

Change Ringing Engine

User Manual



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Contents

1	Introduction to Change Ringing Engine	2
2	Starting Change Ringing Engine	3
3	Getting help	4
4	Looking up a method	5
5	Ringing the method audibly	7
6	Ringing Touches	9
7	Call Changes	11
8	Exporting and Printing	13
9	Settings	14
10	Scripting commands	17
11	File Management	19
A	Bell View and Change Ringing Engine Licence	20

List of Figures

1	Change Ringing Engine on Start up	3
2	Touch of Grandsire Doubles as displayed by the Engine	10
3	Exported touch of Grandsire Doubles in Chrome	18

1 Introduction to Change Ringing Engine

The Change Ringing Engine is a Python program for writing out methods and touches, row by row, producing output in a variety of different formats and even ringing them audibly on a set of bell sound samples!

The Change Ringing Engine uses a traditional command line interface, while its learning curve may be steeper than that of other change ringing applications, this approach offers much flexibility and enables method generation to be scripted for automation. This proves to be useful when producing documents about change ringing which contain a lot of methods. Change Ringing Engine may appeal to ringers who are developers, hackers or power users who like to experiment. For those who simply want an application to display methods, then one with a graphical user interface (like its sister application *Bell View*¹ would get the job done much more easily!

While the Change Ringing Engine comes with some of the most popular methods — we've included all those that come with the current edition of *Diagrams*, others may be added by editing the spreadsheets and reloading it into the library.

Sound is provided by bell samples from St Wilfrid's Harrogate, a 6cwt eight and the nearby St Michael's Beckwithshaw, a 13cwt six. A number of tunings based on these are configured. It is also possible to add other sets too.

Installing Change Ringing Engine

For instructions in obtaining and setting up the Change Ringing Engine, please refer to the document *Installing Bell View and Change Ringing Engine*.

2 Starting Change Ringing Engine

To start the Change Ringing Engine on a Windows PC or a Mac, double click on its icon on the desktop.²

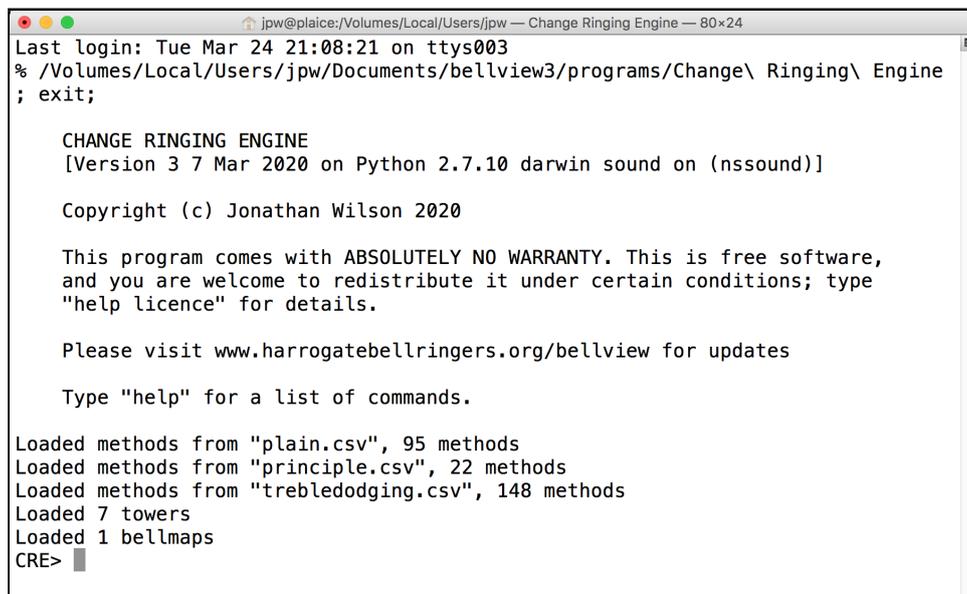
Alternatively, it may be started by opening up Terminal (Mac and Unix) or Command Prompt (Windows) and running the following command

```
python -m crengine
```

If using version 3 Python on a Mac or Unix, it may be necessary to use the following command instead

```
python3 -m crengine
```

On starting up, the following will appear



```
jpw@plai:~/Volumes/Local/Users/jpw — Change Ringing Engine — 80x24
Last login: Tue Mar 24 21:08:21 on ttys003
% /Volumes/Local/Users/jpw/Documents/bellview3/programs/Change\ Ringing\ Engine
; exit;

CHANGE RINGING ENGINE
[Version 3 7 Mar 2020 on Python 2.7.10 darwin sound on (nssound)]

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This program comes with ABSOLUTELY NO WARRANTY. This is free software,
and you are welcome to redistribute it under certain conditions; type
"help licence" for details.

Please visit www.harrogatebellringers.org/bellview for updates

Type "help" for a list of commands.

Loaded methods from "plain.csv", 95 methods
Loaded methods from "principle.csv", 22 methods
Loaded methods from "trebledodging.csv", 148 methods
Loaded 7 towers
Loaded 1 bellmaps
CRE> █
```

Figure 1: Change Ringing Engine on Start up

On the first run, it will install the CRE working folder in the home directory (Mac's or Unix) or profile (Windows PC's) and build the library. If Bell View has been previously used, then this will have already been done.

The Change Ringing Engine is a command line interface, so it only responds when a command is typed and *Enter* is pressed.

To leave the Change Ringing Engine, type `exit` followed by *Enter*³.

3 Getting help

The Change Ringing Engine has a built in rudimentary help system. To find out what is available type `help` (then press *Enter*)

```
CRE> help
```

```
Documented commands (type help <topic>):
```

```
=====
```

appendto	copy	listmethods	pwd	savevars	touch
block	delete	makelibrary	rename	set	tower
callchange	echo	method	repeat	shell	uncomment
cd	exit	plaincourse	ring	show	unset
chime	help	plainhunt	run	showcomments	writeto
clear	history	plainlead	savehistory	sleep	
comment	input	print	saveobjects	stop	

```
Miscellaneous help topics:
```

```
=====
```

```
about bellview licence placenotation towermap
```

To get help about a certain command or topic, type `help` followed by the command (or topic name); for example to find out what `echo` does:

```
CRE> help echo
```

```
Printing text on screen (echo)
```

```
=====
```

```
SYNOPSIS
```

```
    echo text to be printed
```

```
DESCRIPTION
```

```
The echo command prints all its arguments to the screen.
Its main use is to make scripts more verbose. For example:
```

```
CRE> echo Ringing Grandsire Doubles
Ringing Grandsire Doubles
```

Now try the `echo` command

```
CRE> echo The quick brown fox jumps over the lazy dog
The quick brown fox jumps over the lazy dog
```

The `echo` command may not be particularly useful, but should be enough to illustrate how the help system works. In fact `echo` will be of use when scripting commands for automation.

4 Looking up a method

Methods need to be loaded from the library into the Engine workspace. The `listmethods` command lists all the methods available

```
CRE> listmethods
Plain Hunt Singles
Canterbury Place Minimus
Double Bob Minimus
Double Canterbury Place Minimus
Double Court Place Minimus
(more methods)
Yorkshire Surprise Maximus
Zanussi Surprise Maximus
```

To load a method, the `method` command is used. The following will load `Grandsire Doubles` from the library and name it `gs5` in the workspace.

```
CRE> method gs5 "grandsire" 5
Method "gs5" defined: "Grandsire" "5" "3,&1.5.1.5.1" "9" "3.1" "3.123"
```

To find out more about this method, use `show`. This will display the definition of the method in terms of place notation and show the first plain lead, 10 rows in this case.

```
CRE> show gs5
```

```
Method "gs5":
```

```
Attributes:
```

```
Name           : Grandsire Doubles
Type            : Method
Number of Bells : 5
Place Notation  : 3,&1.5.1.5.1
Calling Row     : 9
Bob             : 3.1
Single         : 3.123
```

```
Plain Lead:
```

```
0  12345*
1  21354 3
2  23145 1
3  32415 5
4  34251 1
5  43521 5
6  45312 1
7  54132 5
```

```

8 51423 1
9 15243 5
10 12534* 1

```

A whole plain course may be displayed by using `print`; before using this command, the text height is specified to make sure that the output will fit on the screen, the trace ('blue line') is shown on the third and as substituted asterisks.

```

CRE> set textheight 15
CRE> set tracebells 3
CRE> set traceformat subs
CRE> print gs5

```

```

12*45      125*4      1245*
-----
21*54      2154*      214*5
2*145      251*4      2415*
*2415      52*14      4251*
*4251      5*241      452*1
4*521      *5421      54*21
45*12      *4512      5*412
541*2      4*152      *5142
5142*      41*25      *1524
1524*      142*5      1*254
125*4      1245*      12*45

```

If the terminal has scrolling, then `textheight` can be set to a large number which will ensure that the rows are displayed continuously, which makes it a bit easier to follow.

Many terminals (including Mac OS X Terminal and XTerm in Unix, but not Windows Command Prompt) support ANSI control sequences. If this is the case, then the trace bells may be displayed by coloured numbers instead by using the following command before `print`

```
set traceformat ansi
```

Higher Numbers of Bells

If the method has more than 9 bells, then the following symbols are used to denote the higher numbered bells:

```

O 10   E 11   T 12   A 13   B 14   C 15   D 16
F 17   G 18   H 19   J 20   K 21   L 22

```

While the Change Ringing Engine can support up to 22 bells (3 octaves), a maximum of only 12 bells may be audibly rung with the supplied bell samples.⁴

5 Ringing the method audibly

The Change Ringing Engine supports the ringing of methods in the audible sense, by using sets of pre-recorded bell sample sounds, known as ‘towers’. The Engine comes with the following towers, although it is possible to add others to it:

St Wilfrid Default tower. 12 bells, tenor 6cwt in C⁵

St Michael Heavy ring of 6 bells, tenor 13cwt in F[♯]₆

Default Same as *St Wilfrid*

Dorian Ten bells in Dorian minor scale (bells 2 to 11 of a twelve)

Phrygian Ten bells in a Phrygian minor scale (bells 1 to 10 of a twelve)

Middle 8 A lighter eight using the ninth from a twelve as the tenor and the flat sixth as the fifth.

Front 8 An alternative lighter eight consisting of the front eight of a twelve but with a sharp second.

Front 5 The front five bells of a twelve. They are in the same key as the tenor but an octave higher.

Odd The six odd numbered bells of a twelve

Even The six even numbered bells of a twelve

Westminster Bells 1,2,3 and 6 of a six — same tuning as quarter bells of Westminster chimes.

Before ringing methods on sound samples, it is necessary to load a tower into the workspace. To use the ‘default’ tower and name it `twr`:

```
CRE> tower twr "default"  
Tower "twr" defined
```

Check that it works by chiming rounds

```
CRE> chime twr 12345678
```

Now to ring Grandsire Doubles (`gs5`). Each row is displayed as it is struck. Before ringing, the cover is turned on, so that the covering bell (Tenor) will be rung at the end of each row — this is the usual practice for odd bell methods.⁷

```
CRE> set cover on  
CRE> ring gs5 twr
```

```
12*456  
12*456  
21*546  
2*1456  
*24156  
*42516
```

The ringing may be stopped at any time by typing *Ctrl-C*.

6 Ringing Touches

In order to ring a touch, a new type of object must be introduced — the *block*. A block is a set of rows and rows are added to it as the touch is rung.

A block is defined using the `block` command; for example

```
CRE> block gs120 "Touch of 120 Grandsire Doubles" 5 10
Block "gs120" defined
```

This block is assigned the name `gs120` in the workspace. The last two arguments specify the ‘geometry’ which ensure it is correctly printed. In this case 5 bells and each lead has 10 rows.

An extent of Grandsire Doubles may be rung by calling every other lead; when the 5th is about to dodge 4–5 down and therefore double dodges 4–5 up instead. Bobs are called, except when the 4th is coming out of the hunt, when a single is called instead; thus the leads are: plain, bob, plain, bob, plain, single (repeated).

The touch is therefore formed using the `touch` command which adds the rows to `block gs120`:

```
CRE> touch gs120 gs5 PBPBPS 2
120 rows rang
```

The rows of the touch may be displayed by printing `block gs120`:

```
CRE> print gs120
```

```

jpw@plaipe:/Volumes/Local/Users/jpw — Change Ringing Engine — 74x30
CRE> print gs120

 12345      12534      13425      13542      14235      14523
-----
 21354      21543      31452      31524      41253      41532
 23145      25134      34125      35142      42135      45123
 32415      52314      43215      53412      24315      54213
 34251      53241      42351      54321      23451      52431
 43521      35421      24531      45231      32541      25341
 45312      34512      25413      42513      35214      23514
 54132      43152      52143      24153      53124      32154
 51423      41325      51234      21435      51342      31245
 15243      - 14352      15324      - 12453      15432      S 13254
 12534      13425      13542      14235      14523      13245

 13245      13524      12435      12543      14325      14532
-----
 31254      31542      21453      21534      41352      41523
 32145      35124      24135      25143      43125      45132
 23415      53214      42315      52413      34215      54312
 24351      52341      43251      54231      32451      53421
 42531      25431      34521      45321      23541      35241
 45213      24513      35412      43512      25314      32514
 54123      42153      53142      34152      52134      23154
 51432      41235      51324      31425      51243      21345
 15342      - 14253      15234      - 13452      15423      S 12354
 13524      12435      12543      14325      14532      12345

CRE>

```

Figure 2: Touch of Grandsire Doubles as displayed by the Engine

7 Call Changes

Call change compositions are supported by the Change Ringing Engine and bells may be called either down or up. The first step in producing a call change composition is to declare a block for the rows to go in; for example on six bells

```
CRE> block whittingtons "Call changes to Whittingtons" 6 6
```

When the block is declared, it contains only the initial row — rounds 123456.

To move the 5th to lead, the following changes are called: '5 to 3', '5 to 2', '5 to 1', '5 lead'. The `callchange` command is used

```
CRE> callchange whittingtons 5-3
CRE> callchange whittingtons 5-2
CRE> callchange whittingtons 5-1
CRE> callchange whittingtons 5-
```

If a bell is called without another bell to follow, as in the final command, then it will become the lead bell.

It is possible to call multiple changes with a single command, so the above may also be given as

```
CRE> callchange whittingtons 5-3 5-2 5-1 5-
```

In this example the 5th was called down; however the same may have been called by calling bells up to follow the 5th.

```
CRE> callchange whittingtons 4-5 3-5 2-5 1-5
```

To complete the call to Whittingtons, the third now needs to be moved to follow the 5th:

```
CRE> callchange whittingtons 3-1 3-5
```

Now the rows may be displayed

```
CRE> print whittingtons
```

```
123456
-----
123546
125346
152346
512346
513246
531246
```

To create a musical composition, the `repeat` command may be used which continually makes the same sequence of place swaps until it comes back to rounds. In this example, the following pairs of places are swapped: (4,5), (3,4), (3,2), (2,1), (3,4), (2,3) and this sequence must be repeated an additional four times for it to come round.

```
CRE> repeat whittingtons
24 rows rang
```

Now to ring the call change composition. The rows are repeated four times by setting `repeatrow`, to emulate making the call every fourth stroke.

```
CRE> tower twr "default"
CRE> set repeatrow 4
CRE> ring whittingtons twr
```

8 Exporting and Printing

The Change Ringing Engine does not have a built-in capability for printing methods on a printer; therefore they need to be formatted and saved as a file (e.g. HTML) first and then opened up in an application e.g. a web browser and printed from there.

A method or block may be saved to a file by adding a filename to the `print` command; for example save as an HTML file that may be opened up in a web browser. The number of leads per column is set to 3 so that the entire plain course is formatted in a single column.

```
CRE> set nleads 3
CRE> print gs5 "Grandsire Doubles.html"
```

The file `Grandsire Doubles.html` is saved in the `bellview3` folder by default. It is possible to save to another folder by specifying the full path; e.g.

```
CRE> print gs5 "/home/fred/methods/Grandsire Doubles.html"
```

Other formats are available, by using a different filename extension

ASCII Text (.txt) Plain text that may be opened up in a text editor e.g. Notepad on Windows, TextEdit on Macs or VI/Emacs on Unix.

Comma Separated Value (.csv) CSV files may be opened in spreadsheet applications such as Microsoft Excel. Each place occupies a separate column. Formatting of tracelines are not available in this format.

HTML (.html) This is the recommended format for most users. These files will open up in a web browser and tracelines are included.

Postscript Pages (.ps) Postscript files may be printed on Postscript printers or viewed or printed using Ghostscript. This format outputs an A4 size document which may be more than one page long, depending on how many rows are in the plain course or touch.

Encapsulated Postscript (.eps) All rows are output on a single page which is made as large or small as required. These files are suitable for inclusion in a \LaTeX document.

PDF Pages (.pdf) PDF files may be printed with Adobe Reader. It is necessary to have Ghostscript installed, because Bell View creates the image as Postscript and uses Ghostscript to convert it to PDF.

PNG Image (.png) PNG images are suitable for inclusion on web pages or Microsoft Office documents. It is necessary to have Ghostscript installed, because Bell View creates the image as Postscript and uses Ghostscript to convert it to PNG.

Postscript and PDF formats are multiple A4 page formats, which place as much content on each page as possible; therefore do not require `nleads` to be set.

9 Settings

The Change Ringing Engine has a number of built-in variables whose purpose is to change the way that the Engine operates or how output is displayed. Variables may be changed at either global level or at object (i.e. block or method) level; for example to specify the treble and fifth as trace bells globally

```
set tracebells 15
```

However, to make the setting apply to a method or block, the variable name must be preceded by the object name; for example, to set the trace bells only for block `gs5`:

```
set gs5.tracebells 15
```

Method Formatting

These settings apply to all method formatting whether on the screen or exported in text or graphical format. The trace line for bell has its own colour and weight variables and these may be set regardless of how many bells are being rung or whether or not `tracebells` has been set to show the trace on that bell; for example `colour4` is the colour for the trace on bell 4 and `weightE` is the thickness of the trace line for bell 11.

<code>tracebells</code> <i>bells</i>	Show tracelines for bells listed
<code>colour</code> <i>n</i> <i>colour</i>	Show traceline for bell <i>n</i> in specified colour. Valid colour values are: black, darkred, darkgreen, darkyellow, darkblue, darkmagenta, darkcyan, grey, lightgrey, red, green, yellow, blue, magenta, cyan, white ⁸
<code>weight</code> <i>n</i> <i>value</i>	Sets thickness of traceline for bell <i>n</i> . Valid values are <i>fine</i> , <i>medium</i> or <i>bold</i>
<code>cover</code> <i>off on</i>	If on, add a covering bell (tenor) to the end of each row
<code>skel</code> <i>off on</i>	If on, suppress bell numbers unless under a trace line
<code>showcall</code> <i>off on</i>	If on, show call markers for bobs (–) and singles (S)
<code>showpn</code> <i>off on</i>	If on, show place notation to right of rows
<code>showrule</code> <i>off on</i>	If on, show rules between leads
<code>rulebefore</code> <i>off on</i>	If on, show rules before lead ends rather than after
<code>showcomment</code> <i>off on</i>	If on, show comments to right of rows

Text Formatting

These settings apply to text formatting only. Dimensions are specified as number of characters.

<code>textwidth</code> <i>chars</i>	Width of page
<code>textheight</code> <i>chars</i>	Height of page
<code>textsep</code> <i>chars</i>	Separation between columns
<code>textpages</code> off on	Paginate method if on, otherwise continuous output
<code>traceformat</code> <i>value</i>	Select formatting method for trace: Valid values are: off (no trace), subs (substitute asterisk) or ansi (use ANSI control codes if supported)

Graphical Formatting

These settings apply to the graphical formats: HTML (SVG), Postscript, PDF and PNG. Encapsulated formats, place all the output in a single image with a fixed border determined by `borderwidth` whereas page outputs use `papersize` to specify the output size with the four borders being controlled by parameters such as `leftmargin`.

All lengths are must be given in points rather than inches (72pt) or centimetres (28.35pt)

<code>papersize</code> <i>value</i>	Size of paper. Valid values are: A3 297mm×420mm A4 210mm×297mm (Default) A5 148mm×210mm B5 176mm×250mm letter 8.5in×11in legal 8.5in×14in
<code>landscape</code> off on	Transpose paper dimensions
<code>leftmargin</code> <i>points</i>	Size of left margin (paged output)
<code>rightmargin</code> <i>points</i>	Size of top margin (paged output)
<code>topmargin</code> <i>points</i>	Size of top margin (paged output)
<code>bottommargin</code> <i>points</i>	Size of bottom margin (paged output)
<code>borderwidth</code> <i>points</i>	Width of border for an encapsulated output such as EPS, or HTML
<code>columnsep</code> <i>points</i>	Distance separating columns
<code>fontsize</code> <i>points</i>	Size of text font
<code>nleads</code> <i>number</i>	Number of leads per column (encapsulated output)
<code>imgscale</code> <i>number</i>	Scale factor for PNG image
<code>pagenumbering</code> off on	If on, add page number

Ringling Options

These settings affect audible ringing using bell sample files

<code>cartwheel off on</code>	If on, do not add the customary single place gap at the handstroke lead
<code>repeatrow <i>number</i></code>	Number of times to repeat row being rung; e.g. change to 2 to ring methods whole-pull
<code>pealtime <i>number</i></code>	This sets the speed of ringing as number of minutes that a peal of 5040 changes takes
<code>tempo <i>number</i></code>	Sets the speed for the <code>chime</code> command — number of beats (crochets) per minute
<code>strike off on</code>	To ring silently, change this setting to <code>off</code>

System Options

<code>gspath <i>filepath</i></code>	The full file path of the Ghostscript interpreter which is used to produce PNG or PDF output. On Mac or Unix, it is usually <code>gs</code> . Windows usually requires a full path such as <code>C:\Program Files\gs9.50\bin\gswin64.exe</code> .										
<code>pager <i>filepath</i></code>	The system pager utility (usually <code>more</code> or <code>less</code>)										
<code>pagedoc off on</code>	If on, display help through the pager										
<code>pagerows off on</code>	If on, display methods and blocks through the pager										
<code>shell <i>filepath</i></code>	The system shell that is used when the <code>shell</code> command is invoked. It is usually set from the environment										
<code>sound <i>module</i></code>	<p>This option contains the name of the third party python module that provides sound.</p> <p>This setting can only be changed before the Change Ringing Engine starts and not while it is running. This may be done by placing the command in the initialisation script (<code>crengine.rc</code> in the <code>library</code> subfolder of the CRE working folder).</p> <p>Options are:</p> <table><tr><td><code>none</code></td><td><code>no sound</code></td></tr><tr><td><code>nssound</code></td><td>Cocoa API on Mac OS X</td></tr><tr><td><code>playsound</code></td><td>Cross platform sound generator</td></tr><tr><td><code>pygame</code></td><td>Cross platform sound generator</td></tr><tr><td><code>winsound</code></td><td>Basic sound generator on Windows</td></tr></table> <p>The default is <code>playsound</code> on Windows, <code>nssound</code> on Mac OS X and <code>pygame</code> on Linux</p>	<code>none</code>	<code>no sound</code>	<code>nssound</code>	Cocoa API on Mac OS X	<code>playsound</code>	Cross platform sound generator	<code>pygame</code>	Cross platform sound generator	<code>winsound</code>	Basic sound generator on Windows
<code>none</code>	<code>no sound</code>										
<code>nssound</code>	Cocoa API on Mac OS X										
<code>playsound</code>	Cross platform sound generator										
<code>pygame</code>	Cross platform sound generator										
<code>winsound</code>	Basic sound generator on Windows										
<code>verbose off on</code>	This setting may be turned <code>off</code> to suppress status messages										

10 Scripting commands

The Change Ringing Engine supports the running of commands from a file, known as *scripts*, which saves them having to be typed in each time they are used. There are two commands which do this: `input` and `run`.

To demonstrate this, a script will be created to produce all the rows of an extent of Grandsire Doubles. The paths of the treble, second as a working bell and fifth as the observation bell will be shown.

To do this, create a text file named `grandsire5.txt`⁹ in the `bellview3` folder using a text editor such as Notepad on Windows or Textedit on Macs with the following contents:

```
echo Touch of 120 Grandsire Doubles
method grandsire5 "Grandsire" 5
block extent "Extent of Grandsire Doubles" 5 10
touch extent grandsire5 PSBS
repeat extent
set extent.tracebells 125
set extent.nleads 3
print extent grandsire5.html
```

Now run it, making sure that the working folder is set to default

```
CRE> input grandsire5.txt
Touch of 120 Grandsire Doubles
Method "grandsire5" defined: "Grandsire" "5" "3,&1.5.1.5.1"
    "9" "3.1" "3.123"
Block "extent" defined
40 rows rang
80 rows rang
Block "extent" written to file "grandsire5.html"
```

The output file `grandsire5.html` in the `bellview3` folder may be opened up in a web browser

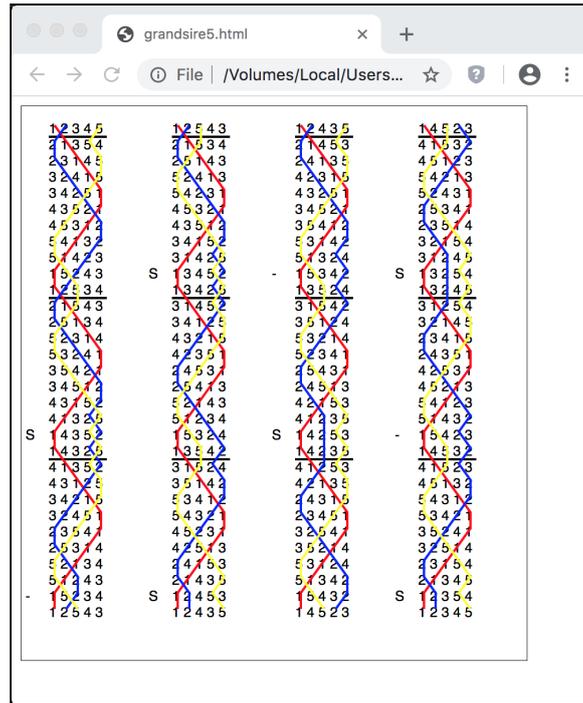


Figure 3: Exported touch of Grandsire Doubles in Chrome

Nesting of files; i.e. using `input` in a script file is possible, but there is a limit to prevent problems occurring with too many levels of nesting.

The `run` command works like `input` except that all methods, blocks and settings are local to the file. Any changes made do not persist in the session on completion and original values are restored instead.

11 File Management

The working folder

The Change Ringing Engine uses a working folder which contains all the resources required to run it; for example tower bell samples and the method library. Output is saved here too by default. This folder is called `CRE` and is located in the Home Directory (Mac OS X and Unix) or user profile (Windows). The `CRE` folder is set up on the first run.

The `pwd` command may be used to show the full path name of the `CRE` working folder; for example

```
CRE> pwd
/Users/fred/CRE
```

To go into a subfolder of `CRE`, say `demo`, use the `cd`¹⁰ command with the folder name. Using `cd` without an argument will return to the `CRE` folder.

```
CRE> cd demo
CRE> pwd
/Users/fred/CRE/demo
CRE> cd
CRE> pwd
/Users/fred/CRE
```

Using operating system commands

The Change Ringing Engine does not have built-in commands for general file management, such as copying, deletion, editing etc. Instead it allows operating system commands to be used by preceding by `shell`. For example on UNIX systems (including Macs), the contents of the current working folder may be viewed by typing

```
CRE> shell ls
```

On Windows, the equivalent command is

```
CRE> shell dir
```

To get an interactive shell session, type `shell` without arguments.

A Bell View and Change Ringing Engine Licence

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Notes

¹In fact, Bell View is a front end to Change Ringing Engine

²The desktop icon may be installed by running the command `python -m crengine -z`

³It is also possible to exit by pressing *Ctrl-D* on Macs or Unix or *Ctrl-Z* on Windows

⁴It is possible to add new sets of bell samples to support ringing on more than 12 bells. The tower configuration is explained in the *Bell View* manual

⁵The bell samples for the back 8 were recorded at St Wilfrid's, Harrogate. The remaining samples were created by 'retuning' using Audacity

⁶Recorded at St Michael's, Beckwithshaw

⁷It is also common to ring four bell methods with a cover

⁸Alternatively, a six digit hexadecimal number such as FFCC99 could be used, but these only work properly in a graphical format

⁹It doesn't matter what the extension is. It has a `.txt` extension as this is the default for Windows Notepad

¹⁰Change directory