Recording an Excel[®] Macro to Specify Date Ranges for Clinical Data

Neil Deochand¹ · Mack S. Costello² · R. Wayne Fuqua¹

Revised: 11 June 2015 / Published online: 12 August 2015
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Abstract The individuals served by behavior analysts are often funded by Medicaid, insurance companies, or private pay. The first two options usually require progress notes detailing graphically and quantitatively the behavioral outcomes. These progress notes usually come in the form of a written account of milestones achieved or barriers faced, graphical displays of behavioral data, and summary tables. The graphical displays are monthly, quarterly, and annual reports for the individuals that they serve. Microsoft Excel[®] is one of the most accessible tools by which to accomplish this task; however, presenting the required date ranges can be a time-consuming task. A task analysis is outlined to automate this process and reduce the time taken to accomplish indirect service hours to the clients served.

Keywords Graphing · Progress notes · Clinical data · Excel[®] · Single-subject design · Macro

Clinical skills deservedly comprise one of the most important repertoires for behavior analysts in practice. Furthermore, tracking client progress utilizing graphs and charts with data across several relevant behavioral dimensions is also vitally important. Task analyses (e.g., Deochand et al. 2015) and videos (e.g., Vanselow and Bourret 2012) on graphing behavioral data are useful tools for practitioners to keep current in their data management and presentation skills. In the case of creating graphical

displays, these enhancements generally take the form of higher quality graphs and time savings in utilizing new methodology. Time-saving strategies are becoming increasingly more important as agencies begin to stipulate the ratio of direct to indirect service hours (e.g., Florida Medicaid allows 4:1; Agency for Health Care Administration—State of Florida 2012).

The use of Microsoft Excel[®] in such task analyses is common because of the wide dissemination of the software. Researchers have attempted to provide access to research-level software and techniques so that applied behavior analysts can employ state-of-the-art techniques in their practice wherever possible (e.g., Dixon et al. 2009; Reed 2009; Reed and Azulay 2011; Reed et al. 2012). Such tutorials have assisted others in what would otherwise be relatively unknown or demanding tasks. One example is generating reinforcement schedules with the use of an Excel[®] tool called a macro (Bancroft and Bourret 2008). A *macro* is a tool that can simplify a complex task by performing multiple operations at once that would otherwise be time consuming. Excel[®] contains a feature called “Record a Macro” that allows the user to record their steps into macro without the need to understand any of the underlying programming.

Practitioners may encounter some repetitive or time-consuming tasks as part of their routine service delivery over extended periods of time for which a macro can be useful. For example, creating a monthly, quarterly, and/or annual progress reports could be streamlined. Additionally, isolation of data sets for particular date ranges for clinical, supervision, or faculty meetings could be quickly accomplished, even with a large data set.

The task analysis below instructs the user to alter the dates of a graph for an entire year of data (or more) from one cell in a spreadsheet without altering embedded (i.e., not drawn in) phase changes that are currently recommended for single-subject graphs in Excel[®] (Deochand et al. 2015; Vanselow

✉ Neil Deochand
neil.deochand@wmich.edu

¹ Department of Psychology, Western Michigan University, 3700 Wood Hall, Kalamazoo, MI 49008, USA

² Department of Psychology, Rider University, New Jersey, USA

and Bourret 2012). Although the initial labor in creating such a template may be time intensive for the reader, the cumulative time saving it could afford throughout a year of practice might serve as an impetus to invest in a relatively small initial response cost.

Recording the Date-Range Macro

Where relevant software differences appear for Mac platforms, an effort has been made to provide additional instructions using the preview version of Office for Mac Excel® 2016. Formulas in the instructions are encapsulated by the symbols [] and will read as [formula]. If the user is reading this from an electronic source, they could copy and paste the formula without the need to transcribe. It is recommended that the reader reference the figures to assist in making the spreadsheets match. While the instructions in the below task analysis are offered as a template, the user can customize with their own data and date-range needs.

To begin, a new Excel® workbook should be opened and a spreadsheet and label the spreadsheet, “Date-Range.” To do this, change the default label “Sheet1” to Date-Range. Although this is an optional step, it helps to compartmentalize the function of each sheet. This is done by going down to the bottom bar right-clicking on Sheet1, selecting RENAME and writing in Date-Range. If you modify this title to something else, be sure to account for this in relevant pieces of the task analysis instructions as well, by replacing Date-Range with your chosen title.

1. Open a new Excel® workbook and go to FILE; then SAVE AS; and after selecting the desired location on your computer, in FILE NAME, label it “Template,” and in SAVE AS TYPE, select “Excel Macro-Enabled Workbook.” Then, click on SAVE.
2. Re-name the Sheet1 spreadsheet to Date-Range.
3. In the spreadsheet named Date-Range, enter the text (see Fig. 1):

“Data” into cell A2

“Start Month” into A3

	A	B	C	D
1				
2	Data		Year Selection	
3	Start Month	August	Start Year	End Year
4	Start Year	2012	2012	2013
5				
6	Month Selection			
7	Start Month	August	8/1/2012	
8	End Month	January	1/31/2013	

Fig. 1 Creating a data range menu in a spreadsheet

“Start Year” into A4

“Month Selection” into A6

Start Month into A7

“End Month” into A8

“Year Selection” into C2

Start Year into C3

“End Year” into D3

We (the authors) like to use the first row to link a common characteristic (e.g., client name or date) to many graphs in multiple tabs from a single cell in Excel®, without the need to repeatedly create text boxes or re-enter the data each time a new client graph is created (see supplementary materials in Deochand et al. 2015).

Enter as text the months “January” to “December” in cells A30 to A41, respectively (this information is placed in the lower cells so that they are less likely to be accidentally altered).

4. While cell B3 is highlighted, go to the DATA tab in the ribbon, click DATA VALIDATION, and select DATA VALIDATION. In the next drop-down submenu, ALLOW, select LIST. In SOURCE, press the spreadsheet button (icon with arrow pointing to top left corner), select by dragging the cursor over cells A30 to A41, and press ENTER and then click the OK button (see Fig. 2). These cells should contain the months of the year previously entered. Copy and paste B3 into cells B7 and B8 or repeat the above steps twice.
5. In B3 and B7, select “August” in the newly created drop-down menu as the start month. In B4, enter “2012” as the start year. In B8, select January in the drop-down menu as the end of the data range. In C4, enter 2012 for the start year of the beginning of the data range, and in D4, enter “2013” for the end of the data range (see Fig. 1). These months and years are just

Fig. 2 Data validation menu used to create a drop-down list

examples; you can use any relevant months/years (as needed) upon completion of the task analysis.

6. Excel® includes a DATE formula that formats information into the sequence of year, month, and day. For example, entering “=DATE(2013, 2, 3)” would output “February 3rd 2013”.
In C7, enter the formula [=DATE(C4,MATCH(\$B7,\$A\$30:\$A\$41,0),1)] and press ENTER. This syntax means that C4 displays the corresponding year. The MATCH function enables a text value to be converted to a numeric value based on its order in the month list (in our example, the list is the months in A30 through A41). MATCH looks up cell B7—in this example, August—and determines it is eighth in the array list, the 0 codes for a one-to-one match. The 1 at the end corresponds to the first of the month.
7. In C8, enter the formula [=DATE(D4,MATCH(\$B8,\$A\$30:\$A\$41,0)+1,0)] and press ENTER. This selects the year in D4, which is 2013. The MATCH function “matches” the text value in B8 to the list range in A30 through A41 (January is the match). Normally, it would output 1 based on the match, but the “+1” makes the month go to “February.” Lastly, in the end day section, the 0 value pushes the date back by 1 day, so that the output is 31 Jan. 2013 instead of 1 Feb. 2013. This formula is used so that the entire month of January is the output rather than just the first of the month.
8. If another spreadsheet is not present, create a separate spreadsheet by left-clicking on the circled plus sign (+) in the bottom left tab.
9. In this separate spreadsheet, which is labeled Sheet2 by default, the hypothetical data will be contained. In cell A1 and B1, enter the text “Date.” In A2, enter the formula [=“>”&’Date-Range’!\$C\$7]. The output should be “>=41122.” This specifies this cell value as equal to/or greater than 1 Aug. 2012, which is the cell from C7 in the Date-Range spreadsheet. This would change depending upon the value in C7 enabling users to make different selections.
10. In B2, enter the formula [=“<”&’Date-Range’!\$C\$8], the output should be “<=41305.” This specifies this cell as equal to or less than 31 Jan. 2013.
11. In cell A4, enter the text Date. In cell A5, enter the formula [=DATE(’Date-Range’!\$B\$4,MATCH(’Date-Range’!\$B\$3,’Date-Range’!\$A\$30:\$A\$41,0),1)]. This will make the Date-Range spreadsheet control the starting date for the data in Sheet2.
12. In cell A6, enter the formula [=DATE(YEAR(A5),MONTH(A5),DAY(A5)+1)]. This will then output the next day sequentially to cell A5. Click on cell A6, place the cursor over the bottom right corner of the cell until a black cross appears. When this happens, click and drag down to the desired number of cells. The number of cells dragged down determines how many units will be filled; for our example, dragging to cell A369 encompasses a year of data.
Note: if the user intends to create weekly axes sequences, then in the DAY section, replace the +1 with “+7” and extend cells to the desired row (adjust instructions where necessary to adjust for any purposeful deviations).
13. In cell B4, enter Data. Actual data could be placed in cells to the right of the date in column A. For our purposes, hypothetical data will be placed in column B by entering “365” into cell B5 and entering “364” into cell B6.
14. While selecting cells B5 and B6, drag the data down to B369. An alternative quicker process is, while the two cells are selected, to double click the black cross cursor in the bottom right corner of cell B6. The end result should be that 1 is the last value in cell B369. Click away from the column to deselect all the data before starting the next step.
15. To create a graph with a line data series, while highlighting cells A4 to B369, go to the INSERT tab and choose SCATTER with straight lines and markers (see full instructions in Deochand et al. 2015 or Vanselow and Bourret 2012). It should contain data showing a linear descending trend from 1 Aug. 2012 to 31 Jul. 2013.
16. In the VIEW tab, in the MACROS drop-down menu, select RECORD MACRO...(in Mac Excel® 2016 in the VIEW tab, select RECORD MACRO option), make a name for the macro, such as “DateFilter,” and click the OK button.
17. In the shortcut key, select a letter like “D” as it can serve to enable the macro without the need for creating a button. We use capital letters so that SHIFT is part of the command, so it does not interfere with other shortcut functions (in Mac Excel® 2016, the equivalent shortcut is OPTION+COMMAND+SHIFT+D). Then, press OK. One may also give an optional description (e.g., we use “selects data ranges from total data in the Date-Range spreadsheet for analysis/ presentation/ progress reports”).
18. In the DATA tab, select ADVANCED in the filter section (see Fig. 3). In the LIST RANGE, select A4 down to B369 for our example. Make sure to include all the columns that are sources for graph data so that the macro affects the relevant data. In the CRITERIA RANGE, select \$A\$1:\$B\$2 which specifies the desired date range that will constrain the data. Press OK.
19. Now, return back to the VIEW tab and select MACROS and STOP RECORDING. Note that the data will end at 31 Jan. 2013 and any graph created from the data would also end at that date. If the user were to change the date

Fig. 3 Advanced filter sub-option menu

range specified in the Date-Range tab and press the shortcut to use the macro, it will adjust accordingly.

20. Save the file by using the shortcut **CONTROL+S**. When you close and re-open the file, you will be prompted with a security warning message, which will appear below the Menu Ribbon. Click the **ENABLE CONTENT** button. The security warning message will close, and the date-range macro will be operational. Note that doing this for a macro you have not recorded or are unsure as to the function of in another Excel® workbook could potentially pose a threat to your computer.

Optional Steps

21. It can be valuable to hide rows that contain important formulas or protect the sheet. While selecting rows 1 to 3 in Sheet2, go to **DATA** and click **GROUP**. A minus sign should appear on the left hand side next to the numbers. Click on this to hide those rows.

To protect the Date-Range worksheet, go to **REVIEW** and select **PROTECT SHEET**. A **PROTECT SHEET** menu will appear prompting the user to enter a password. Enter a memorable password, press **OK**, and another menu will appear to enter that same password again. Mac Excel 2016 users can enter the same password within one dialogue box.

22. The **DEVELOPER** tab is needed to create a button to run the macro. If **DEVELOPER** is not present on the ribbon, then go to **FILE** and **OPTIONS** and select **CUSTOMIZE RIBBON** and choose **DEVELOPER** and **ADD>>** (the check-box in the right column has to be checked). In Mac, use the **EXCEL** menu click **PREFERENCES**; in the **AUTHORING** section, select **VIEW**; and then at the bottom **IN RIBBON**, **SHOW** check the **DEVELOPER TAB**.

23. Click **DEVELOPER** and in the submenu **INSERT**, select **Button** (See Fig. 4). It should be the first icon in the upper left hand corner that reads “Button” when the cursor is hovered over it. In Mac Excel® 2016, there is no **INSERT** section; just select **BUTTON** from the **DEVELOPER** tab.
24. Draw the button in Sheet2 in rows 1 to 3, making note not to place it in the data range where it could be collapsed when the macro is run. The user may change the size and shape of the button after it has been created by using the small white boxes surrounding the button when right-clicked.
25. Upon completion of the button, a submenu called **Assign Macro** appears. In **MACRO NAME**, select the name of the macro that has been created, in this case **DateFilter**. After this is completed, right-click on the button and select **EDIT TEXT** to change the name with a better description of the function, e.g., “Update Graph.”

Altering the specified date ranges in the Date-Range spreadsheet enables the macro to make changes after left-clicking the button or by holding **CONTROL+SHIFT+D** if a shortcut was chosen. Now, the procedure of editing date ranges through a number of repeatable steps has been compressed into a simpler process. By altering the date ranges and then using the shortcut or button, changes are

Fig. 4 Form Control options after Developer has been added to the ribbon

immediately made throughout the graphs and spreadsheet.

Discussion

When graphs are created using data in Sheet2 containing the adjustable date ranges from the Date-Range spreadsheet, all the graphs can be simultaneously altered without having to manage each individually. This process should simplify creating a progress report using Microsoft Excel®. This is just one of the many options where a macro in Excel® can simplify what could otherwise be a repetitive adjustment of multiple graphs.

It is important to note that there are other options to accomplish this task, such as using pivot tables and pivot charts by using the DATE FILTER option; however, there are some notable disadvantages to such a method. The first disadvantage is that the data in the pivot table or pivot chart do not automatically update when the source data is changed, requiring the user to refresh the pivot table to allow for changes in the data source to become apparent. Secondly, using multiple pivot charts for lots of data is memory intensive and can result in the software crashing. Lastly, it does not have a function for creating a customizable date range adjustable from one cell, which is a time-saving component of this task analysis. This process would be accomplished by the user by going through the traditional routine to create a date range for a graph. However, pivot tables can be extremely useful for summing data without the use of formulas and should not be discounted because they can easily group data into weekly or monthly summaries after the source data has been entered.

In conclusion, we recommend behavior analysts familiarize themselves with macros by customizing this template so that it can be successfully used in their respective practices. These can be used for ease of interval reporting for reimbursement and for

reducing indirect hours so that we can provide more direct time to those we serve.

Acknowledgments The authors acknowledge the Behavioral Medicine Laboratory in the Psychology Department at Western Michigan University, 2704 Wood Hall, Kalamazoo, MI 49008.

Compliance with Ethical Standards No sources of funding were utilized to present this information. The authors know of no conflicts of interest that would present any financial or non-financial gain as a result of potentially publication of this manuscript. Human subjects were not utilized in the formation of this task analyses. All materials contained herein are not plagiarized, and this article is not under review elsewhere and will not be submitted to another outlet while under consideration.

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