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Subject: Alternate plot scales

Posted by [Brad Gom](#) on Wed, 06 Jan 1999 08:00:00 GMT

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I'm looking for a way to draw a secondary plot scale. The problem is that I want the second axis scale to be a function of the first.

For example, the lower x-axis is a standard linear scale, and the upper x-axis is the square of the lower axis. Now the tricky part: I want the tickmarks for the second axis to occur at regular -numeric- (not graphical) intervals.

eg. if the lower scale had ticks at [4,5,6,7,8], then it would be trivial to have the upper axis with the corresponding ticks labeled [16,25,36,49,64]. What I want is for the ticks on the upper axis to occur at some interval like [20,25,30,35,40,45,50,55,60] so that their spacing on the plot gets tighter but the numeric interval is constant.

Thanks

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Subject: Re: Alternate plot scales

Posted by [Brad Gom](#) on Thu, 07 Jan 1999 08:00:00 GMT

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I believe Richard French sent you the link (thanks Richard).

I messed around a bit, and I think I figured out how to do it with AXIS. My way seems to be quite cumbersome. I was hoping someone had a slick routine that, given the function for the alternate x-axis, would calculate (or interpolate) the corresponding alternate y-axis, and pick aesthetically spaced tick intervals.

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Subject: Re: Alternate plot scales

Posted by [wgallery](#) on Fri, 08 Jan 1999 08:00:00 GMT

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In article <36943AAC.CF73BE02@uleth.ca>,

Brad Gom <gombg@uleth.ca> wrote:

- > I'm looking for a way to draw a secondary plot scale. The problem is
- > that I want the second axis scale to be a function of the first.
- >
- > For example, the lower x-axis is a standard linear scale, and the upper
- > x-axis is the square of the lower axis. Now the tricky part: I want the
- > tickmarks for the second axis to occur at regular -numeric- (not
- > graphical) intervals.

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 > occur at some interval like [20,25,30,35,40,45,50,55,60] so that their  
 > spacing on the plot gets tighter but the numeric interval is constant.  
 >  
 > Thanks  
 >  
 >

I have written a procedure I think will solve your problem. It is like axis but the spacing between the tick marks is non-linear--hence the name of the procedure is `non_linear_axis.pro`. I use it for labeling plots with, say, wavenumber on the bottom and wavelength on the top. To do this, use a call to plot to generate the basic plot but with `xstyle=!x.style+8` to suppress the upper x axis. Then call `non_linear_axis` to draw the upper x axis.

The procedure can draw an x (top or bottom) or y (left or right) axis, with labeling on the left or right (top or bottom), with title. You can control the length of the tick marks and the format of the labels (numeric or ascii). Complete documentation is included in the code.

Good luck.

```

;+ ; NAME: ; non_linear_axis ; ; PURPOSE: ; Draw an axis for a quantity
that varies non-linearly ; ; CATEGORY: ; Plotting ; ; CALLING SEQUENCE:
; non_linear_axis, ; ; INPUTS: ; v = fltarr(n_v): array of values
corresponding to existing axis ; u = fltarr(n_v): array of values u
corresponding to v: u = f(v) ; ; OPTIONAL INPUTS: ; ; ; KEYWORD PARAMETERS:
; pos = ??? something to do with positioning the labels but I can't remember
; just what ; format= format for axis labels. Default = '(I)' ; title =
title for axis. Default is no title ; yaxis = 1: indicates an y axis
(vertical) is to be drawn. Default: x axis ; charsize = size of characters.
Default = 1 ; flip = not set: characters printed for top x axis or right y
axis, ; set: characters printed for bottom x axis or left y axis ; tic_fac
= length of tick marks relative to default of 1 ; n_skip = preserve only
every n_skip'th label ; ; EXAMPLE: ; Let f be an array of frequency values
in wavenumbers and s be the ; corresponding spectrum. To plot the spectrum
versus wavenumber and then ; draw a wavelength scale on the top axis: ;
(Assume f goes from 2200 to 2500 cm-1. wavelength = 1e4/wavenumber) ;
plot,f,s,xstyle=8,ymargin=[5,5],xtitle='Wavenumber',ytitle=' Spectrum' ;
u=[4.1, 4.2, 4.3, 4.4, 4.5] ;label the new axis with these values ;
non_linear_axis, 1e4/u, u, format = '(f5.1)', title = 'Wavelength' ; ;
MODIFICATION HISTORY: ; William Gallery, AER, Inc., May, 1997 ; Dec., 1998:
added n_skip parameter ; limited ticks and labels to range of existing axis
;- PRO Non_linear_axis, v, u, du, pos=pos, format=format, title=title,
yaxis=yaxis, $ charsize=charsize, flip=flip, tick_fac=tick_fac, $

```

```

n_skip=n_skip

IF n_elements(charsize) LE 0 THEN charsize = 1.
IF n_elements(yaxis) GT 0 THEN axis = 'y' ELSE axis = 'x'
IF n_elements(flip) LE 0 THEN BEGIN
    sign = 1                ;characters above or to right of axis
    orig = 1                ;top or right axis
    offset = 0              ;offset characters above or to right of axis
ENDIF ELSE BEGIN
    sign = -1               ;characters below or to left of axis
    orig = 0                ;bottom or left axis
    offset = 1              ;offset characters below or to left of axis
ENDELSE

if n_elements(tick_fac) le 0 then tick_fac = 1. ;scale factor for tickmarks

IF n_elements(pos) LE 0 THEN BEGIN
    axis_coord = convert_coord(!X.crange, !Y.crange, /data, /to_data)
    CASE axis OF
        'x': pos = !Y.crange(orig) ;y position of x axis, bottom or top
        'y': pos = !X.crange(orig) ;x position of y axis, right or left
    ENDCASE
ENDIF
IF n_elements(title) LE 0 THEN title = "
IF n_elements(format) LE 0 THEN fmt = '(I)' ELSE fmt = format
IF n_elements(n_skip) LE 0 THEN n_skip = 1

;;Limit ticks and labels to within the range of the existing axis

CASE axis OF
    'x': w = where(u GE !x.crange(0) AND u LE !x.crange(1))
    'y': w = where(u GE !y.crange(0) AND u LE !y.crange(1))
ENDCASE
uu = u(w)
vv = v(w)
n_vv = n_elements(vv)

;;Need the height of a character in data coordinates
ch_size = [!D.x_ch_size/(!D.x_size*!X.s(1)), $
            !D.y_ch_size/(!D.y_size*!Y.s(1))]*charsize
;;Convert uu to a string array
s_u = strtrim(string(uu, format=fmt), 2)
;;Find length of longest element of s_u
s_len_max = max(strlen(s_u))

;;Draw axis line
CASE axis OF
    'x': BEGIN

```

```

;;Draw the axis line
plots, !X.crange, [!Y.crange(orig), !Y.crange(orig)], /data

;;Plot tick marks for uu
FOR k=0, n_vv-1 DO BEGIN
  plots, [vv(k), vv(k)], [ pos, pos-sign*ch_size(1)*tick_fac], /data
ENDFOR

;;Print the values of uu centered above the tick mark
FOR k=0, n_vv-1, n_skip DO $
  xyouts, vv(k), pos+sign*(ch_size(1)+offset)*0.4, $
  /data, align=.5, charsize=charsize, s_u(k)

;;Print the title above the top axis
xyouts, total(!X.crange)/2., pos+sign*(ch_size(1)+offset)*2, /data, $
  align=.5, charsize=charsize*1.0, title
END
'y': BEGIN
  ;;Draw axis line
  plots, [!X.crange(1), !X.crange(1)], !Y.crange, /data

  ;;Plot tick marks for u  FOR k=0, n_vv-1 DO BEGIN  plots, [pos,
pos+sign*ch_size(0)*.6*tick_fac], [vv(k), vv(k)], /data  ENDFOR

  ;;Print the values of u to the right of the tick mark
  FOR k=0, n_vv-1, n_skip DO $
    xyouts, pos+sign*ch_size(0)*(s_len_max*orig+1), $
    vv(k)-ch_size(1)*.4, /data, align=1, charsize=charsize, s_u(k)

  ;;Print the title outside the axis
  xyouts, pos+sign*ch_size(0)*(s_len_max+3), total(!Y.crange)/2, $
  /data, align=.5, charsize=charsize*1.0, orien=180+sign*90., title

END
ENDCASE

return
END

```

|                                      |                     |
|--------------------------------------|---------------------|
| William O. Gallery                   | wgallery@aer.com    |
| Atmospheric & Environmental Research | Voice(617) 349-2284 |
| 840 Memorial Drive                   | (617) 547-6207      |
| Cambridge, Massachusetts 02139       | FAX (617) 661-6479  |

|                                      |                     |
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Subject: Re: Alternate plot scales

Posted by [Kevin P. Reardon](#) on Mon, 11 Jan 1999 08:00:00 GMT

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> Brad Grom wrote:  
> I'm looking for a way to draw a secondary plot scale. The problem  
> is that I want the second axis scale to be a function of the  
> first.  
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> For example, the lower x-axis is a standard linear scale, and the  
> upper x-axis is the square of the lower axis. Now the tricky  
> part: I want the tickmarks for the second axis to occur at  
> regular -numeric- (not graphical) intervals.

Brad,

just playing around I came up with something like this that seems to be at least in the general direction of what you were looking for. It ain't pretty (in particular, the rounding of step is pretty ad hoc), but it should at least give you some ideas on how to get what you want.

```
; create an X axis that runs from 50 to 10000
```

```
xaxis=(findgen(101)*99.5)+50
```

```
; plot data with no X axes
```

```
plot_oj,xaxis,findgen(100)+randomn(100,100)*1,$  
  xran=[max(xaxis),min(xaxis)],xsty=5,/ysty,ymargin=[10,2]
```

```
; choose a spacing (20 steps) and plot lower X axis
```

```
step=fix((((10^!x.crange(1)-10^!x.crange(0))/20.)/10.-0.5)*10  
axis,xaxis=0,/xlog,xtickv=findgen(21)*step+10000,xticks=20
```

```
; choose a spacing (30 steps)
```

```
step=fix((((10^!x.crange(1))^2-(10^!x.crange(0))^2)/30.) $  
  /1000.-0.5)*1000.
```

```
; plot upper X axis, the square-root of the lower X-axis
```

```
axis,xaxis=1,xrange=(10^!x.crange)^2,/xlog,$  
  xtickv=findgen(31)*step+(10^!x.crange(0))^2,xticks=30
```

```
; plot detached X axis with normal logarithmic spacing
```

```
axis,1,-15,xaxis=0,xrange=[1/(10^!x.crange(1)),$  
  1/(10^!x.crange(0))],/xlog
```

```
; plot vertical lines
topticks=findgen(31)*step+(10^!x.crangle(0))^2
for i=0,30 do plots,(sqrt([topticks(i),topticks(i)])),!y.crangle
```

One could also use the XTICK\_GET keyword to get the values for each tickmarks, and then a similar FOR loop for the vertical lines. I hope this helps a bit.

cheers,  
kevin reardon  
Osservatorio Astronomico di Capodimonte

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