I HEAR I FORGET
I SEE I REMEMBER
I DRAW I UNDERSTAND

DEVELOPMENT OF EASILY CUSTOMIZABLE TEMPLATES FOR VISUAL ORGANIZERS AND GRAPHICAL ILLUSTRATIONS

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Theater @ School v.s. Cinema

School	Cinema
	

Why?

A Typical Lecture

The Lecturer

- Standing and talking
- Watching slides
- Drawing on board
- Check clock on the wall

Students

- Sit back and relax
- Listen to the lecture
- Watching slides
- Resist temptation to
  - Sleeping
  - Daydreaming
  - playing with phone
- Check clock on the wall

Leftover in Student's mind:

- Some graphics/pictures/equations (if we are lucky!)
- Compare this to watching a movie: they have perfect recall!
  - They are engaged into the film!

Basic Modes of Learning

- VAK model (Barbe et. al. 1979):
  - Visual: I see (I remember)
  - Auditory: I hear (I forget)
  - Kinesthetic: I draw (I understand)
- Need tools to help
  - visual + kinesthetic learning

Visual- Kinesthetic Learning

- Basic learning techniques
  - From infants to adults
- Easier to understand with graphics
  - "A picture worth thousands words"
  - Graphical analysis > Verbal/Mathematical
- Learning through drawing
  - Mindmap; Flow Chart Diagram
- Economics
  - Graphical analysis is very important for introductory classes (e.g. Demand and Supply)
  - Even true for graduate level

Computer Graphics

- Computer and Internet
  - Easy to copy and find graphics in the internet
  - Easy to generate tables/statistical/mathematical graphics
- NOT easy to generate diagram or semi-accurate diagram
  - Office: only good for very simple graph
  - Professional software: overkill and expensive

Two Goals

- Templates for graphics/diagrams
- **Easy-to-use** tools to generate diagrams
- Useful for students
  - Facilitate learning by drawing
  - Prepare their own notes (instead of drawing by hand and take pictures)
  - Learn some basic programming (big problem for students: employers complains too)
- Useful for teachers

Graphical language : Tikz

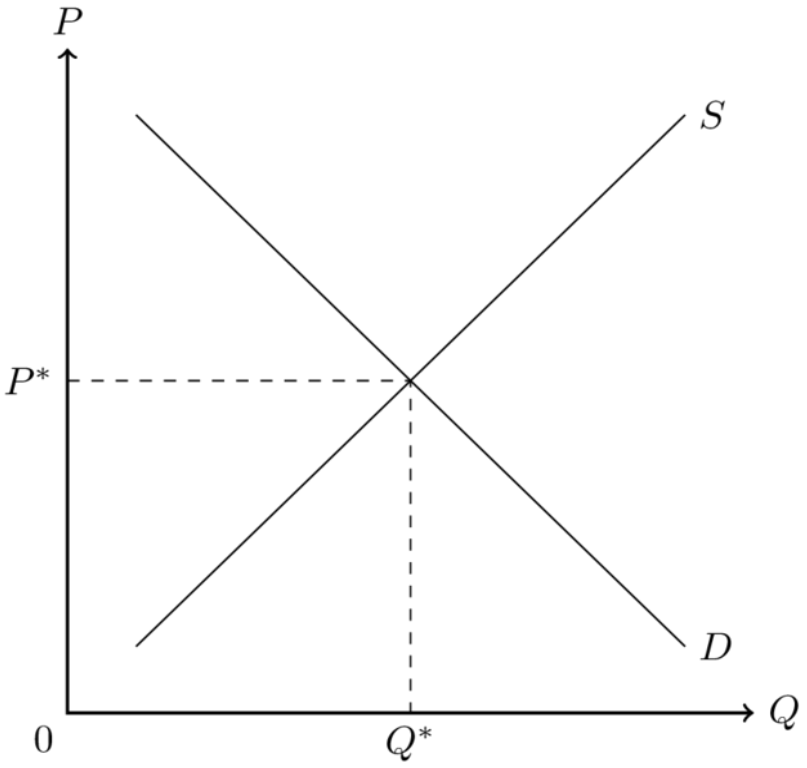
- Drawing language in Latex
  - Latex: typesetting system (very useful to mathematical articles
- Tikz
  - A command-based drawing by coordinates
- Example of Tikz:
  - Draw a line from (0,0) to (1,1)
  - \draw (0,0) – (1,1)

Goal One

Customizable Templates

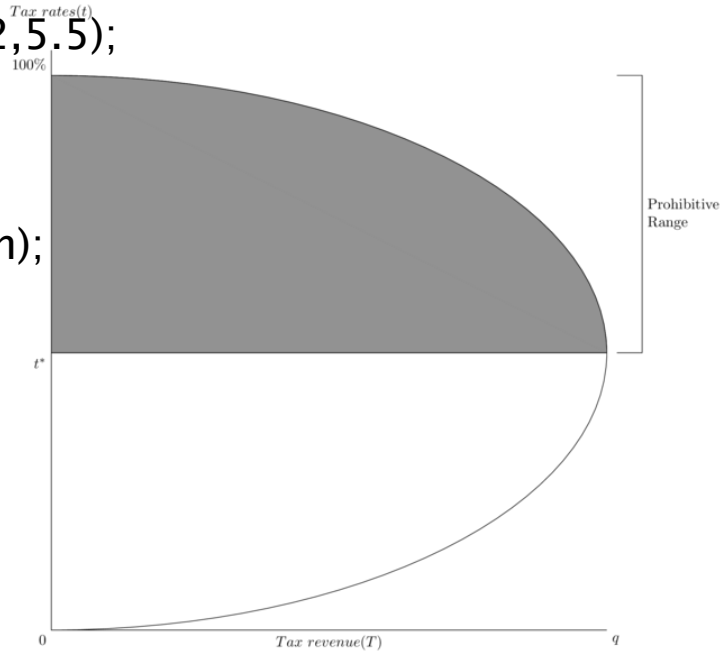
Example: D and S

```
\begin{tikzpicture}
    \draw [thick,<->] (0,10) node[above]{$P$}--(0,0)--(10,0)
    node[right]{$Q$};
    \node [below left] at (0,0) {$0$};
    \node [below] at (5,0) {$Q^*$};
    \node [left] at (0,5) {$P^*$};
    \draw (1,1)--(9,9) node[right]{$S$};
    \draw (1,9)--(9,1) node[right]{$D$};
    \draw [dashed] (0,5)--(5,5)--(5,0);
\end{tikzpicture}
```



Example: Laffer Curve

```
\begin{tikzpicture}
\node[align=left, right] at (11.7,8.25) {Prohibitive\\Range};
\node [above left] at (0,11){$100\%$};
\node [above] at (0,12){$Tax\ rates(t)$};
\node [below] at (5.5,0){$Tax\ revenue(T)$};
\draw (0,11.5) -- (0,0) node[below left]{$0$} -- (11,0) node[below right]{$q$};
\draw (11.2,11) -- (11.7,11) -- (11.7,5.5) -- (11.2,5.5);
\draw (0,0) arc(-90:90:11cm and 5.5cm);
\draw (0,5.5) node[below left]{$t^*$} -- (11,5.5);
\draw[fill=gray] (11,5.5) arc (0:90:11cm and 5.5cm);
\draw[fill=gray] (11,5.5) -- (0,5.5) -- (0,11);
\end{tikzpicture}
```



Goal One: Template

- More than 100 commonly used graphics in economics are created
- Available online at

  http://sites.google.com/site/kochiuyu/Tikz

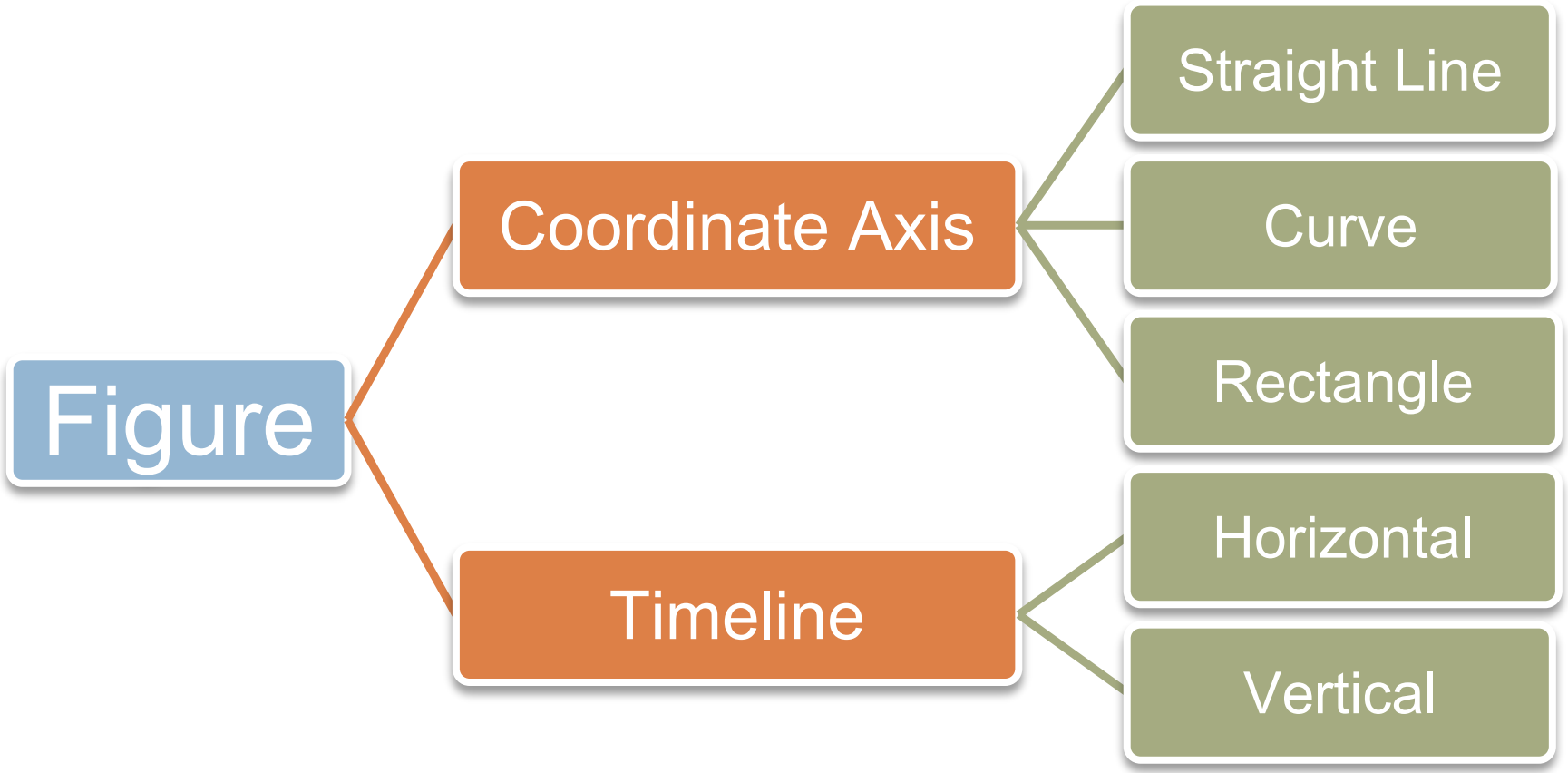
Goal Two

Tools to Generate Diagram

Graphic Generator

- HTML and JavaScript
- Cross-platform: run on smartphones
- Focus on two types of graphs
  - Simple diagrams: lines and curves
  - Timeline: vertical/horizontal

Tools Developed



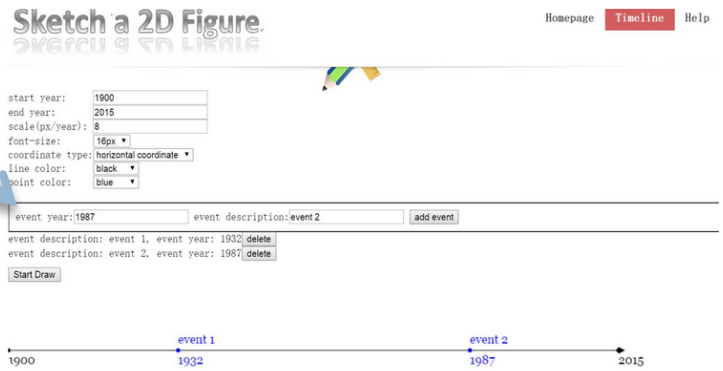
HomePage

Navigation Bar:
click to enter different drawing interface
or
click the pictures for different type of figures

Introduction for this Website Application:
can be used to draw two types of graphs

Simple Graph Generator:

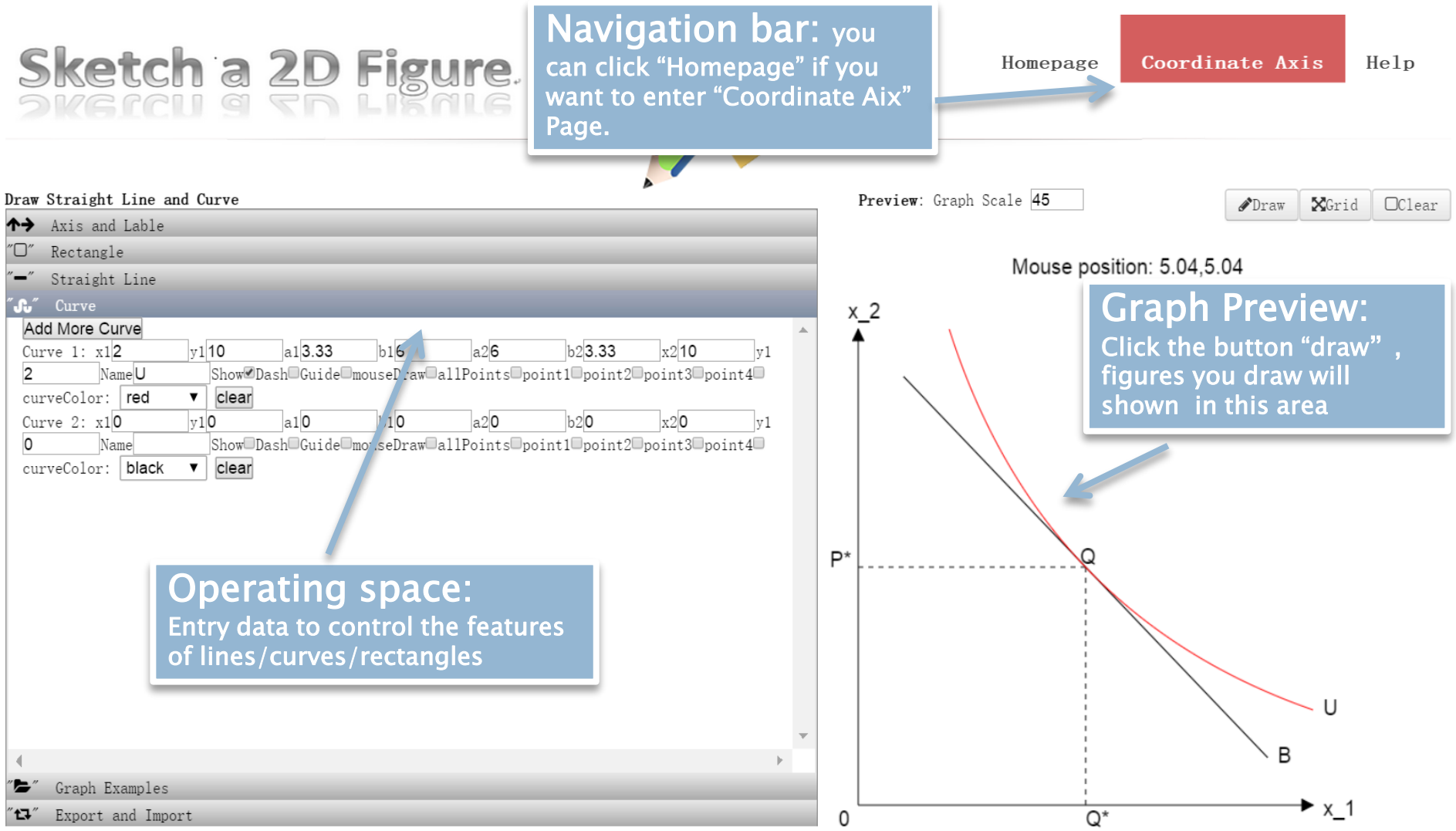
You can enter this interface to draw lines, curves and rectangles. There are two methods to draw these graphs. One is directly to enter the coordinate value and another is to use mouse to click the interface to draw figures. The generator also generates graphics that can be saved as jpg or important to tikz. In addition, to further facilitate construction of complicated graph, you can import an export the graphics created in text file format. Finally, there are some existing examples figures for your convenience.



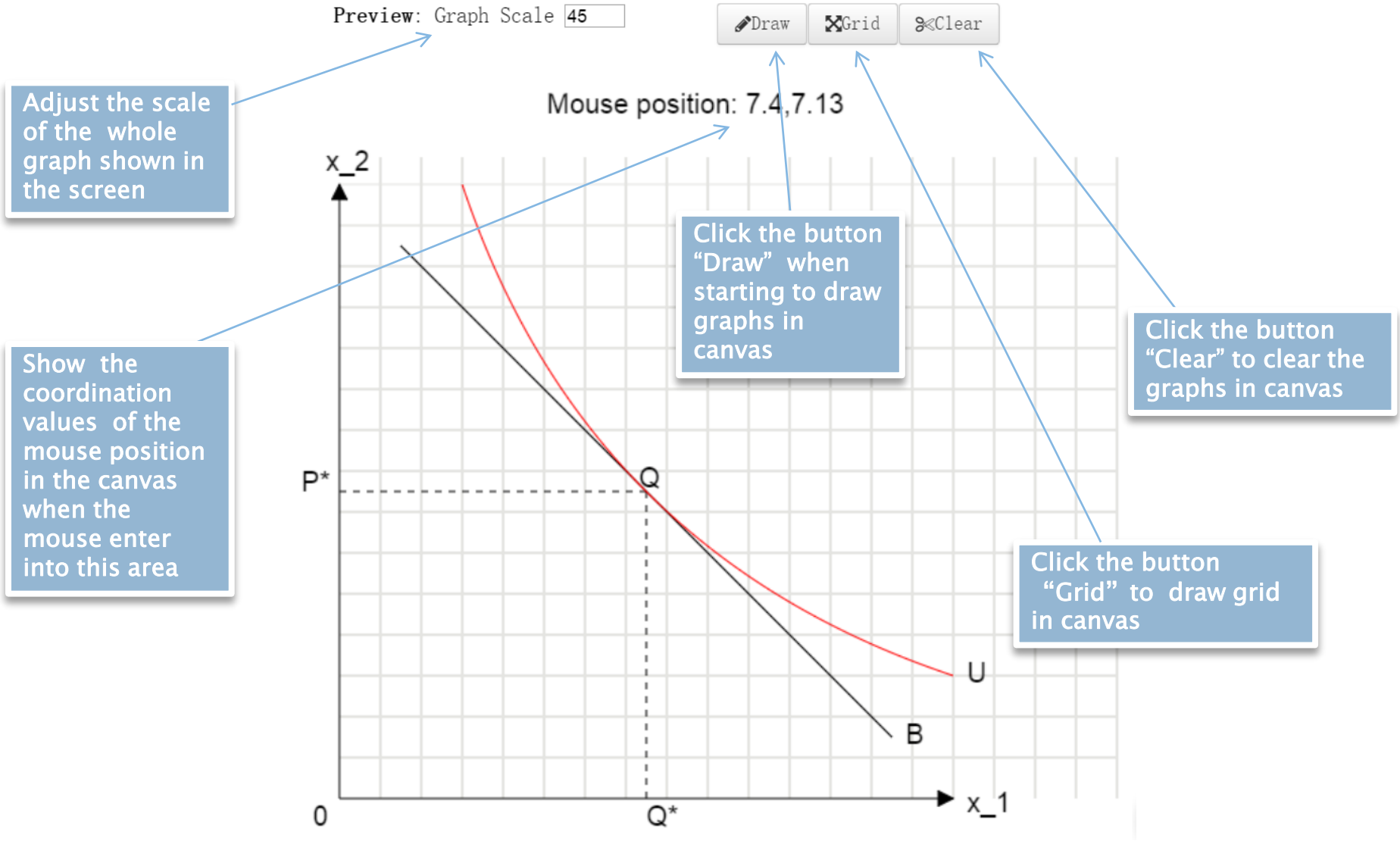
Timeline generator:

You can use this simple timeline generator in HTML to produce both landscape or portrait version of timelines. You only need to type in the starting time, ending time, time of event and event description. A timeline can be automatically generated. The color of the timeline, font size, scale of the line can be easily customized. The generator generates graphics that can be saved as jpg or important to tikz. The following is preliminary version of the software.

Simple Diagram



Drawing Canvas



Tikz Code

Latex code:
the latex code of the figures drawn in the canvas area will accordingly shown in this area.

Latex Code

Double click to select all

```
\documentclass{minimal}
\usepackage{tikz}
\begin{document}
\begin{tizkzpicture}

\draw[thick,<->] (0,10) node[above]{$x_2$}--(0,0)--(10,0) node[right]{$x_1$}; % Axis and Lable
\node [below left] at (0,0) {$0$};%Origin
\node [below] at (5,0) {$Q*$}; % X-Lable 1
\node [left] at (0,5) {$P*$}; %Y-Lable 1
\draw(1,9)--(9,1) node[right]{$B$};
\draw(0,5)--(5,5) node[right]{$$};
\draw(5,0)--(5,5) node[right]{$$};
\draw(2,10) ..controls (3.33,6) and (6,3.33) .. (10,2) node[right]{$U$};
```

Adding Label and Axis

Axis and Labels:

Draw coordinate axis including the name and location of the axis as well as the origin in this area.

Draw points at x & y axis.

Draw Straight Line and Curve

Axis and Lable

Axis:

x: 10 Name Q y: 10 Name P

origin: Name 0

x-axis: Name Q* located at 5 Name located at 0

y-axis: Name P* located at 5 Name located at 0

Points:

Name M located at (4 , 2)

Name N located at (7 , 6)

Name located at (0 , 0)

Add Point

Points:

Draw points at any location in canvas area and add points if required.

Rectangle

Straight Line

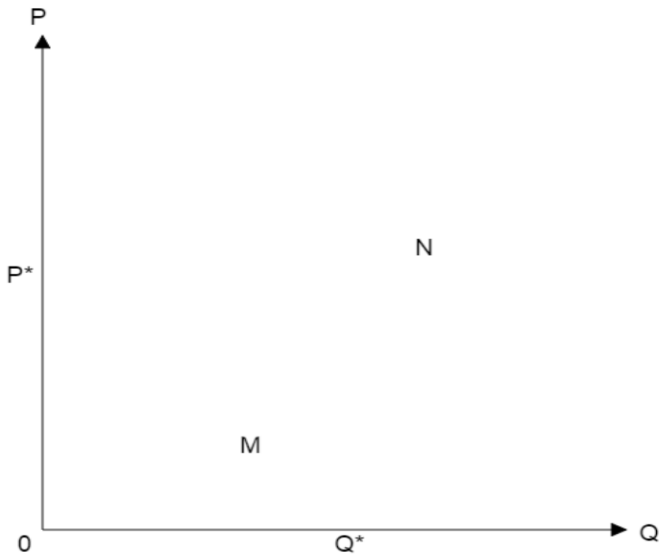
Curve

Graph Examples

Export and Import

Preview: Graph Scale 45 Draw Grid Clear

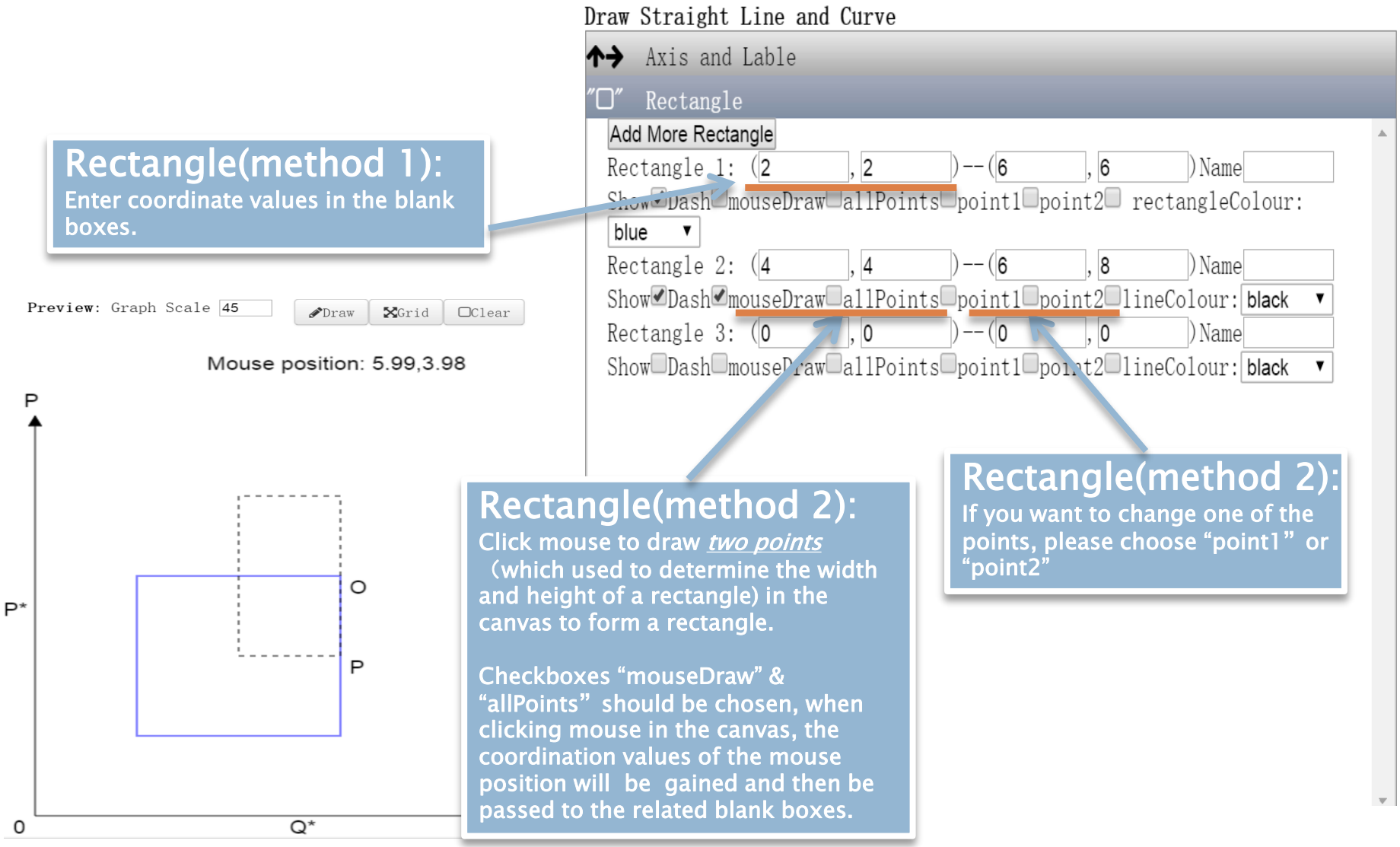
Mouse position: 6.46,5.35



Graph Preview

Adding Rectangle

Rectangle(method 1):
Enter coordinate values in the blank boxes.



Rectangle(method 2):
Click mouse to draw *two points* (which used to determine the width and height of a rectangle) in the canvas to form a rectangle.

Checkboxes "mouseDraw" & "allPoints" should be chosen, when clicking mouse in the canvas, the coordination values of the mouse position will be gained and then be passed to the related blank boxes.

Rectangle(method 2):
If you want to change one of the points, please choose "point1" or "point2"

Adding Line

Straight Line (method1):
Enter coordinate values in the blank boxes.

Draw Straight Line and Curve

Axis and Lable

Rectangle

Straight Line

Add More Line

Straight Line 1: (1, 1)--(9, 9) Name S Show ☑
Dash ☐ mouseDraw ☐ allPoints ☐ point1 ☐ point2 ☐ lineColour: red clear

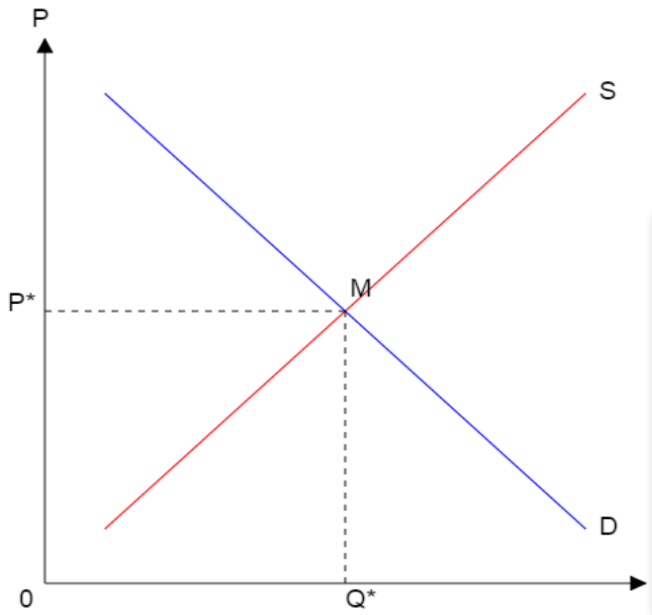
Straight Line 2: (1, 9)--(9, 1) Name D Show ☑
Dash ☐ mouseDraw ☐ allPoints ☐ point1 ☐ point2 ☐ lineColour: blue clear

Straight Line 3: (0, 5)--(5, 5) Name Show ☑
Dash ☑ mouseDraw ☐ allPoints ☐ point1 ☐ point2 ☐ lineColour: black clear

Straight Line 4: (5, 0)--(5, 5) Name Show ☑
Dash ☑ mouseDraw ☑ allPoints ☑ point1 ☐ point2 ☐ lineColour: black clear

Preview: Graph Scale 45 Draw Grid Clear

Mouse position: 5.33,7.82



Straight Line(method 2):
Click mouse to draw *two points* to determine a line in canvas area.

Checkboxes "mouseDraw" & "allPoints" should be chosen, when clicking mouse in the canvas, the coordination values of the mouse position will be gained and then be passed to the related blank boxes.

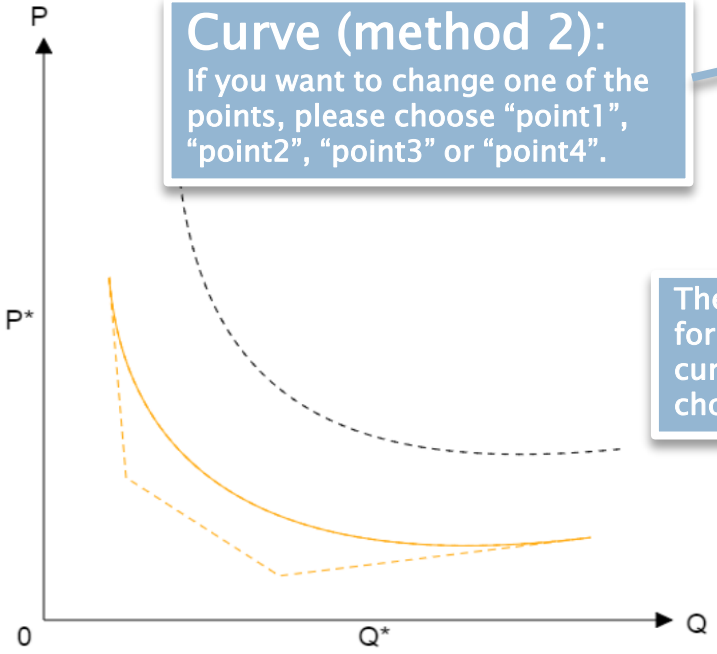
Straight Line(method 2):
If you want to change one of the points, please choose "point1" or "point2".

Adding Curve

Curve (method 1):
Enter coordinate values in the blank boxes.

Preview: Graph Scale 45 Draw Grid Clear

Mouse position: 5.22,4.16



Curve (method 2):
If you want to change one of the points, please choose “point1”, “point2”, “point3” or “point4”.

Draw Straight Line and Curve

Axis and Lable
Rectangle
Straight Line
Curve

Add More Curve

Curve 1: x1 1.04 y1 5.89 a1 1.31 b1 2.45 a2 3.75 b2 0.76 x2 8.71 y1 1.42 Name Show Dash Guide mouseDraw allPoints point1 point2 point3 point4 curveColor: orange clear

Curve 2: x1 2.17 y1 7.54 a1 2.62 b1 3.71 a2 4.84 b2 2.49 x2 9.17 y1 2.94 Name Show Dash Guide mouseDraw allPoints point1 point2 point3 point4 curveColor: black clear

Curve 3: x1 y1 a1 b1 a2 b2 x2 y2 Name Show Dash Guide mouseDraw allPoints Point1 Point2 Point3 Point4 curveColor: black

The line track of the four points for the reference of drawing curves will be drawn when choosing “Guide”

Curve (method 2):
Click mouse to draw *four points* to determine a line in canvas area.

Checkboxes “mouseDraw” & “allPoints” should be chosen, when clicking mouse in the canvas, the coordination values of the mouse position will be gained and then be passed to the related blank boxes.

Examples

Draw Straight Line and Curve

- Axis and Lable
- Rectangle
- Straight Line
- Curve
- Graph Examples

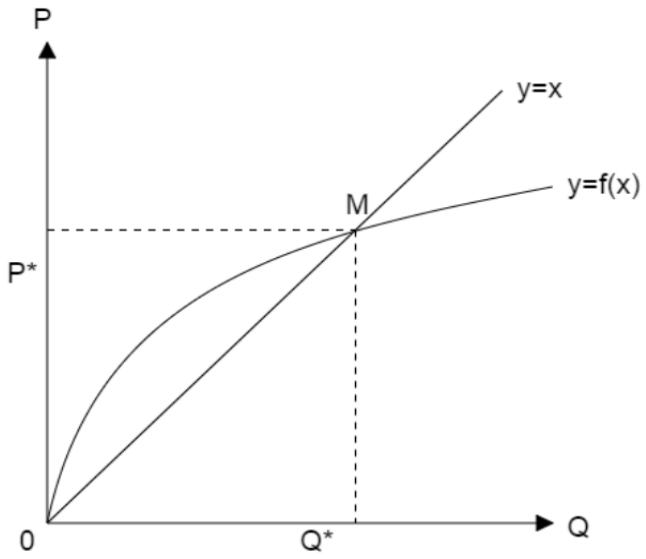
Examples: Demand and Supply | Growth | Cost Curve | Utility Max

- Export and Import

Some economic graph examples : click one of the button to draw corresponding economic figure.

Preview: Graph Scale 35 | Draw | Grid | Clear

Mouse position: -0.46,7.47

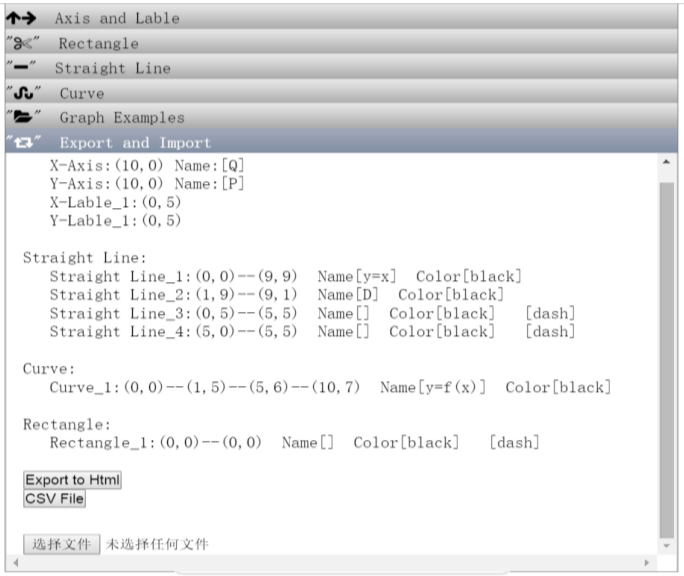


Graph Preview

Import and Export

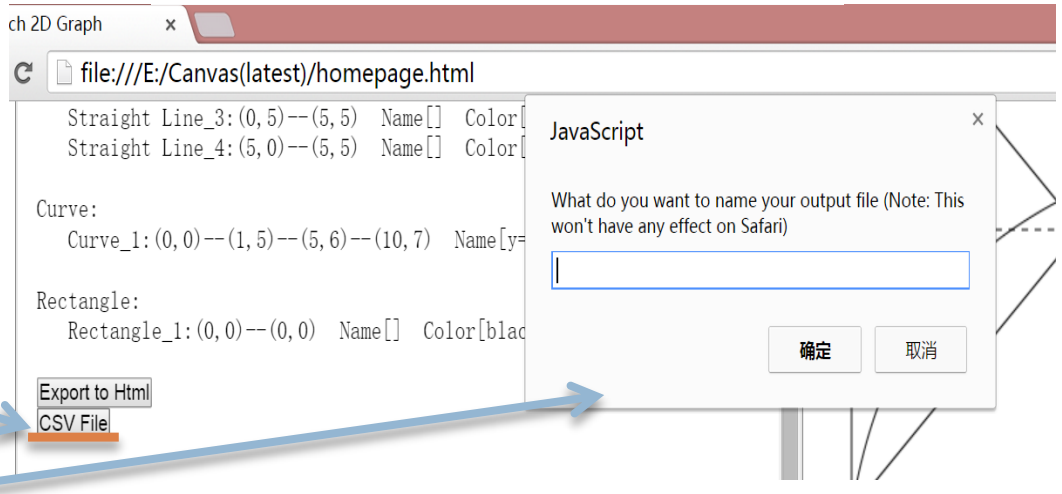
Export:

Step 1: Click the button “export to Html” to export the current figures data in this area.



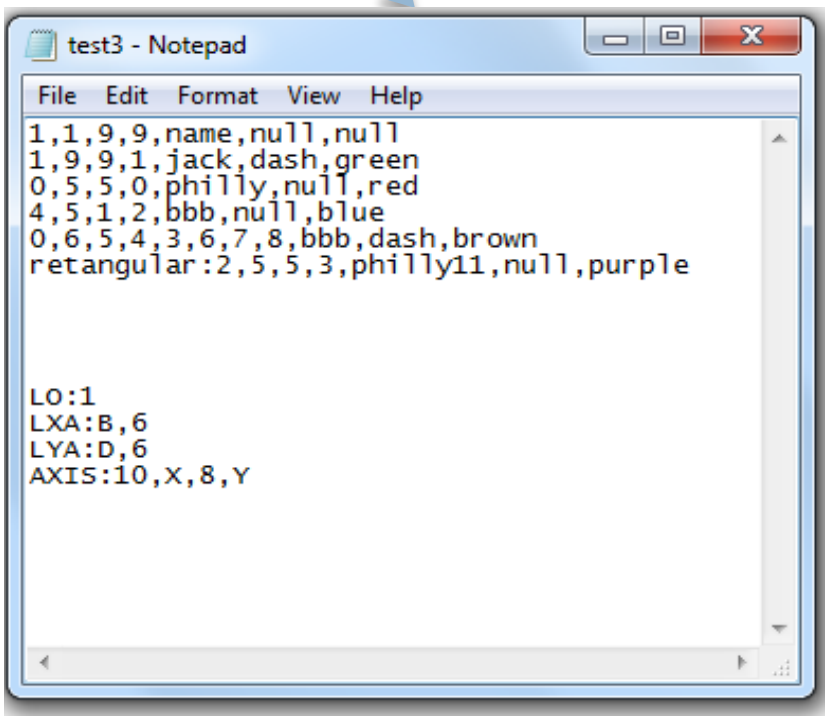
Export:

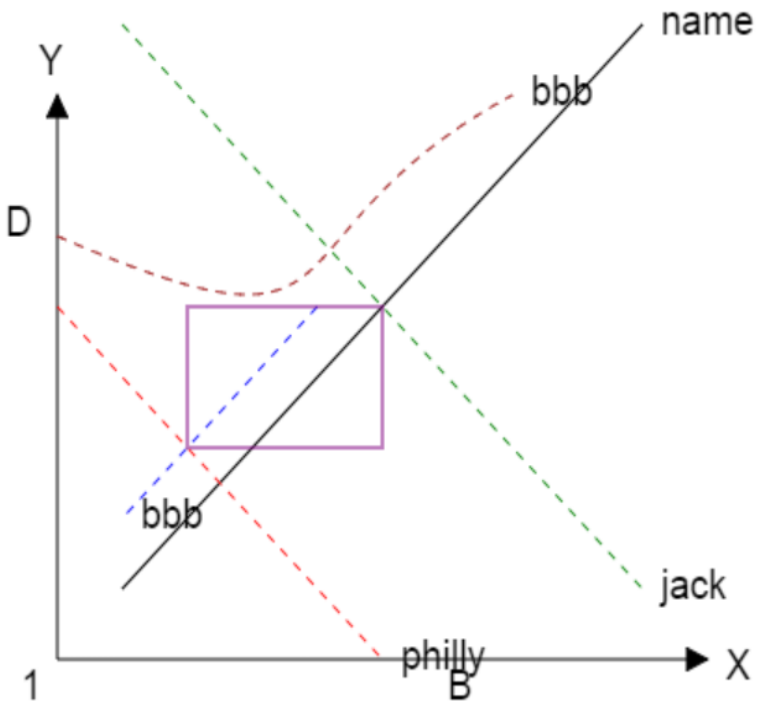
Step 2: When finishing the first step, click the button ‘csv File” to export the figures data in to csv files. You can enter the name for the file.



Export Format

Import : import local files based on certain format.





Graph Preview

Export Format Explain

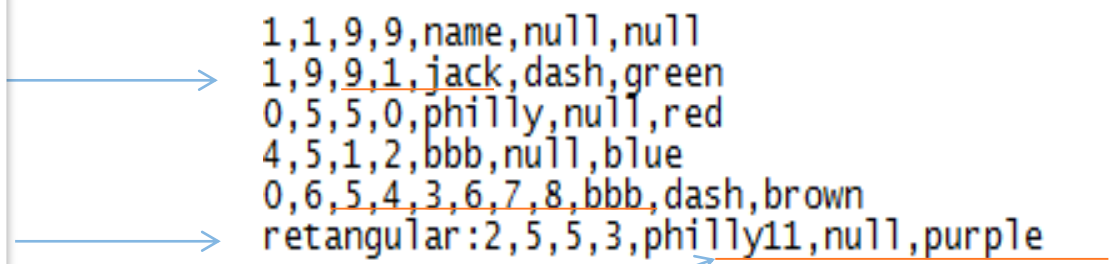
1.Number

Four numbers mean straight lines or rectangles. To differentiate them, write the label "rectangle" before the corresponding number .

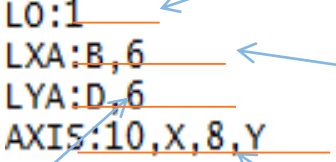
Eight numbers mean curves.

2.Parameters after number

The three parameter after numbers stands for Name, dash and color separately. If there is no related data, "null" will be shown in corresponding position.



LO: Name for origin

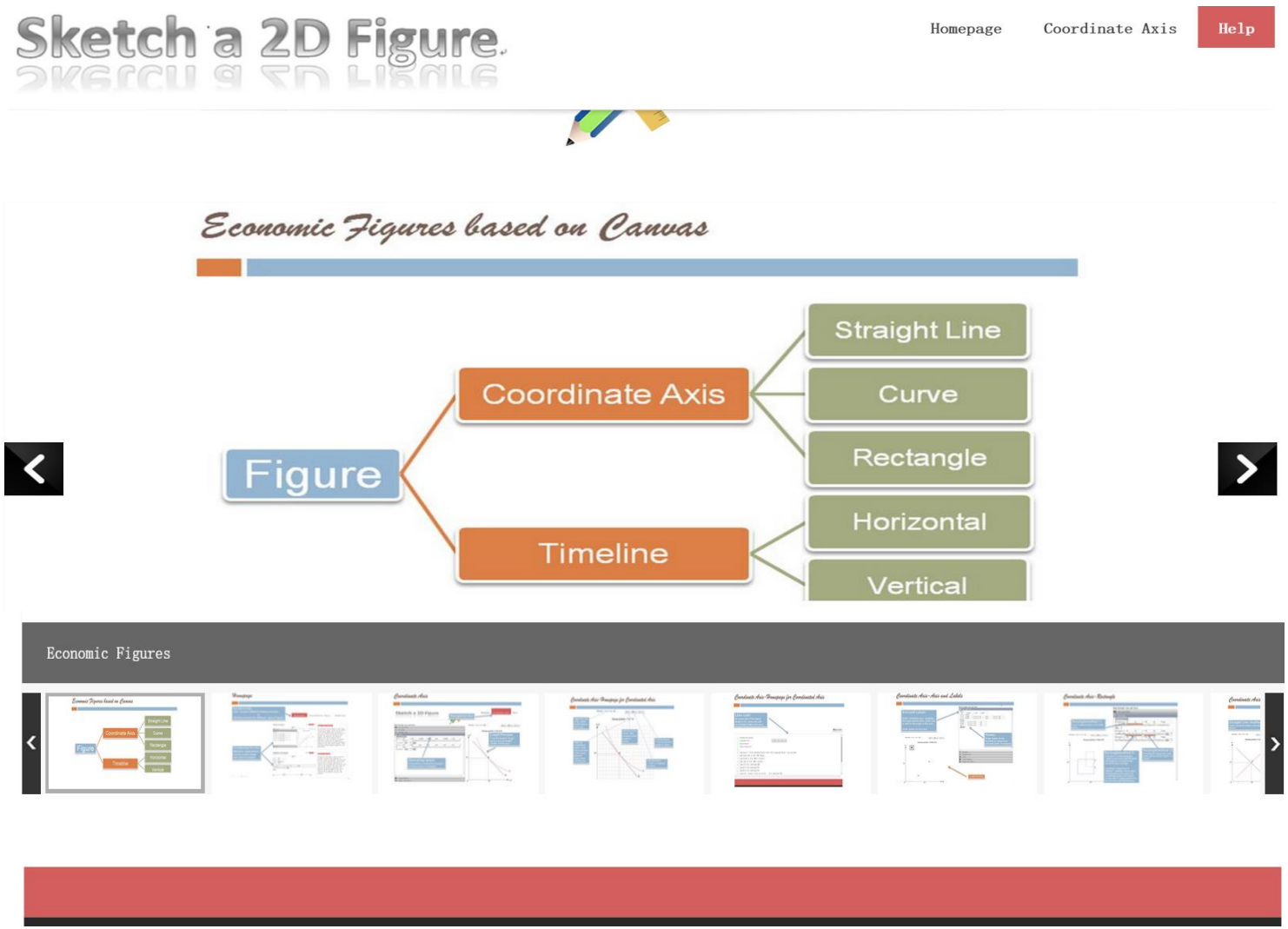


LXA: Name and location for points at x-axis.

LYA: Name and location for points at y-axis.

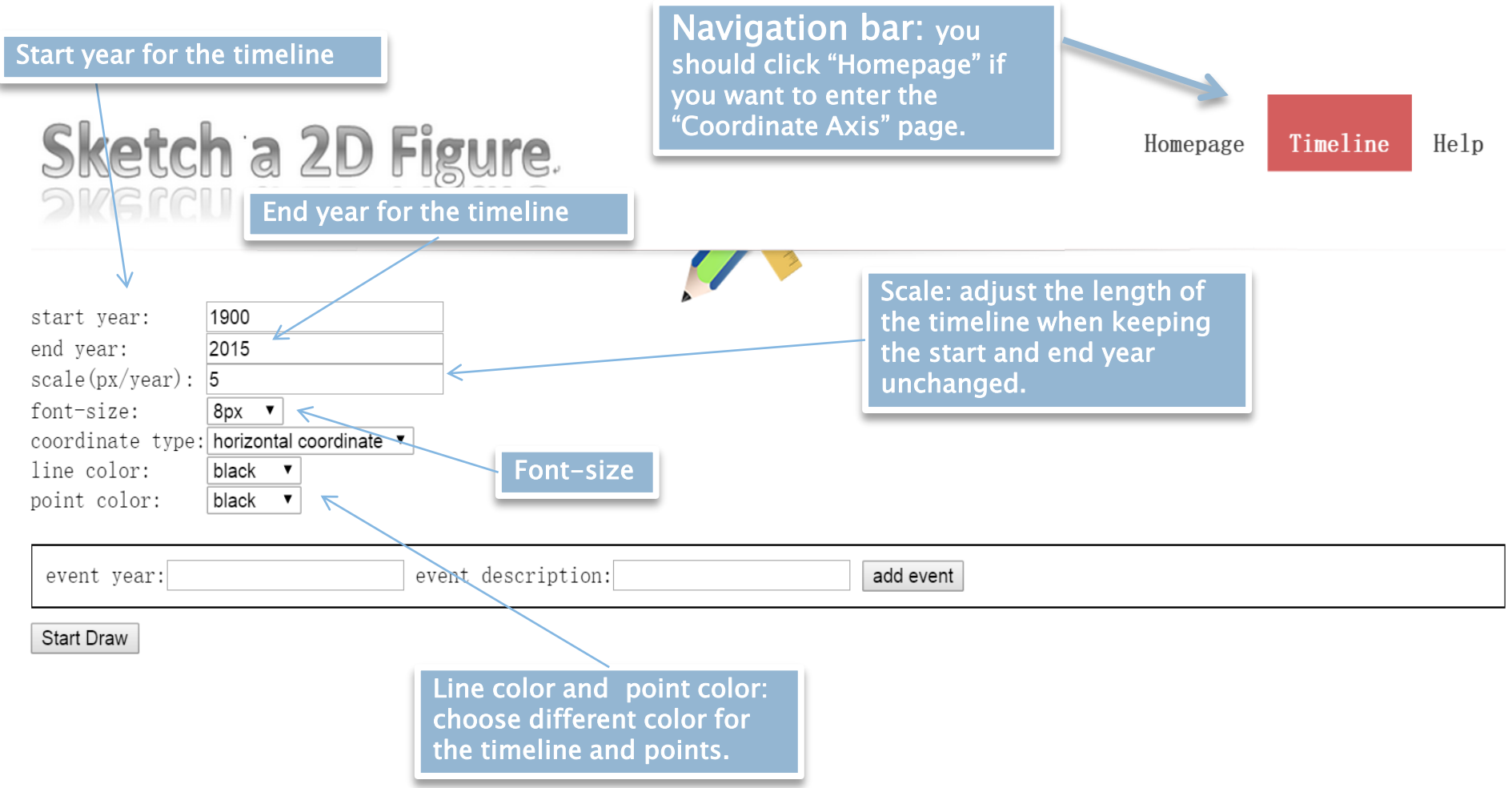
AXIS: Name and location for X and Y axis.

Help Page

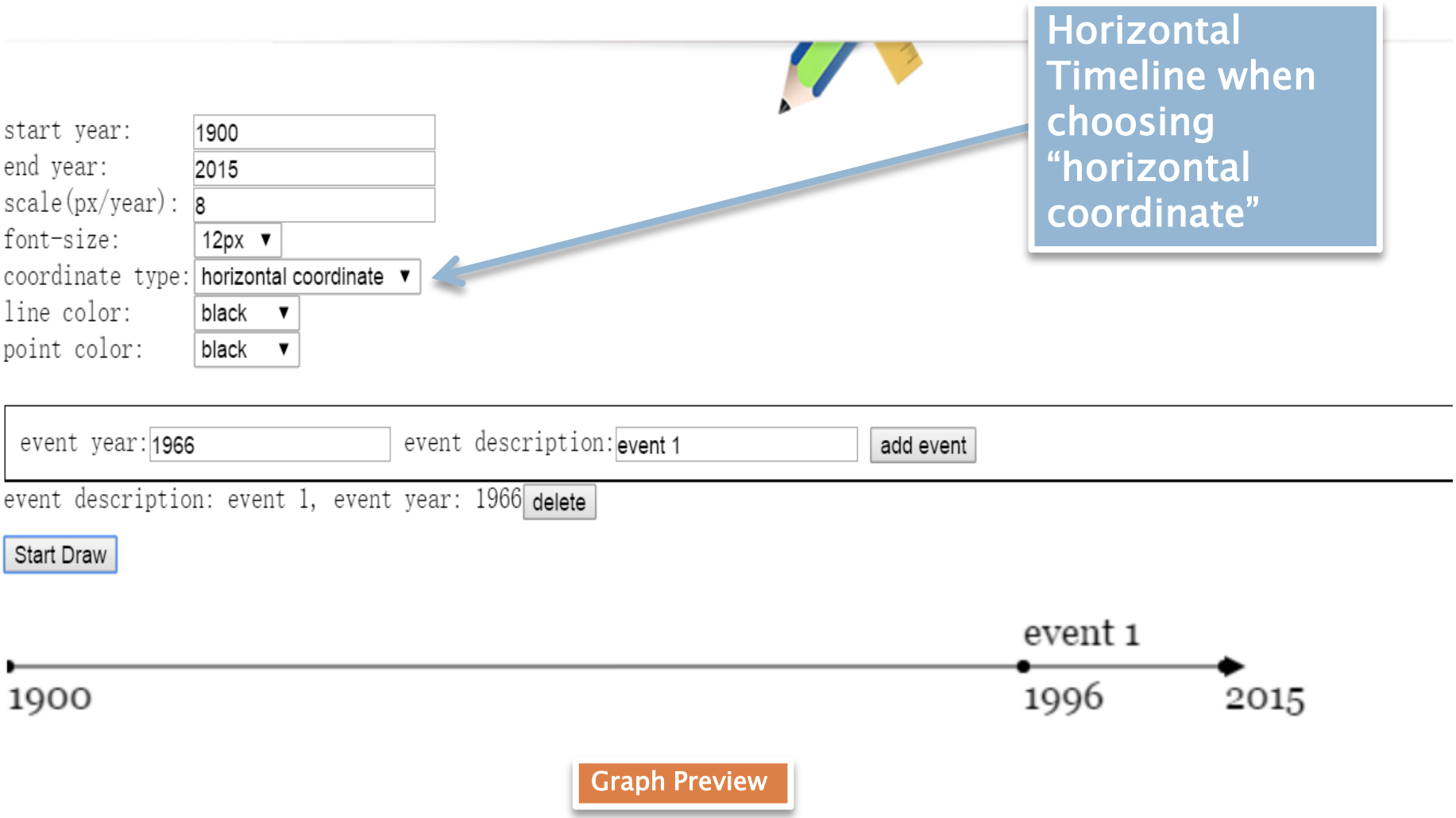


"Help":
Usage instruction for drawing figures in "Coordinate Axis" Page.

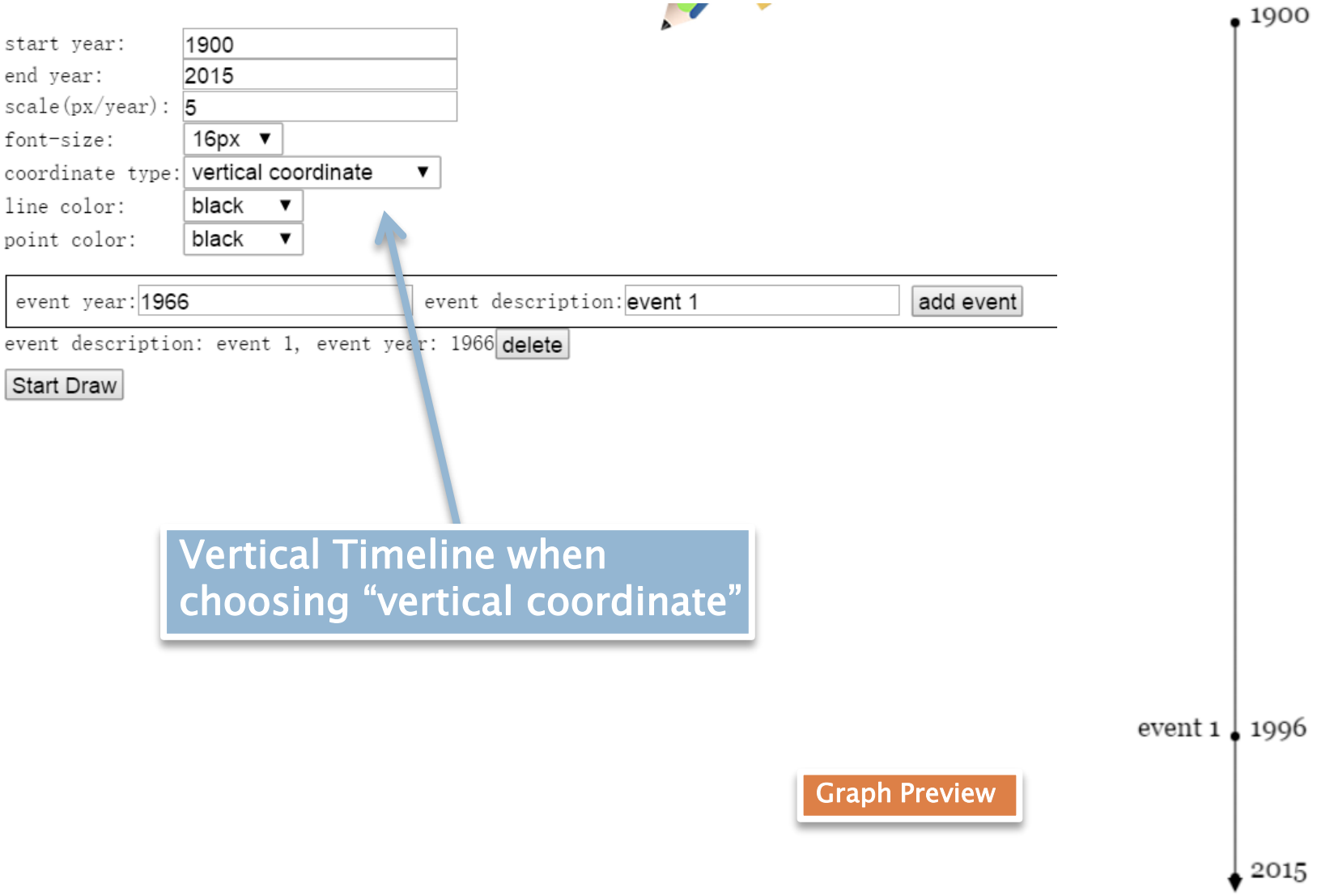
Timeline Interface



Horizontal Coordinates



Vertical Time line



Events

Enter the *event year* (chose between the start and end year), *event description*, and then click the button "add event".

event year: 1981 event description: event 3 add event

event description: event 1, event year: 1921 delete

event description: event 2, event year: 1945 delete

event description: event 3, event year: 1981 delete

Start Draw

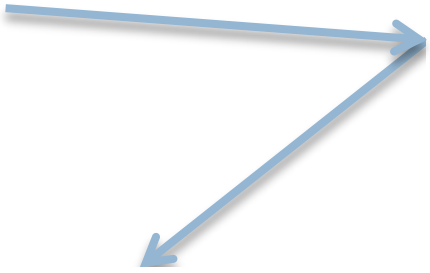
When adding one or more event, you can click the button *"start draw"* to draw the time line as shown in canvas.

If you want to delete one or more event, you should click the button "*delete"* and then click *" start draw"* to finish the delete.

Graph Preview

Latex Code

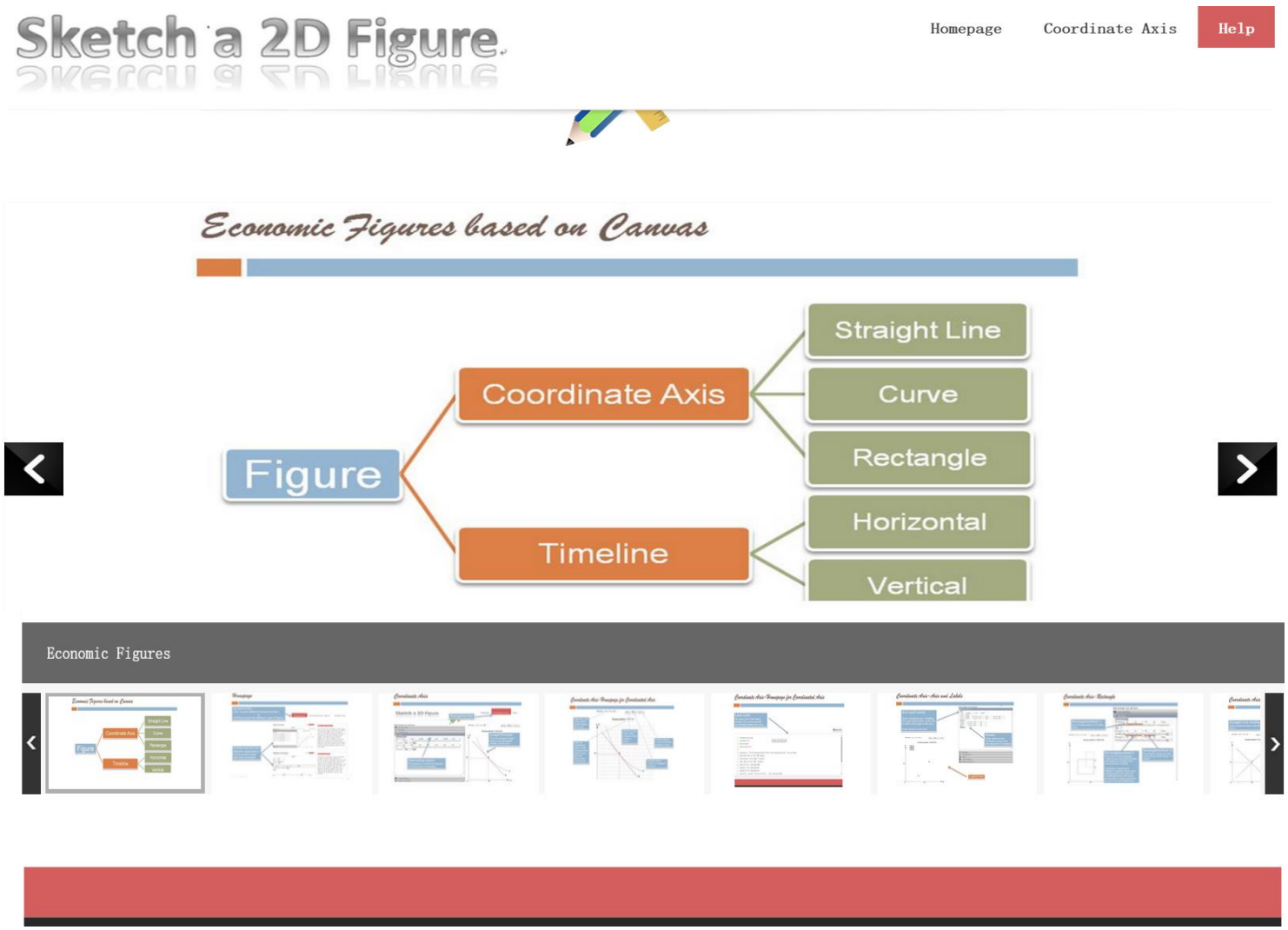
Latex code:
the latex code of the timelines drawn in the canvas area will accordingly shown in this area.




```
\documentclass{minimal}
\usepackage{tikz}
\begin{document}
\begin{tikzpicture}
\draw [->black] (0pt,0pt)--(575pt,0pt);
\node[below] at (0pt,0pt) {1900};
\node[below] at (575pt,0pt) {2015};
\node[above] at(115pt,0pt) {event 1};
\node[below] at(115pt,0pt) {1923};
\fill[black](115pt,0pt) circle [radius=1pt];
\node[above] at(225pt,0pt) {event 2};
\node[below] at(225pt,0pt) {1945};
\fill[black](225pt,0pt) circle [radius=1pt];

```

Help File



"Help":
Usage instruction for drawing figures in "Timeline" Page.

Download

- Available for download as a zip file at the website

  https://sites.google.com/site/kochiuyu/Tikz/Generator.zip

Conclusion

- Tools to help draw diagram
  - Large number of templates
  - HTML/Javascript Generator
- Graphs can be saved as graphics file/or directly used in LaTex systems
- Future potential works:
  - More templates
  - More user friendly generator