

Why visualize data?

Part 1

Facts, truth, and beauty

What is truth?

Core principles of the universe?

Underlying trends in society?

Something transcendental?

Reality?

How do we find truth?

Science!



Neil deGrasse Tyson 

@neiltyson



The good thing about Science is that it's true whether or not you believe in it.

10:41 AM · Jun 14, 2013 · [TweetDeck](#)

14.3K Retweets **8.3K** Likes



761



14.3K



8.3K



But wait!

Beware of scientism!

"... promotion of science as the best or only objective means by which society should determine normative and epistemological values"

Science is not the only way

Art

Music

Literature

Religion

Nature

Nothing here is factual...

...but it all reveals truth



Cosette from *Les Misérables*



King Lear

Beethoven's 9th symphony

Facts \neq truth

**Where does truth come when
there are no facts?**

Beauty

Rhetoric and beauty

Essence • Structure

Content • Form

Truth • Beauty

Content + form

**Art is how we translate core,
essential content (or truth!)
to different forms
for specific audiences.**

Truth is beautiful

Truth \neq facts

**Truth comes from aesthetic
combination of content and form**

Facts require beauty to be true

Data and beauty

Just show me the data!

```
head(my_data, 10)
```

```
## # A tibble: 10 x 2
##       x     y
##   <dbl> <dbl>
## 1  55.4  97.2
## 2  51.5  96.0
## 3  46.2  94.5
## 4  42.8  91.4
## 5  40.8  88.3
## 6  38.7  84.9
## 7  35.6  79.9
## 8  33.1  77.6
## 9  29.0  74.5
## 10 26.2  71.4
```

```
mean(my_data$x)
```

```
## [1] 54.26327
```

```
mean(my_data$y)
```

```
## [1] 47.83225
```

```
cor(my_data$x, my_data$y)
```

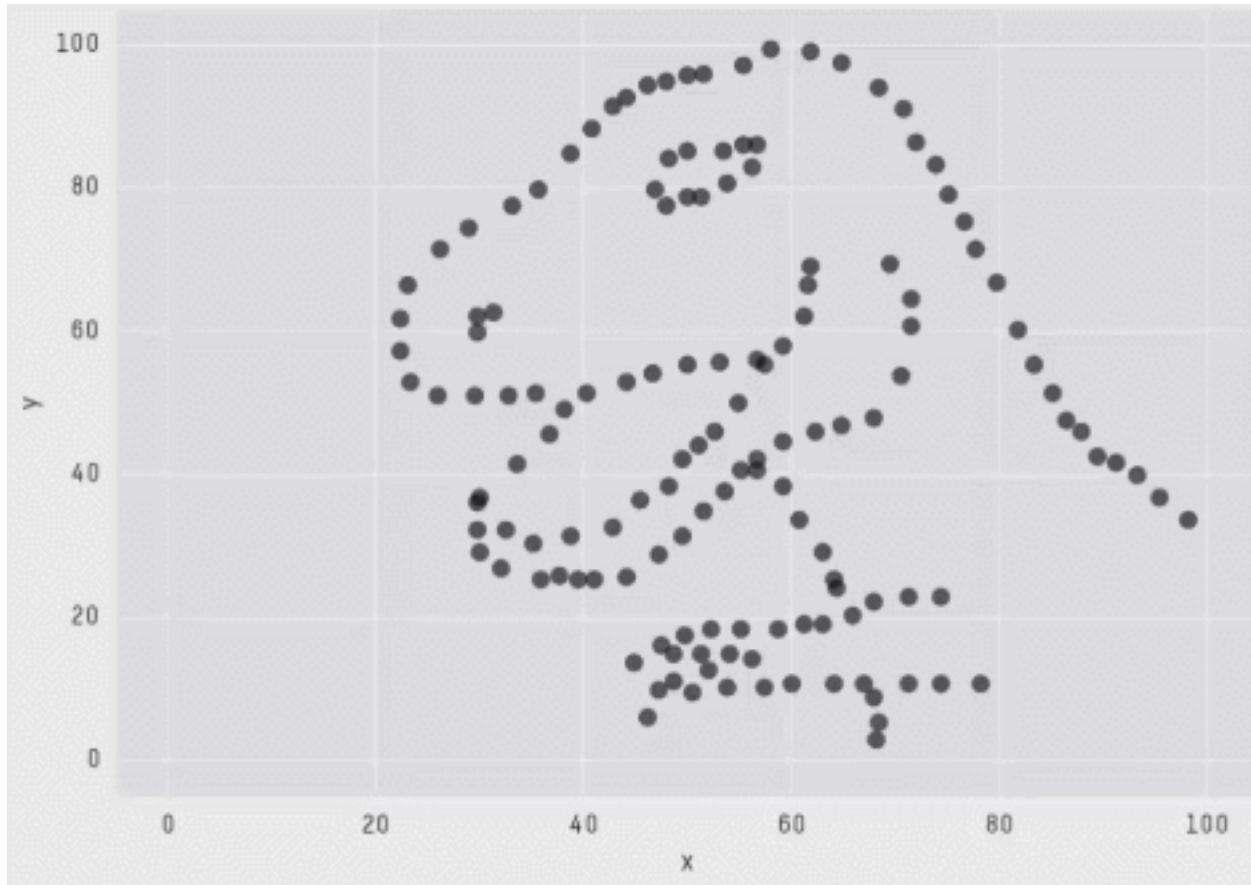
```
## [1] -0.06447185
```

Seems reasonable

Seems reasonable

No correlation

oh no

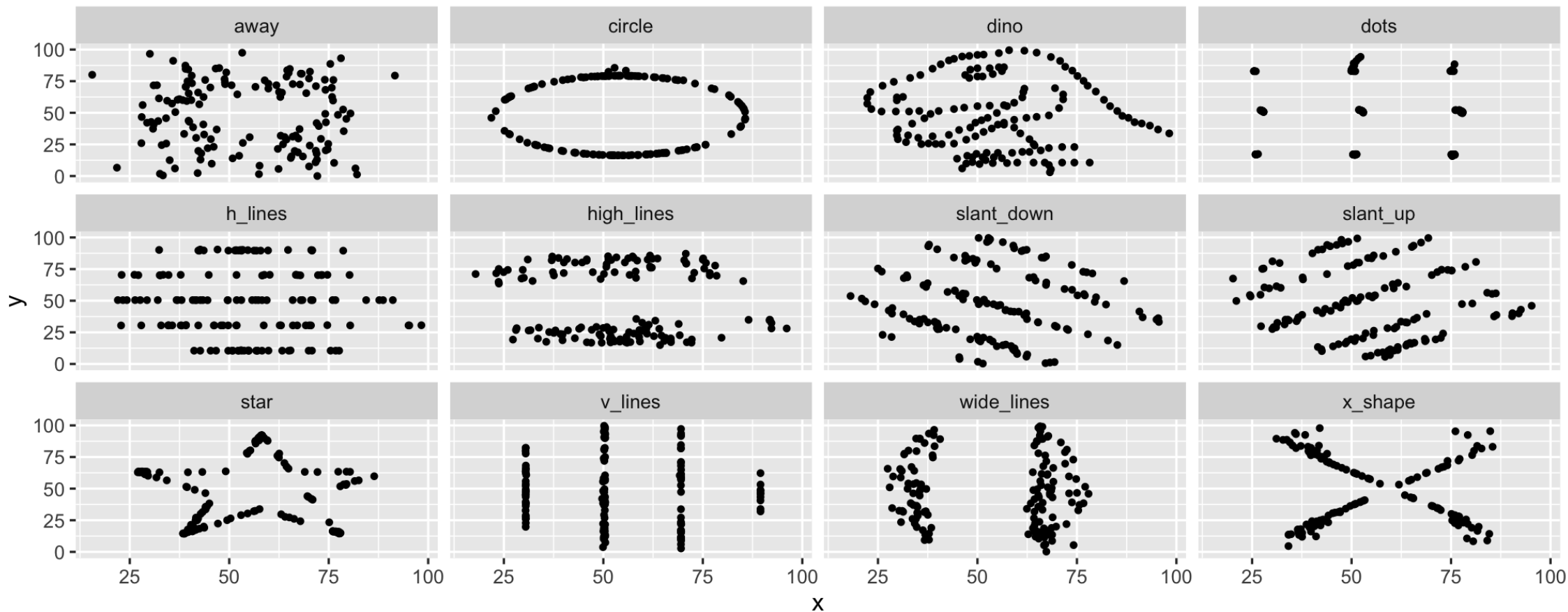


```
X Mean: 54.2659224  
Y Mean: 47.8313999  
X SD   : 16.7649829  
Y SD   : 26.9342120  
Corr.  : -0.0642526
```

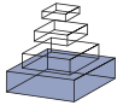
The Datasaurus Dozen

Raw data is not enough

Each of these has the same mean, standard deviation, variance, and correlation



Humans love patterns



Superior pattern processing is the essence of the evolved human brain

Mark P. Mattson^{1,2*}

¹ Laboratory of Neurosciences, National Institute on Aging Intramural Research Program, Baltimore, MD, USA

² Department of Neuroscience, Johns Hopkins University School of Medicine, Baltimore, MD, USA

Edited by:

J. Michael Williams, Drexel University, USA

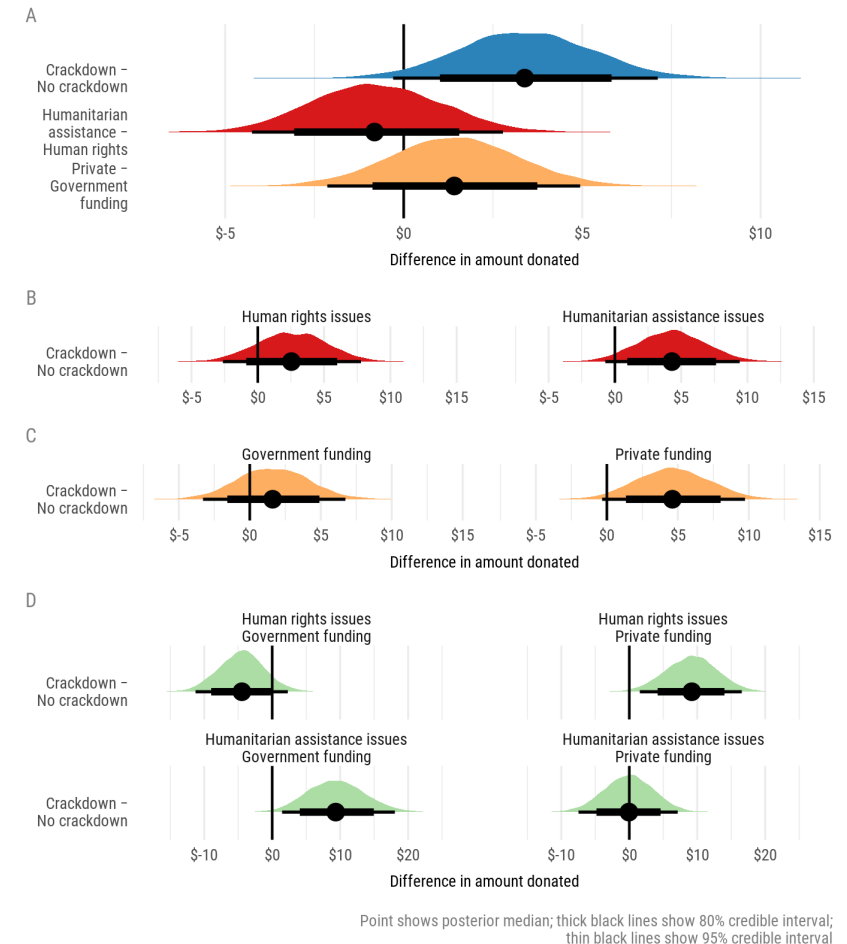
Humans have long pondered the nature of their mind/brain and, particularly why its capacities for reasoning, communication and abstract thought are far superior to other species, including closely related anthropoids. This article considers superior pattern

<https://doi.org/10.3389/fnins.2014.00265>

Beauty is necessary to see patterns

Table 2: Mean values and differences in means for amount donated in “crackdown” (treatment) and “no crackdown” (control) conditions; values represent posterior medians

H _{1b}	Amount _{Treatment}	Amount _{Control}	Δ	%Δ	p(Δ ≠ 0)
Crackdown – No crackdown	16.34	12.93	3.39	26.3%	0.97
Humanitarian assistance – Human rights	14.06	14.85	-0.82	-5.5%	0.67
Private – Government funding	15.13	13.71	1.42	10.4%	0.79
H _{2b} and H _{3b}	Amount _{Crackdown}	Amount _{No crackdown}	Δ	%Δ	p(Δ ≠ 0)
Human rights issues	17.4	14.86	2.54	17.2%	0.83
Humanitarian assistance issues	15.91	11.68	4.3	36.9%	0.95
Government funding	13.83	12.24	1.61	13.1%	0.74
Private funding	18.95	14.23	4.62	32.4%	0.97
H _{2b} and H _{3b} (nested)	Amount _{Crackdown}	Amount _{No crackdown}	Δ	%Δ	p(Δ ≠ 0)
Human rights issues, Government funding	10.56	15.15	-4.46	-29.5%	0.91
Human rights issues, Private funding	23.76	14.5	9.19	63.8%	0.99
Humanitarian assistance issues, Government funding	21.42	11.89	9.35	77.9%	0.99
Humanitarian assistance issues, Private funding	15.69	15.72	-0.05	-0.3%	0.51



Beauty is necessary for truth