

PLSC 502 – Fall 2024

Descriptive Graphics

September 16, 2024

We use plots to:

- Know your data.
- Catch mistakes.
- Learn something...

Example: Africa, 2015

AutoSave

Africa2015 - Saved to my Mac

Search [Cmd + Ctrl + U]

HomeInsertDrawPage LayoutFormulasDataReviewViewAutomateAcrobat

General

Conditional FormattingFormat as TableCell Styles

InsertDeleteFormat

Sort & FilterFind & SelectAdd-InsAnalyze DataCreate PDF and Share links

CommentsShare

B2

fx

Angola

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
	Country	Capital	Longitude	Latitude	SubSaharan	Population	PopulationDensity	VDEM	Democracy	ConflictOnset	HIVPrevalence	AdversityRate	HomicidesPer100k	ProgWomenInParliament	LiteracyRate	GiniIndex			
1	ISO3	Country	Capital	Longitude	Latitude	SubSaharan	Population	PopulationDensity	VDEM	Democracy	ConflictOnset	HIVPrevalence	AdversityRate	HomicidesPer100k	ProgWomenInParliament	LiteracyRate	GiniIndex		
2	AGO	Angola	Luanda	13.242	-8.81159	1	28127721	22.96173979	0.304	-2	0	1.8	148.074	4.45823347	36.81818182	NA			
3	BDI	Burundi	Bujumbura	29.3639	-3.3784	1	10727148	417.7238318	0.216	-1	0	1.3	60.503	4.297507394	36.36363636	NA			
4	BEN	Benin	Porto-Novo	2.6323	6.4779	1	10502783	96.95621674	0.698	7	0	1.1	95.516	NA	7.228915693	NA			47.8
5	BFA	Burkina Faso	Ouagadougou	-1.53395	12.3606	1	18718019	68.41381213	0.374	6	0	0.9	122.57	0.640029031	9.448818906	NA			
6	BWA	Botswana	Gaborone	25.8201	24.6544	1	2305171	4.067494221	0.686	8	0	21	54.22	NA	9.523805024	NA			53.3
7	CAF	Central African Republic	Bangui	21.6407	5.69306	1	4819333	7.735935343	0.288	0	0	4	160.531	NA	NA	NA			
8	CIV	Cote d'Ivoire	Yamoussoukro	-4.0305	5.332	1	23596741	74.20358805	0.513	4	0	2.7	112.915	NA	9.163346814	NA			41.5
9	CMR	Cameroon	Yaounde	11.5174	3.8721	1	23012646	48.68237609	0.359	-4	1	3.6	118.841	3.741421049	31.11111111	NA			
10	COD	Cong. Dem. Rep.	Kinshasa	15.3222	-4.326	1	78056904	34.69570764	0.347	5	0	0.8	116.739	NA	8.94308431	NA			
11	COD	Cong. Rep.	Brazzaville	15.2662	-4.2767	1	5064386	14.82982723	0.254	-4	0	3.6	115.052	NA	7.352941176	NA			
12	COM	Comoros	Moroni	43.2418	11.6986	1	790226	392.3782912	0.503	9	0	0.1	66.546	NA	3.03030303	NA			
13	CPV	Cabo Verde	Praia	-23.5067	14.9218	1	552196	137.0139998	0.844	10	0	0.8	64.655	8.330828048	20.63333333	86.79029083			42.4
14	DZA	Algeria	Algiers	3.65697	36.7397	0	385431154	16.60262056	0.293	2	1	0.1	11.888	1.380709964	31.6017316	NA			
15	EGY	Egypt, Arab Rep.	Cairo	31.2461	30.0882	0	97723799	98.17047466	0.198	-4	1	0.1	56.931	1.750852941	NA	NA			31.8
16	ERI	Eritrea	Asmara	38.9183	15.3315	1	3340006	27.58311825	0.07	-7	0	0.7	70.691	NA	22	NA			
17	ETH	Ethiopia	Addis Ababa	38.7468	0.02274	1	102471895	90.80046232	0.238	-3	0	1.2	76.59	NA	38.75685558	NA			35
18	GAB	Gabon	Libreville	0.45162	0.38632	1	2028517	7.872536518	0.366	3	0	3.7	103.618	NA	14.16066667	NA			
19	GHA	Ghana	Accra	-0.20765	1.57045	1	2887269	126.8829173	0.736	8	1	1.8	69.995	1.818437565	10.90909091	NA			
20	GIN	Guinea	Conakry	-13.7	9.51968	1	11625988	47.31400781	0.468	4	0	1.6	132.184	NA	21.92882456	NA			
21	GMB	Gambia, The	Banjul	-16.5885	13.4496	1	2253133	222.6416008	0.263	-5	0	1.8	78.309	NA	9.433062264	50.77769636			35.9
22	GMB	Guinea-Bissau	Bissau	-15.1804	11.8037	1	1788919	63.61731863	0.551	6	0	3.3	102.21	NA	13.7254902	NA			
23	GNQ	Equatorial Guinea	Malabo	8.7741	3.7623	1	1346973	48.02042781	0.183	-6	0	6.6	161.13	NA	24	NA			
24	KEN	Kenya	Nairobi	36.8126	1.27975	1	44855486	92.31978478	0.472	9	1	4.28	4.9	4.8255887229	18.71426871	34	NA		40.8
25	LES	Lesotho	Maseru	-10.7957	6.30039	0	4612329	47.8854755	0.642	6	0	1.3	140.429	NA	10.95890411	NA			
26	LIB	Libya	Tripoli	13.1072	32.8578	0	6182235	3.519235141	0.282	0	1	0.1	7.616	NA	15.95744661	NA			
27	LSO	Lesotho	Maseru	27.7167	-29.0208	1	2118521	69.78000659	0.661	8	0	24.1	90.797	NA	25	NA			
28	MAR	Morocco	Rabat	-8.0704	33.9905	0	34880456	77.70960542	0.294	-4	0	0.1	29.145	1.242774821	16.96202532	NA			
29	MDG	Madagascar	Antananarivo	45.7167	-20.4667	1	24658012	42.71938911	0.466	8	0	0.2	136.29	NA	20.52860152	NA			
30	MU	Mali	Bamako	-7.69334	13.5667	1	18112967	14.84433326	0.55	1	1	1	163.29	NA	10.95890411	NA			
31	MOZ	Mozambique	Maputo	32.5713	25.9664	1	26843246	34.13520944	0.454	5	0	12.4	174.077	NA	39.6	56.03900146	NA		
32	MRT	Mauritania	Nouakchott	-15.9824	18.2367	1	946520	3.828679538	0.457	-2	0	0.4	83.095	NA	25.1700803	NA			
33	MUS	Mauritius	Port Louis	57.4977	-20.1605	1	1282879	632.3880821	0.836	10	0	8.05	24.49	1.623937771	11.5840209	92.70760345	NA		
34	MWI	Malawi	Lilongwe	33.7703	-13.3699	1	16938942	27.76663343	0.582	6	0	0.6	31.928	NA	16.69696667	62.14353943	NA		
35	NAM	Namibia	Windhoek	17.0931	-22.5448	1	2287204	2.772660909	0.731	6	0	12.8	70.805	NA	41.34615265	NA			59.1
36	NER	Niger	Niamey	2.1073	13.514	1	20128124	15.89020605	0.624	6	1	0.3	177.002	NA	13.27433628	NA			
37	NGA	Nigeria	Abuja	7.48906	0.58084	1	183995785	202.0222284	0.594	7	1	NA	114.982	NA	5.555555556	NA			35.9
38	RWA	Rwanda	Kigali	30.0587	-1.95325	1	11642959	471.9480706	0.275	-3	0	3.2	39.296	2.518542401	63.75	NA			
39	SDN	Sudan	Khartoum	32.5363	15.5832	1	38717178	20.43424946	0.245	-4	0	0.1	83.526	NA	30.51643192	NA			
40	SEN	Senegal	Dakar	-17.4734	14.7247	1	14356181	74.95942937	0.645	7	0	4	73.745	0.267518152	42.66666667	NA			

Africa2015

Example: Africa, 2015

```
> summary(Africa)
```

ISO3	Country	Capital	Longitude	Latitude	SubSaharan
Length:53	Length:53	Length:53	Min. : -23.5	Min. : -29.5	Min. : 0.000
Class :character	Class :character	Class :character	1st Qu.: 1.2	1st Qu.: -6.2	1st Qu.: 1.000
Mode :character	Mode :character	Mode :character	Median : 15.3	Median : 4.8	Median : 1.000
			Mean : 16.1	Mean : 2.3	Mean : 0.906
			3rd Qu.: 31.6	3rd Qu.: 12.4	3rd Qu.: 1.000
			Max. : 57.5	Max. : 36.8	Max. : 1.000

Population	PopulationDensity	VDEMDemocracy	POLITYDemocracy	ConflictOnset	HIVPrevalence
Min. : 93419	Min. : 3	Min. : 0.070	Min. : -9.00	Min. : 0.000	Min. : 0.10
1st Qu.: 3340006	1st Qu.: 22	1st Qu.: 0.282	1st Qu.: -2.00	1st Qu.: 0.000	1st Qu.: 0.70
Median : 11642959	Median : 59	Median : 0.454	Median : 4.00	Median : 0.000	Median : 1.80
Mean : 22611250	Mean : 99	Mean : 0.439	Mean : 2.59	Mean : 0.176	Mean : 4.68
3rd Qu.: 26843246	3rd Qu.: 101	3rd Qu.: 0.593	3rd Qu.: 7.00	3rd Qu.: 0.000	3rd Qu.: 4.90
Max. : 183995785	Max. : 632	Max. : 0.844	Max. : 10.00	Max. : 1.000	Max. : 29.90
		NA's : 2	NA's : 2	NA's : 2	NA's : 4

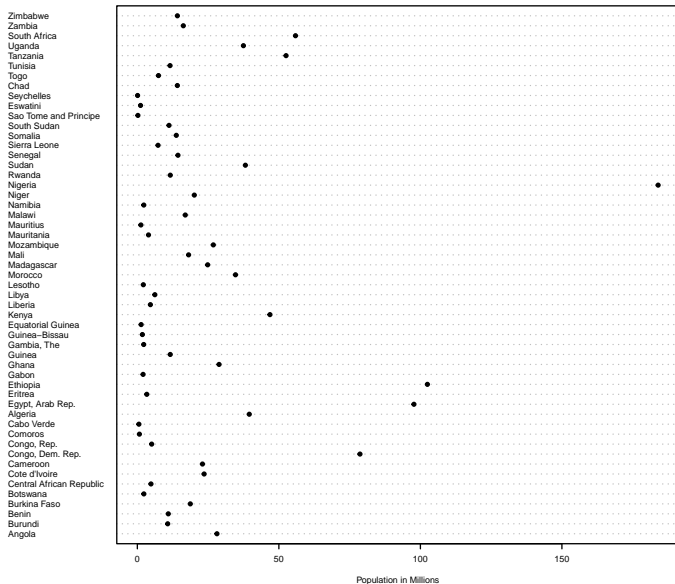
AdFertilityRate	HomicidesPer100K	PropWomenInParliament	LiteracyRate	GINIIndex
Min. : 7.6	Min. : 0.3	Min. : 3.0	Min. : 26.0	Min. : 31.8
1st Qu.: 70.7	1st Qu.: 1.7	1st Qu.: 11.3	1st Qu.: 52.1	1st Qu.: 35.9
Median : 96.0	Median : 3.7	Median : 18.2	Median : 62.9	Median : 41.5
Mean : 96.7	Mean : 5.3	Mean : 21.9	Mean : 64.4	Mean : 42.7
3rd Qu.: 127.9	3rd Qu.: 6.2	3rd Qu.: 31.4	3rd Qu.: 84.6	3rd Qu.: 47.8
Max. : 177.0	Max. : 33.4	Max. : 63.8	Max. : 94.4	Max. : 59.1
	NA's : 34	NA's : 2	NA's : 43	NA's : 40

A Better (?) Summary

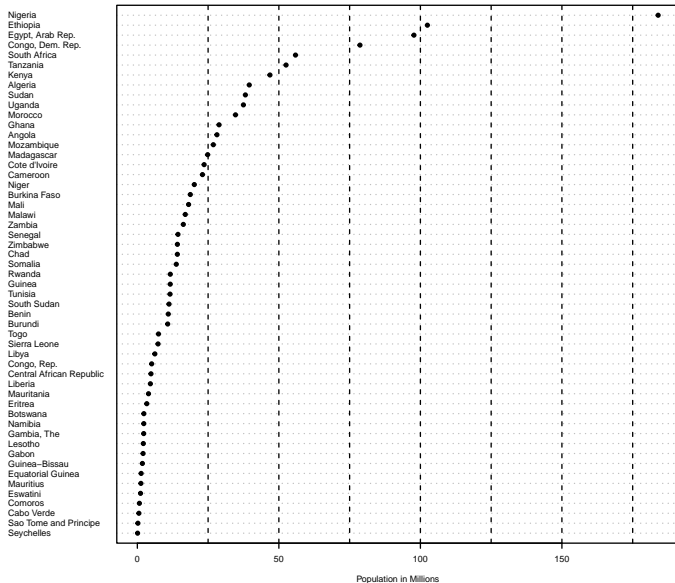
```
> describe(Africa,skew=FALSE)
```

	vars	n	mean	sd	median	min	max	range	se
ISO3*	1	53	27.00	15.44	27.00	1.00	53.00	52.00	2.12
Country*	2	53	27.00	15.44	27.00	1.00	53.00	52.00	2.12
Capital*	3	53	27.00	15.44	27.00	1.00	53.00	52.00	2.12
Longitude	4	53	16.06	20.56	15.27	-23.51	57.50	81.01	2.82
Latitude	5	53	2.33	16.59	4.85	-29.52	36.79	66.31	2.28
SubSaharan	6	53	0.91	0.30	1.00	0.00	1.00	1.00	0.04
Population	7	53	22611249.51	32291310.26	11642959.00	93419.00	183995785.00	183902366.00	4435552.59
PopulationDensity	8	53	98.84	127.05	59.32	2.77	632.39	629.62	17.45
VDEMDemocracy	9	51	0.44	0.20	0.45	0.07	0.84	0.77	0.03
POLITYDemocracy	10	51	2.59	5.13	4.00	-9.00	10.00	19.00	0.72
ConflictOnset	11	51	0.18	0.39	0.00	0.00	1.00	1.00	0.05
HIVPrevalence	12	49	4.68	6.82	1.80	0.10	29.90	29.80	0.97
AdFertilityRate	13	53	96.75	42.40	95.99	7.62	177.00	169.39	5.82
HomicidesPer100K	14	19	5.33	7.34	3.74	0.27	33.42	33.15	1.68
PropWomenInParliament	15	51	21.89	13.08	18.18	3.03	63.75	60.72	1.83
LiteracyRate	16	10	64.35	23.80	62.94	26.00	94.37	68.36	7.53
GINIIndex	17	13	42.72	8.92	41.50	31.80	59.10	27.30	2.47

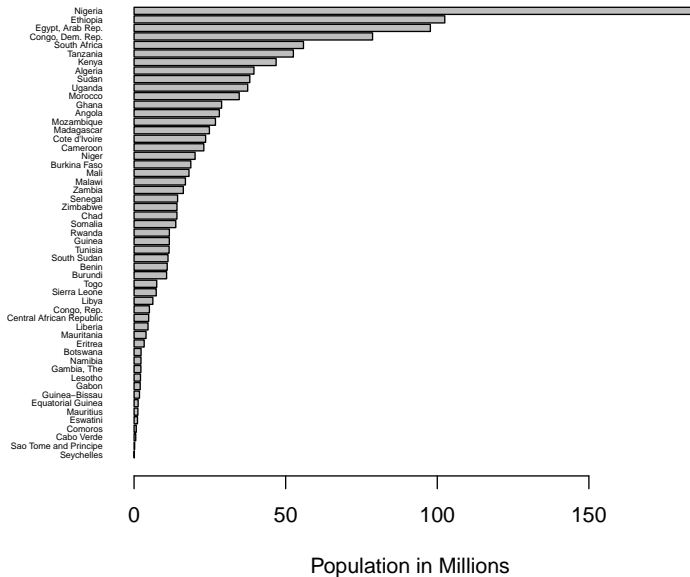
The Dotchart



The Dotchart, Sorted

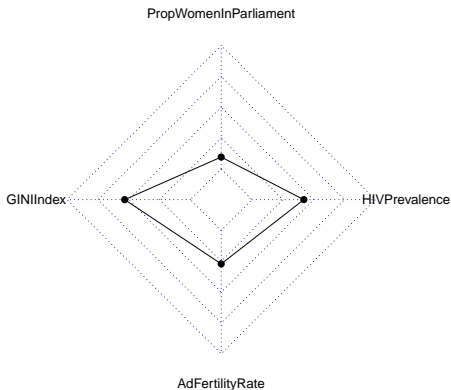


The Barchart, Sorted



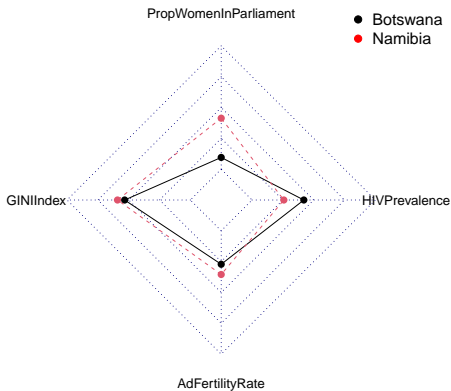
“Spiderplots” / Radar Plots / etc.

Radar Chart: Botswana



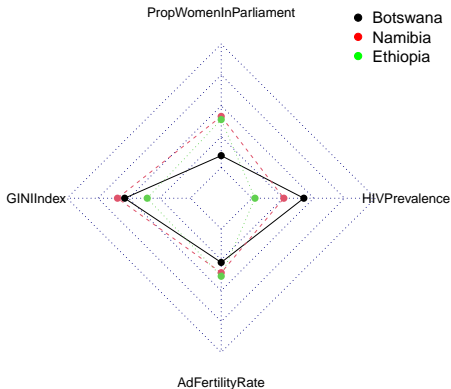
“Spiderplots” / Radar Plots / etc. (cont’d)

Radar Chart: Botswana and Namibia

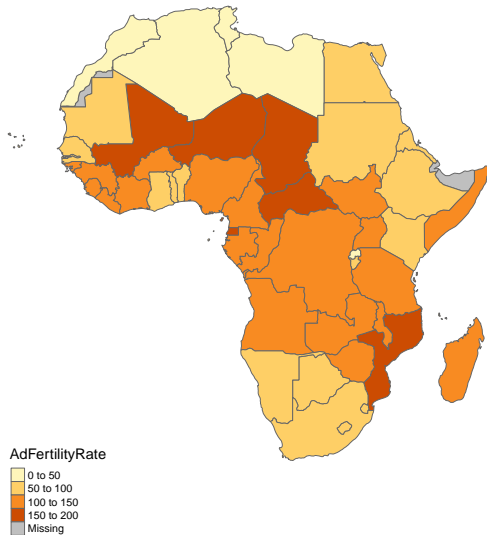


Even More Radar Plots!

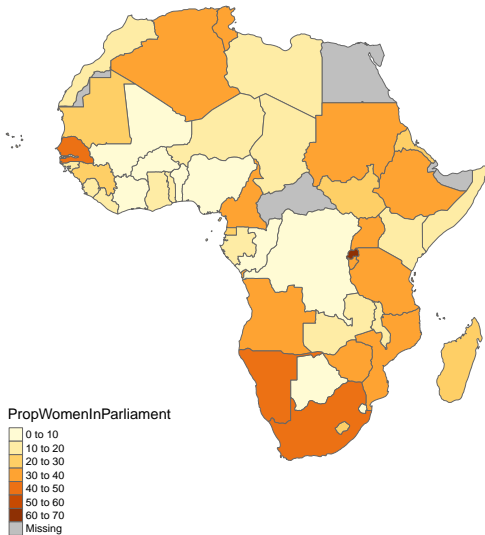
Radar Chart: Botswana, Namibia, and Ethiopia



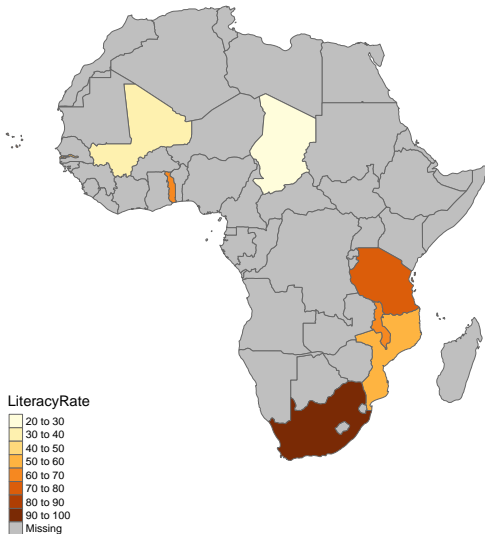
OMG MAPS



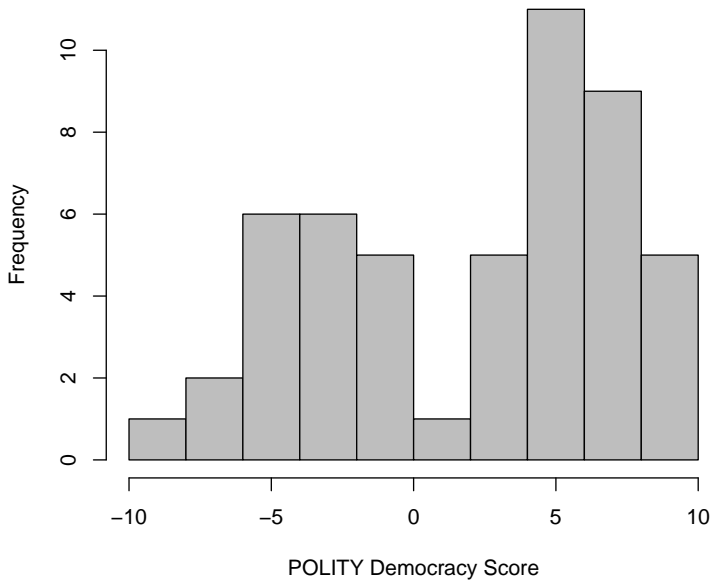
Another One!



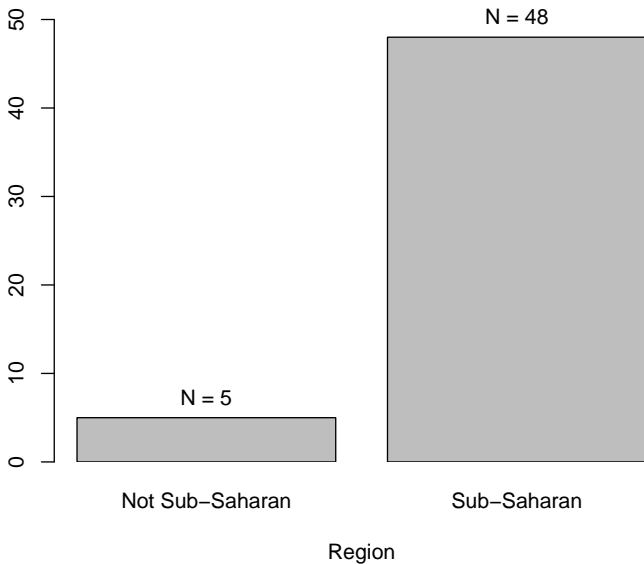
One More (w/lots missing)



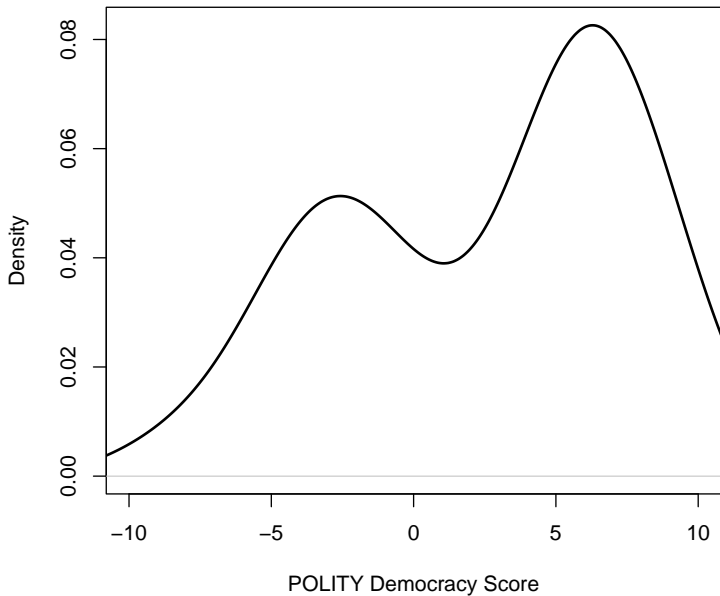
The Histogram



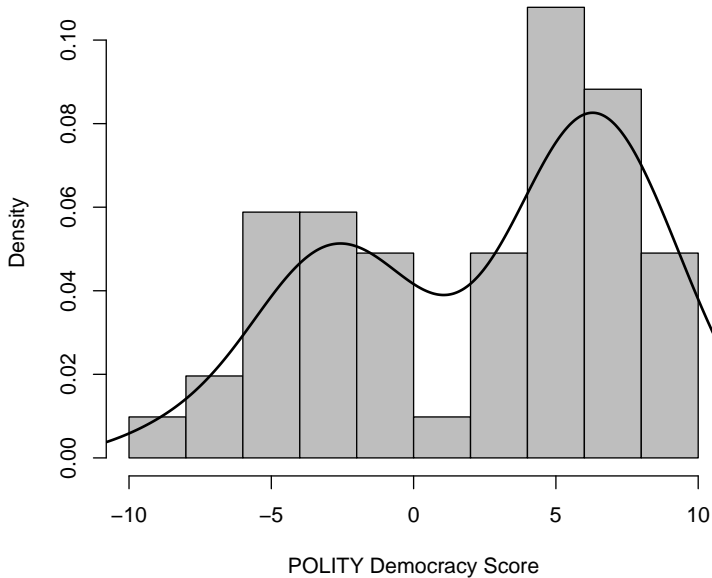
Another Histogram



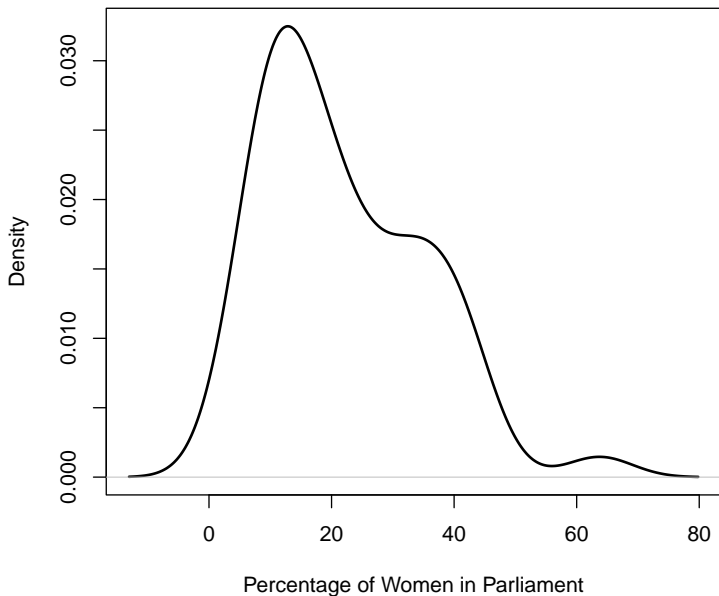
Kernel Density Plot



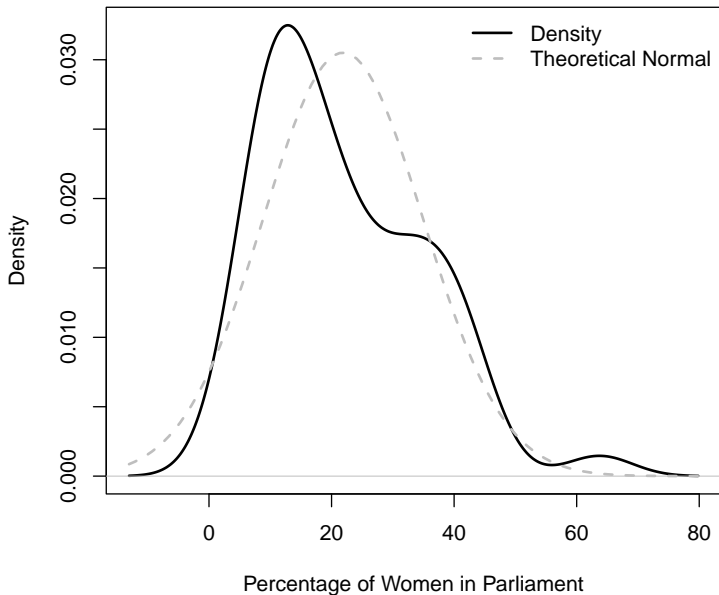
Combined Plot



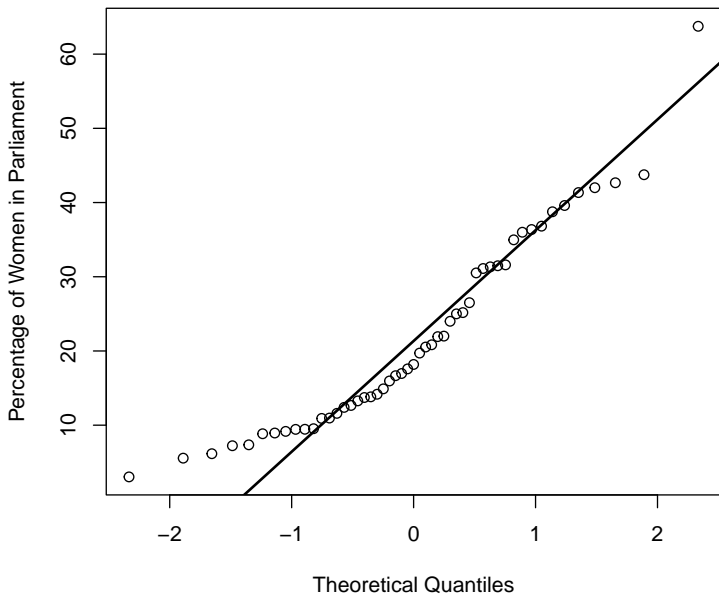
Density Plot: Prop. Women in Parliament



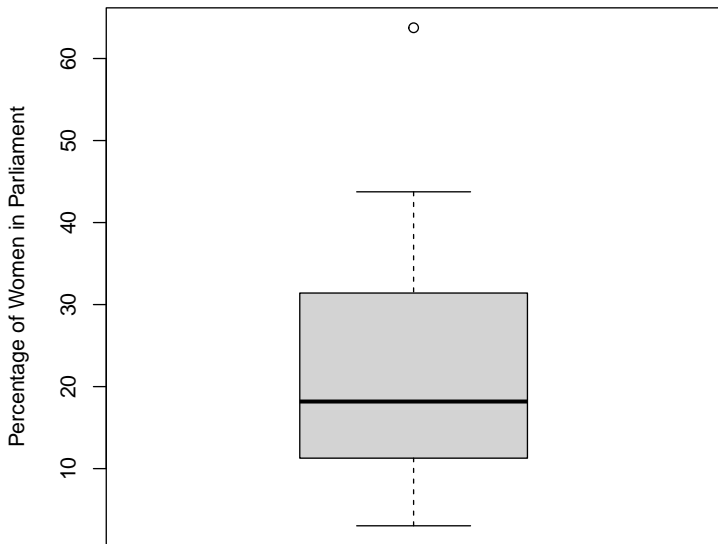
Overlay a Normal Distribution



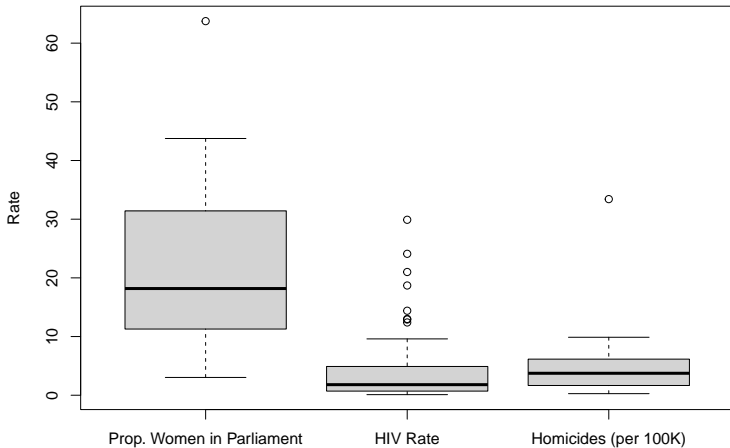
Q-Q Plot: Prop. Women in Parliament



Boxplot: Prop. of Women in Parliament



Boxplot: Women in Parliament, HIV, and Homicides



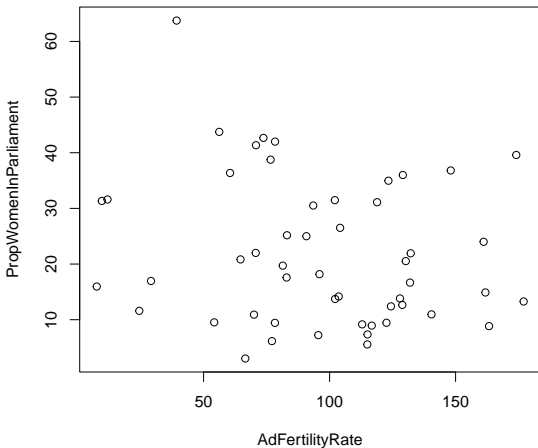
Other Univariate Graphics

- *Stripplots* (or *stripcharts*)
- *Pie charts*
- “Donut” plots
- “Stem and leaf” plots

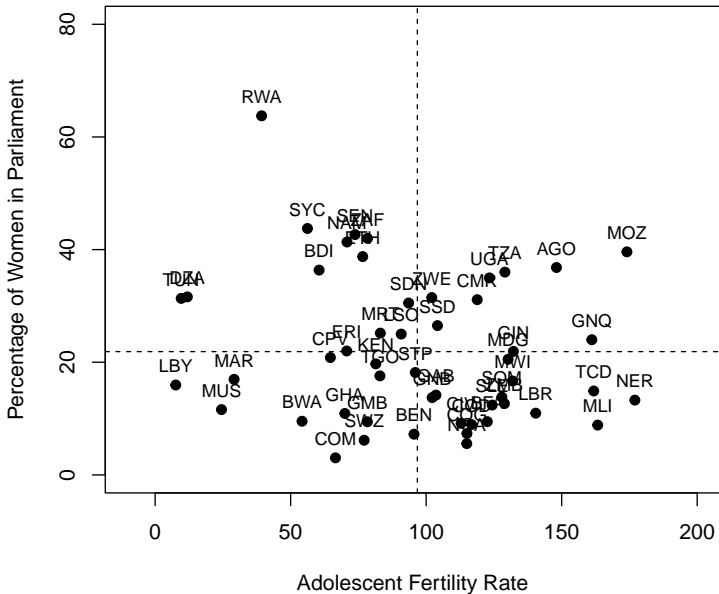
Bivariate and Multivariate Plots

Continuous Data: Scatterplots

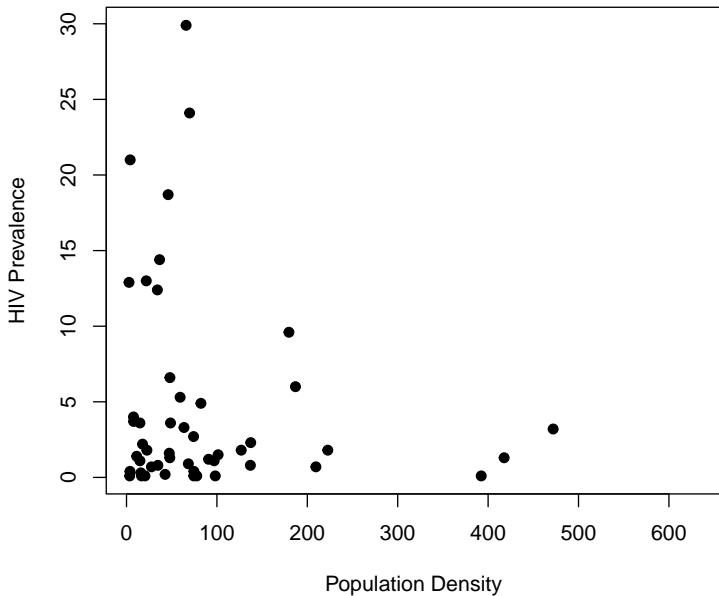
```
> with(Africa, plot(AdFertilityRate, PropWomenInParliament))
```



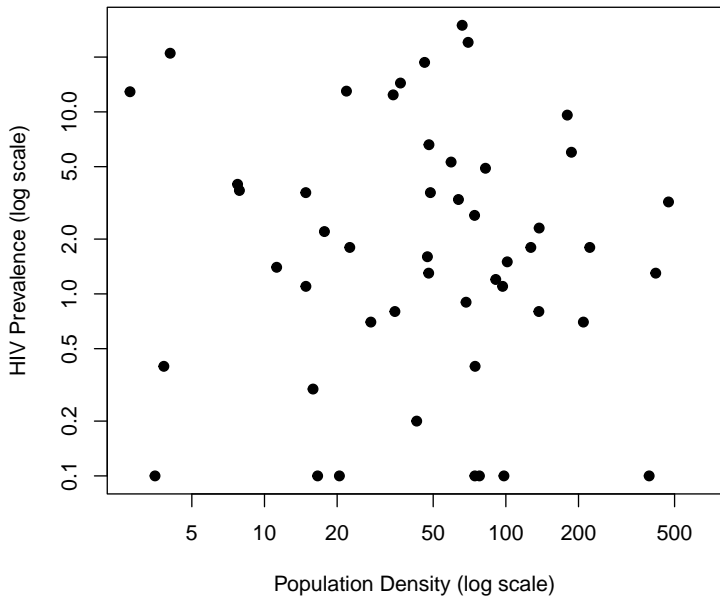
A Better Scatterplot



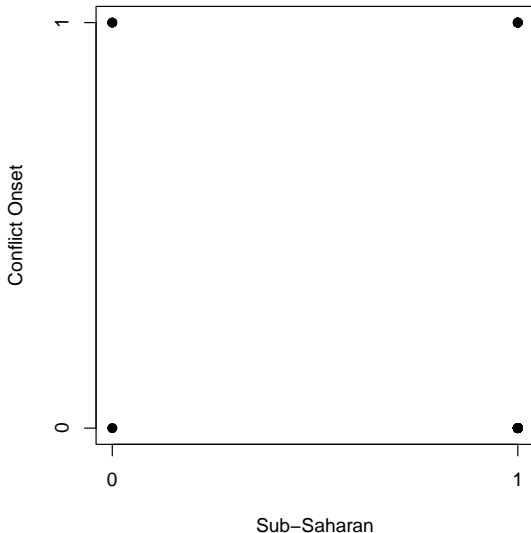
Skewed Data



Log-Scale Axes



How Not To Draw A Scatterplot

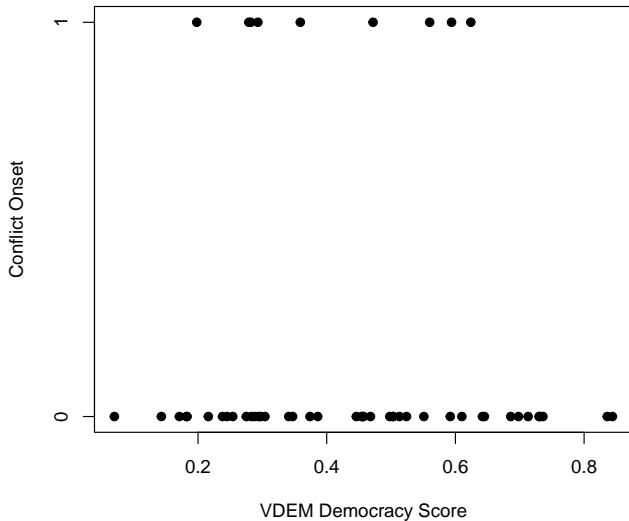


Binary Data = Tables

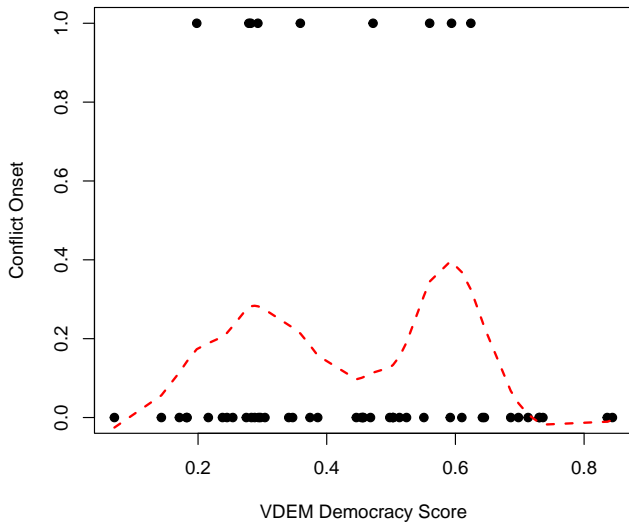
```
> with(Africa, xtabs(~SubSaharan+ConflictOnset))
```

	ConflictOnset	
SubSaharan	0	1
0	2	3
1	40	6

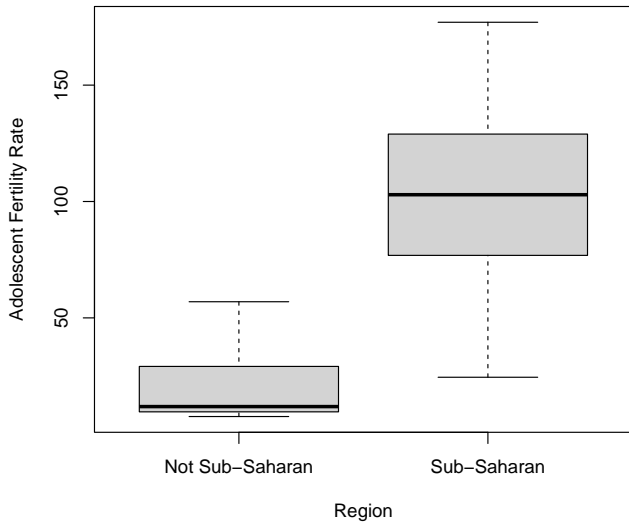
Mixed Binary-Continuous



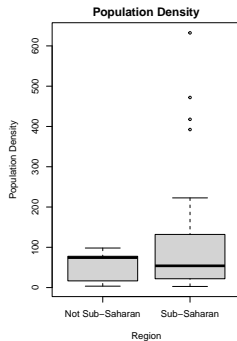
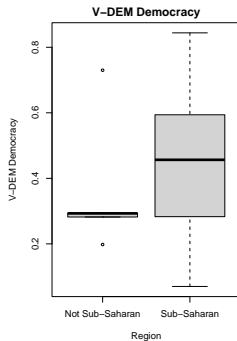
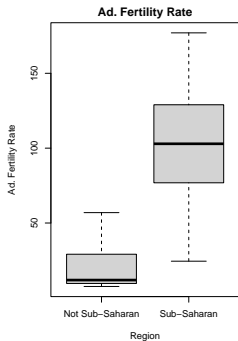
Smoothed Plot



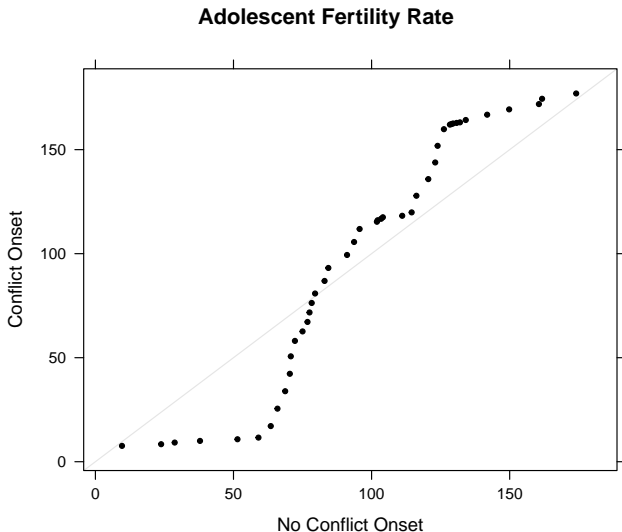
Conditioned Boxplots



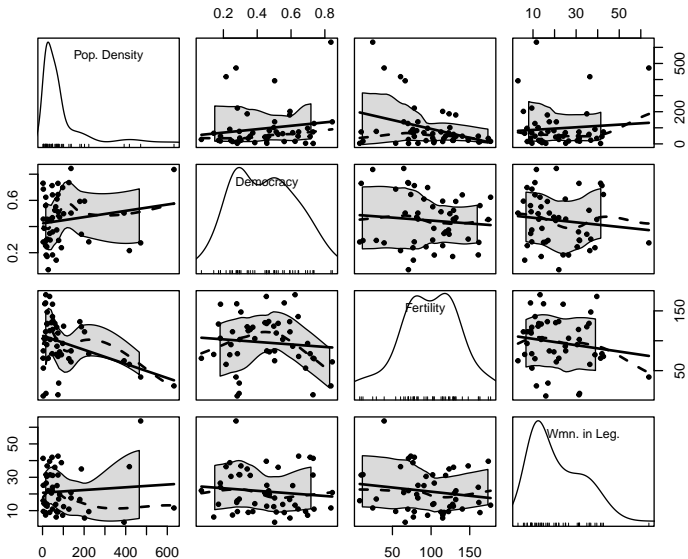
Multiple Conditioned Boxplots



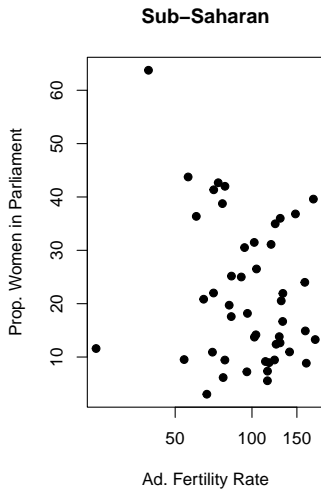
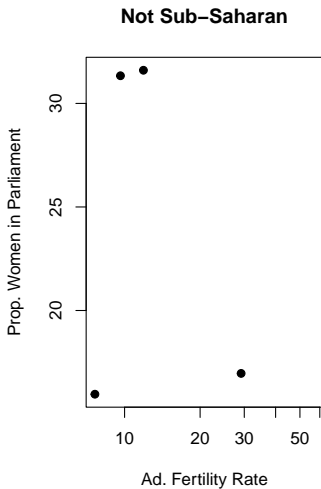
Empirical Q-Q Plot: Adolescent Fertility



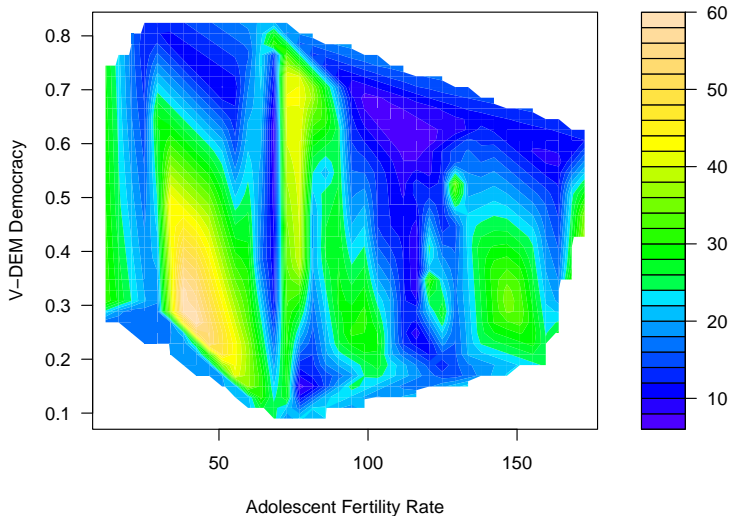
Scatterplot Matrix



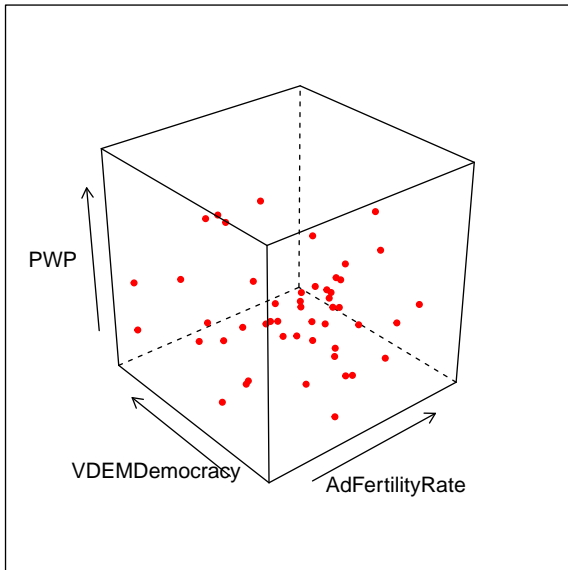
Conditional Scatterplots



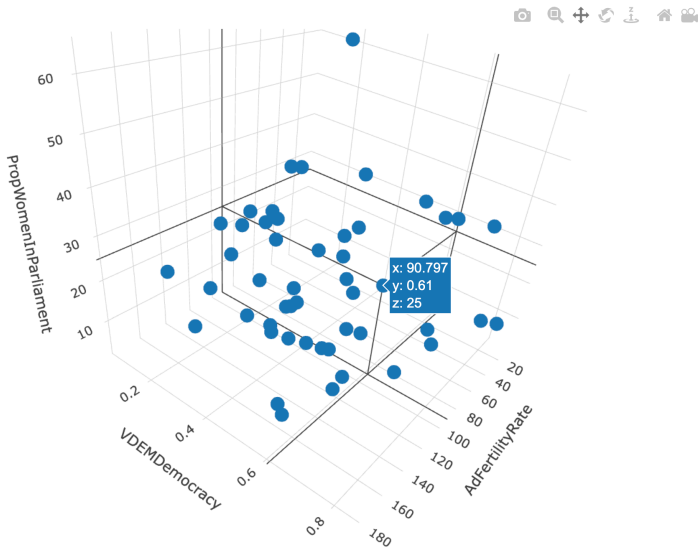
Contour Plot (Prop. Women Legislators)



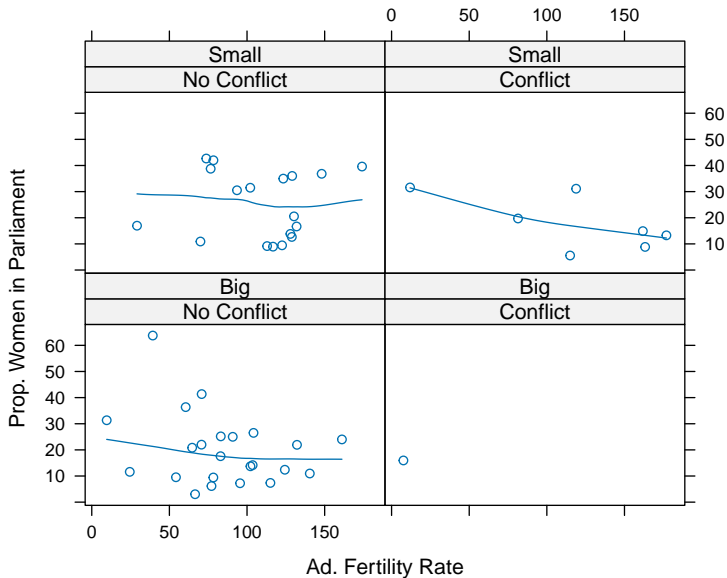
"3-D" Scatterplot



Interactive 3-D Scatterplot



“Four-Way” Scatterplots



“Tidy” Graphics / Visualization

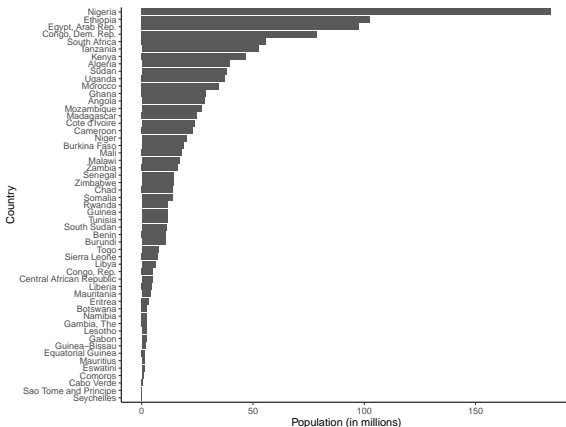
Visualization in the Tidyversetm:

- Loosely based on Wilkinson’s “Grammar of Graphics”
- ggplot2 is the core package for doing graphics in the Tidyversetm...
- ...but there are many others (check that page for any package starting with the letters gg...)
- Syntax is very different, and more “modular”
- Visualizations are built in layers / stages

ggplot Example 1: Barchart

```
p<-ggplot(data=Africa, aes(x=reorder(Country,Population),  
                             y=Population/1000000)) +  
  geom_bar(stat="identity") +  
  labs(y="Population (in millions)",x="Country") +  
  theme_classic() + coord_flip()
```

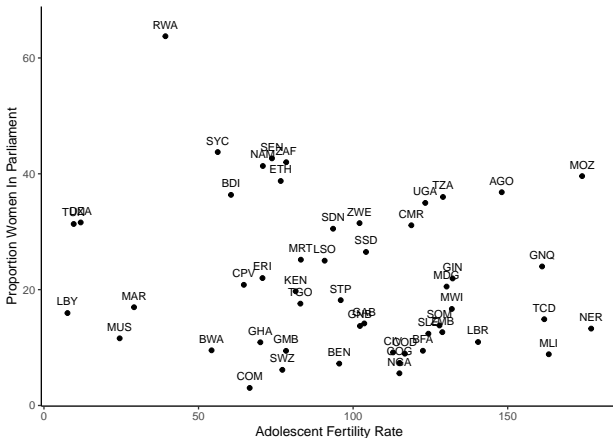
p



ggplot Example 2: Scatterplot

```
p2<-ggplot(data=Africa, aes(x=AdFertilityRate,y=PropWomenInParliament)) +  
  geom_point() + theme_classic() +  
  labs(y="Proportion Women In Parliament",x="Adolescent Fertility Rate") +  
  geom_text(label=Africa$ISO3,size=3,nudge_y=2)
```

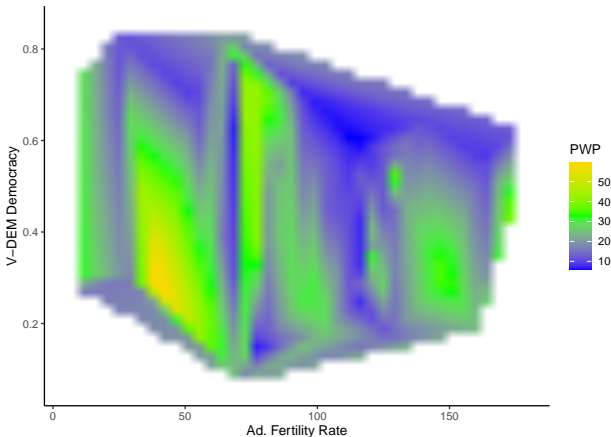
p2



ggplot Example 3: Contour Plot

```
p3<-ggplot(data=df,aes(x=x,y=y,fill=z)) +  
  geom_raster(interpolate = TRUE) +  
  scale_fill_gradientn(colours = c("blue","green","gold"),  
    na.value = "#FFFFFF",name="PWP") +  
  labs(y="V-DEM Democracy",x="Ad. Fertility Rate") +  
  theme_classic()
```

p3



R Graphics: The Power of plot

plot:

- `plot` (formally, `plot.default`) is the base-R graphics central command for visualization
- `plot()` is also a *method* – it does different things depending on what kind of object is placed inside the `()`s

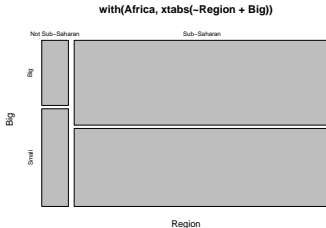
Example:

```
> plot(with(Africa, xtabs(~Region+Big)))
```

Crosstable:

```
> with(Africa, xtabs(~Region+Big))
```

Region	Big	Small
Not Sub-Saharan	2	3
Sub-Saharan	25	23



R Graphics: Parameters

The `par` command sets graphical parameters; type `?par` on the R command line for more...

A few common / useful `par` commands:

- `par(mar(a,b,c,d))` sets the *margins* of the plot (`a` = bottom, `b` = left, `c` = top, `d` = right)
- `par(mfrow=c(x,y))` draws multiple figures on the same plot; `x` is the number of rows of figures, `y` is the number of columns
- `par(new)` allows for overplotting (drawing multiple graphs “on top of” each other)
- `xlog`, `ylog` allow for logarithmic scales on plots

R Graphics: Making Things

To create a graphic, you have to open a *graphics device*...

- The command sequence is basically (a) open the device, (b) do the things, (c) close the device (which outputs the file).
- Example:

```
> # Make a PDF in the local / working directory:  
>  
> pdf("MyPDF.pdf",7,5) # Turn on the PDF device; make the aspect ratio 7:5  
>   (that is, seven units wide and five units tall)  
> plot(muslperc,adrate,data=Africa) # Make the plot  
> dev.off() # Turn off the PDF-maker device
```

Available graphics devices include:

- pdf() (PDFs)
- png() (PNGs)
- bmp() (bitmaps)
- jp() (JPEGs)
- tiff() (TIFFs)