Stat405

Advanced layering

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Motivation

Layering

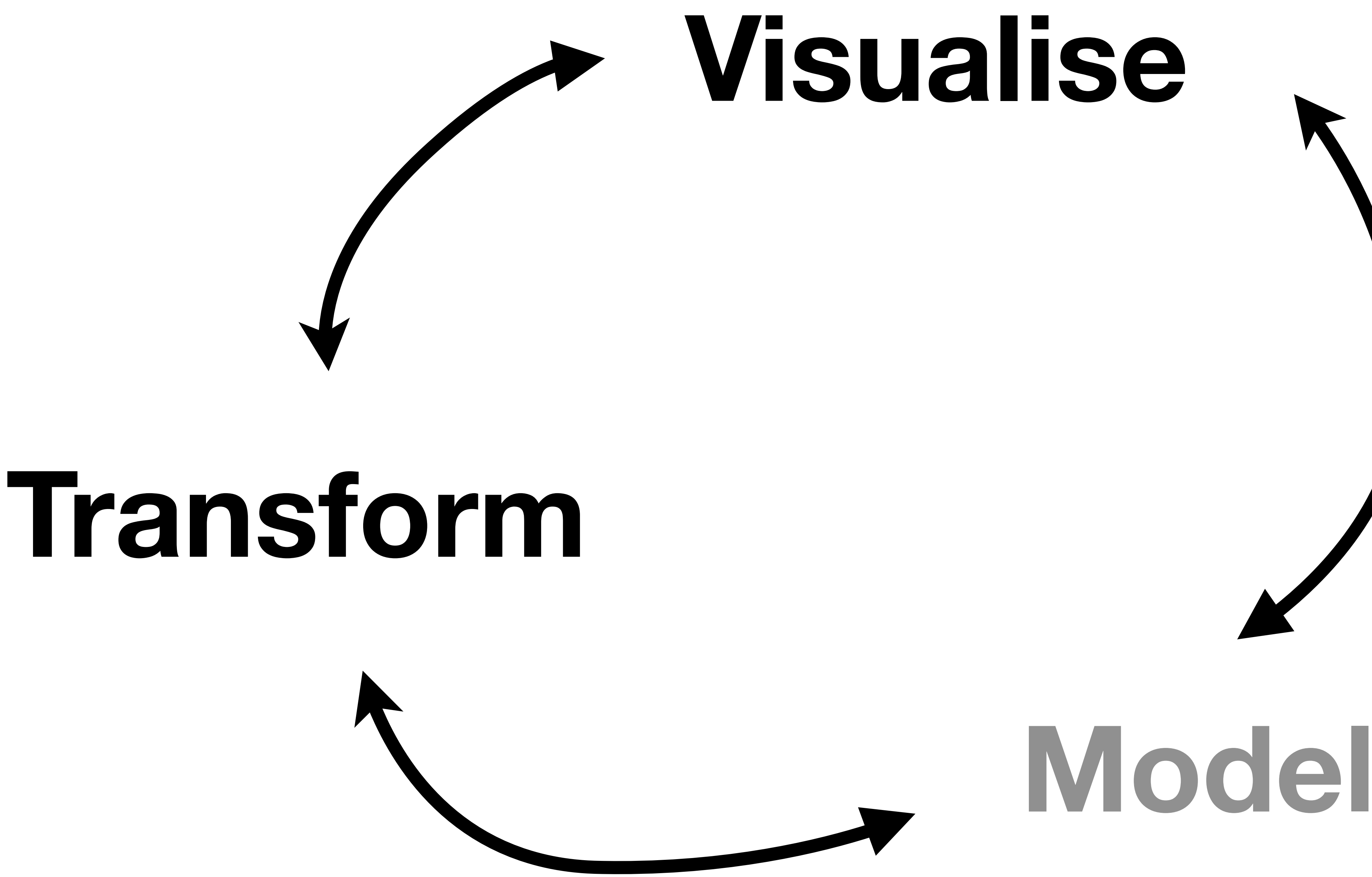
Key to rich graphics is taking advantage of layering.

Three types of layers: context, raw data, and summarised data

Each can come from a different dataset.

Iteration

- First plot is never the best. Have to keep iterating to understand what's going on.
- Don't try and do too much in one plot.
- Best data analyses tell a story, with a natural flow from beginning to end.


Visualise
Transform
Model

Geom review

Lines

- `geom_path`: join points with a "line"
- `geom_line`: "functional" line, draws ordered by lowest to highest x
- `geom_segment`: line segments specified by start and end locations
- `geom_vline`, `geom_hline`, `geom_abline`: lines that span the whole plot

Variability

- `geom_errorbar`, `geom_crossbar`, `geom_pointrange`: show lower, upper and mid point of y for fixed x
- `geom_linerange`: lower and upper
- `geom_ribbon`: continuous x

Distribution

- `geom_boxplot`: show summary of y for fixed x
- `geom_dotplot`: show individual points, adjusted so they don't overlap
- `geom_violin`: sideways density plots

Rectangles

- `geom_bar`: base always on x axis
- `geom_rect`: arbitrary rectangles (geom_bar is a special case)
- `geom_tile`/`geom_raster`: tile the plane with equally sized rectanges

Symmetric diamonds?

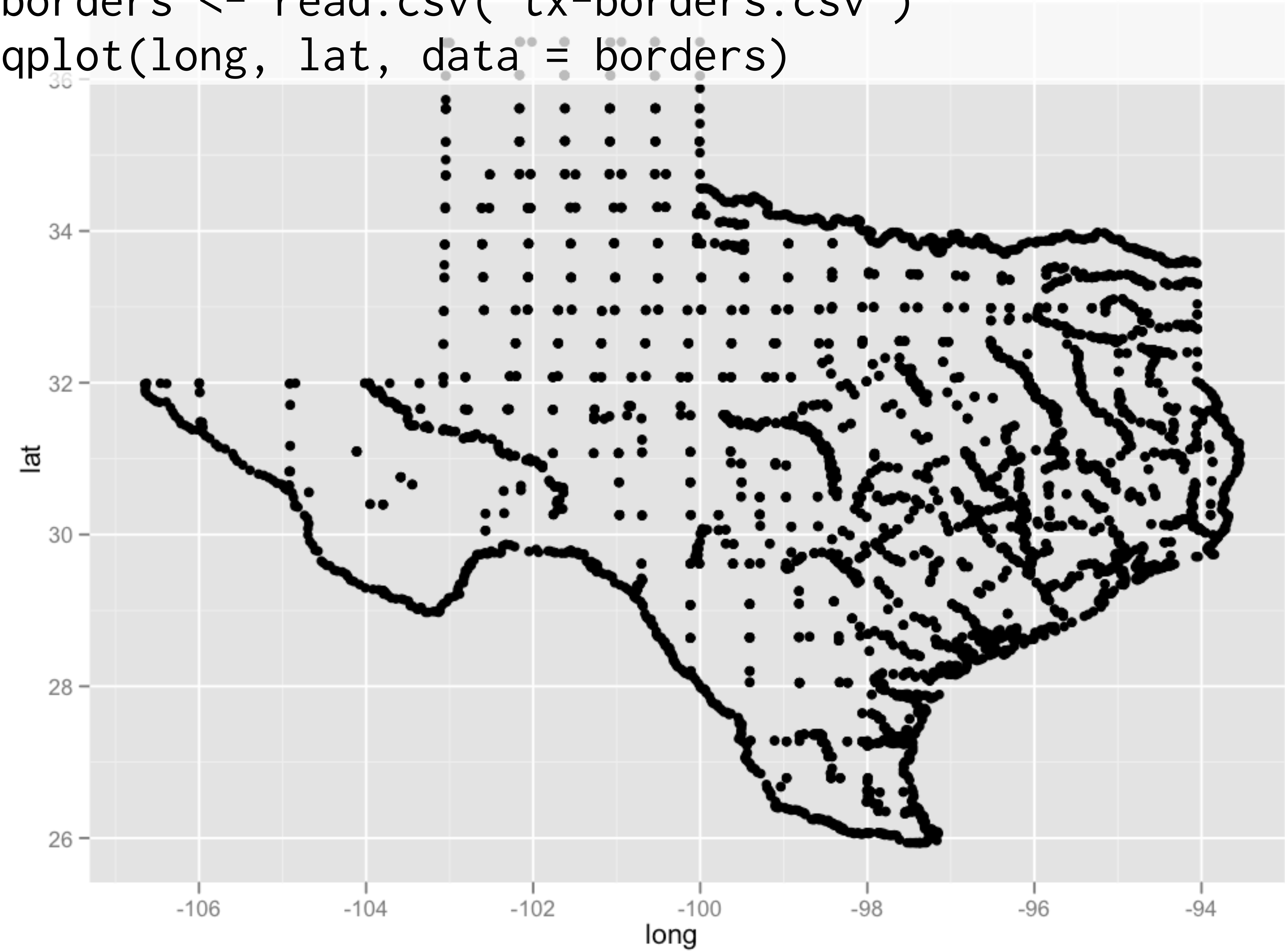
```
qplot(x, y, data = diamonds)
diamonds$x[diamonds$x == 0] <- NA
diamonds$x[diamonds$x > 10] <- NA
diamonds$y[diamonds$y == 0] <- NA
diamonds$y[diamonds$y > 10] <- NA
qplot(x, y, data = diamonds)

diamonds <- mutate(diamonds,
  area = x * y,
  lratio = log10(x / y))

qplot(area, lratio, data = diamonds)
diamonds$lratio[abs(diamonds$lratio) > 0.02] <- NA
```

```
ggplot(diamonds, aes(area, lratio)) +
  geom_point()

ggplot(diamonds, aes(area, lratio)) +
  geom_hline(yintercept = 0, size = 2, colour = "white") +
  geom_point() +
  geom_smooth(method = lm, se = F, size = 2)

ggplot(diamonds, aes(pr, abs(lratio))) +
  geom_hline(yintercept = 0, size = 2, colour = "white") +
  geom_point() +
  geom_smooth(se = F, size = 2)
```

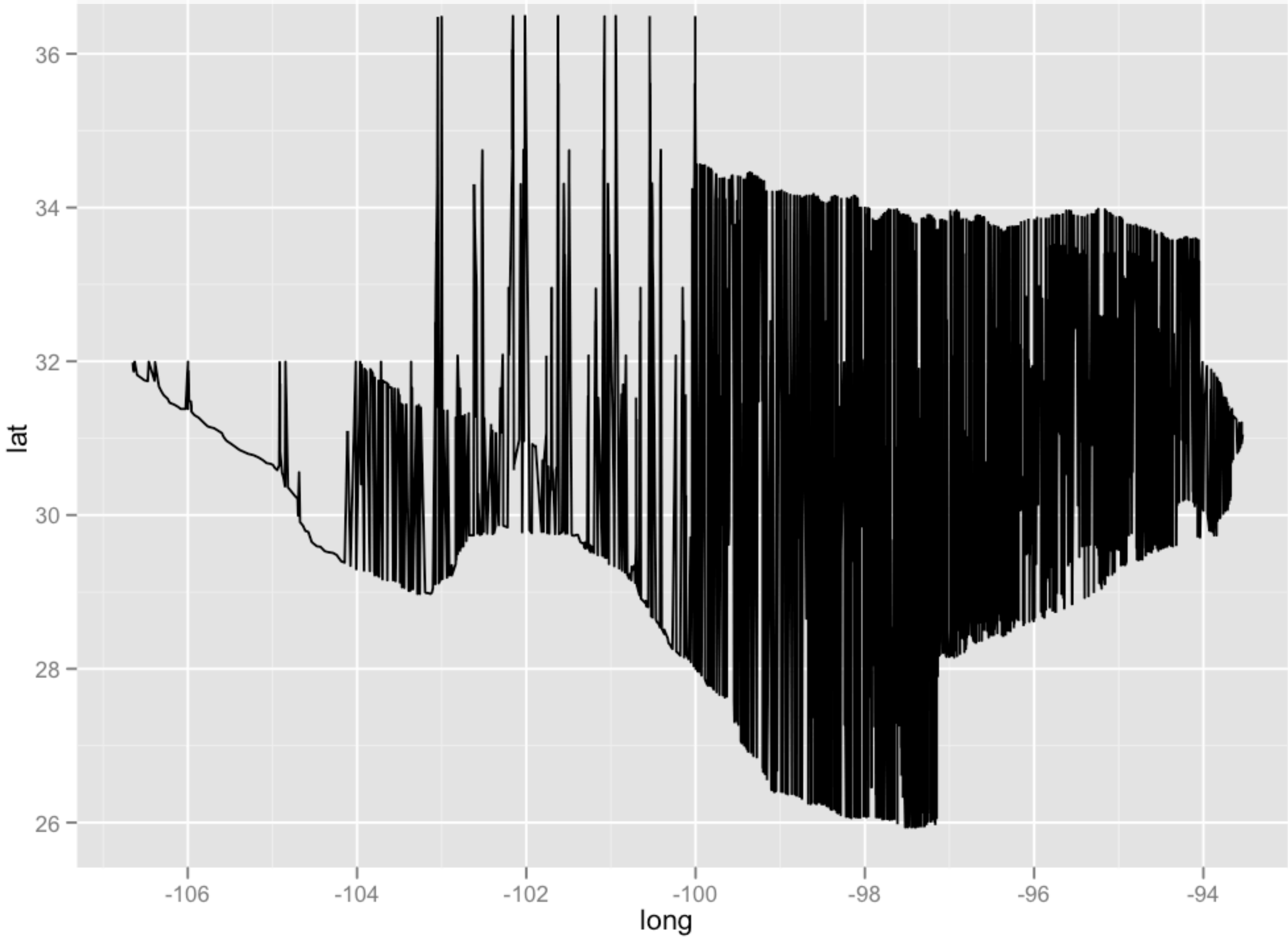
```
ggplot(diamonds, aes(area, abs(lratio))) +
  geom_hline(yintercept = 0, size = 2, colour = "white") +
  geom_boxplot(aes(group = round_any(area, 5))) +
  geom_smooth(se = F, size = 2)

ggplot(diamonds, aes(area, abs(lratio))) +
  geom_hline(yintercept = 0, size = 2, colour = "white") +
  geom_boxplot(aes(group = round_any(area, 5)))

ggplot(diamonds, aes(area, lratio)) +
  geom_hline(yintercept = 0, size = 2, colour = "white") +
  geom_boxplot(aes(group = interaction(sign(lratio),
   round_any(area, 5))), position = "identity")
```

More maps

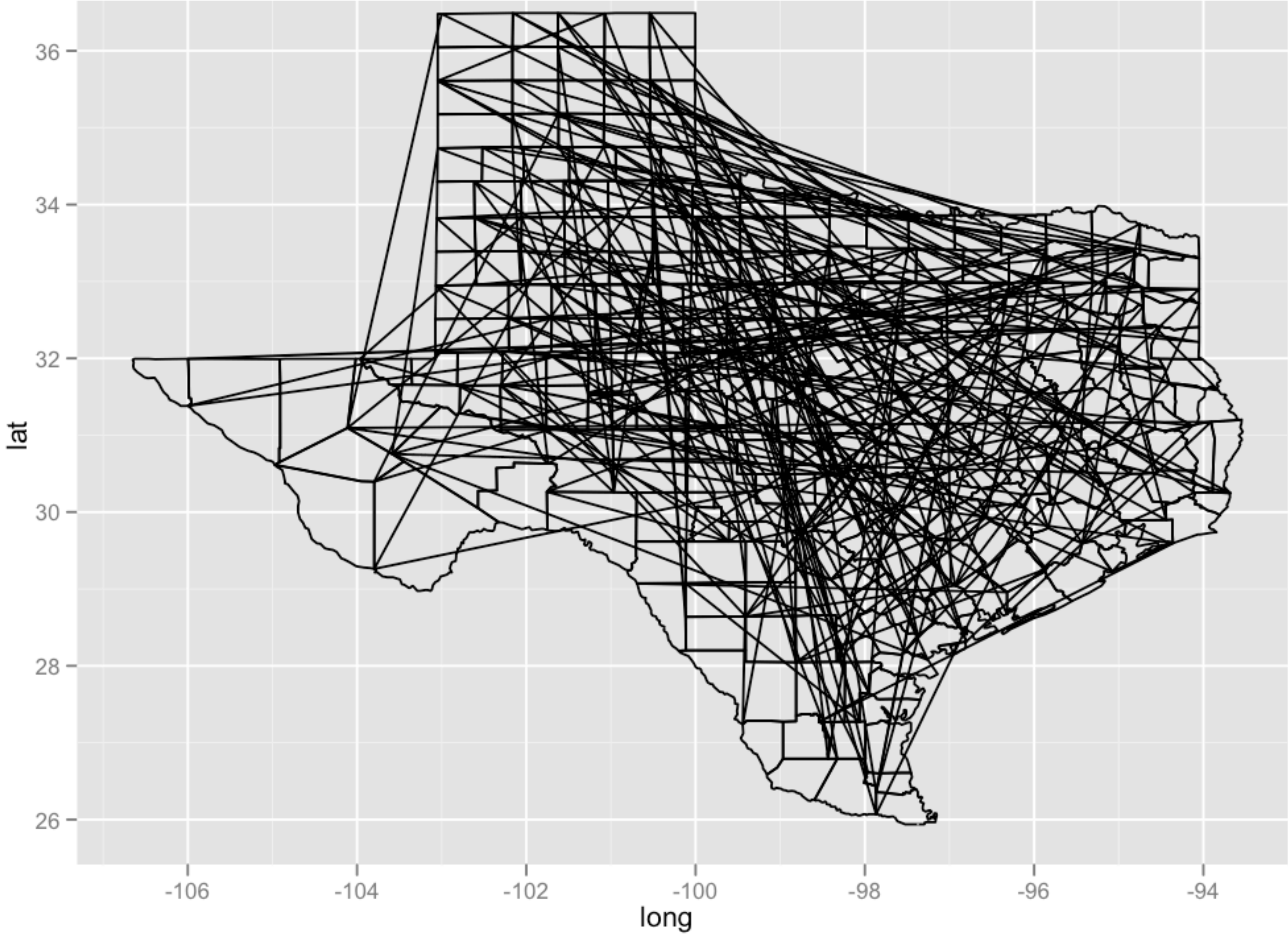
```
borders <- read.csv("tx-borders.csv")
qplot(long, lat, data = borders)
```



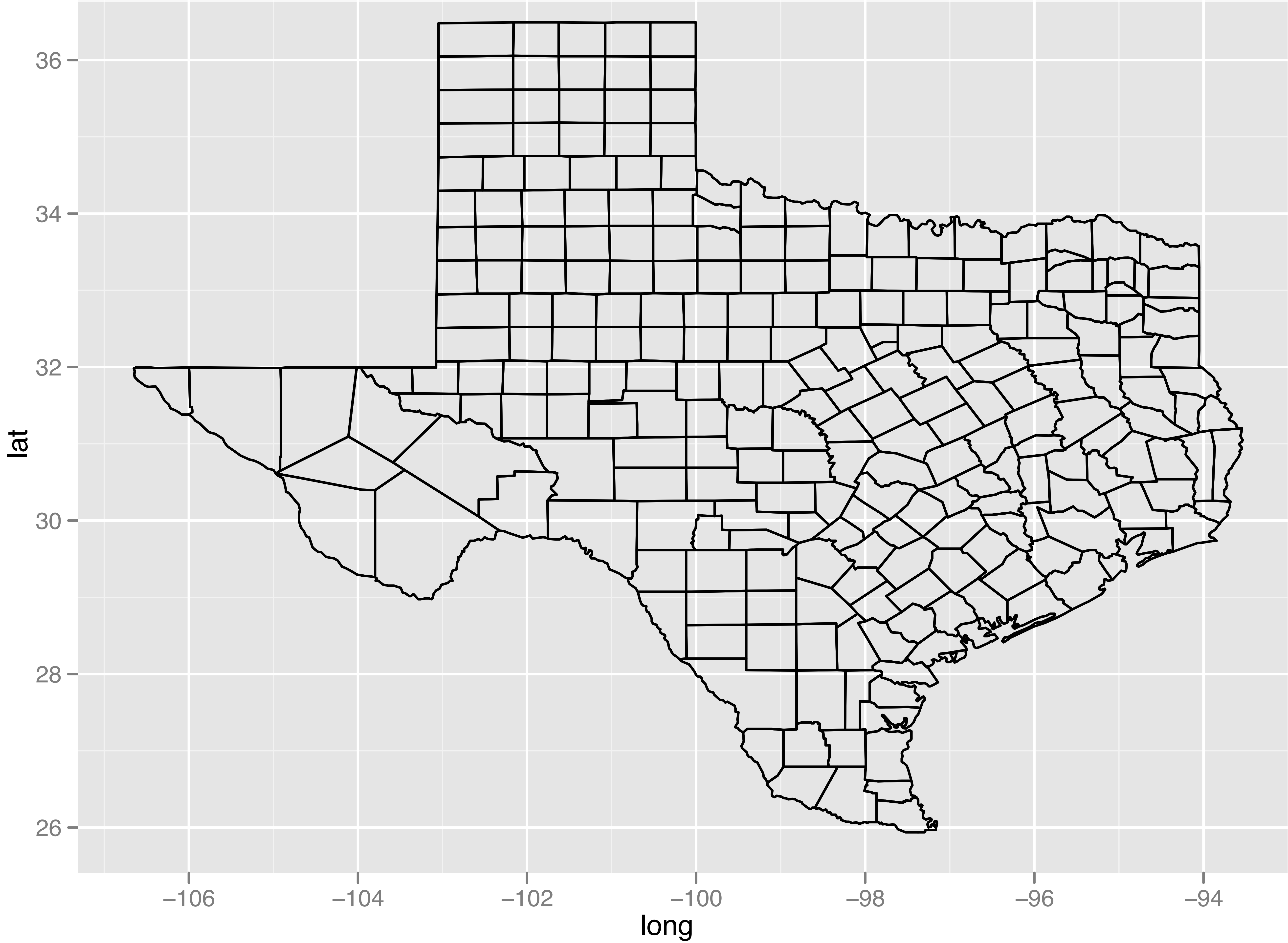
```
qplot(long, lat, data = borders, geom = "line")
```



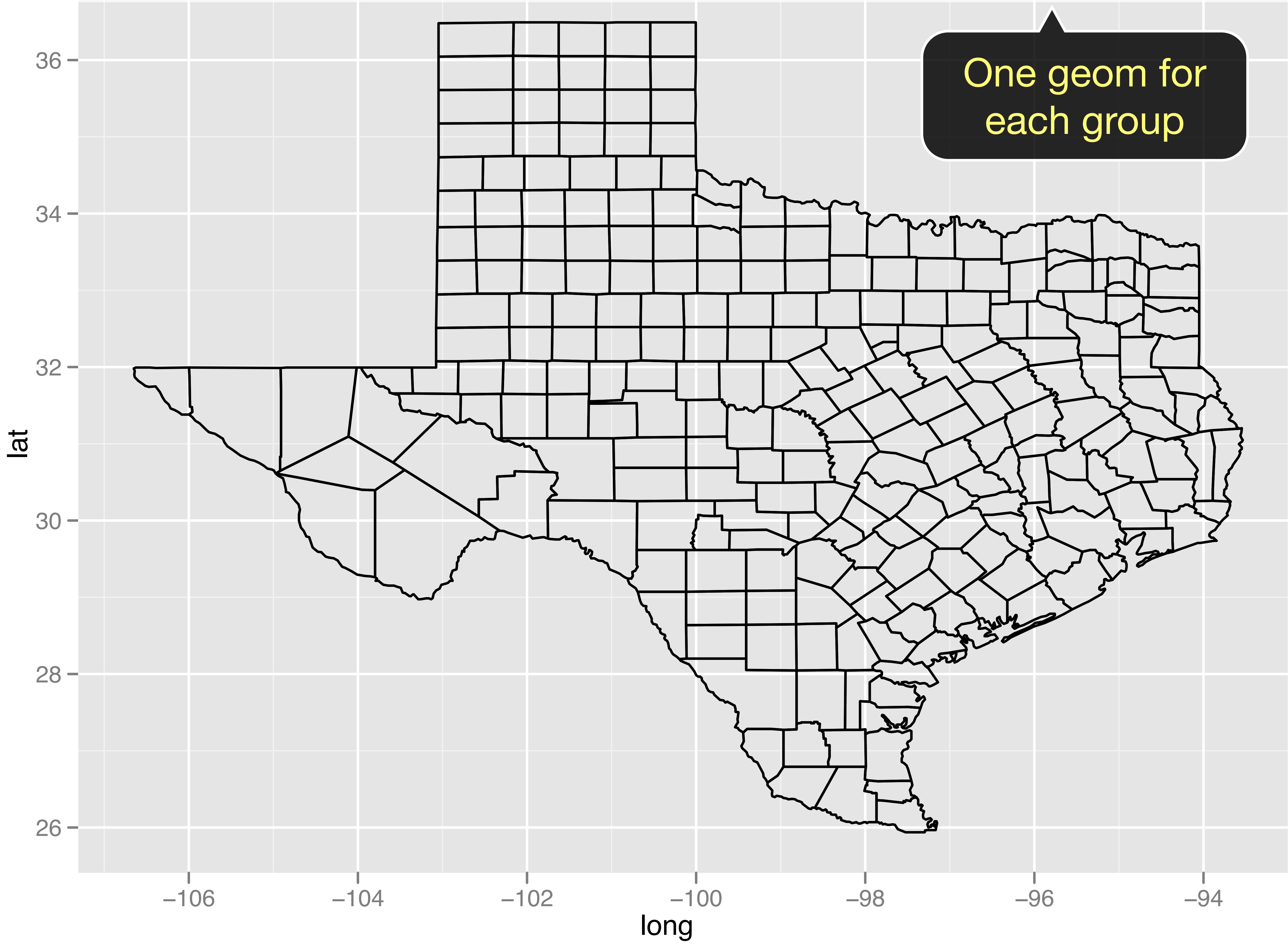
```
qplot(long, lat, data = borders, geom = "path")
```



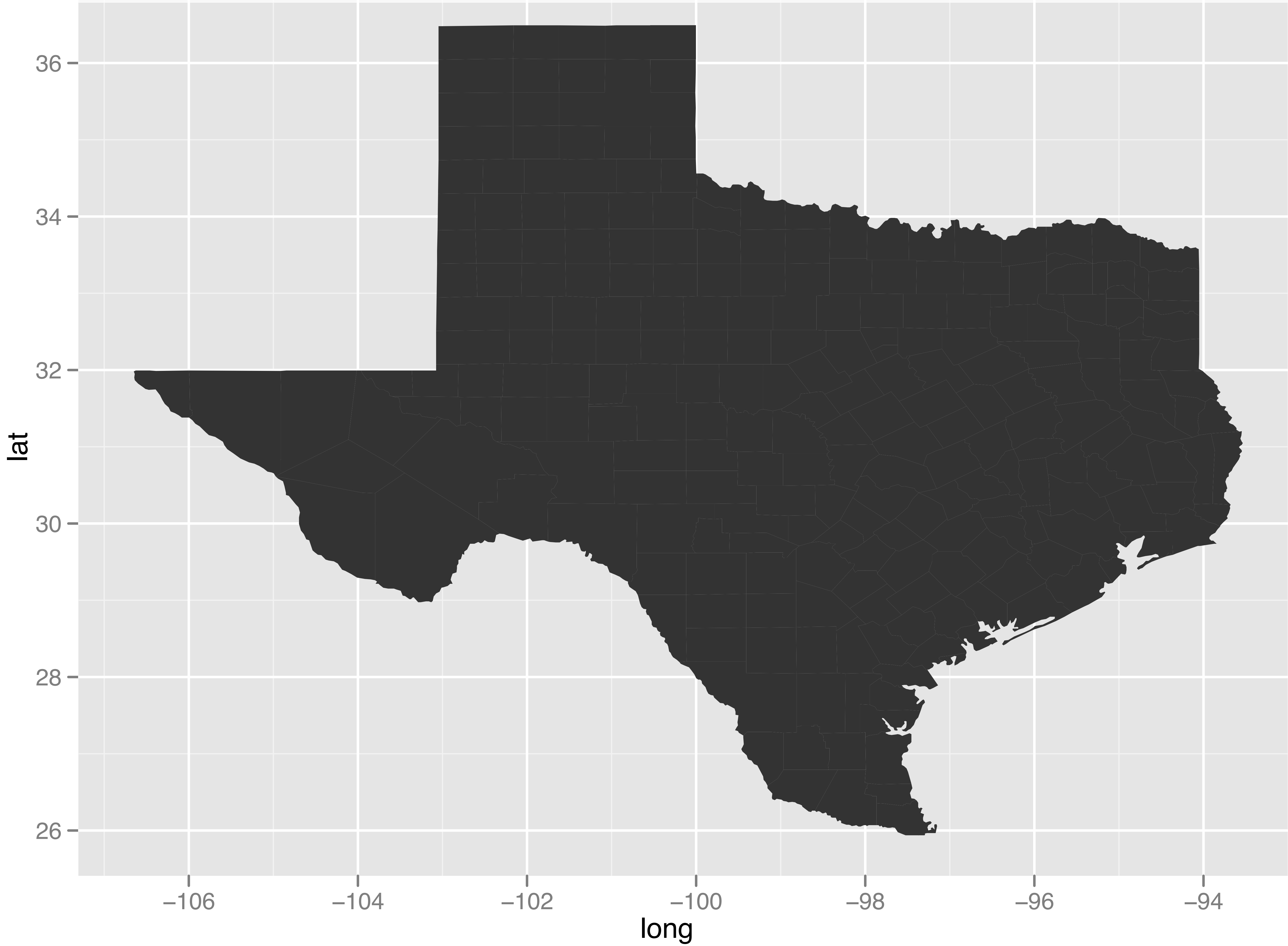
```
qplot(long, lat, data = borders, geom = "path", group = group)
```



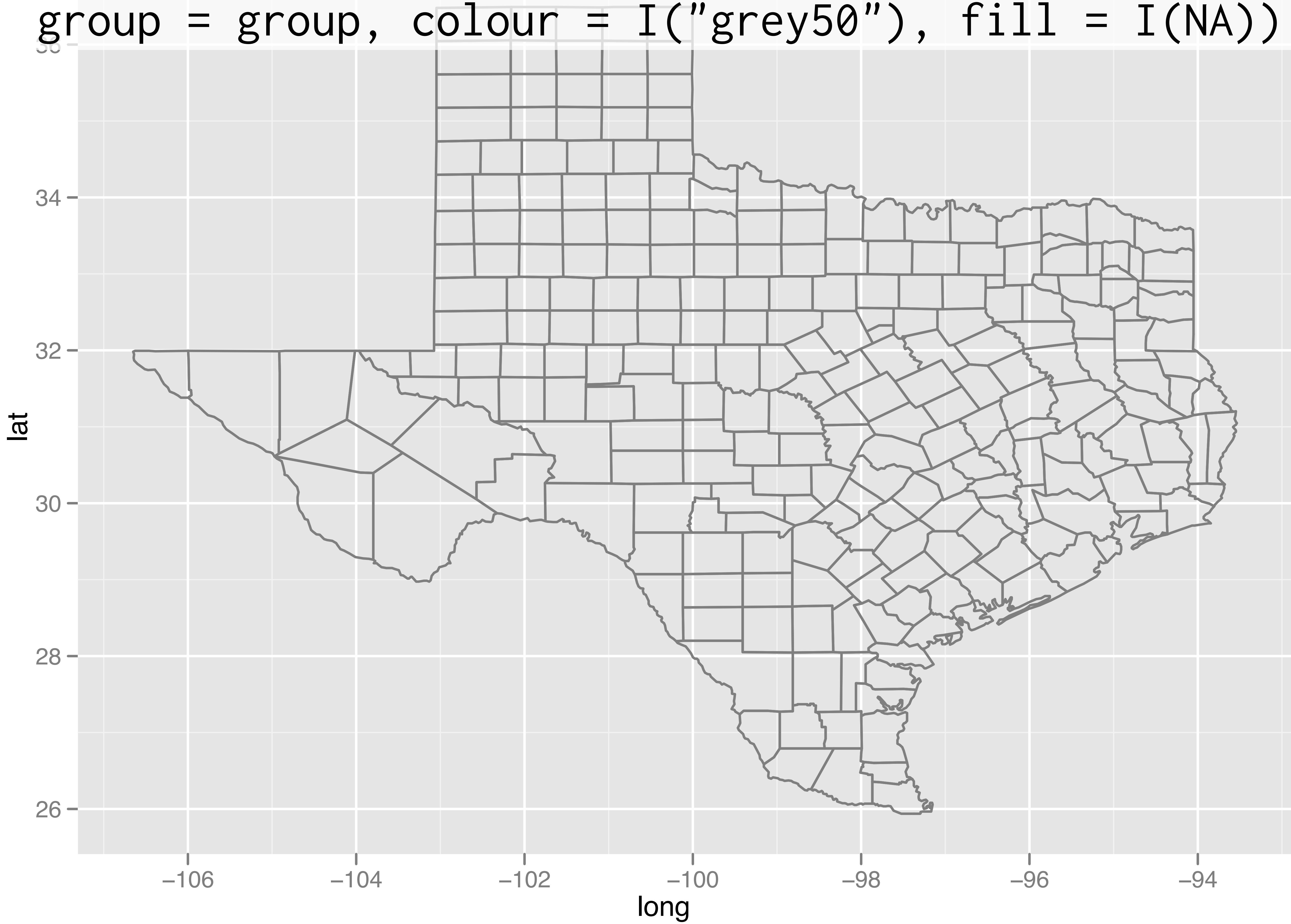
```
qplot(long, lat, data = borders, geom = "path", group = group)
```



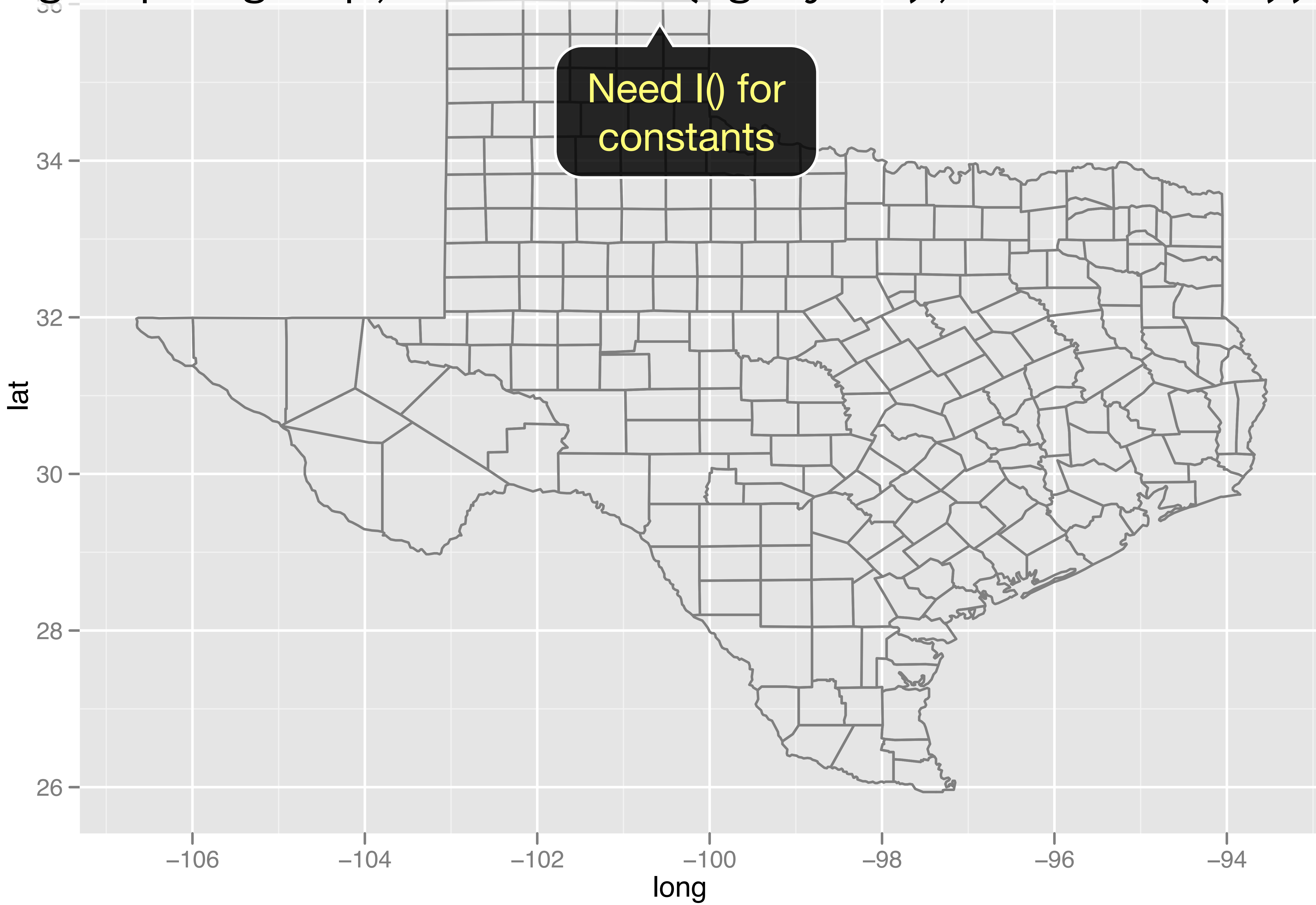
```
qplot(long, lat, data = borders, geom = "polygon", group = group)
```



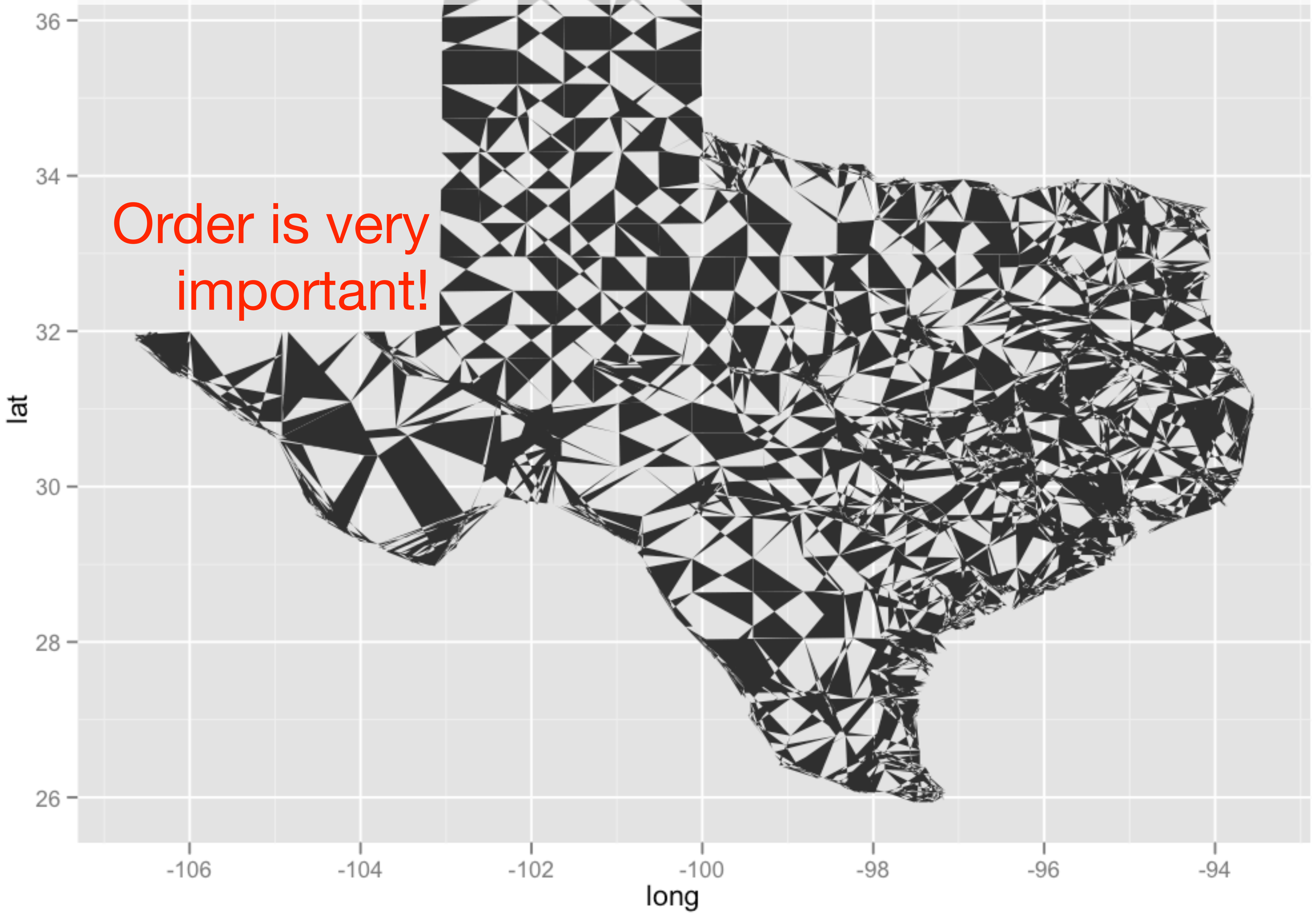
```
qplot(long, lat, data = borders, geom = "polygon",
  group = group, colour = I("grey50"), fill = I(NA))
```



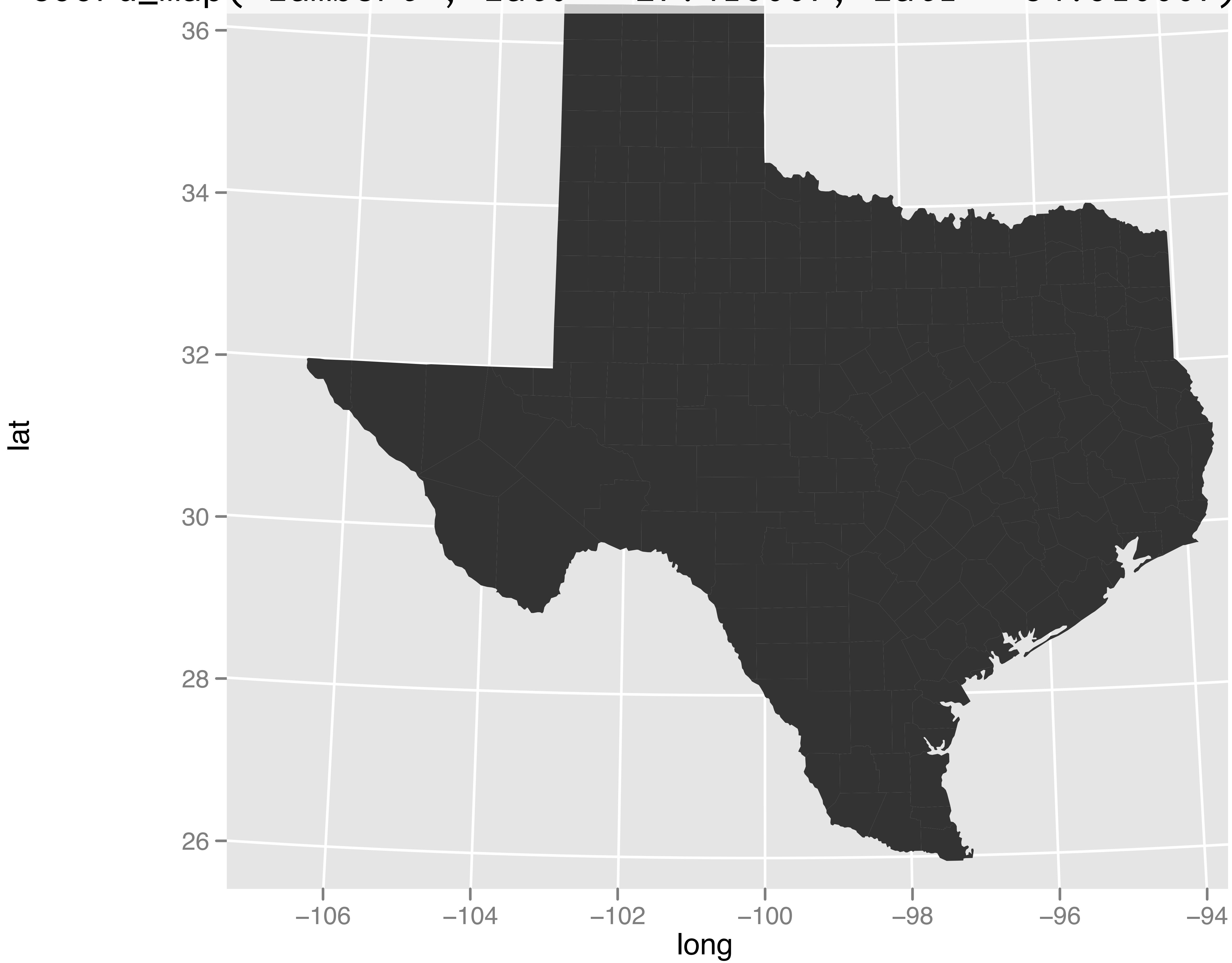
```
qplot(long, lat, data = borders, geom = "polygon",
  group = group, colour = I("grey50"), fill = I(NA))
```



```
borders <- borders[sample(nrow(borders)), ]
qplot(long, lat, data = borders, geom = "polygon", group = group)
```



```
qplot(long, lat, data = borders, geom = "polygon", group = group)
  coord_map("lambert", lat0 = 27.416667, lat1 = 34.916667)
```



Your turn

How could you add county names to this plot? (Hint: think about where you'd want to position them, and how you might summarise the data)

```r
library(ggplot2)
library(plyr)

tx <- read.csv("tx-borders.csv",
  stringsAsFactors = FALSE)

mid_range <- function(x) mean(range(x, na.rm = TRUE))
centers <- ddply(tx, "county", summarise,
  long = mid_range(long),
  lat = mid_range(lat))

ggplot(mapping = aes(long, lat)) +
  geom_path(aes(group = group), data = tx) +
  geom_text(aes(label = county), data = centers)
```

```
centroid <- function (x1, y1) {
  n <- length(x1)
  wrap <- c(n, 1:(n - 1))
  x2 <- x1[wrap]
  y2 <- y1[wrap]
  a <- x1 * y2 - x2 * y1
  s <- sum(a) * 3
  if (s < 1e-3) {
    c(mean(x1), mean(y1))
  } else {
    c(sum((x1 + x2) * a)/s, sum((y1 + y2) * a)/s)
  }
}

centers <- ddply(tx, "county", function(df) {
  c <- centroid(df$long, df$lat)
  data.frame(long = c[1], lat = c[2])
})
```

Map data

Maps are a common type of layer. They are easily recognized and provide context for spatial data. Fairly low-res maps of states and countries can be had from the maps package

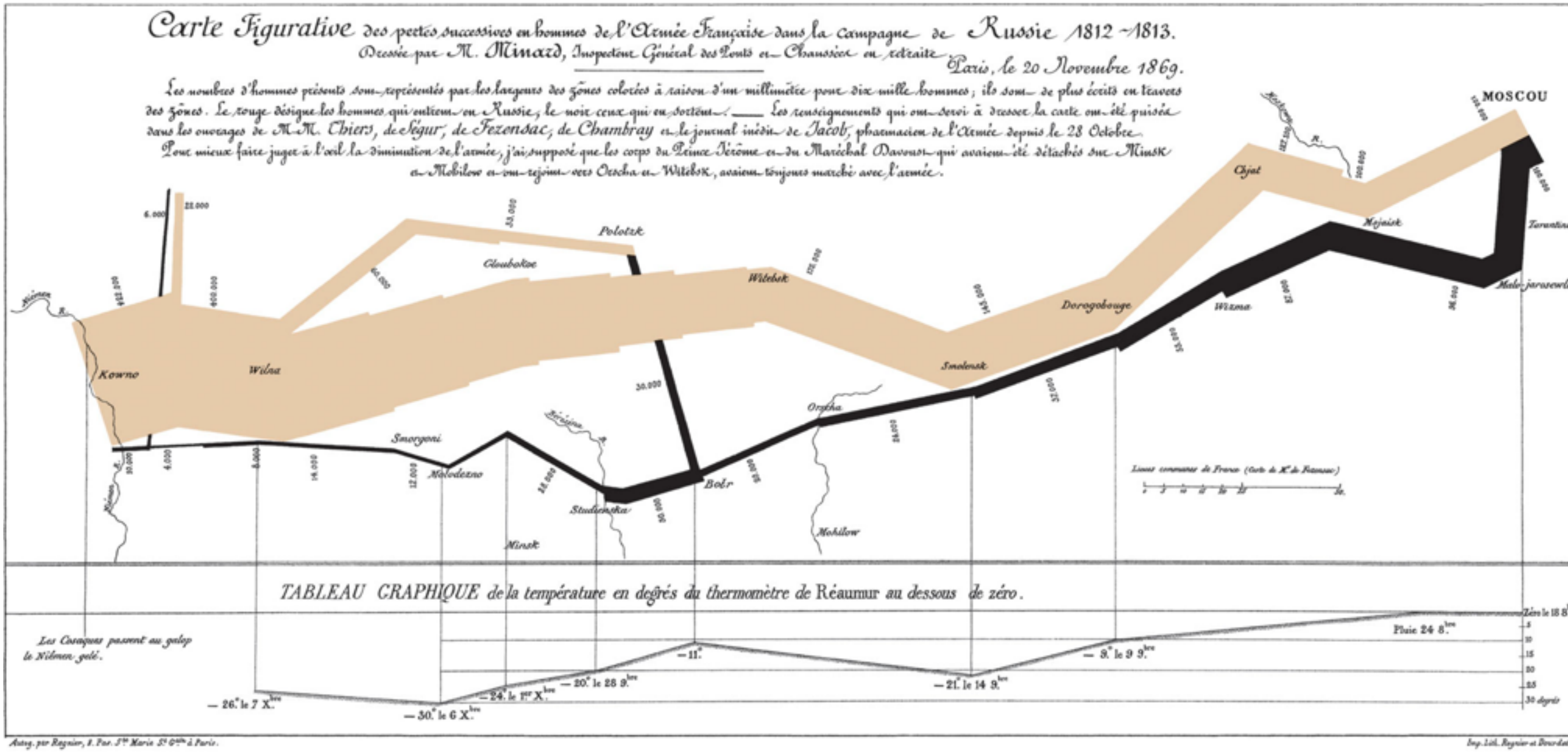
Source of map data

- `maps` (states, counties)
- `ggmap` (google, osm)
- `osmar` (polygon data)
- http://gadm.org

```
# install.packages("sp")

library(sp)
load(url("http://gadm.org/data/rda/CHE_adm1.RData"))

head(as.data.frame(gadm))
ch <- fortify(gadm, region = "ID_1")
str(ch)

qplot(long, lat, group = group, data = ch,
  geom = "polygon", colour = I("white")) +
  coord_map()
```

```r
# install.packages("maps")

library(maps)
states <- map_data("state")

ggplot(states, aes(long, lat)) +
  geom_path(aes(group = group))
```

Napoleon's march



Public domain image from http://en.wikipedia.org/wiki/File:Minard.png

Your turn

What are the layers in Minard's plot?

What geom and aesthetics do each layer use?

Which layers show the main data and which show contextual information?

```
troops <- read.table("minard-troops.txt", header=T)
cities <- read.table("minard-cities.txt", header=T)

russia <- map_data("world", region = "USSR")

qplot(long, lat, group = group, data = russia,
  geom = "polygon")

russia[russia$long < 0, ]
russia <- subset(russia, group != 32)
qplot(long, lat, group = group, data = russia,
  geom = "polygon")
```

Your turn

Attempt to recreate Napoleon’s march by Minard as closely as possible

```
ggplot(troops, aes(long, lat)) +
  geom_path(aes(size = survivors, colour = direction,
    group = group), lineend = "round") +
  geom_text(aes(label = city), size = 4, data = cities)
```

```
ussr <- geom_polygon(aes(long, lat, group = group),
  data = russia, fill = "white")

ggplot(troops, aes(long, lat)) +
  ussr +
  geom_path(aes(size = survivors, colour = direction,
    group = group, lineend = "round")) +
  geom_text(aes(label = city), size = 3,
    data = cities)
```

```
# polishing plot
last_plot() +
  scale_size(range = c(1, 6),
    breaks = c(1, 2, 3) * 10^5, labels = comma(c(1, 2, 3) * 10^5)) +
  scale_colour_manual(values = c("bisque2","grey10")) +
  xlab(NULL) +
  ylab(NULL) +
  coord_equal(xlim = c(20, 40), ylim = c(45, 65))
```