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# MATLAB

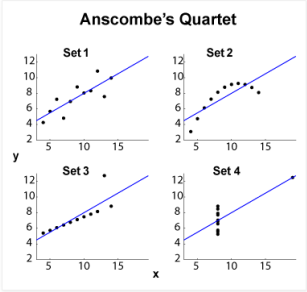
interactive plotting

## Topics

- Create various types of graphs
- Select variables to plot directly from a workspace browser
- Easily create and manipulate subplots in the figure
- Add annotations such as arrows, lines, and text
- Set properties on graphics objects

# Visualize your data?

- Anscombe Quartet
- *File: anscombe_quartet.m*




| I | | II | | III | | IV | |
|---|---|---|---|---|---|---|---|
| x | y | x | y | x | y | x | y |
| 10 | 8.04 | 10 | 9.14 | 10 | 7.46 | 8 | 6.58 |
| 8 | 6.95 | 8 | 8.14 | 8 | 6.77 | 8 | 5.76 |
| 13 | 7.58 | 13 | 8.74 | 13 | 12.74 | 8 | 7.71 |
| 9 | 8.81 | 9 | 8.77 | 9 | 7.11 | 8 | 8.84 |
| 11 | 8.33 | 11 | 9.26 | 11 | 7.81 | 8 | 8.47 |
| 14 | 9.96 | 14 | 8.10 | 14 | 8.84 | 8 | 7.04 |
| 6 | 7.24 | 6 | 6.13 | 6 | 6.08 | 8 | 5.25 |
| 4 | 4.26 | 4 | 3.10 | 4 | 5.39 | 19 | 12.50 |
| 12 | 10.84 | 12 | 9.13 | 12 | 8.15 | 8 | 5.56 |
| 7 | 4.82 | 7 | 7.26 | 7 | 6.42 | 8 | 7.91 |
| 5 | 5.68 | 5 | 4.74 | 5 | 5.73 | 8 | 6.89 |

http://neurochannels.blogspot.be/2008/07/anscombes-quartet.html

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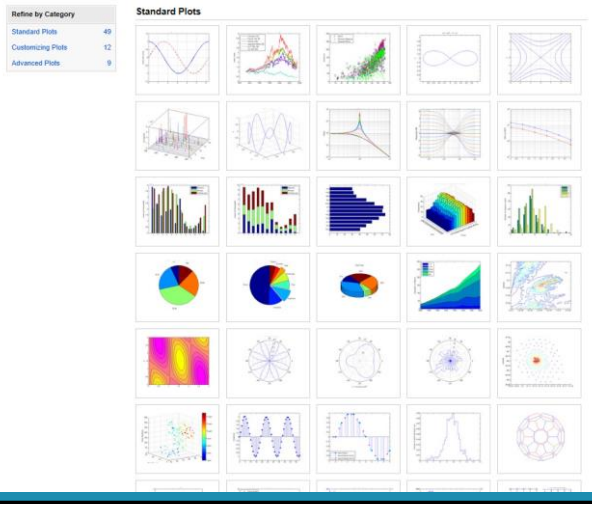
# MATLAB plot gallery

- https://nl.mathworks.com/products/matlab/plot-gallery.html

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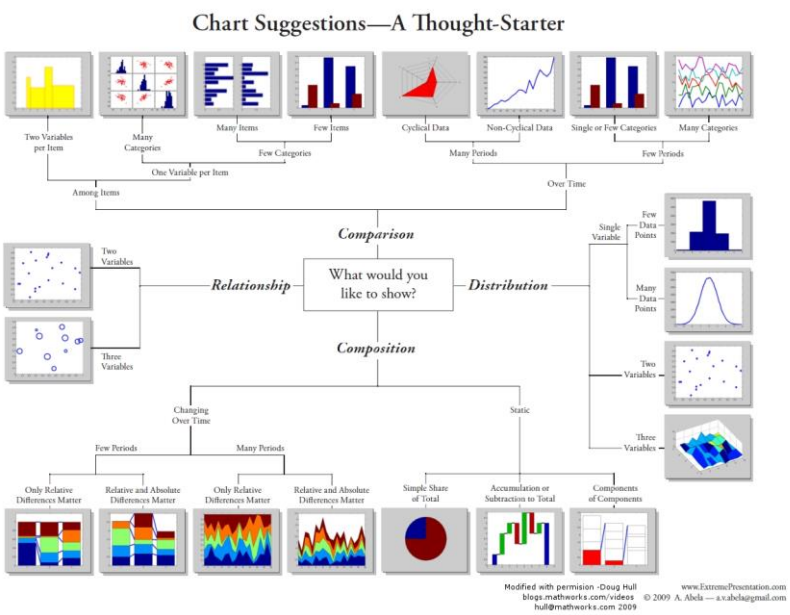
# Choosing a good chart

- Before creating a chart, ask yourself: what story do I need to tell?
- Graph works best when the message is contained in the shape of the data (patterns, trends, exceptions, ...) (Stephen Few)
- Chart-Thought-Starter (Andrew Abela- extremepresentation.typepad.com)
- Check MATLAB Blog (http://blogs.mathworks.com/videos/2009/01/16/flow-chart-shows-which-visualization-to-use/)
- Check also MATLABcentral





# Plotting your data

| |
|---|
| Prepare your data |
| Call elementary plotting function |
| Select line and marker characteristics |
| Set axis limits, tick marks, and grid lines marks, and grid lines |
| Annotate the graph with axis labels, legend and text |

- Steps in plotting your data
- If only previewing or exploring data, steps 1 and 2 may be all you need.
- If creating presentation graphics, you may want to finetune your graph by positioning it on the page, setting line styles and colors, adding annotations, etc.



# interactive plot editing

- MATLAB supports two ways to edit the plots you create:
  - Interactively: use the mouse to select and edit objects
  - Programmatically: using MATLAB functions at the command line or in an M-file
- Interactive mode:
  - perform point-and-click editing of graphs
  - modify the appearance of a graphics object by double-clicking on the object and changing the values of its properties
  - access the properties through a gui

# Plotting your data

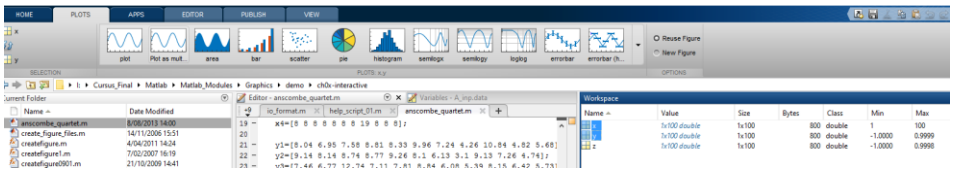
- Have your data prepared in the workspace
- 2 ways to work interactively:

1. Start from variables
   1. Select variables in workspace
   2. Select plot from menu
2. Start graphic figure window
   1. `plottools`

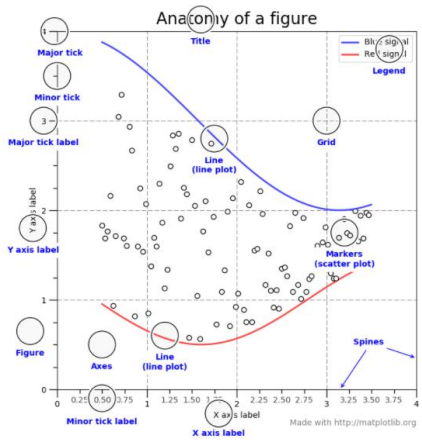


# Plotting your data

- Prepare your data
  - `X = [1:50];`
  - `Y = sin(x);`
- Use Toolstrip > Plot
  - Select variables from workspace (ctrl + mouse click)
  - Select plot type



# Anatomy of a figure

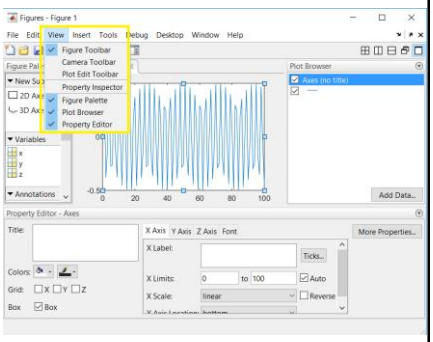


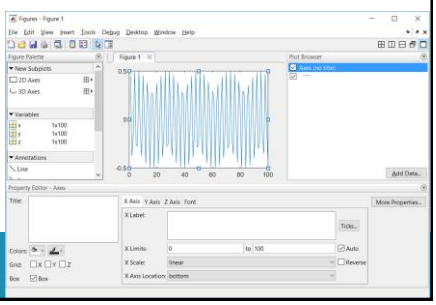

- Axis
- Label
- Legend
- Title
- Ticklabels
- Boundaries of the figure(top, bottom, left, and right).
- Grid
- Source: Matplotlib 3.0 Cookbook (S.R. Poladi – Packt Publishing)



# Plotting Tools

- Start:
  - use the `plottools` command.
  - from the figure toolbar – View menu
- 3 basic plotting tools
  - Figure Palette,
  - Plot Browser,
  - Property Editor.



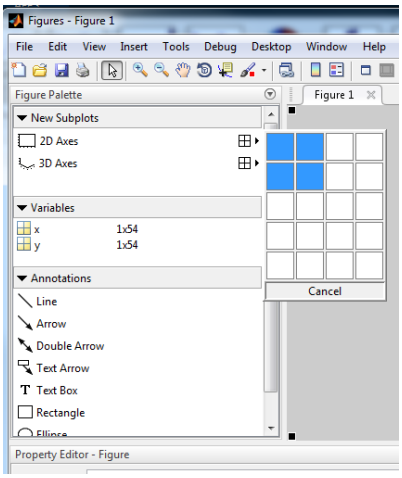



# Basic plotting tools

- Figure Palette: create and arrange subplot axes, view and plot workspace variables, and add annotations.
- Plot Browser:
  - select and control the visibility of the axes or graphic objects plotted in the figure.
  - add data to any selected axes by clicking the Add Data button.
- Property Editor: set common properties of the selected object.



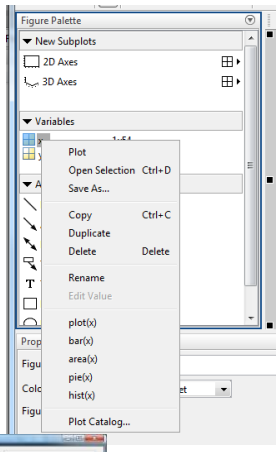
# Figure Palette / subplots

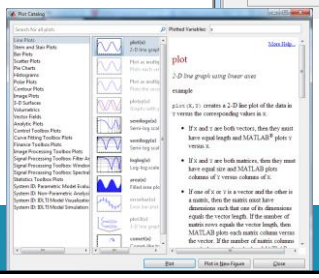



- **New Subplots** — Add 2-D or 3-D axes to the figure.
  - create a grid of either 2-D or 3-D axes.
  - click the grid icon next to the axes type.
  - move the cursor, squares darken to indicate the layout of axes

# Figure Palette / variables

- displays current workspace variables.
- double-clicking a variable opens that variable
- select a variable and right-click to display the context menu, select a graphics function to plot the variable.
- If the desired plotting function is not available from the context menu, you can select More Plots to display the Plot Catalog tool.



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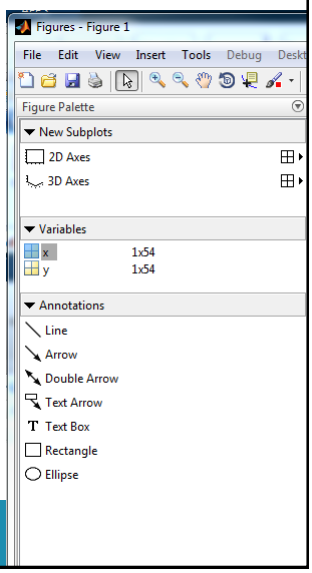
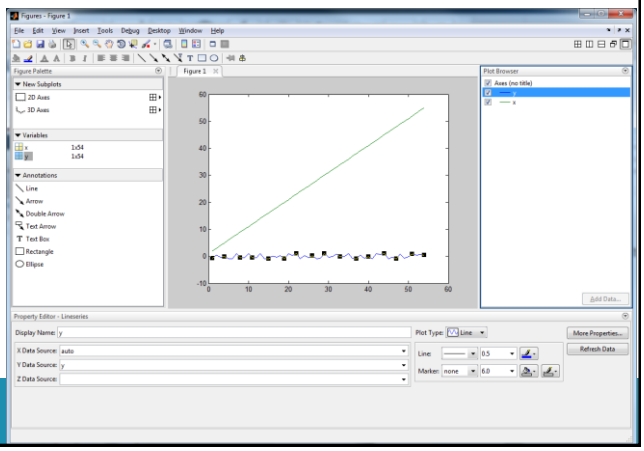
# Figure Palette / annotations

- Add text, lines and arrows, rectangles, ellipses, and other annotation objects anywhere on the figure
- Anchor annotations to locations in data space
- Add a legend and colorbar
- Add axis labels and titles
- Edit the properties of graphics objects



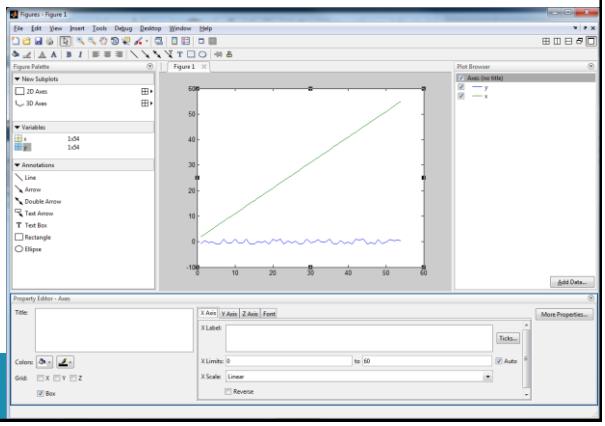
# Plot Browser

- provides a legend of all the graphs in the figure. It lists each axes and the objects (lines, surfaces, etc.) used to create the graph.



# Property Editor

- Property Editor enables you to change the most commonly used object
- select an object, the property editor changes accordingly
- to access all object properties, use the Property Inspector.



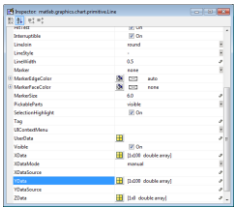
# Saving Your Work (*.fig)

- in a format that can be opened during another MATLAB session
  - Select **Save** from the figure window **File** menu or click the **Save** button on the toolbar. If this is the first time you are saving the file, the **Save As** dialog box appears.
  - Make sure that the **Save as type** is **Fig-File**.
  - Specify the name you want assigned to the figure file.
  - Click **OK**.



# Saving Your Work (*.fig)

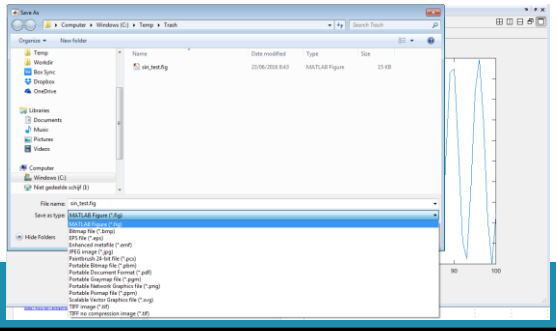
- Information is kept in fig file
  - Cannot be used in MS Office
- Test:
  - Create a plot
  - Save it as fig
  - Clear all data
  - Open fig file
  - Use Property Inspector



- https://nl.mathworks.com/matlabcentral/answers/100687-how-do-i-extract-data-from-matlab-figures

# Saving Your Work (image file format)

- in a format that can be used by other applications
  - Select the format from the list of formats in the **Save as type** drop-down menu.
  - Enter the name you want to give the file.
  - Click **Save**.



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# Saving Your Work (image file format)

| Raster Format | Characteristics |
|---|---|
| tif | Lossless: Document scanning and imaging format. |
| jpg | Lossy: big compression ratio, good for photographic images |
| bmp | Uncompressed format (windows os). |
| png | Lossless: improve and replace GIF. |
| bmp | Uncompressed format (windows os). |

| Vector / Compound Format | Characteristics |
|---|---|
| svg | Created to provide a vector format for the web. It can be created in Illustrator and a few online image editing programs. |
| pdf | The PDF has to be saved from a vector program to be a true vector PDF. If you save a PDF from Photoshop, it will still get pixelated |
| eps | The EPS was the PDFs predecessor. Nowadays, this format is dying off |

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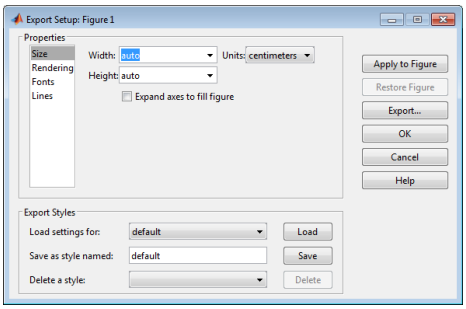
# Export setup

- https://www.mathworks.com/help/matlab/creating_plots/customize-figure-before-saving.html
- Clicking **File** > **Export Setup**
- Changes are applied to the figure






# Generate code

- generate code to reproduce this graph by selecting **Generate M-File** from the **Figure** menu.
  MATLAB creates a function that recreates the graph and opens the generated M-File in the editor.
- This feature is particularly useful for capturing property settings and other modifications made using the plot tools GUI.
- **Data Arguments**
  Generated functions do not store the data necessary to recreate the graph.
  You must supply the data arguments
- **Limitations**
  Attempting to generate code for graphs containing a large number of graphics objects (e.g., greater than 20 plotted lines) might be impractical.