclusion relations between chord and gamut than in the functional case. (A detailed description of how prolongation filtering is done is beyond the scope of this guide.)

One more type of functionality needs to be explained, and that is 'autofunctionality', as is assigned by default to the major triad and some other chord-types. This arises from a recognition that the core chord-types of common practice – the major and minor triads – tend not to impose their functionality on a given musical situation, but to take their functionality from the context. Their functionality is more fluid than is the case with chord-types such as the dominant seventh. If we were to attempt to assign a default function to the minor triad, for example, should it be I (as one might expect in minor gamuts), or should it be II (as one might expect in major)? The point is, the chord's intrinsic functionality varies according to the context the gamut provides. Marking the triads – together with a few other chord-types – as 'autofunctional' places responsibility for assessing this context in the hands of the software. You can override this using the relevant spin-button if you wish.

The other controls on the Common-practice chords page of the dialog are the **Details** buttons that allow you to see the basic definitions of each chord-type. It's worth clicking on a few of these buttons to see which properties of a chord are defined in the Tonalities system – you'll see that it's far more than just a matter of which notes are 'in the chord'.

The second page of the Language Settings dialog is headed **Standard chords**. This page is very similar to the Common-practice chords page – it just has a different list of chords. If any of these are not self-explanatory to you from the names, just click on the relevant Details button to see how the chord-type is defined.

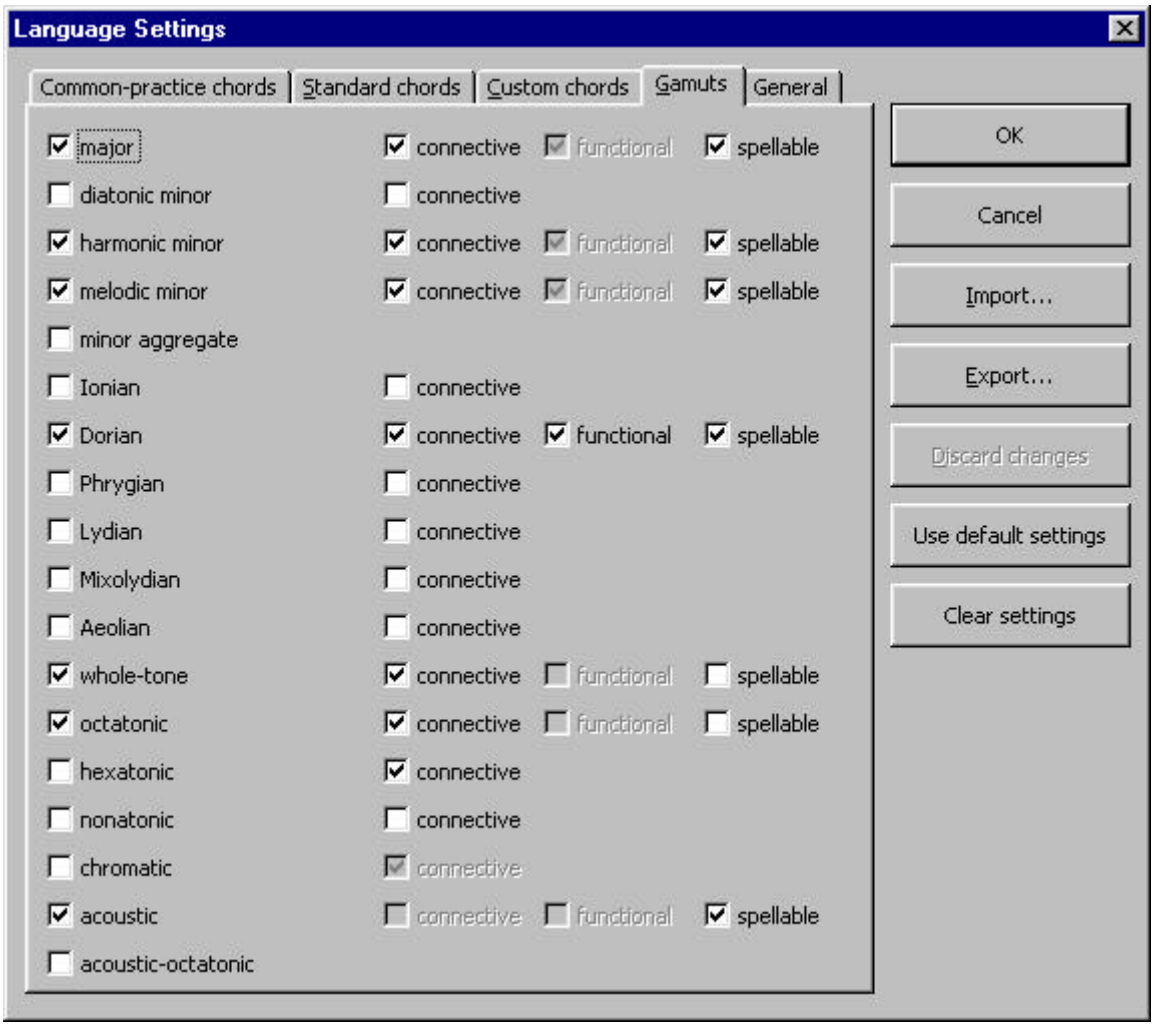
The third page of the dialog is the **Custom chords** page, which has the potential to look similar to the previous chord pages, but by default has no chord-types on it at all. This is because it presents the user with the opportunity to define additional chord-types appropriate to a particular analytical situation. For example, the music data file that contains the whole of Scriabin's *Feuillet d'album* Op. 58 includes a definition for this composer's famous 'mystic chord'. Chord-type definitions are made using the **Custom chord wizard**, which walks you through the process of generating a definition similar to those that can be accessed (read-only) on the built-in chord pages using the Details buttons. The screen shot (p. 9) shows the initial state of the Custom chord wizard, as if you have called it up to edit the definition of the mystic chord. You'll see that the notes of the mystic chord on C are selected, but it doesn't actually matter which



transposition of a custom chord-type you work with – Tonalities will derive a transposable definition from your input.

Leaving chords, we now reach the **Gamuts** page (see the screen shot below). Tonalities uses the word 'gamut' to refer to musical entities that might go variously under the terms scale, mode and collection. Although a present there is no facility to define custom gamut-types, a wide range of configurations is possible in the present version of the software.

Each gamut-type may be selected as a potential prolonging gamut (i.e. to operate *within* a segment) and/or as a connective gamut (to operate *between* adjacent segments). If you select a gamut-type as a



potential prolonging gamut, then you may additionally select or deselect up to two additional properties of prolonging gamuts: (1) whether or not it admits functionality; (2) whether or not it is spellable. In some cases the 'functional' option isn't available – for example, in the case of the whole-tone gamut-type. Conversely, the four common-practice gamut-types at the top of the dialog page are *always* functional – you can't change this, though you may if you wish, for example, deselect the major gamut-type and replace it by the Ionian (for which functionality isn't available, precisely because this would cause an ambiguity with the major scale). A few gamuts can't be selected as potential connectives, but conversely the chromatic gamut is *always* potentially connective, so that no analysis will break down simply because a connective gamut between two segments can't be found.

Gamut-types may be spellable or not according to your preference. Spelled matches of chords or gamuts adhere to the note-class definitions – so that, for example, C Fb G won't be recognised as a C major triad, but C E G will. In an unspelled match, the pitches in the segment are interpreted as pitch-classes, so that C Fb G *would* be recognised as an unspelled C major triad. When reporting what it finds, Tonalities appends the word 'collection' to any musical object it has found unspelled (connective gamuts are always unspelled). In fact, it generally tries to find both spelled and unspelled matches, but has ways of preferring the spelled ones. The exceptions to this rule are: (1) where the segment is marked with $* rather than $, and (2) where the user has deselected spellability for the gamut-type in question. If either of these exceptions applies, then only unspelled matches for the appropriate musical objects will be attempted.

The gamut-types that I would suggest are most likely to raise this question of spellability are, fairly obviously, the **interval-cyclic** gamuts – whole-tone, octatonic, hexatonic, nonatonic and chromatic. Whether or not a gamut-type is interval-cyclic is one of 23 properties currently embodied in a gamut-type definition, and a further 10 are invoked when a particular instance of a gamut is recognised. The sheer number of these properties is the principal reason why no facility for defining custom gamut-types has yet been implemented.

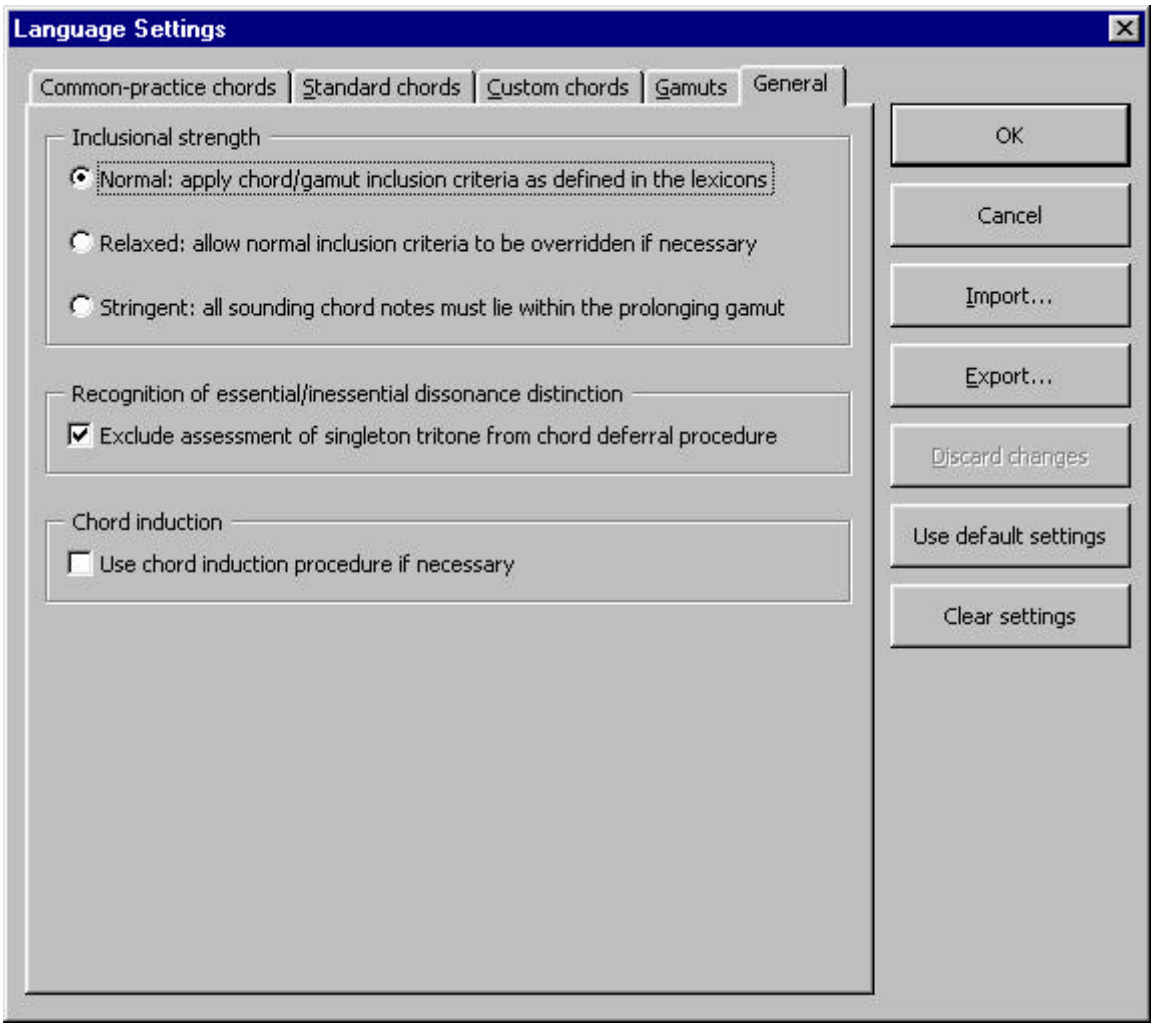
Experience suggests that fine-tuning the gamut settings can often be the hardest aspect of the task of configuring a tonal system that allows the software to undertake a satisfactory analysis of a particular musical extract. The final page of the Language Settings dialog, however, provides a small number of **General** settings that can in some circumstances make a crucial difference. Each is given a brief explanation in the dialog, as shown in the screen shot (p. 11).

The setting for **Inclusional strength**, for which there are three alternatives, affects the process of prolongation filtering in two ways. First, as the heading suggests, it affects the criteria against which inclusion relations between the paired chord and gamut are tested. Every chord-type definition includes a list of the note-classes that *must* intersect with the prolonging gamut, and another list of those that *must not* – though in most cases the latter list is empty. If the Inclusional strength setting is Normal, then it is the defined inclusion/exclusion relationships, and only those relationships, that must hold. The other two possible settings (Relaxed and Stringent) are applied as preference rules – which in Tonalities are defined formally as filtering criteria that are applied only if they filter out at least one but not all of the remaining prolongations. The Relaxed setting, broadly speaking, is useful when chromatic voice-leading within segments seems to retain a linear coherence of its own, but not necessarily in a tight relationship with the chords. The Stringent setting is worth trying if you are using a lot of inclusive gamut- and/or chord-types.

The second way in which the Inclusion strength setting affects prolongation filtering is that, depending on the other Language Settings, it may affect the order in which the filtering tests are applied to the list of prolongations. This topic is beyond the scope of this guide, but it may be useful to stress that before it starts an analysis, Tonalities assesses the Language Settings you have chosen and makes certain summary judgements about them, which then affect quite a lot of its decision-making, over and above the effect of the basic Language Settings themselves.

The **Recognition of essential/inessential dissonance distinction** setting, which is only available when the chord and gamut settings lie within the domain of common-practice, affects a specific phase of the filtering process, termed chord deferral, in which larger chords normally give way to smaller chords if they are related by inclusion. This basic rule is normally overridden if the larger chord contains one tritone interval, because this interval generally serves to define the chord's function with exceptional clarity, and (in a common-practice situation) to act as a position-finder in relation to the prolonging gamut. However, some mid 18th-century music (such as the Bach chorales in one of the supplied music data files) may usefully be analysed without this tritone interval necessarily being prioritised in all circumstances.

The **Chord Induction** setting refers to a powerful feature that allows the Tonalities software to find chord-like entities within segments, even when no defined chord-type can be matched. 'Atonal' music that



is texturally akin to tonal music may be analysed in this way, thus to a significant extent bridging the gap between tonal and atonal theory. If the music you are working with is likely to contain extraordinary chords that you may not have foreseen, and/or you envisage having to define some custom chords, then it is worth selecting this option – though if you are stepping through the segments in the normal way and haven't selected this option, Tonalities will ask you whether you want to use chord induction when it can't match one of the chord-types selected in your Language Settings.

And finally …

Thank you for reading this far. I hope you get some pleasure out of working with the Tonalities software, and some value from what it provides. **If you have my permission to use the software, please be aware that this does not imply any warranty or acceptance of liability. The software is not in the public domain, nor is it freeware or shareware. You should not disclose your ID to a third party, or distribute the software or the supplied music data files or this guide. If you prepare any music data files yourself, I should be glad to receive a copy in case any software issues are raised.**

If you find what appears to be a software bug, or something else that is inexplicable, please contact me on Anthony.Pople@nottingham.ac.uk and I will do my best to deal with it. At any rate I shall be pleased to discuss the problem. The Tonalities project remains ongoing, and the software itself is likely to be developed well beyond the current version (6.25) in due course. There are many broader considerations in 20th-century tonal music which I believe the underlying theory addresses but which are not at present reflected in the functionality of the software. I am aware of some of these shortcomings, and have some lines of development planned, but I would also be pleased to receive comments at any time.

