Interactive graphics in R:

A state of the union

http://bit.ly/1f1qBYP

Hadley Wickham

@hadleywickham

RStudio

August 2015

Why interactive?

- **Pan/zoom**: navigate to area of interest
- **Query**: what is this point?
- **Linked brushing**: connect multiple graphics
- Plus many other specialised tools

	Strengths	Weaknesses	Examples
Speak in tongues	Fast!	Hard to install. Very deep	ggobi, cranvas, iplots, loon, ...
Hack existing graphics	Works with existing code!	Limited by existing code	animInt, shiny + ggplot2, plot.ly, ...
(Ab)Use the browser	Only need a browser to use	Can be slow. Mixed computation is challenging	R/qtlcharts, leaflet, threejs, networkd3, bokeh, plot.ly, ...

Speak in tongues

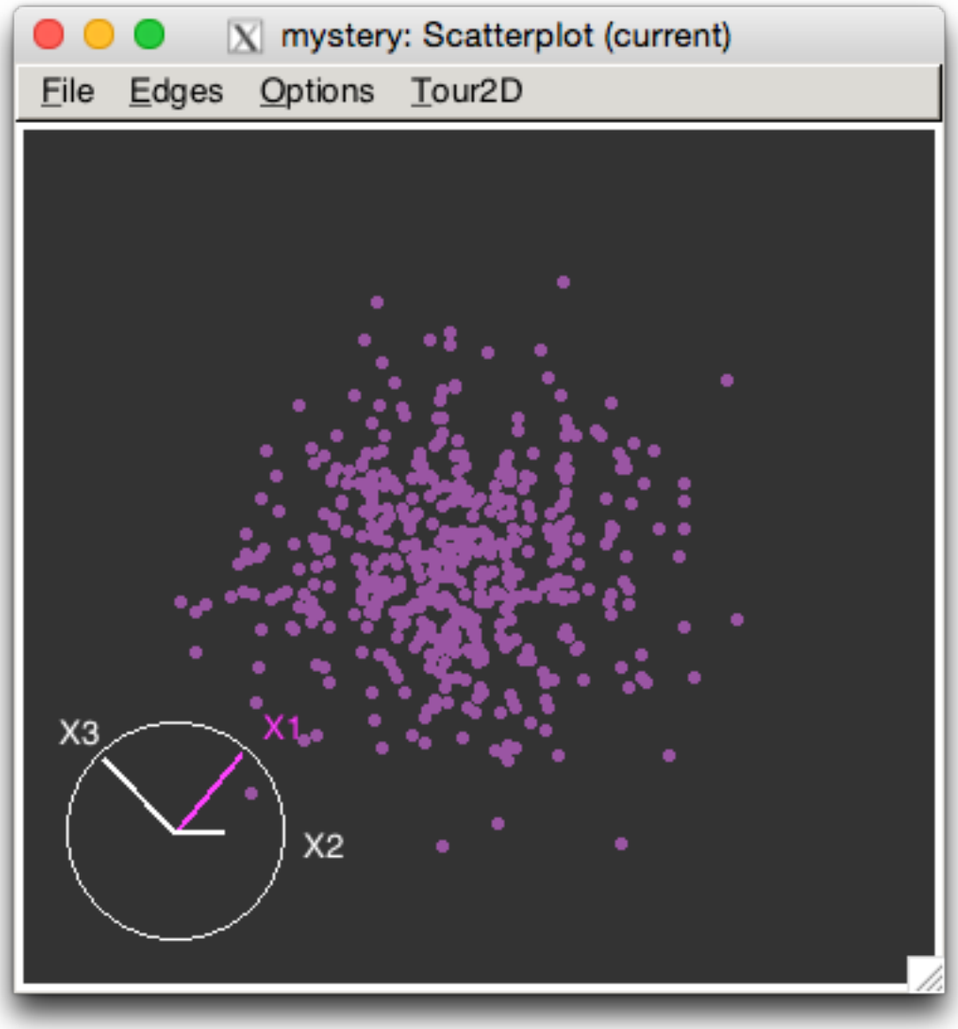
rggobi	Deborah Swayne, Duncan Temple Lang, Michael Lawrence, me	1991 (S + XGobi) 2001 (rggobi 1.0) 2006 (rggobi 2.0)	ggobi (C)
iplots	Simon Urbanek	2006 (iplots) 2009 (acinonyx)	C++, openGL
cranvas	Michael Lawrence, Heike Hofmann, Yihui Xie, Xiaoyue Cheng	2011	qtpaint (R) >> qtbase (R) >> qt (C++)
loon	Adrian Waddell, Wayne Oldford	2014	tcl/tk

rggobi

Known for: grand tour

Lets you script ggobi, a powerful tool for high-d vis.

See also clusterfly & classifly.

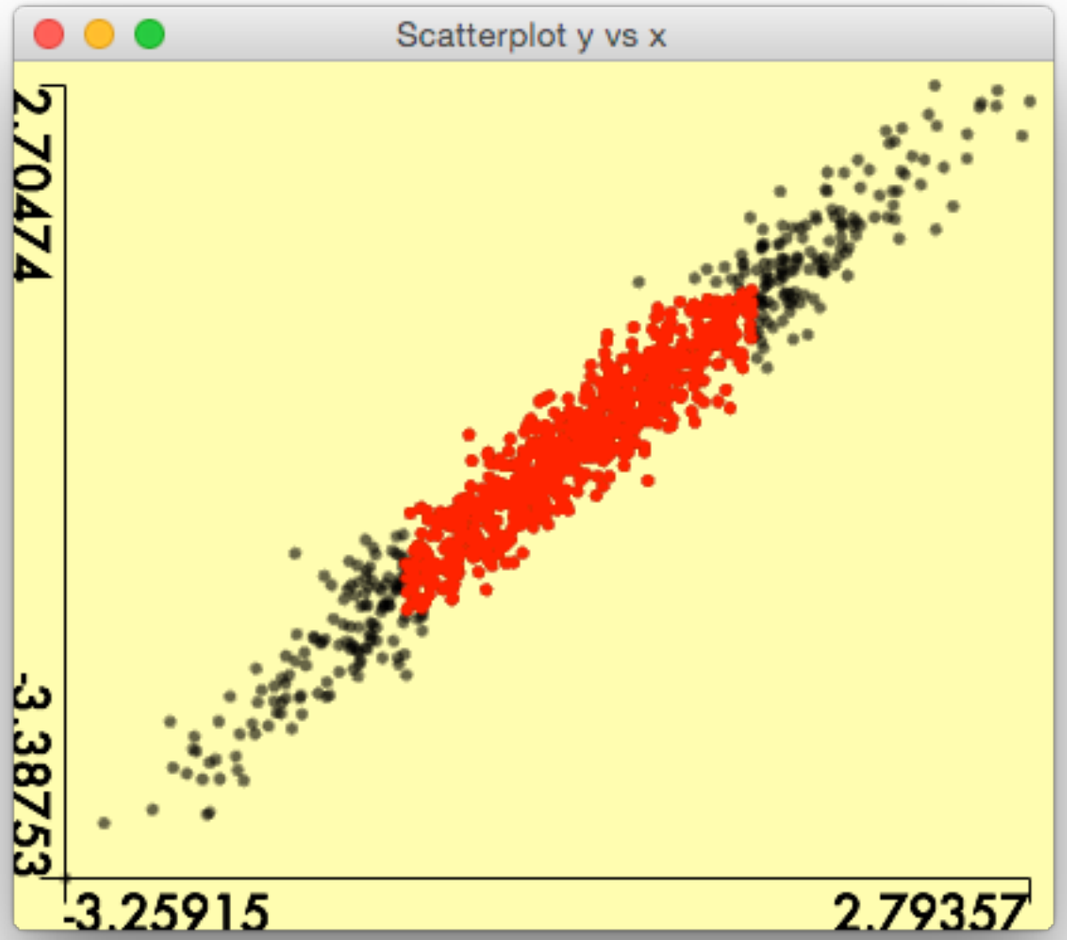


iplots

Known for: high-performance

Series of packages by Simon Urbanek.

Built on openGL (and the GPU)

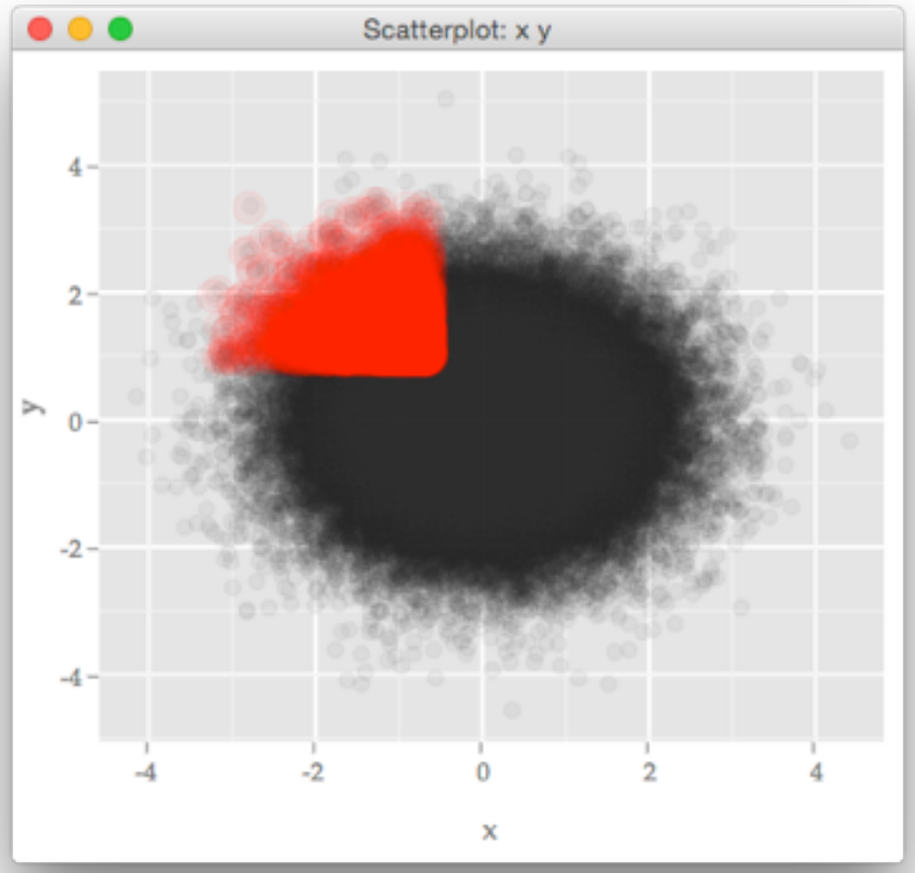


cranvas

Spiritual successor to ggobi.

Layered approach: qtbase, qtpaint, cranvas. Only R code in cranvas.

Built around a mutable data frame.

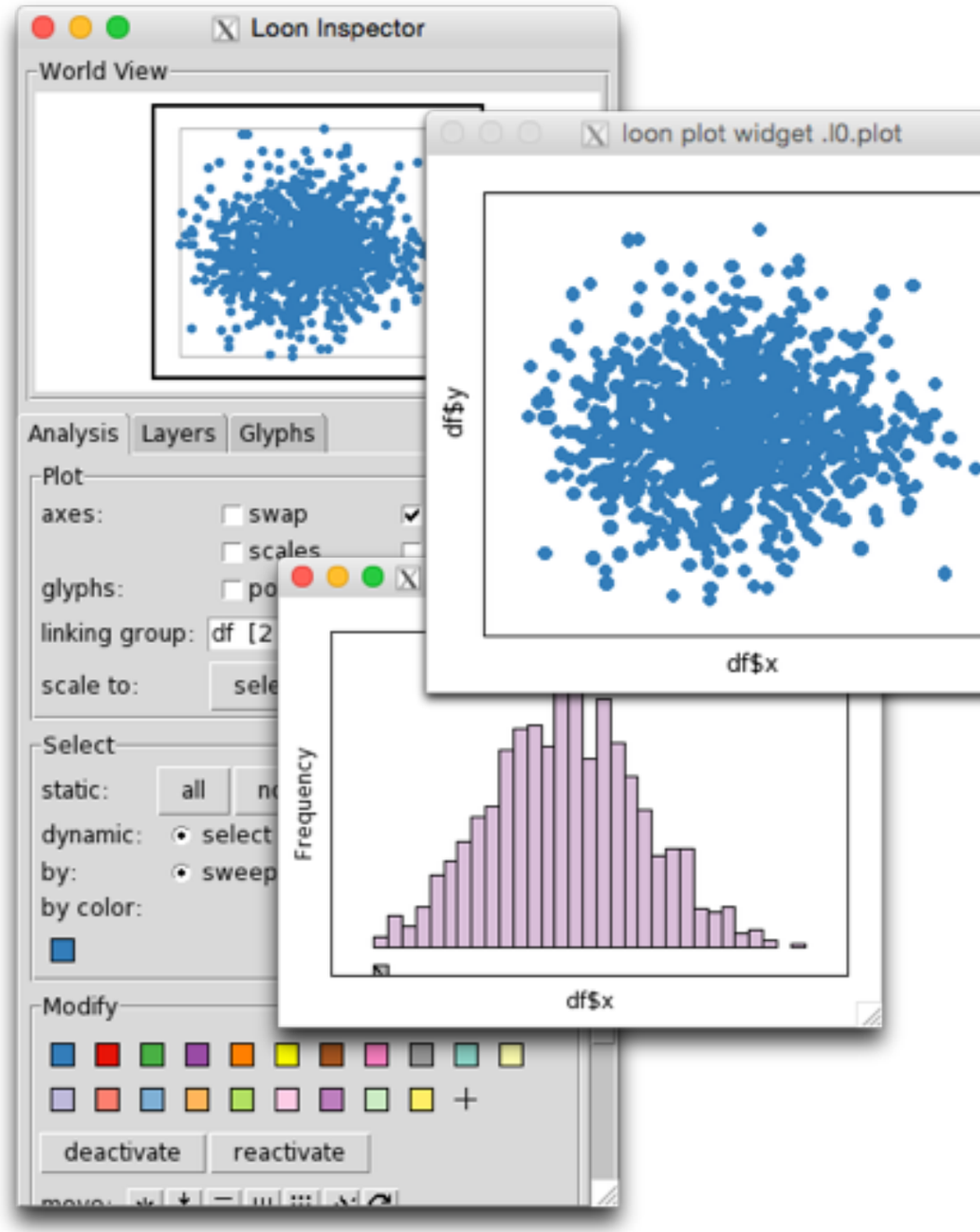


loon

Very recent package
(not publicly available yet)

Built on tcl/tk
(makes install easy)

Provides full interactive graphics environment within R.



Hacks

"A pragmatic solution to a complex problem."

animInt	Toby Dylan Hocking, Susan VanderPlas, Carson Sievert	Hacks ggplot2 to add animation, querying & linked brushing. Pure JS.
ggplot2 + shiny	Winston Chang	Hacks ggplot2 to add querying and linked brushing. Built on shiny
Others	animation, ggiraph, gridSVG, playwith, zoom, ...	

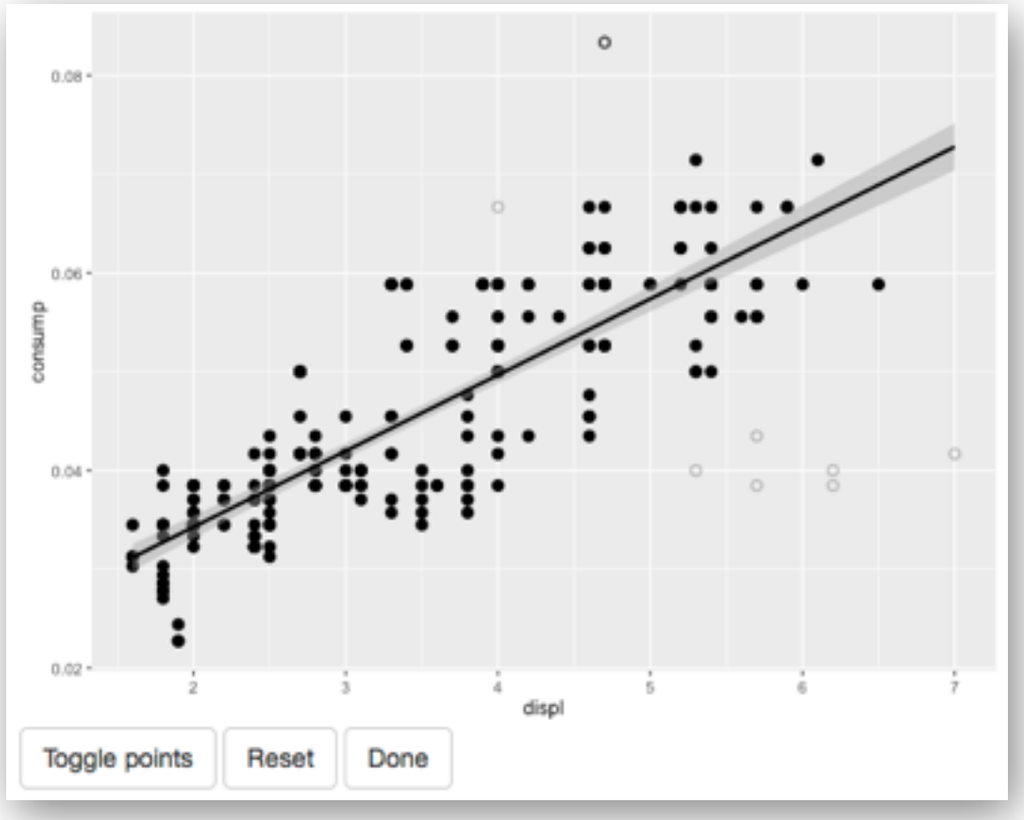
animInt

ggplot2 + shiny

Written by Winston Chang

Access ggplot2 (and base) brush and hover events from shiny

Makes it possible to create interactive ggplots



Abuse the browser

plotly

R/qtlcharts

tree3

htmlwidgets for R

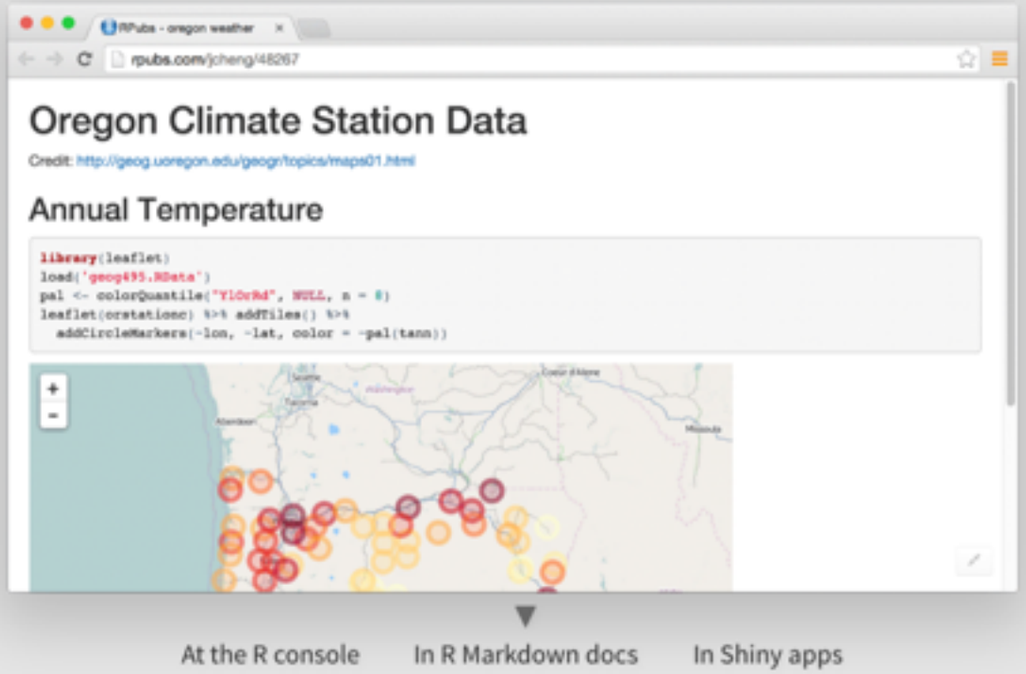
Home | Showcase | Develop | GitHub

Bring the best of JavaScript data visualization to R

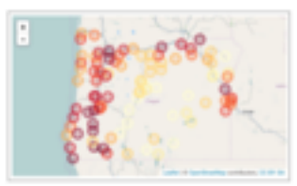
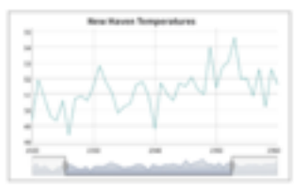
Use JavaScript visualization libraries **at the R console**, just like plots

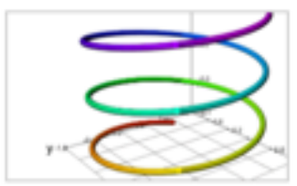
Embed widgets in **R Markdown** documents and **Shiny** web applications

Develop new widgets using a framework that seamlessly bridges R and JavaScript



Widgets in action

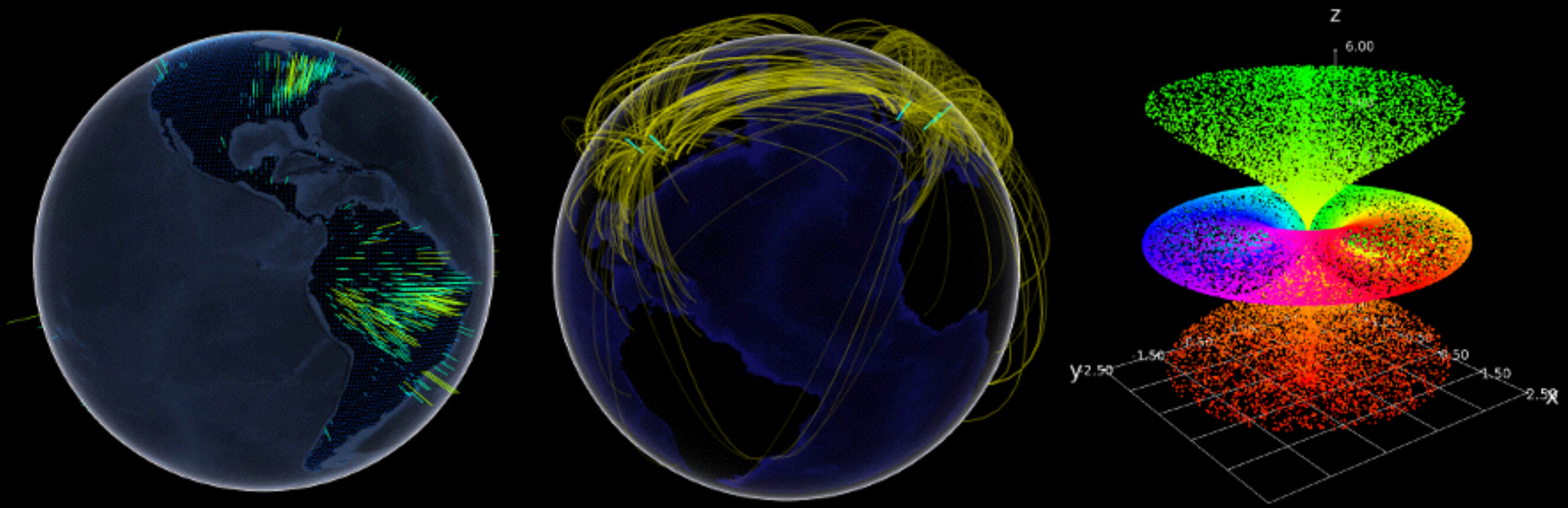


See how just a line or two of R code can be used to create interactive visualizations with Leafet (mapping), dygraphs (time-series), networkD3 (graph visualization), and more.

See the showcase »

threejs

http://bwlewis.github.io/rthreejs/



Superzip | Interactive map | Data explorer

leaflet

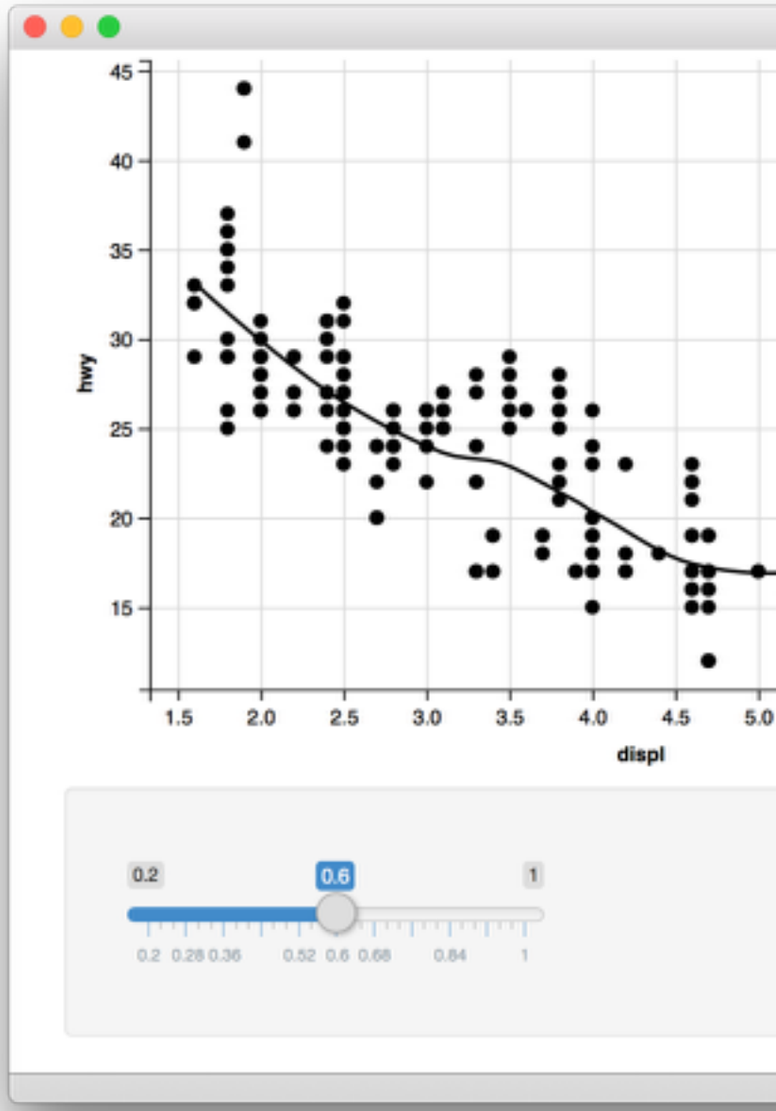
https://rstudio.github.io/leaflet/

ggvis

Goal: ggplot2 + interactivity

Unification of animation, streaming & interactivity via reactivity (from Shiny).

Lots of bits missing, but a lot of promise.



Where should computation occur?

- In R? Can do anything you can do in R & you don't need to learn a new language.
- In JS? Computation done closer to rendering, so latency is lower.
- A mix? Can you have the best of both worlds?

Conclusion

	Strengths	Weaknesses	Examples
Speak in tongues	Fast!	Hard to install. Designed for deep users	ggobi, cranvas, iplots, loon, ...
Hack existing graphics	Works with existing code!	Limited by existing code	animInt, shiny + ggplot2, plot.ly, ...
(Ab)Use the browser	Only need a browser to use	Can be slow. Mixed computation is challenging	R/qtlcharts, leaflet, threejs, networkd3, bokeh, plot.ly, ...

http://bit.ly/1f1qBYP

https://github.com/hadley/15-state-of-the-union

Reproducibility

- What does you want to reproduce? Results of analysis or path of analysis?
- Connection to R makes all graphics fundamentally more reproducible.
- Most packages allow you to capture code to create plot & capture interactive state.

Publication

- What does it mean to publish an interactive graphic?
- Browser based techniques have huge promise.
- Still, most interactive graphics will need some static snapshots