

ggmap : Interfacing ggplot2 and RgoogleMaps

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Department of Statistics

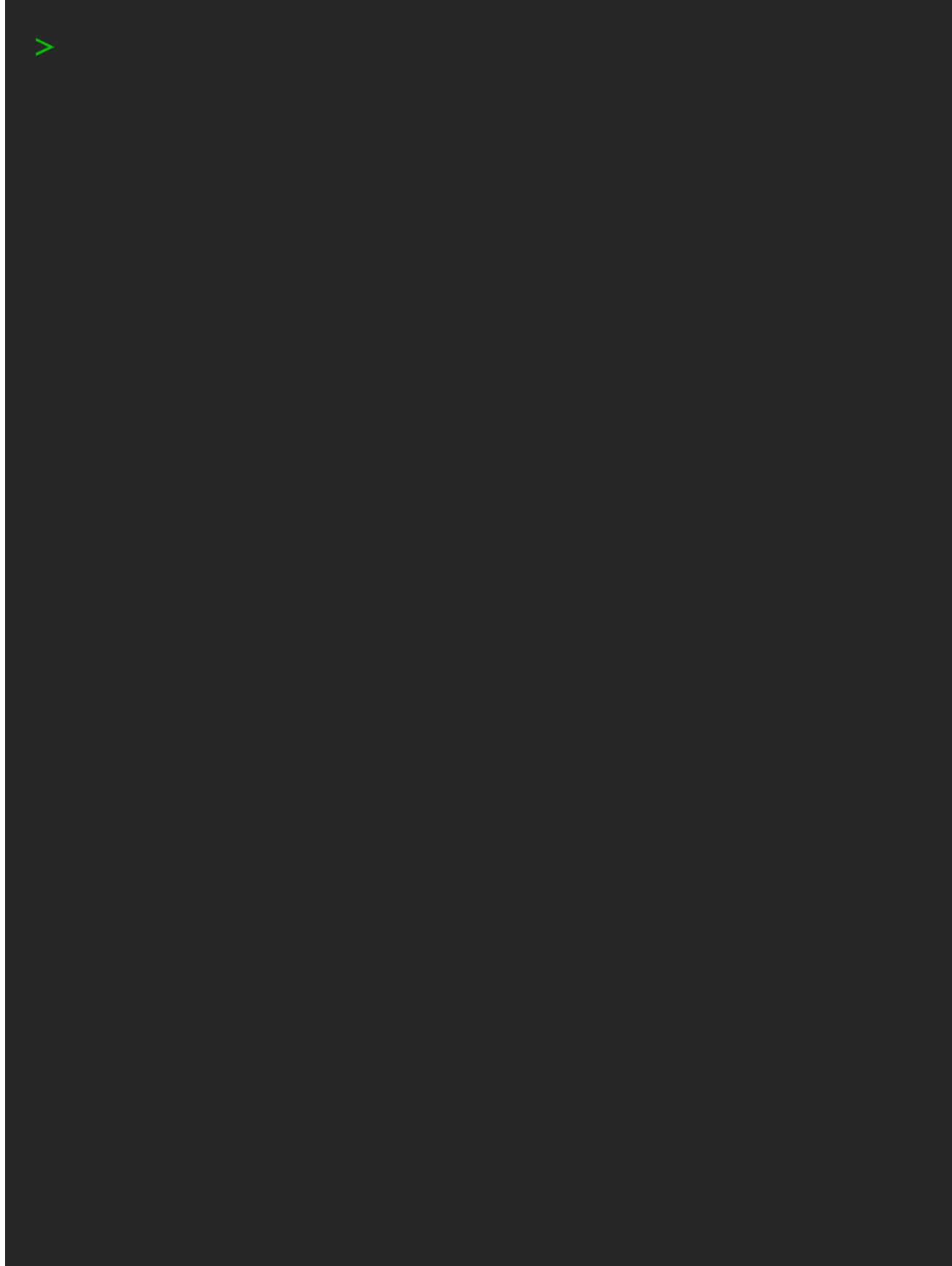


RICE[®]

useR!
June 13, 2012



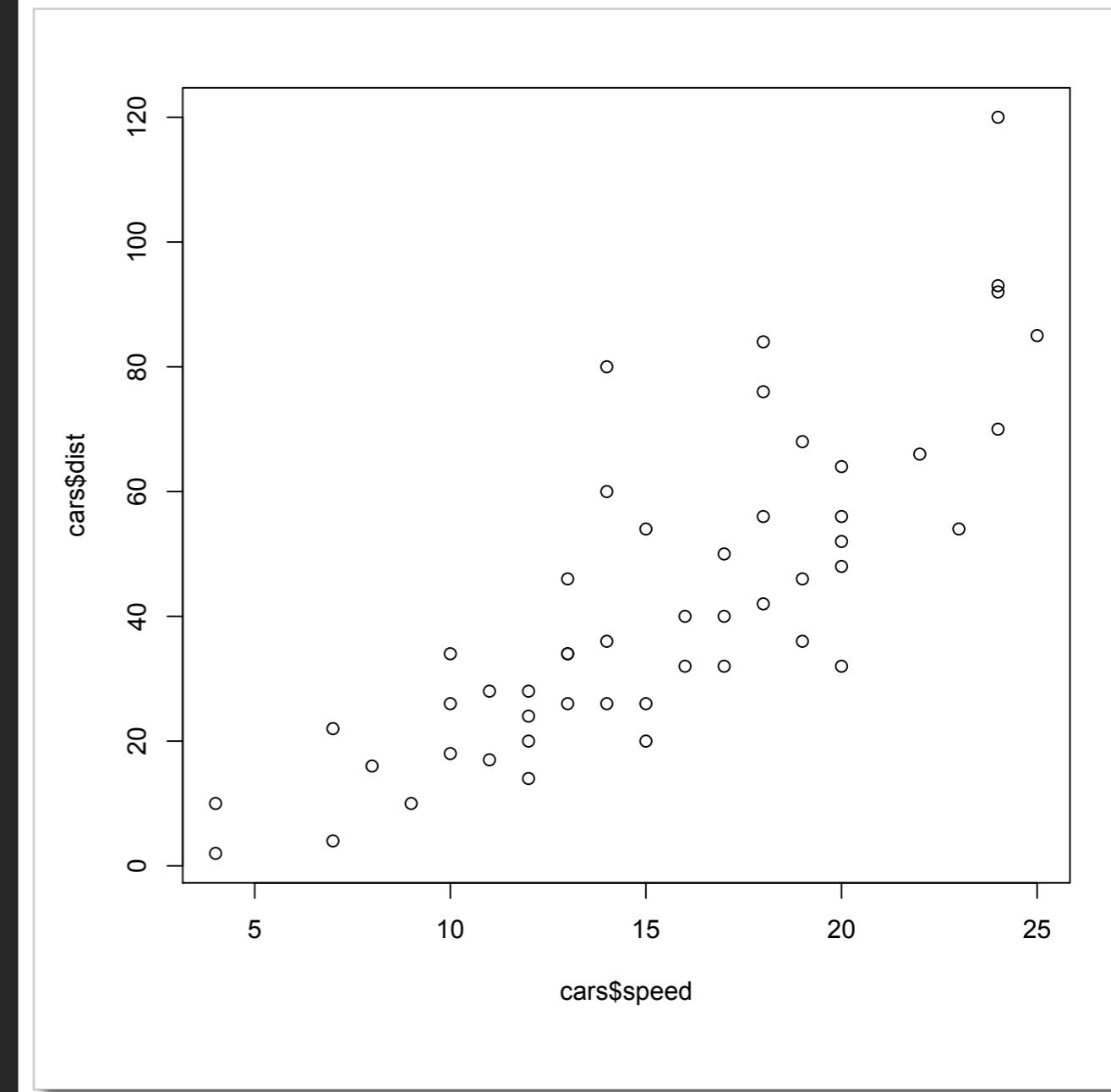
```
>
```



```
> head(cars)
   speed dist
1     4    2
2     4   10
3     7    4
4     7   22
5     8   16
6     9   10
>
```

ggplot2

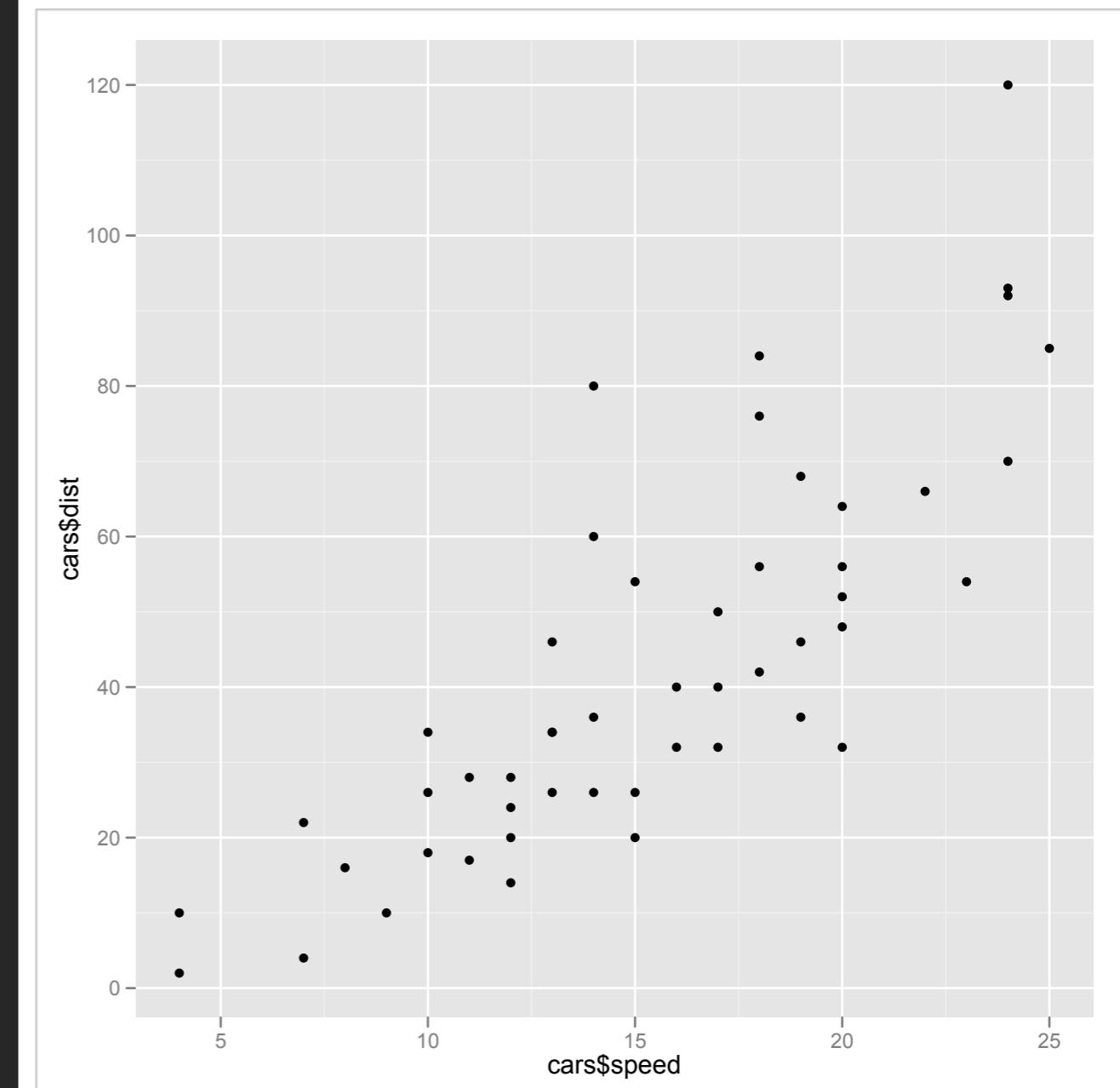
```
> head(cars)
  speed dist
1     4     2
2     4    10
3     7     4
4     7    22
5     8    16
6     9    10
> plot(cars$speed, cars$dist)
>
```



ggplot2

```
> head(cars)
  speed dist
1     4     2
2     4    10
3     7     4
4     7    22
5     8    16
6     9    10

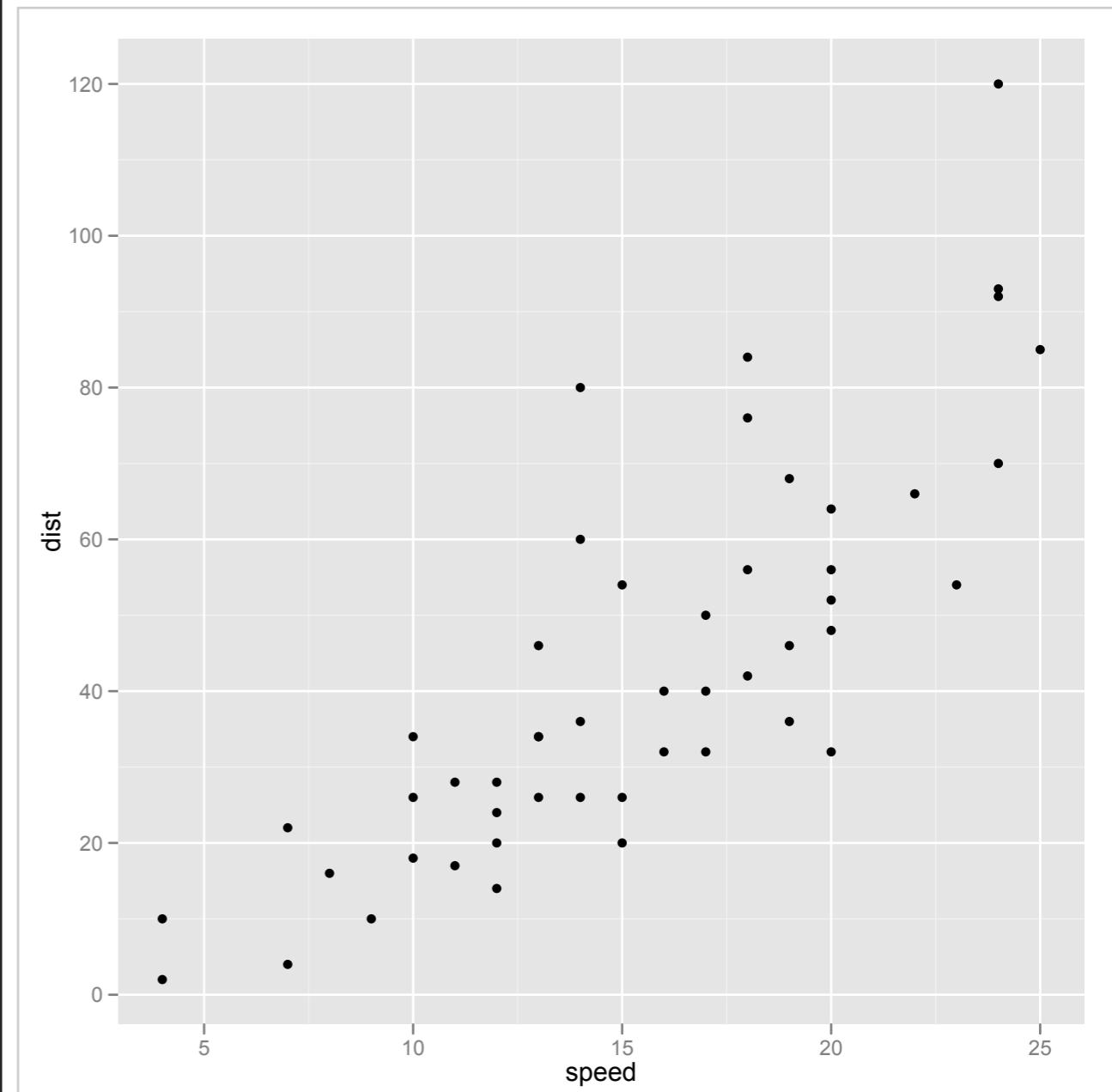
> plot(cars$speed, cars$dist)
> library(ggplot2)
> qplot(cars$speed, cars$dist)
>
```



ggplot2

```
> head(cars)
  speed dist
1     4     2
2     4    10
3     7     4
4     7    22
5     8    16
6     9    10

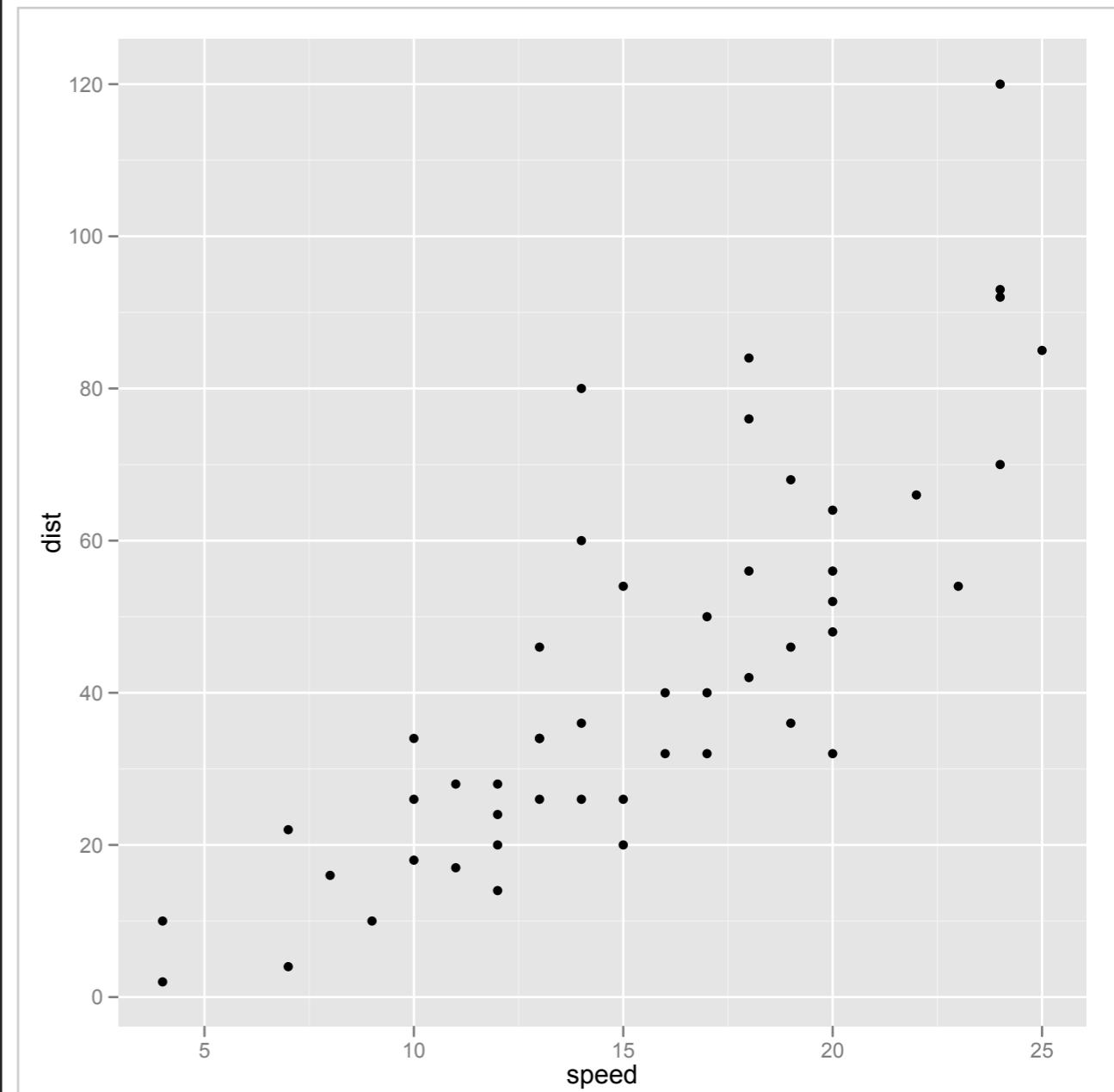
> plot(cars$speed, cars$dist)
> library(ggplot2)
> qplot(cars$speed, cars$dist)
> qplot(speed, dist, data = cars)
>
```



ggplot2

```
> head(cars)
  speed dist
1     4     2
2     4    10
3     7     4
4     7    22
5     8    16
6     9    10

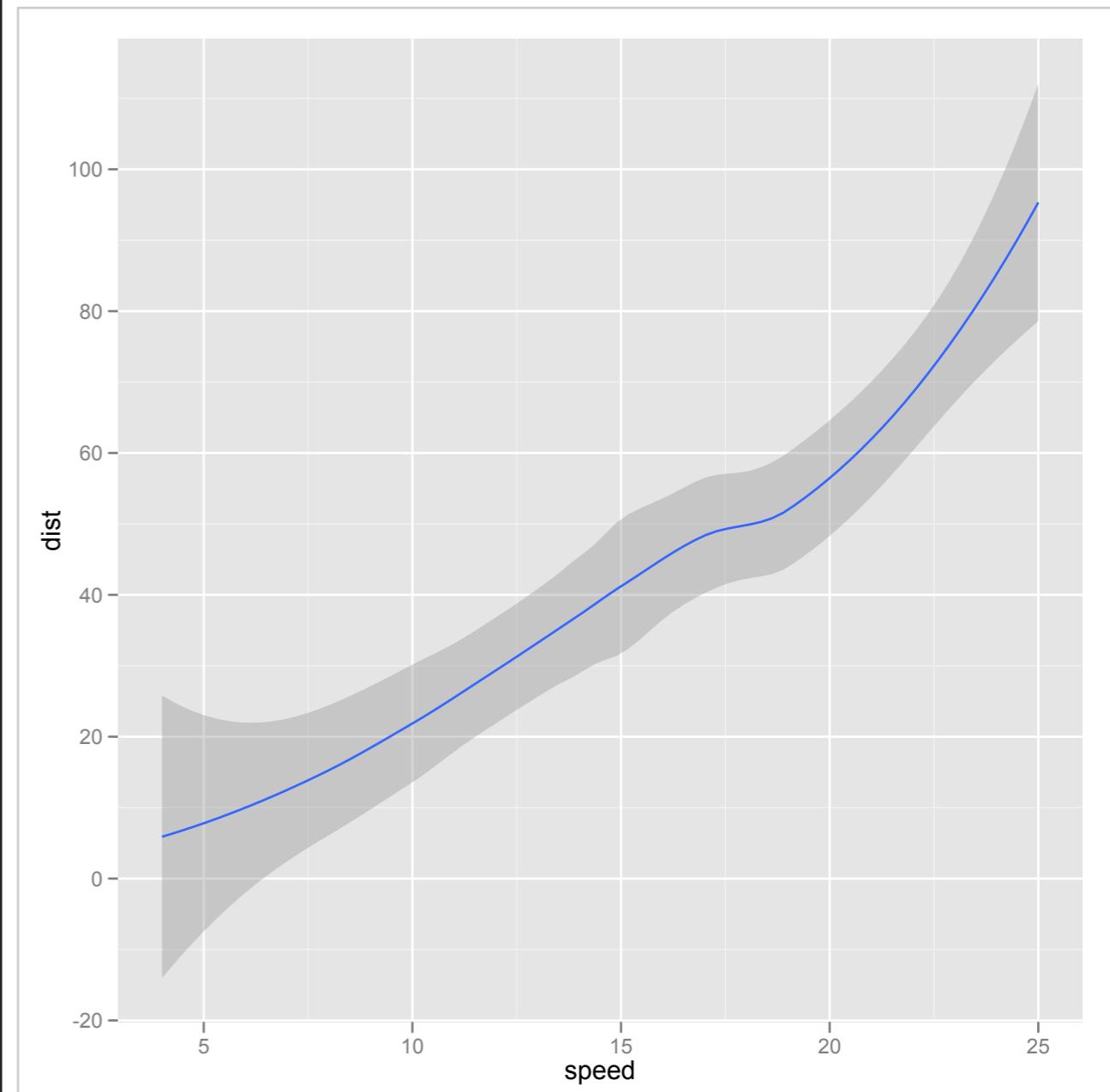
> plot(cars$speed, cars$dist)
> library(ggplot2)
> qplot(cars$speed, cars$dist)
> qplot(speed, dist, data = cars)
> qplot(speed, dist, data = cars,
+       geom = 'point')
>
```



ggplot2

```
> head(cars)
  speed dist
1     4    2
2     4   10
3     7    4
4     7   22
5     8   16
6     9   10

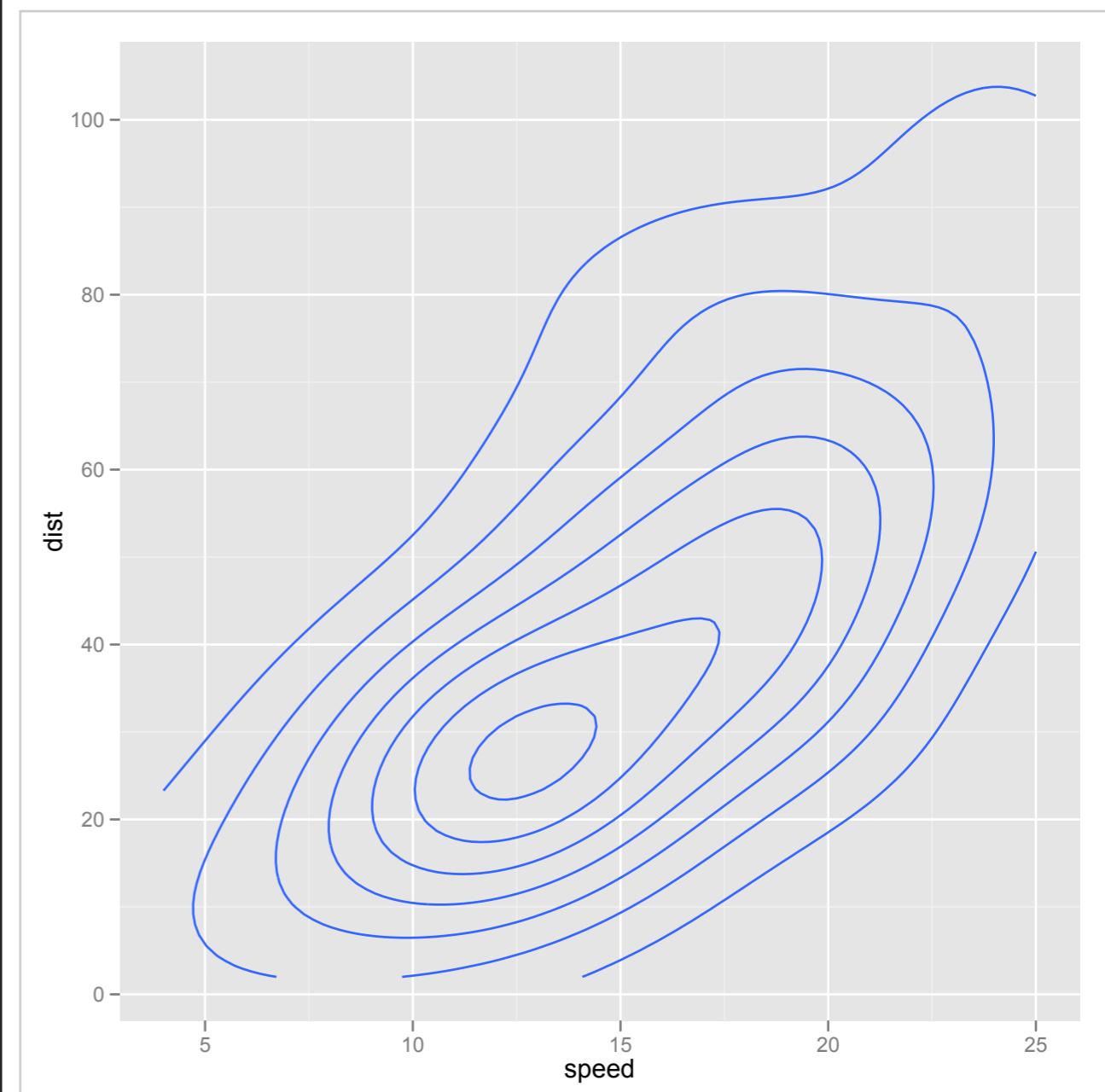
> plot(cars$speed, cars$dist)
> library(ggplot2)
> qplot(cars$speed, cars$dist)
> qplot(speed, dist, data = cars)
> qplot(speed, dist, data = cars,
+       geom = 'point')
> qplot(speed, dist, data = cars,
+       geom = 'smooth')
>
```



ggplot2

```
> head(cars)
  speed dist
1     4     2
2     4    10
3     7     4
4     7    22
5     8    16
6     9    10

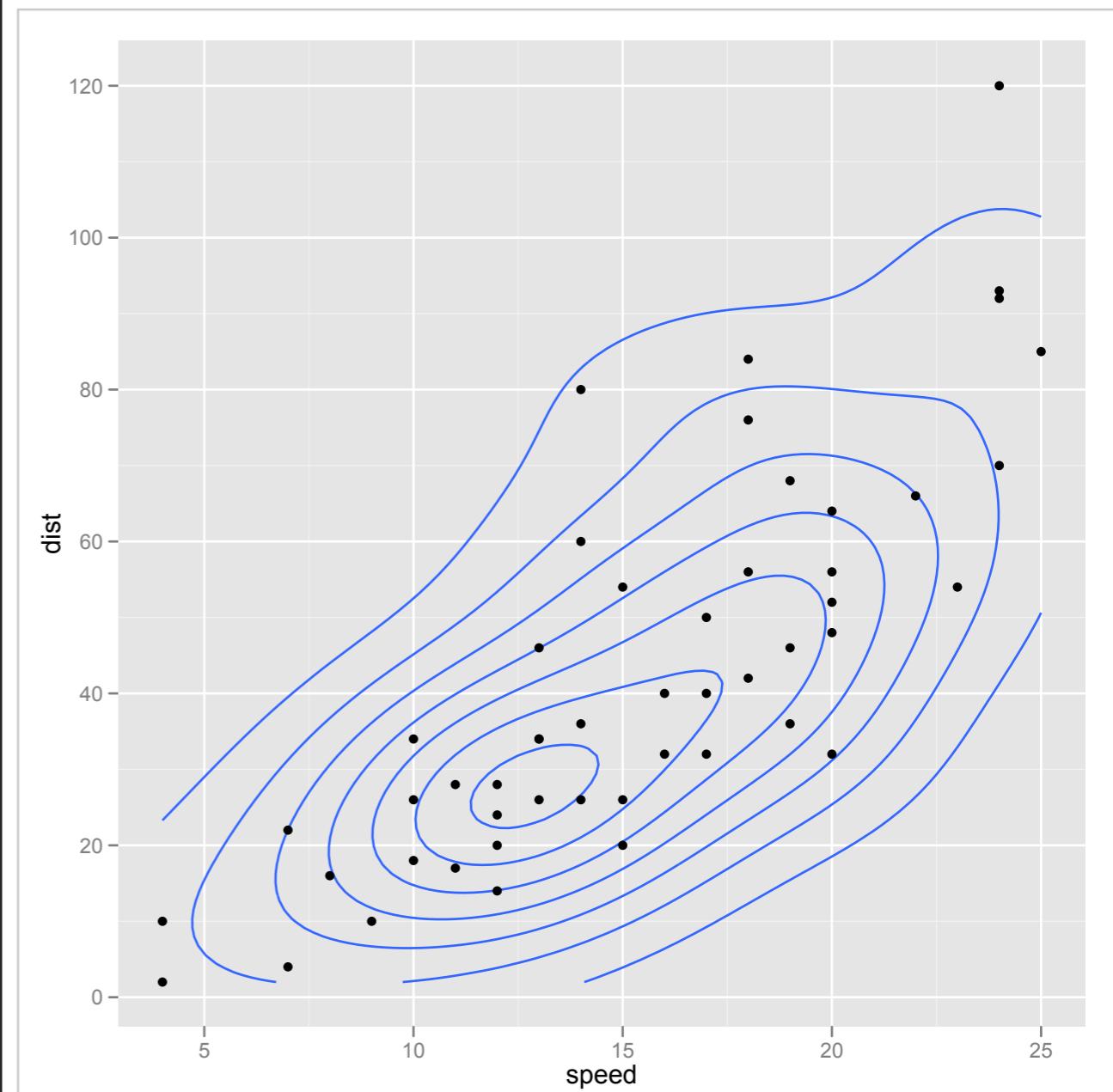
> plot(cars$speed, cars$dist)
> library(ggplot2)
> qplot(cars$speed, cars$dist)
> qplot(speed, dist, data = cars)
> qplot(speed, dist, data = cars,
+       geom = 'point')
> qplot(speed, dist, data = cars,
+       geom = 'smooth')
> qplot(speed, dist, data = cars,
+       geom = 'density2d')
>
```



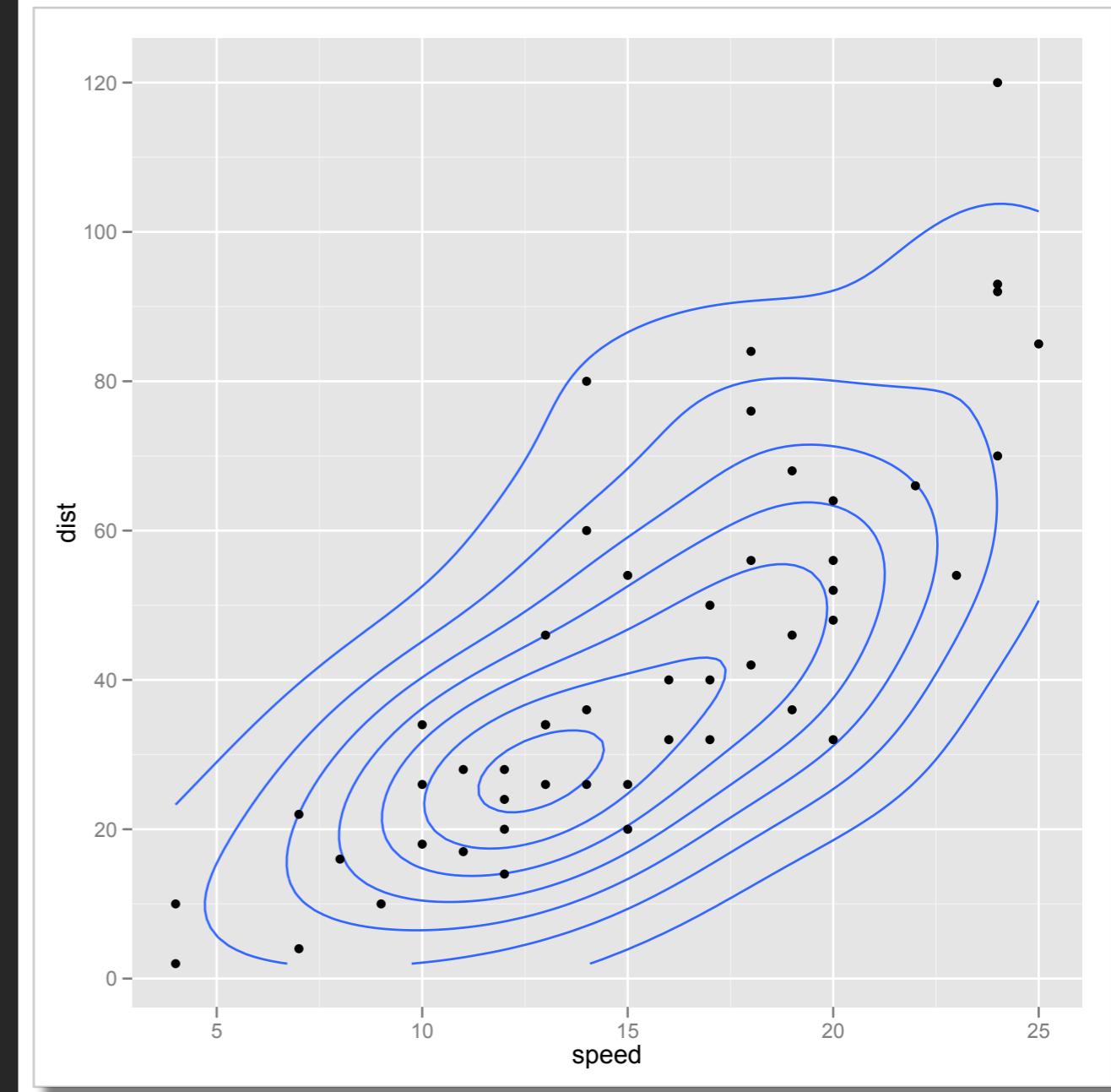
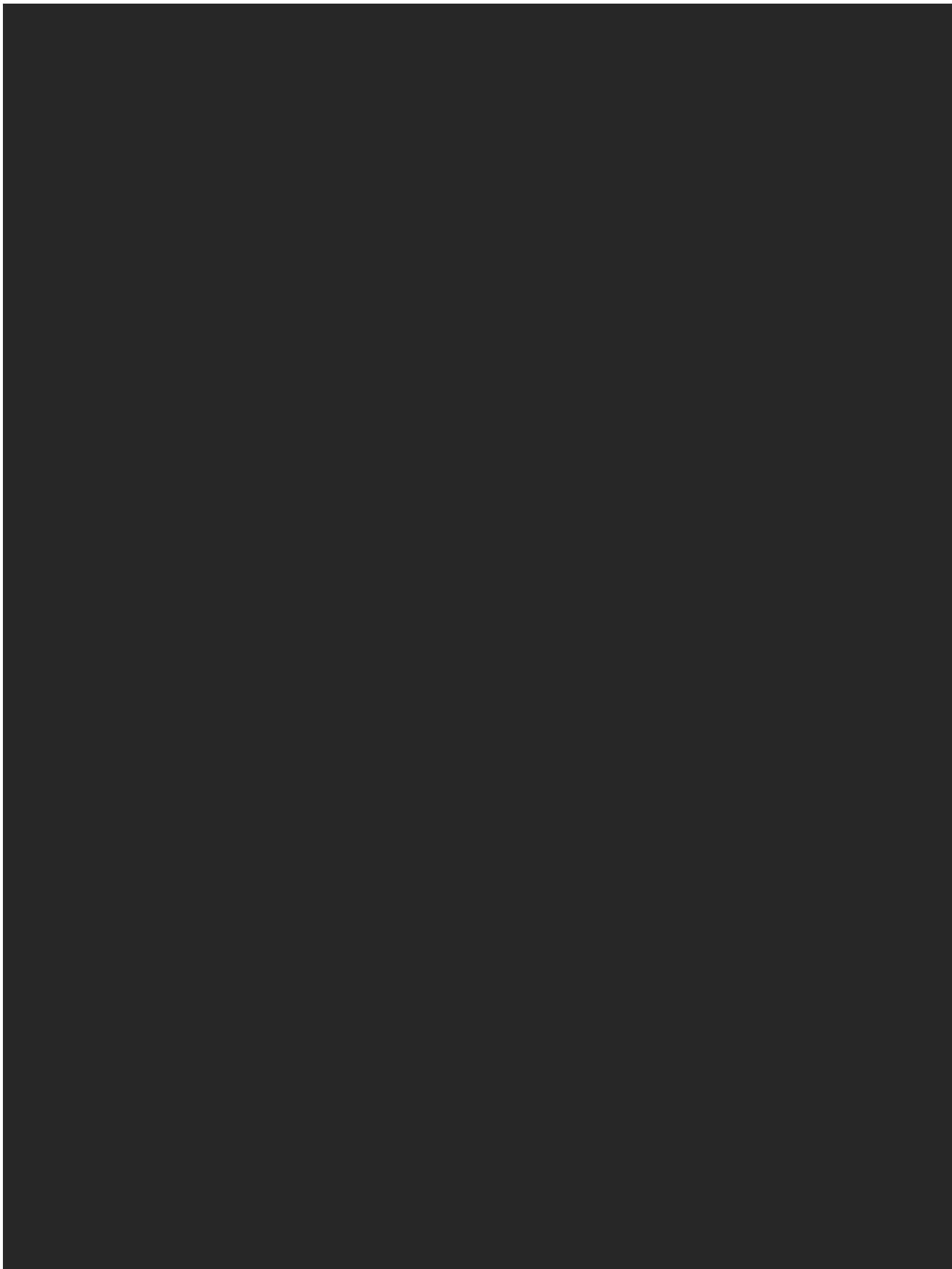
ggplot2

```
> head(cars)
  speed dist
1     4    2
2     4   10
3     7    4
4     7   22
5     8   16
6     9   10

> plot(cars$speed, cars$dist)
> library(ggplot2)
> qplot(cars$speed, cars$dist)
> qplot(speed, dist, data = cars)
> qplot(speed, dist, data = cars,
+       geom = 'point')
> qplot(speed, dist, data = cars,
+       geom = 'smooth')
> qplot(speed, dist, data = cars,
+       geom = 'density2d')
> qplot(speed, dist, data = cars,
+       geom = c('density2d', 'point'))
>
```

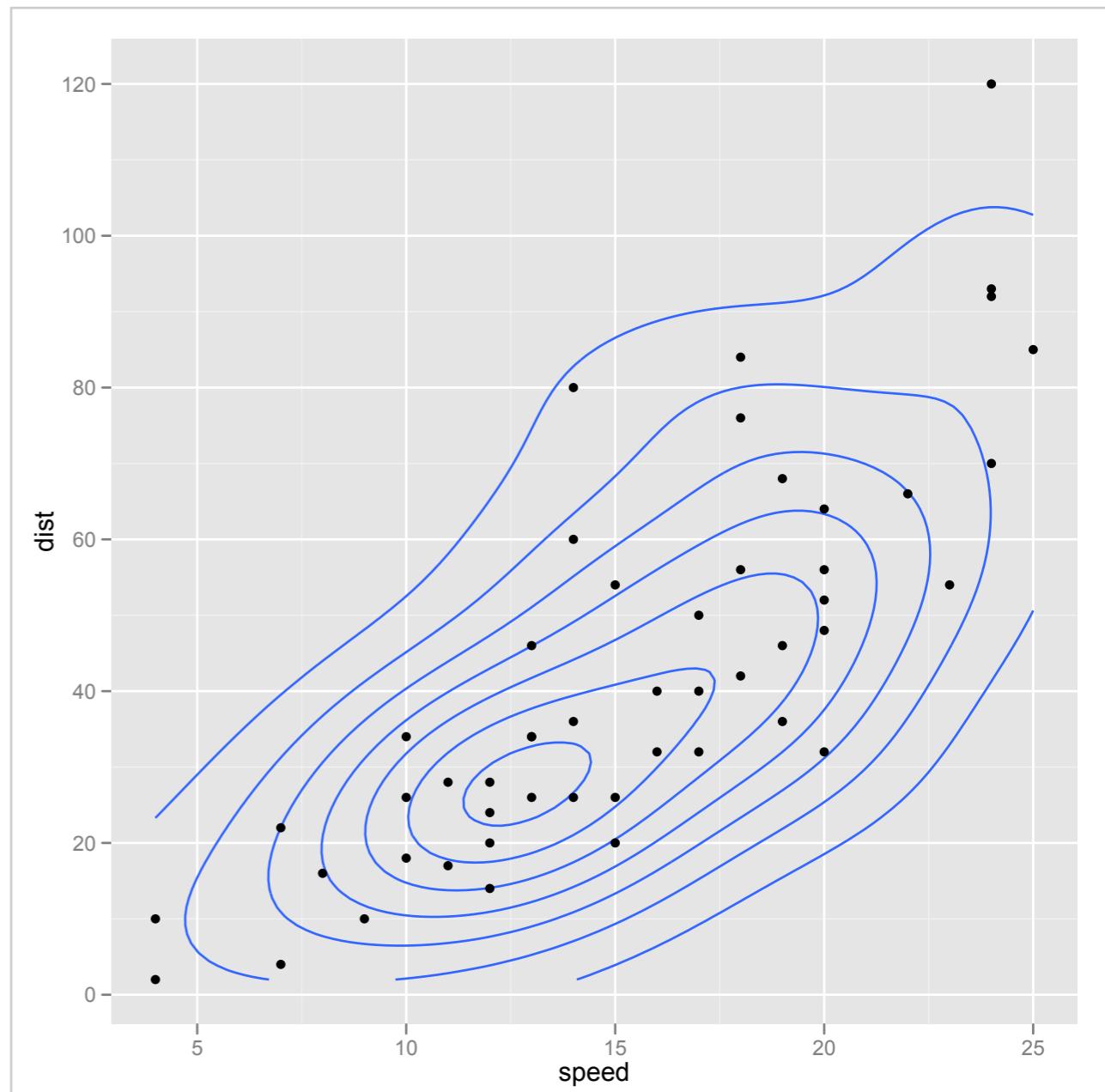


ggplot2



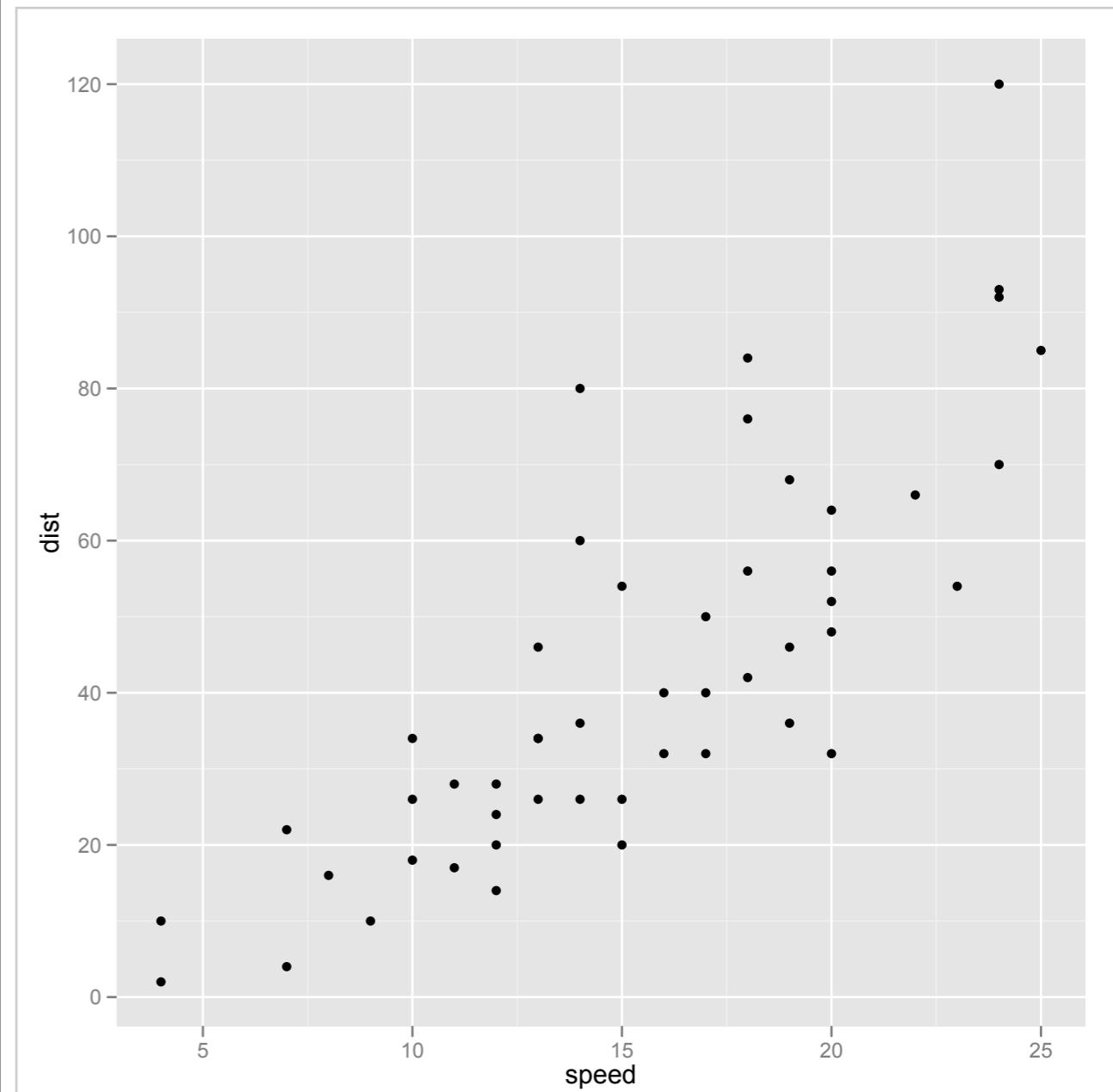
ggplot2

>



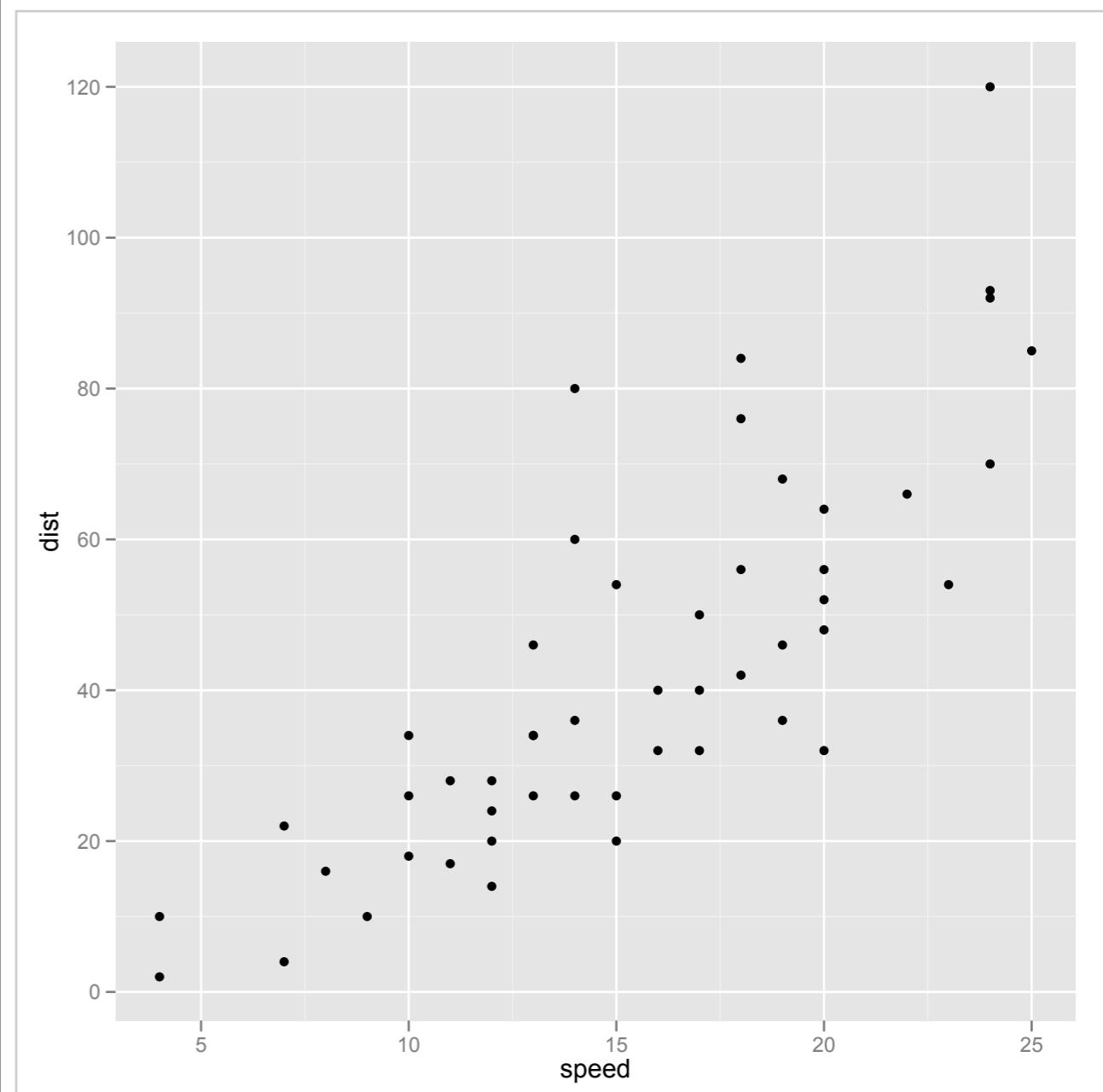
ggplot2

```
> ggplot() +  
+   geom_point(  
+     aes(x = speed, y = dist),  
+     data = cars  
+   )  
>
```



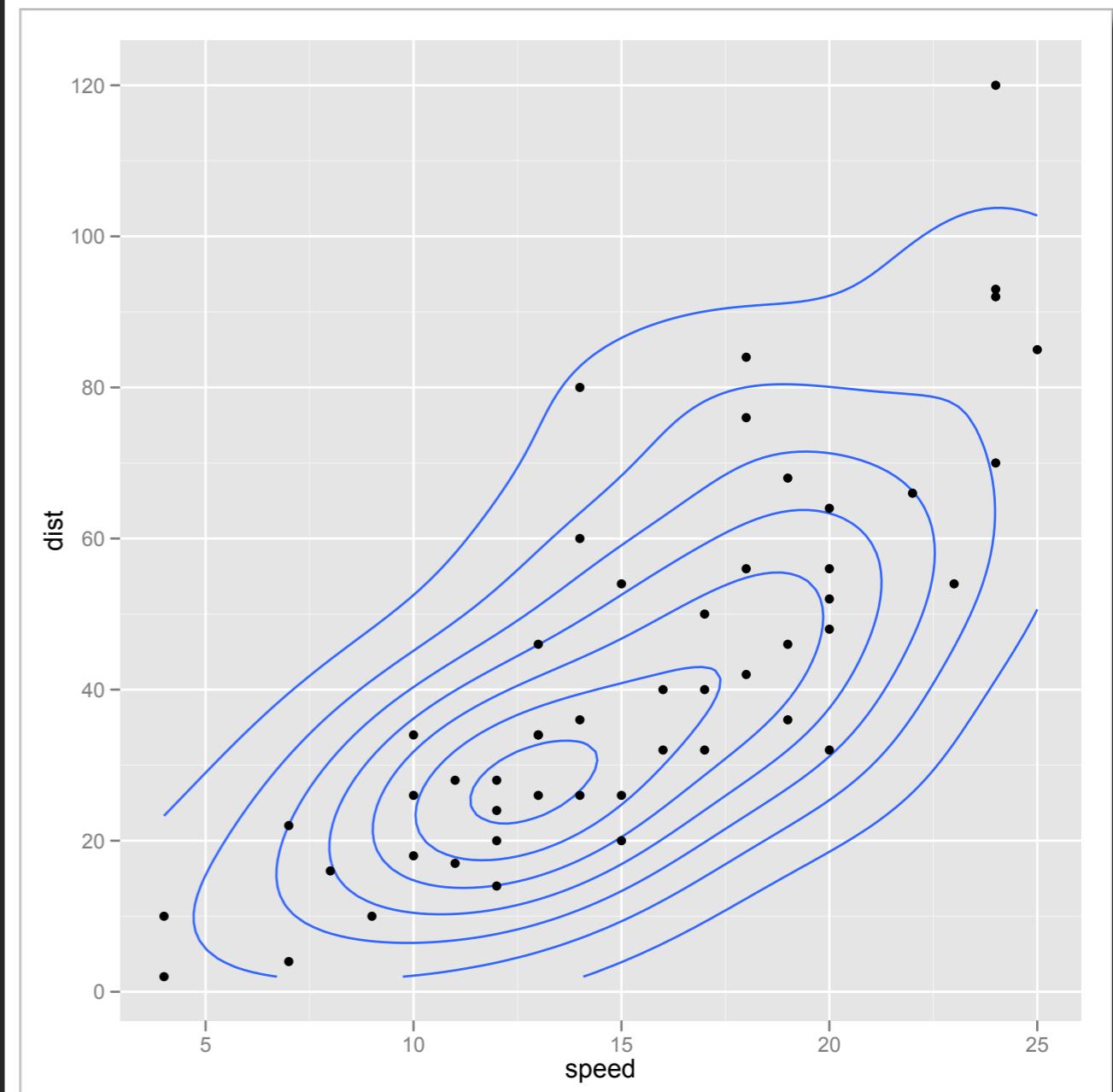
ggplot2

```
> ggplot() +      This is a layer
+   geom_point(
+     aes(x = speed, y = dist),
+     data = cars
+   )
>
```



ggplot2

```
> ggplot() +      This is a layer
+   geom_point(
+     aes(x = speed, y = dist),
+     data = cars
+   )
> ggplot() +
+   geom_density2d(
+     aes(x = speed, y = dist),
+     data = cars
+   ) +
+   geom_point(
+     aes(x = speed, y = dist),
+     data = cars
+   )
>
```

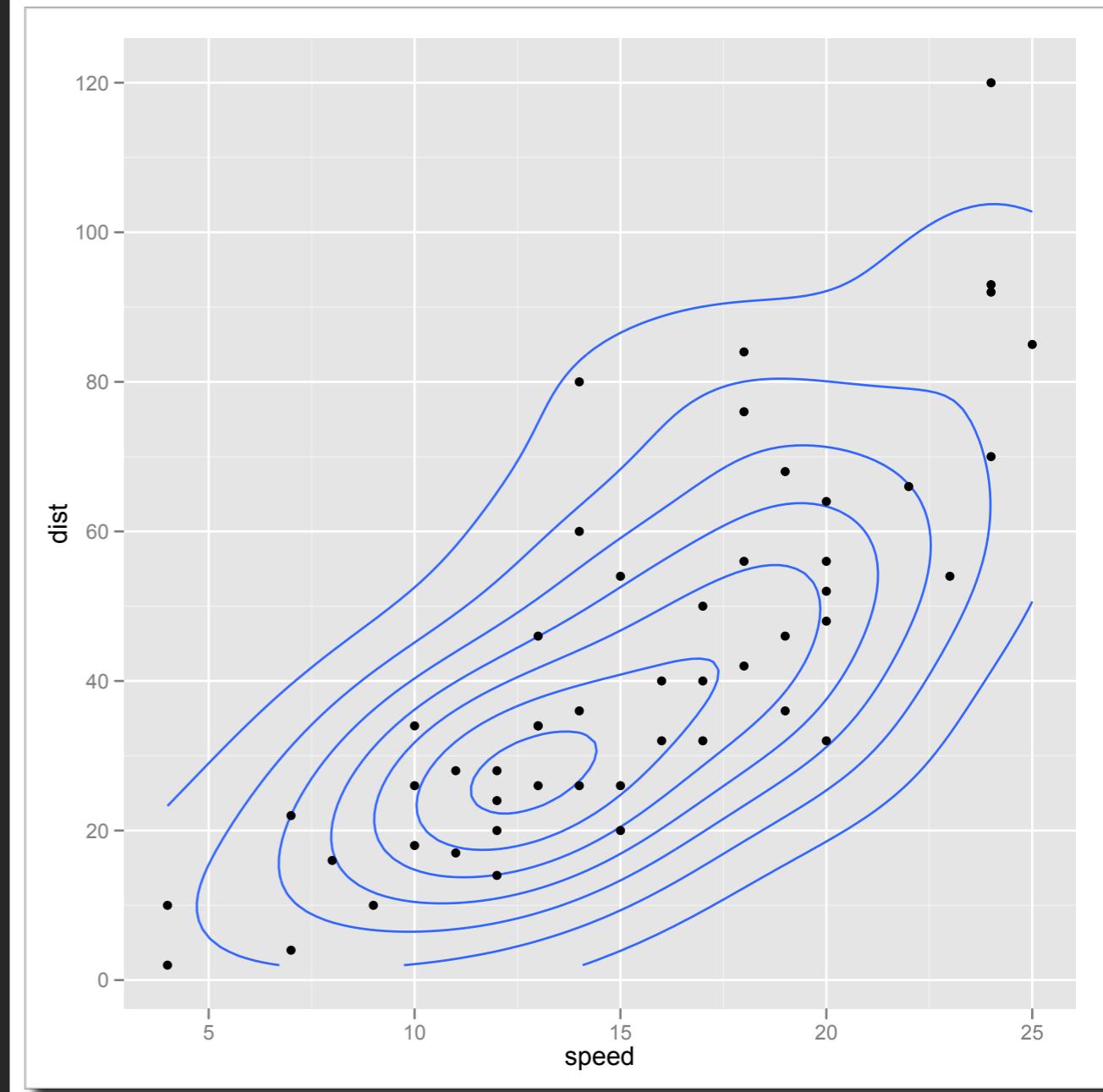


ggplot2

```
> ggplot() +      This is a layer
+   geom_point(
+     aes(x = speed, y = dist),
+     data = cars
+   )
> ggplot() +
+   geom_density2d(
+     aes(x = speed, y = dist),
+     data = cars
+   ) +
+   geom_point(
+     aes(x = speed, y = dist),
+     data = cars
+   )
> We can add several layers
```

Layer 1

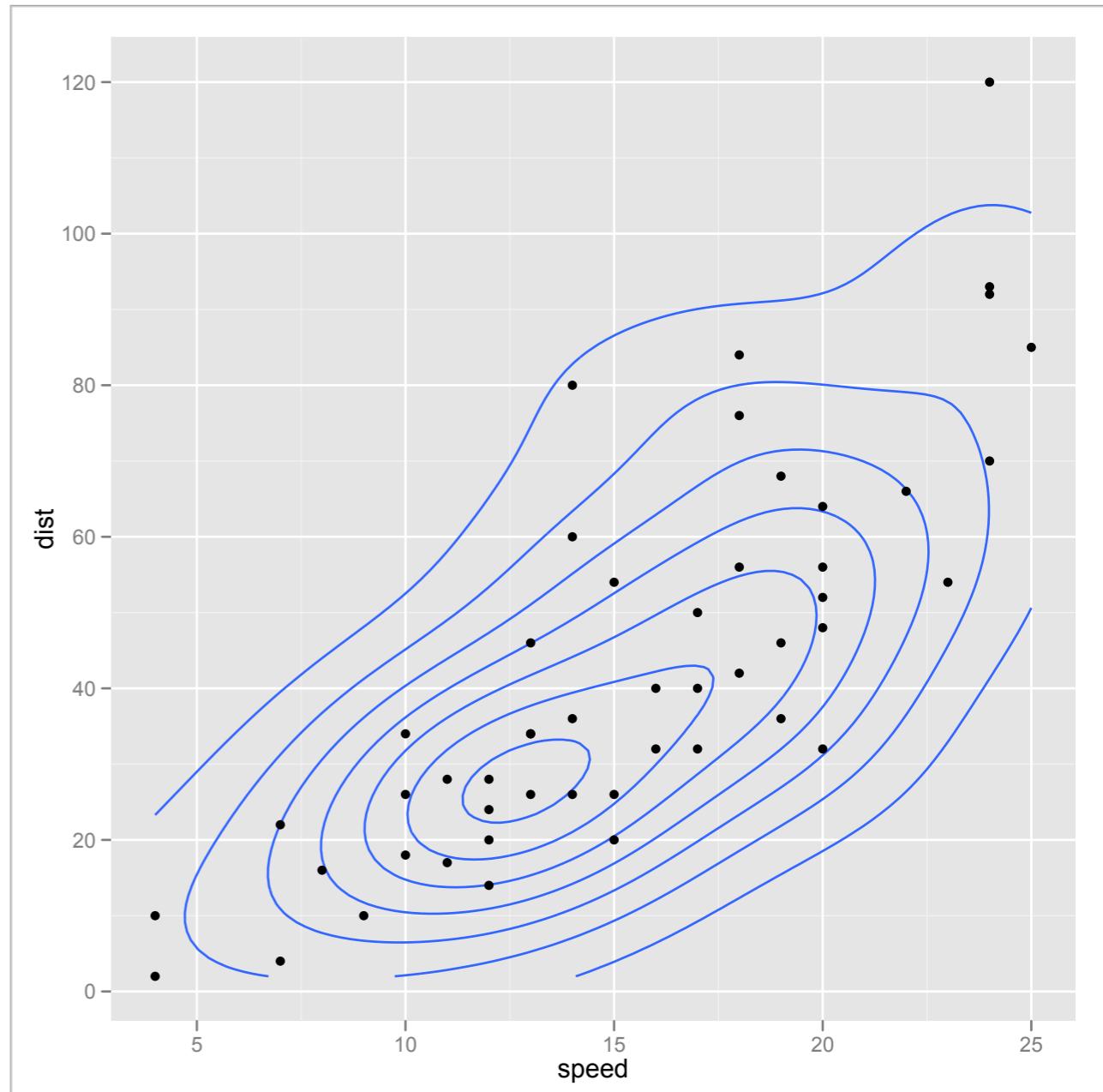
Layer 2



ggplot2

```
> ggplot() +      This is a layer
+   geom_point(
+     aes(x = speed, y = dist),
+     data = cars
+   )
> ggplot() +      Layer 1
+   geom_density2d(
+     aes(x = speed, y = dist),
+     data = cars
+   ) +
+   geom_point(
+     aes(x = speed, y = dist),
+     data = cars
+   )
> We can add several layers
```

This is the “base” layer (it’s blank here)

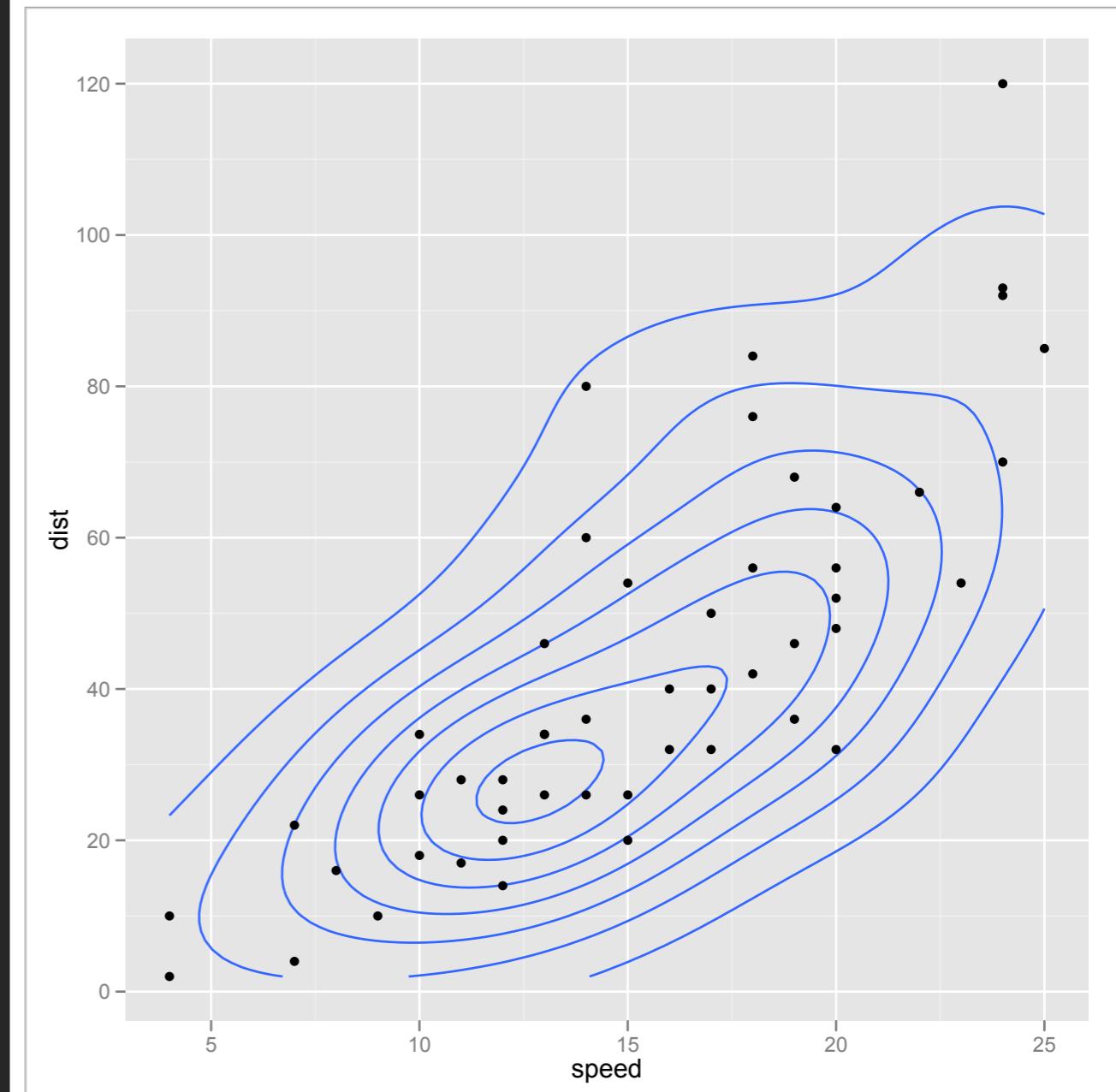


ggplot2

```
> ggplot() + This is a layer
+   geom_point(
+     aes(x = speed, y = dist),
+     data = cars
+   )
> ggplot() +
+   geom_density2d(
+     aes(x = speed, y = dist),
+     data = cars
+   ) +
+   geom_point(
+     aes(x = speed, y = dist),
+     data = cars
+   )
> We can add several layers
```

This is the “base” layer (it’s blank here)

ggmap : use a map for the base layer



Two constructs to make the base layer

Two constructs to make the base layer



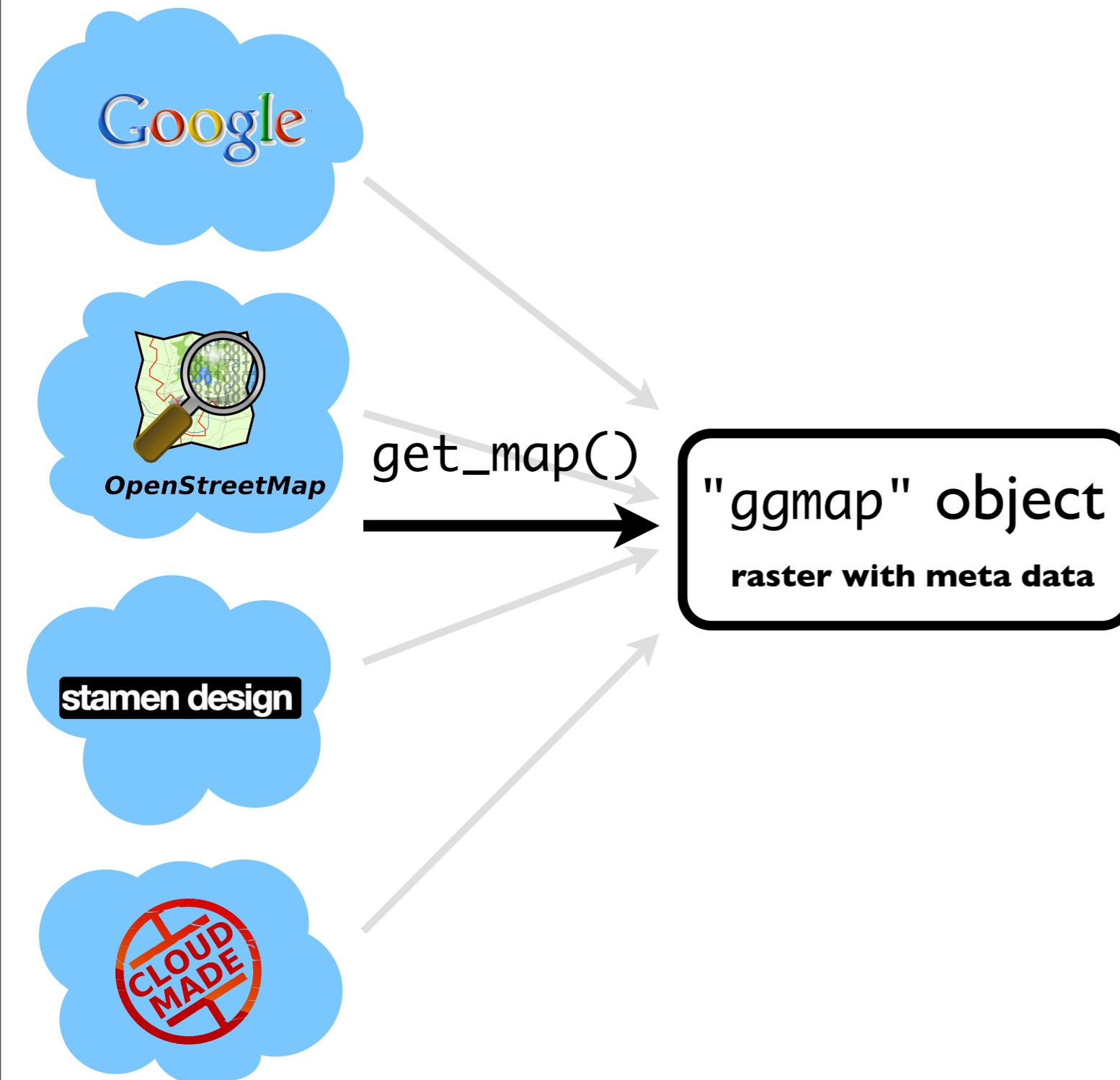
Google™



stamen design

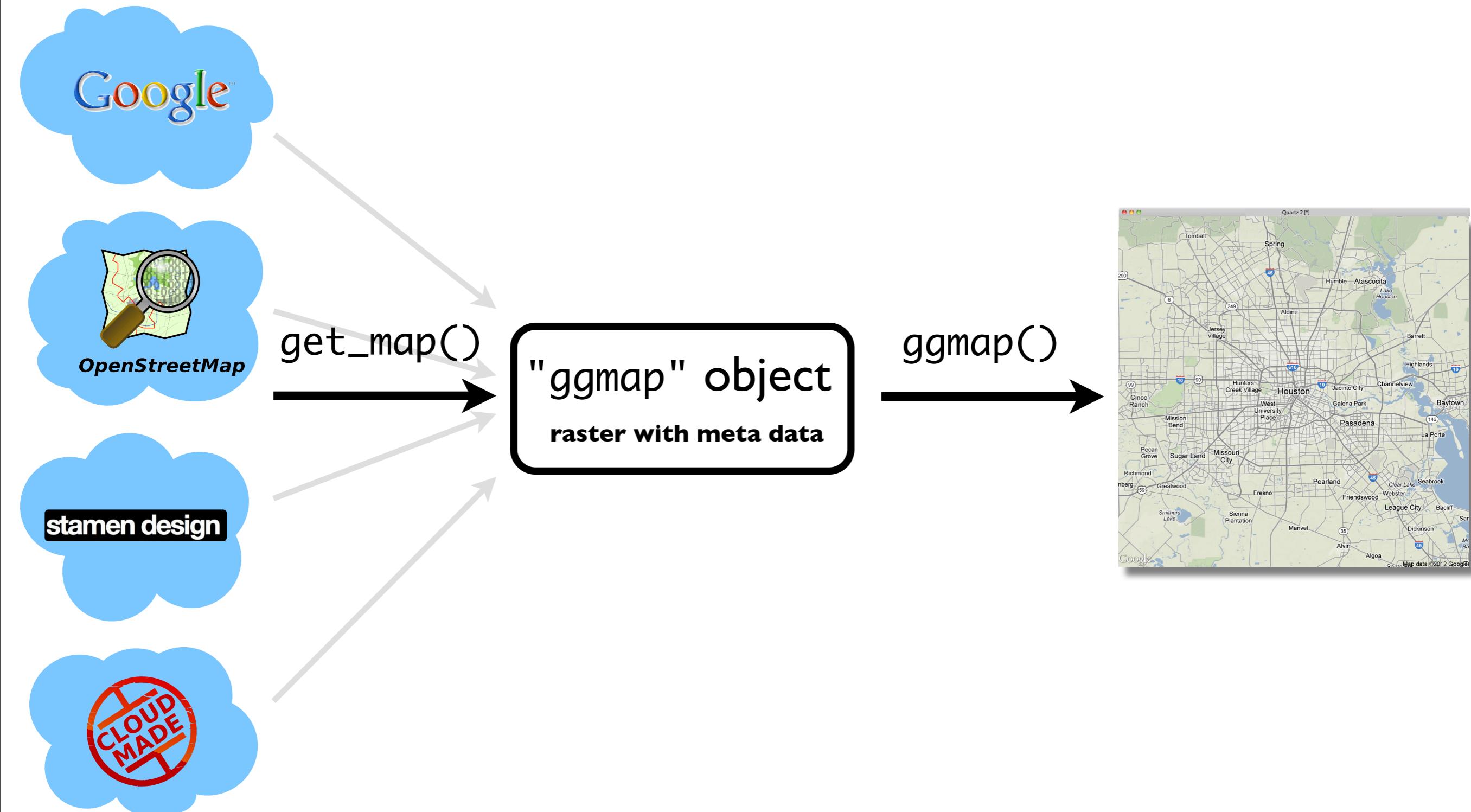


Two constructs to make the base layer

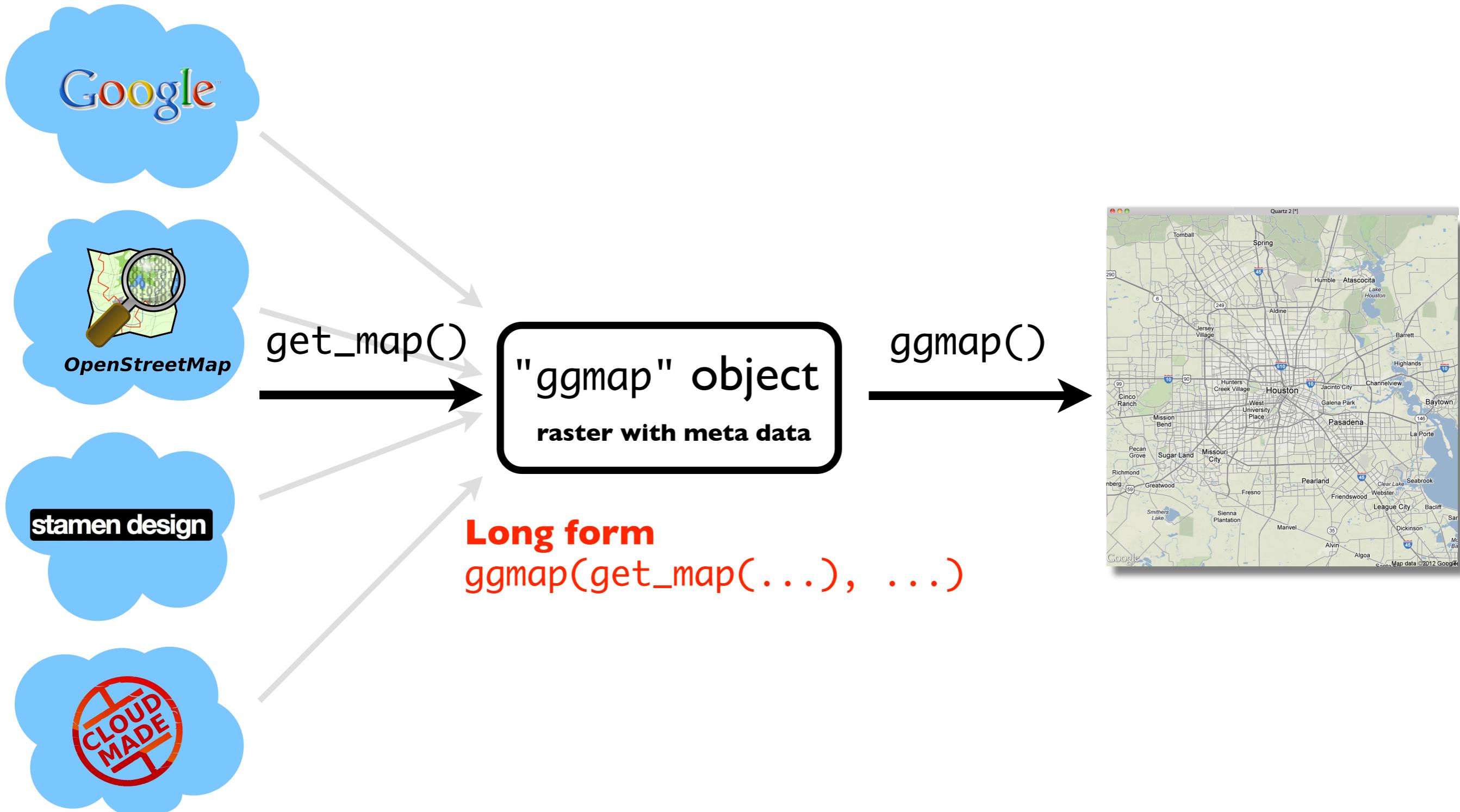


ggmap - the base layer

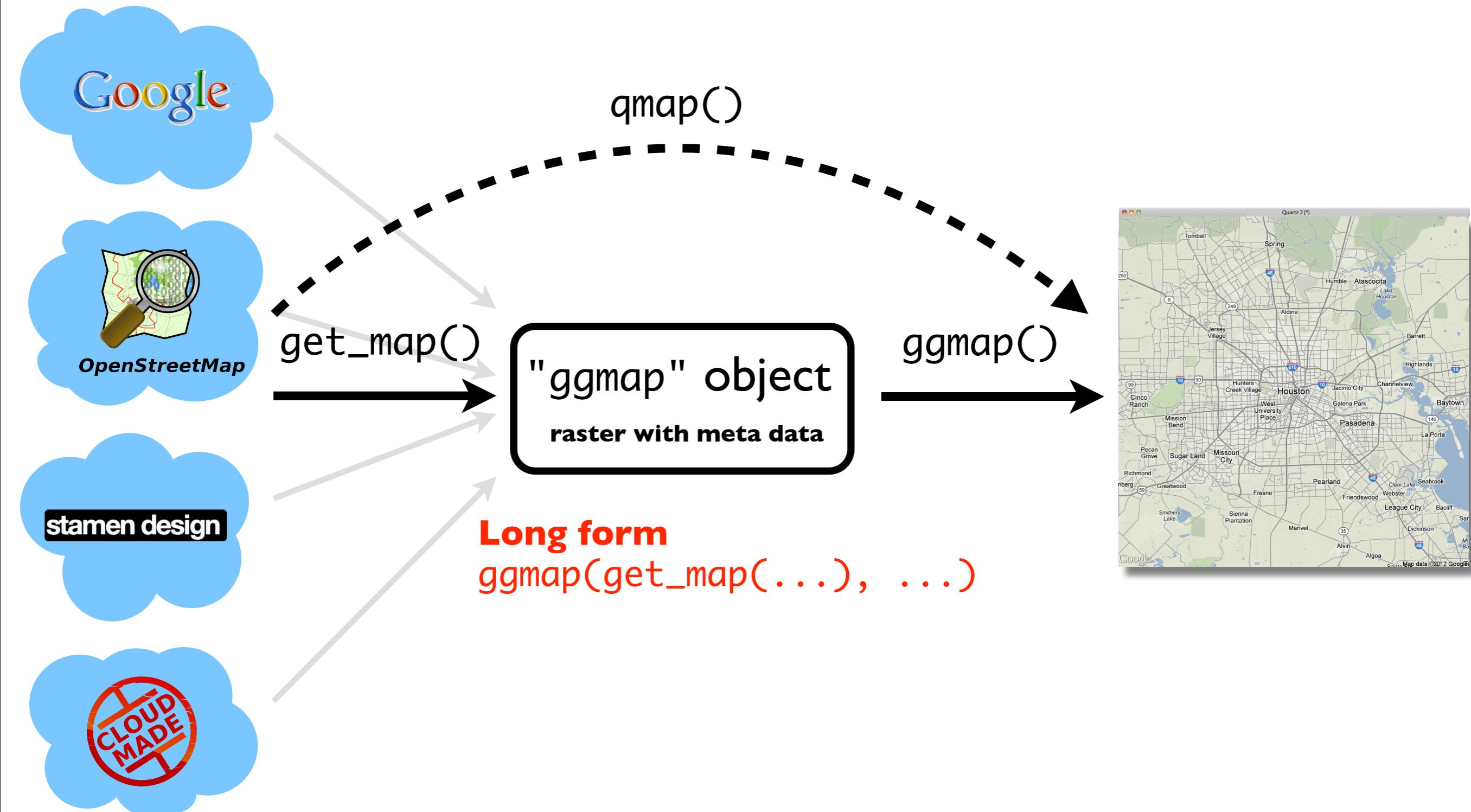
Two constructs to make the base layer



Two constructs to make the base layer

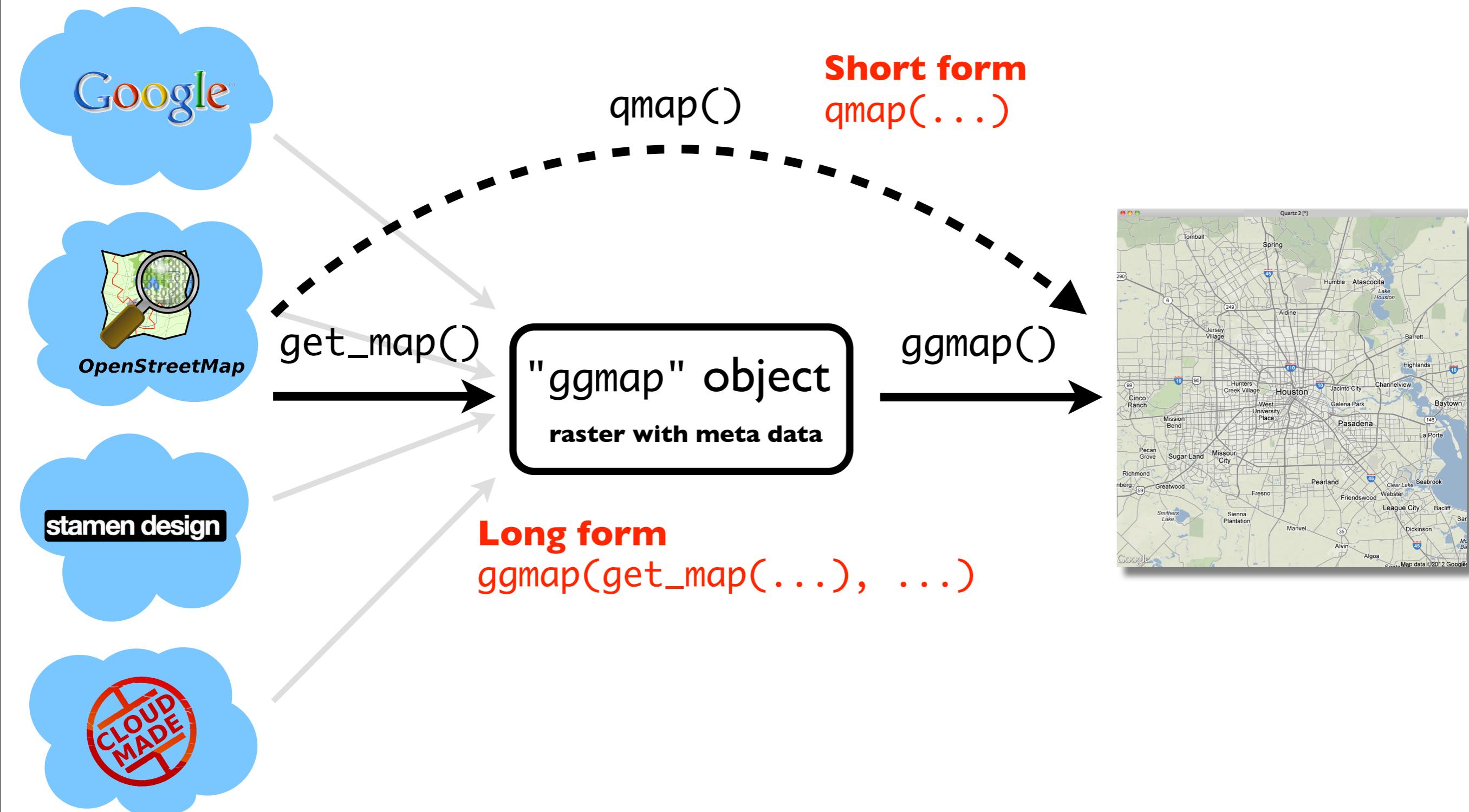


Two constructs to make the base layer

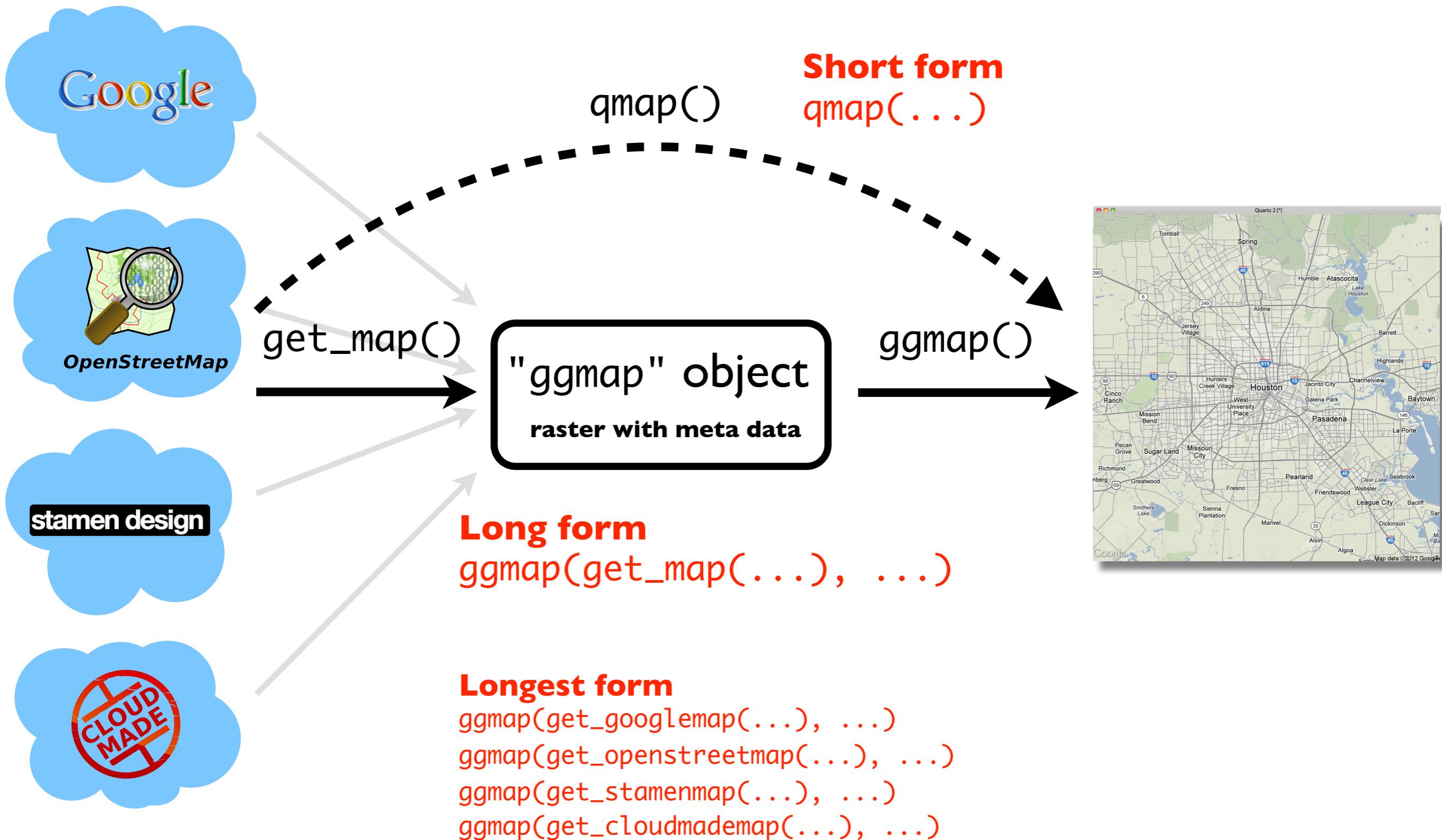


ggmap - the base layer

Two constructs to make the base layer

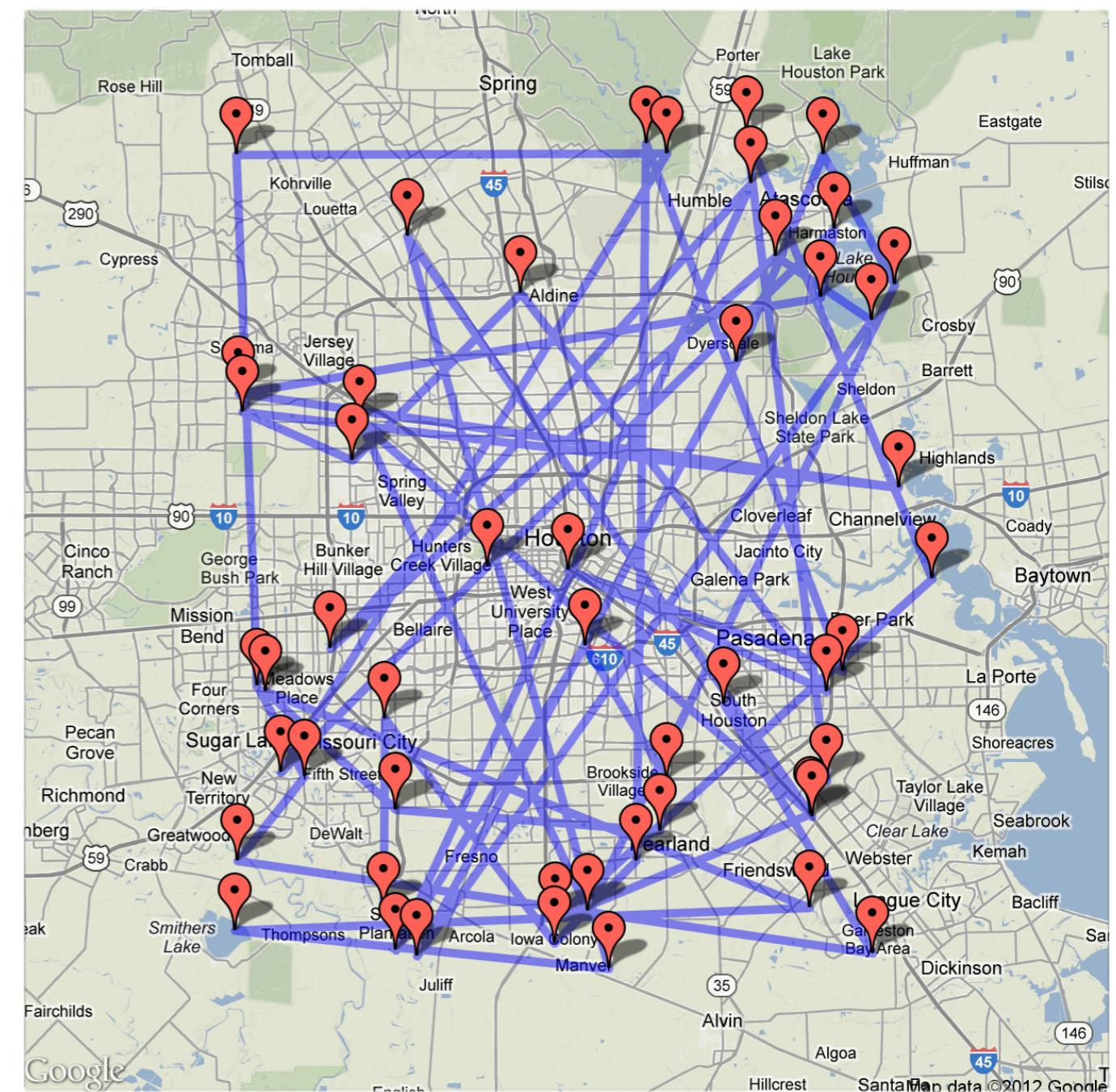
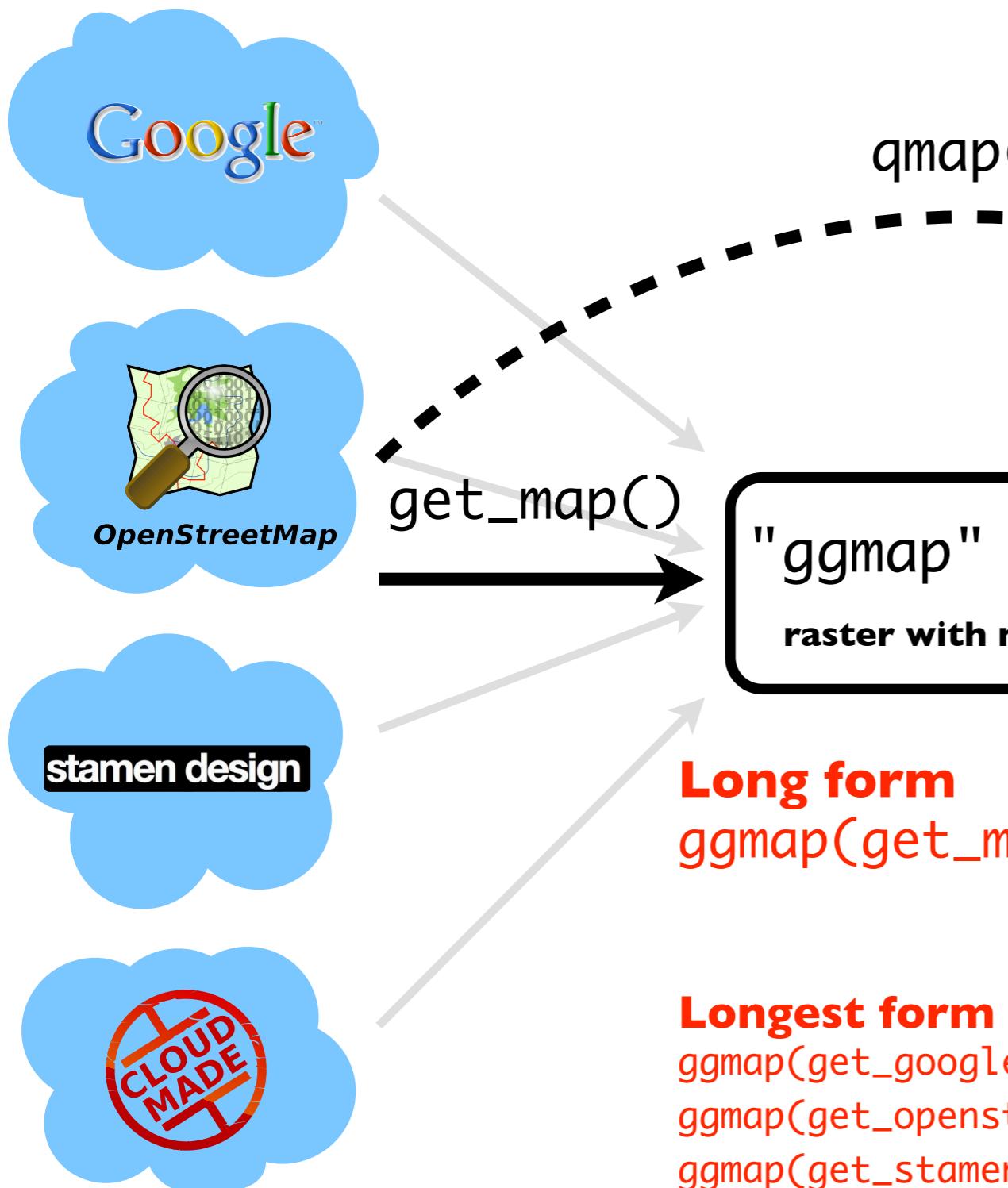


Two constructs to make the base layer



ggmap - the base layer

Two constructs to make ggmaps



Longest form

```
ggmap(get_googlemap(...), ...)
ggmap(get_openstreetmap(...), ...)
ggmap(get_stamenmap(...), ...)
ggmap(get_cldmademap(...), ...)
```

get_map arguments

get_map arguments

location - Map dependent

location - Map dependent

	Longitude/Latitude Center	Bounding box
Google	✓	✗ <small>(currently)</small>
OpenStreetMap	✓	✓
stamen design	✓	✓
CLOUD MADE	✓	✓

get_map arguments

location - Map dependent

zoom -

get_map arguments

`location` - Map dependent

`zoom` - Map zoom 2–20 integer (2 ≈ continent, 20 ≈ building)

get_map arguments

`location` - Map dependent

`zoom` - Map zoom 2–20 integer (2 ≈ continent, 20 ≈ building)

`maptype` -

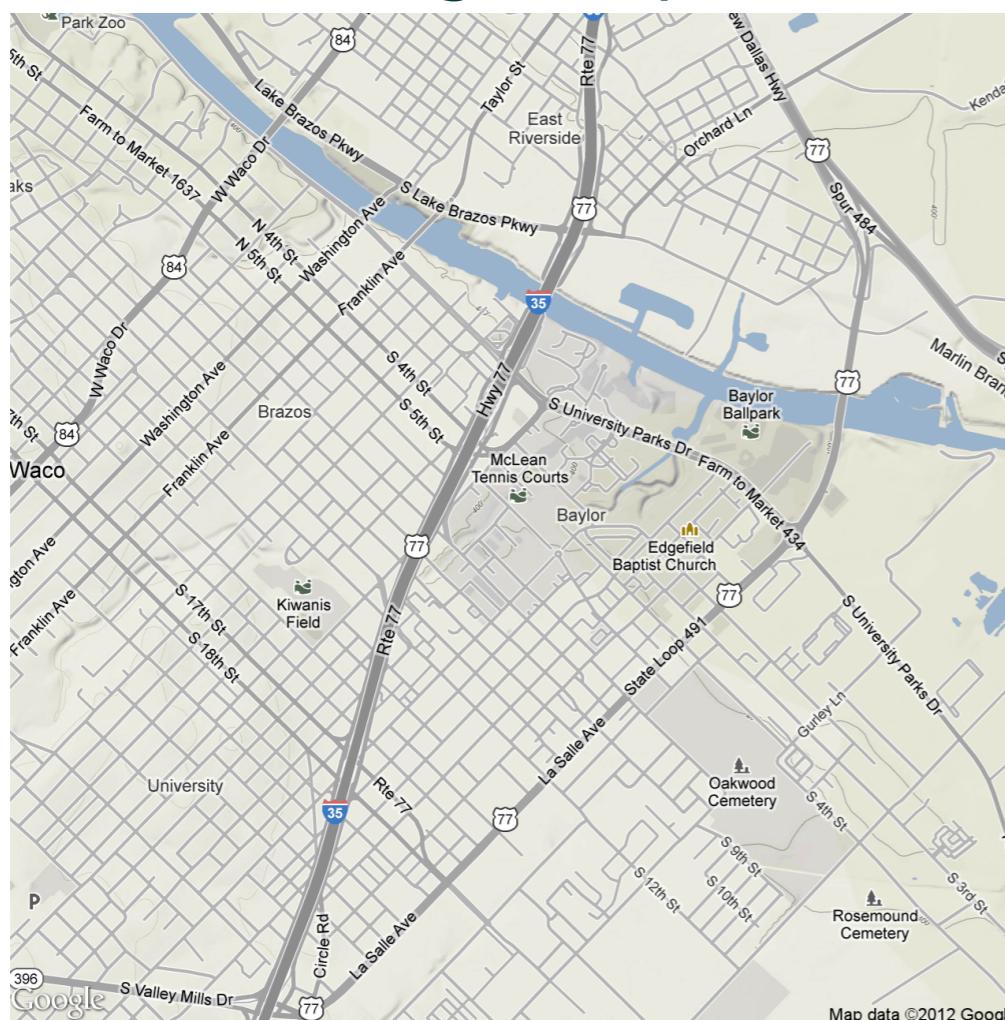
get_map arguments

location - Map dependent

zoom - Map zoom 2–20 integer (2 ≈ continent, 20 ≈ building)

maptype -

Google Maps hybrid



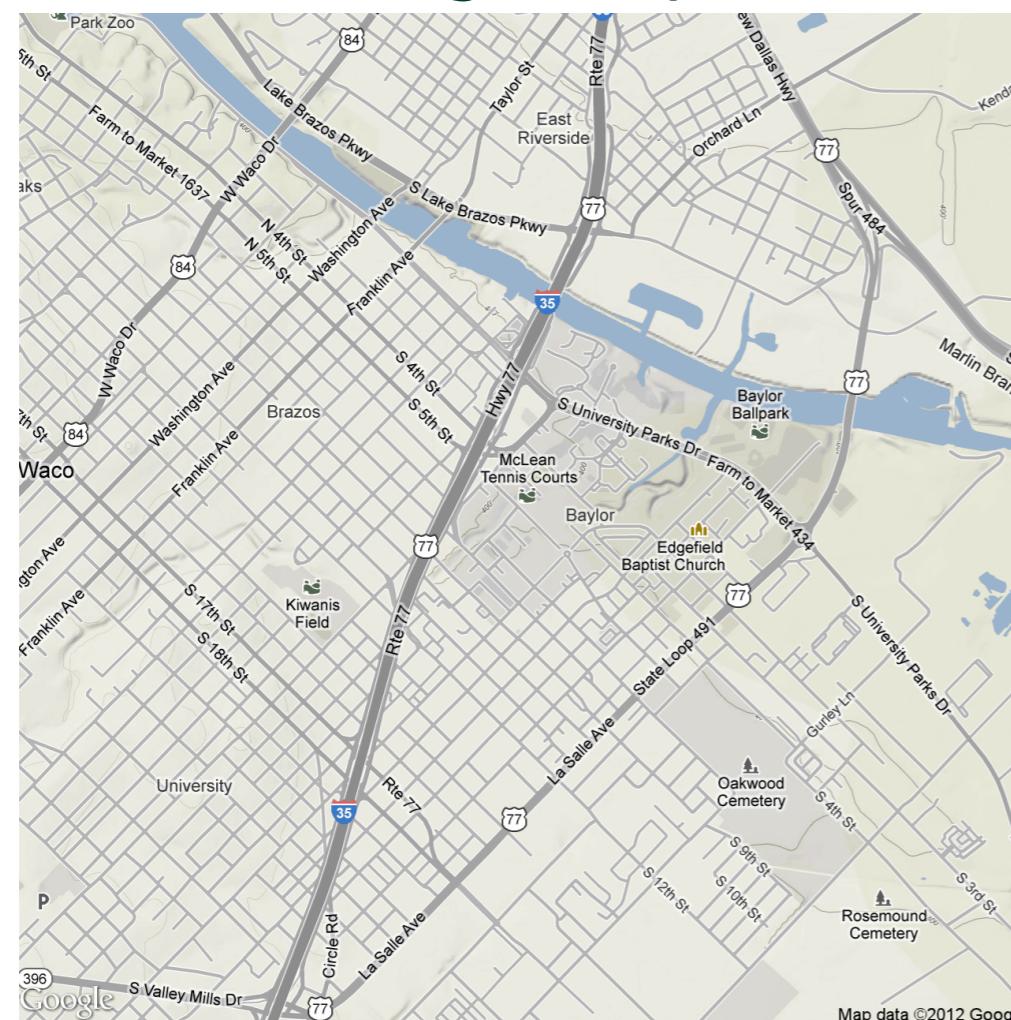
get_map arguments

location - Map dependent

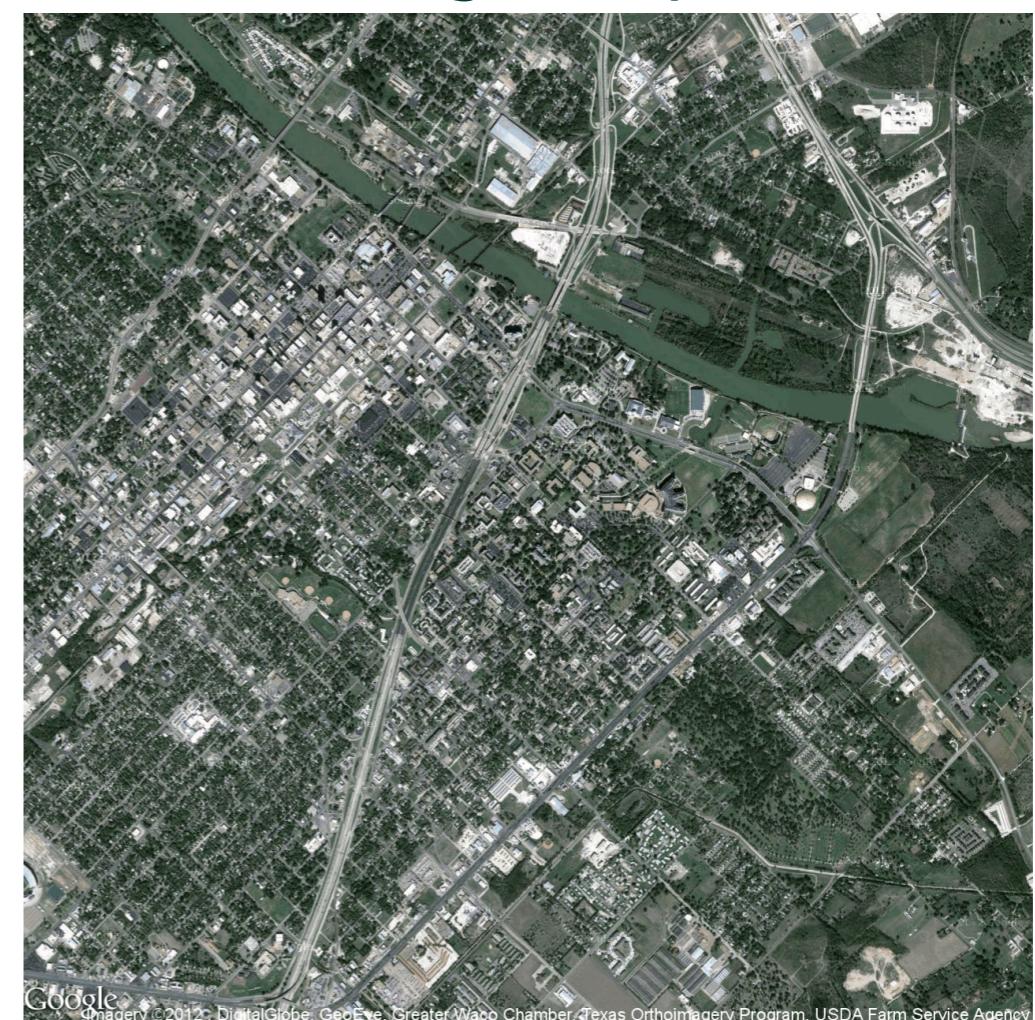
zoom - Map zoom 2–20 integer (2 ≈ continent, 20 ≈ building)

maptype -

Google Maps hybrid



Google Maps satellite

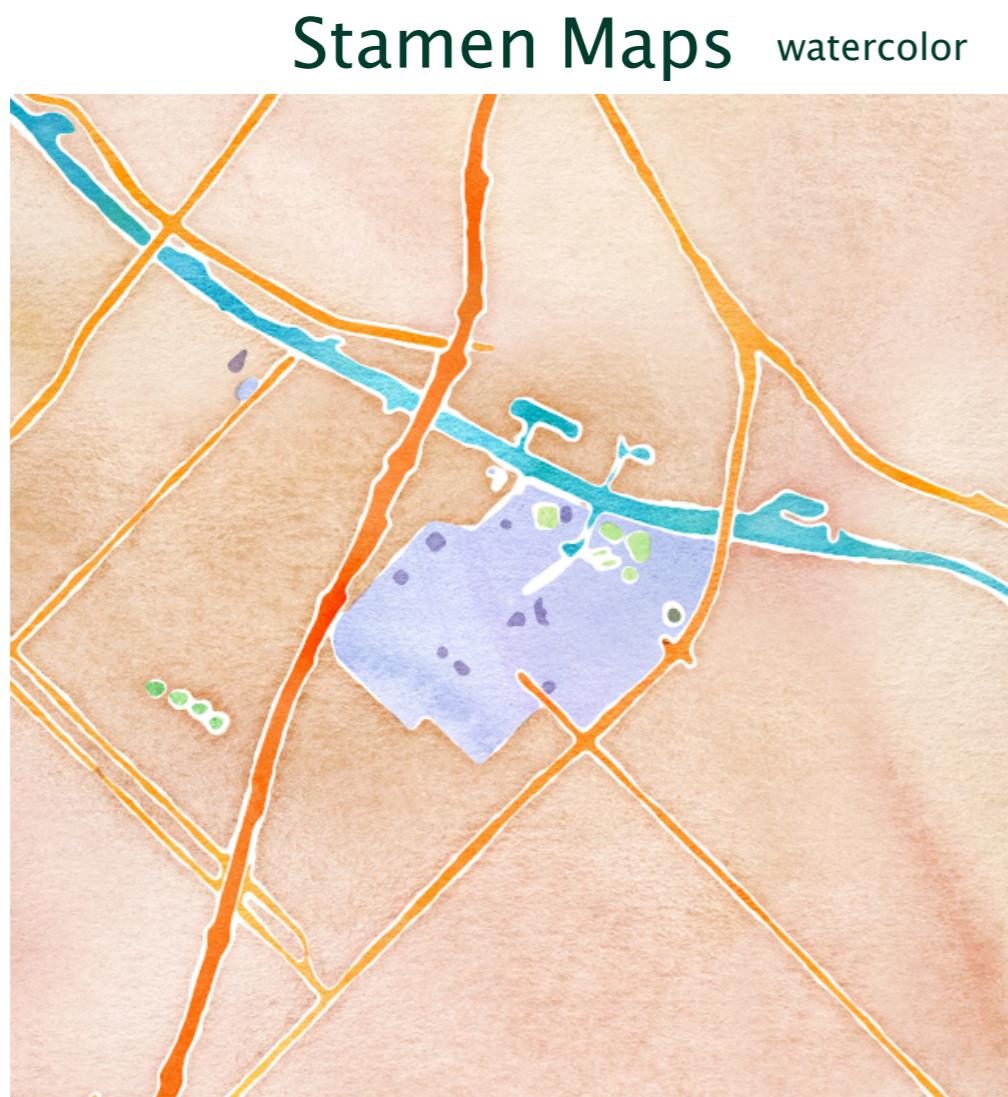


get_map arguments

location - Map dependent

zoom - Map zoom 2–20 integer (2 ≈ continent, 20 ≈ building)

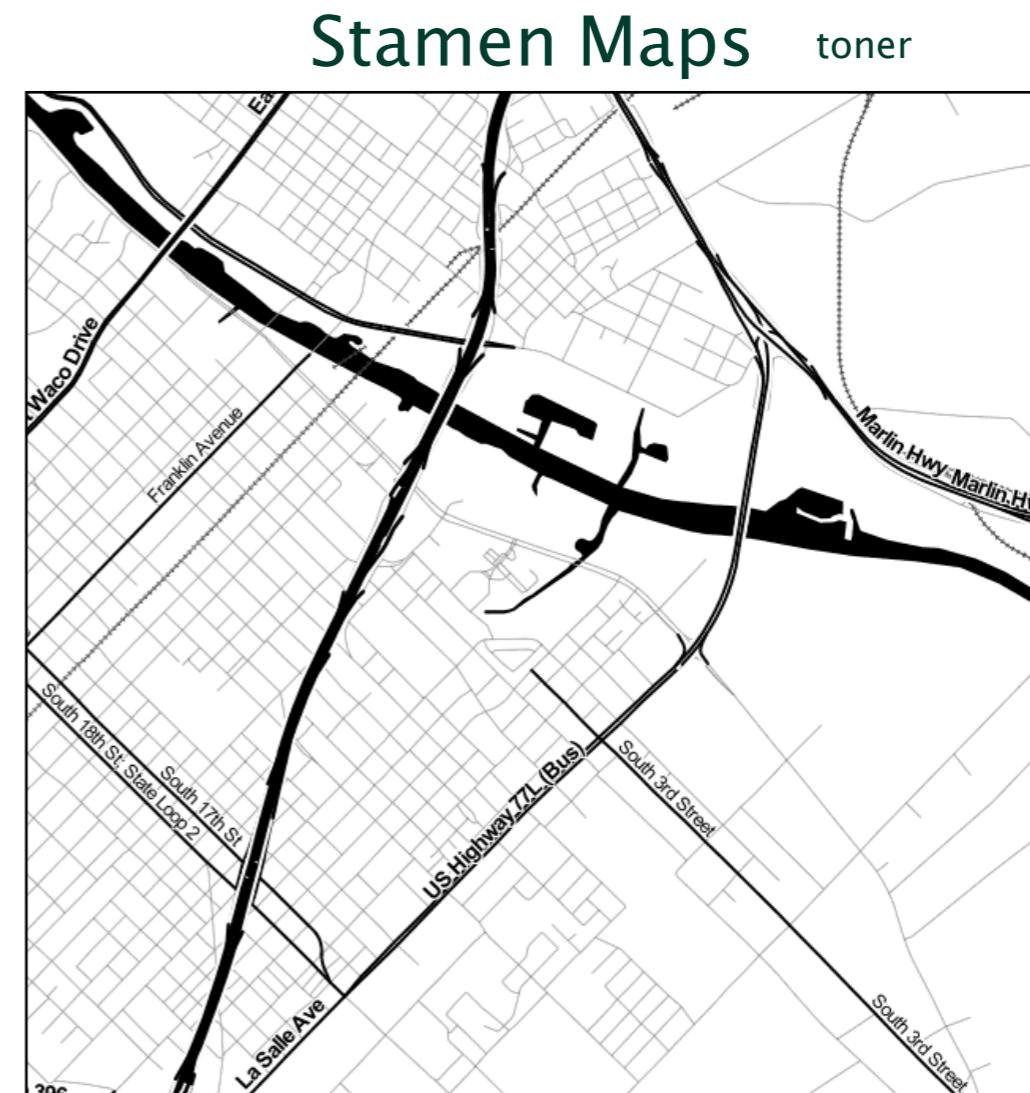
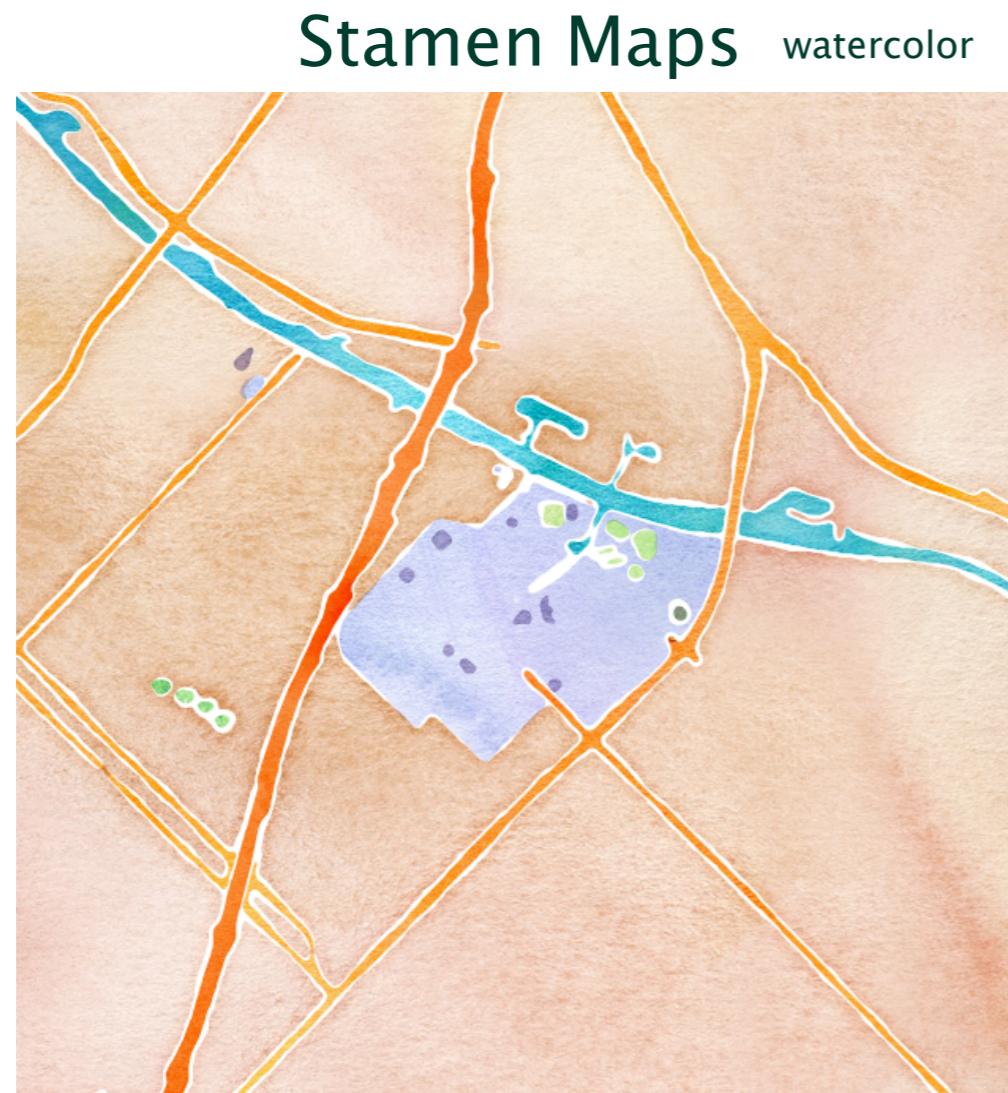
maptype -



location - Map dependent

zoom - Map zoom 2–20 integer (2 ≈ continent, 20 ≈ building)

maptype -



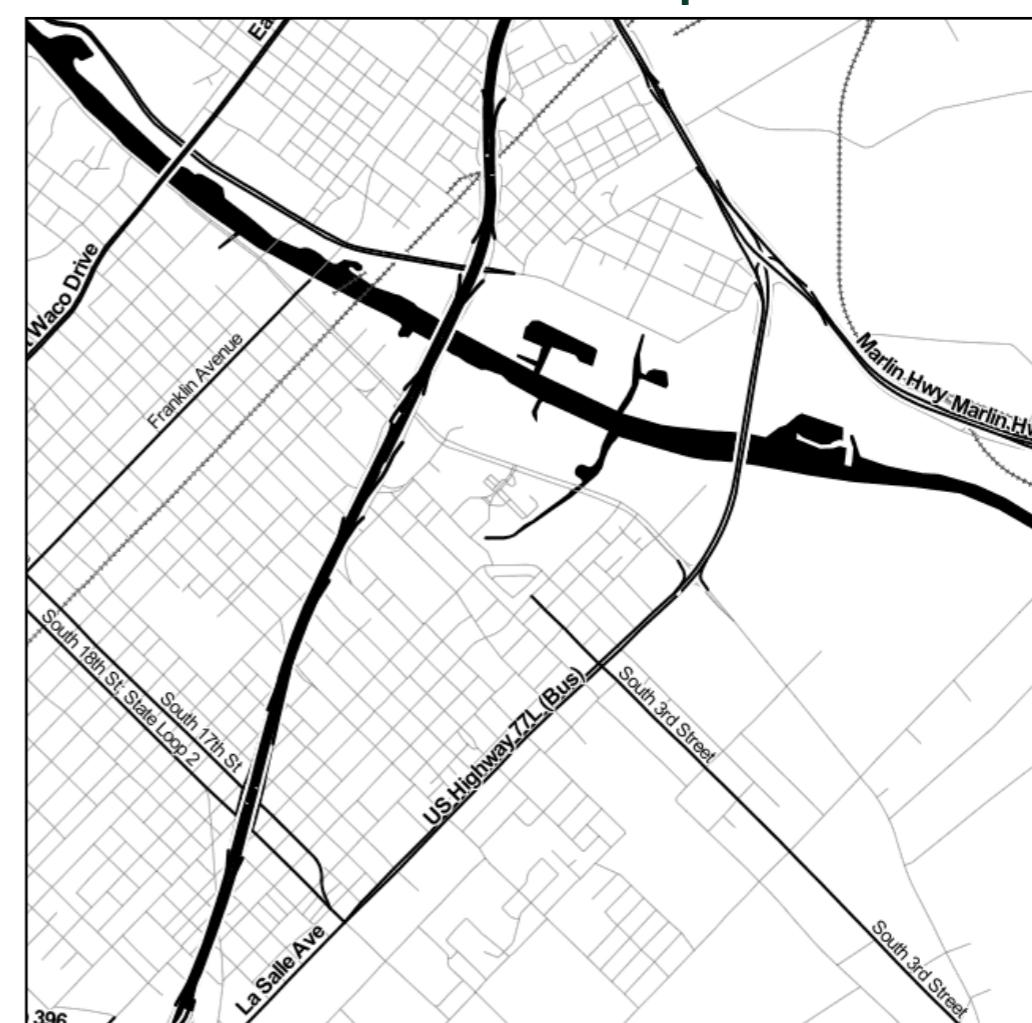
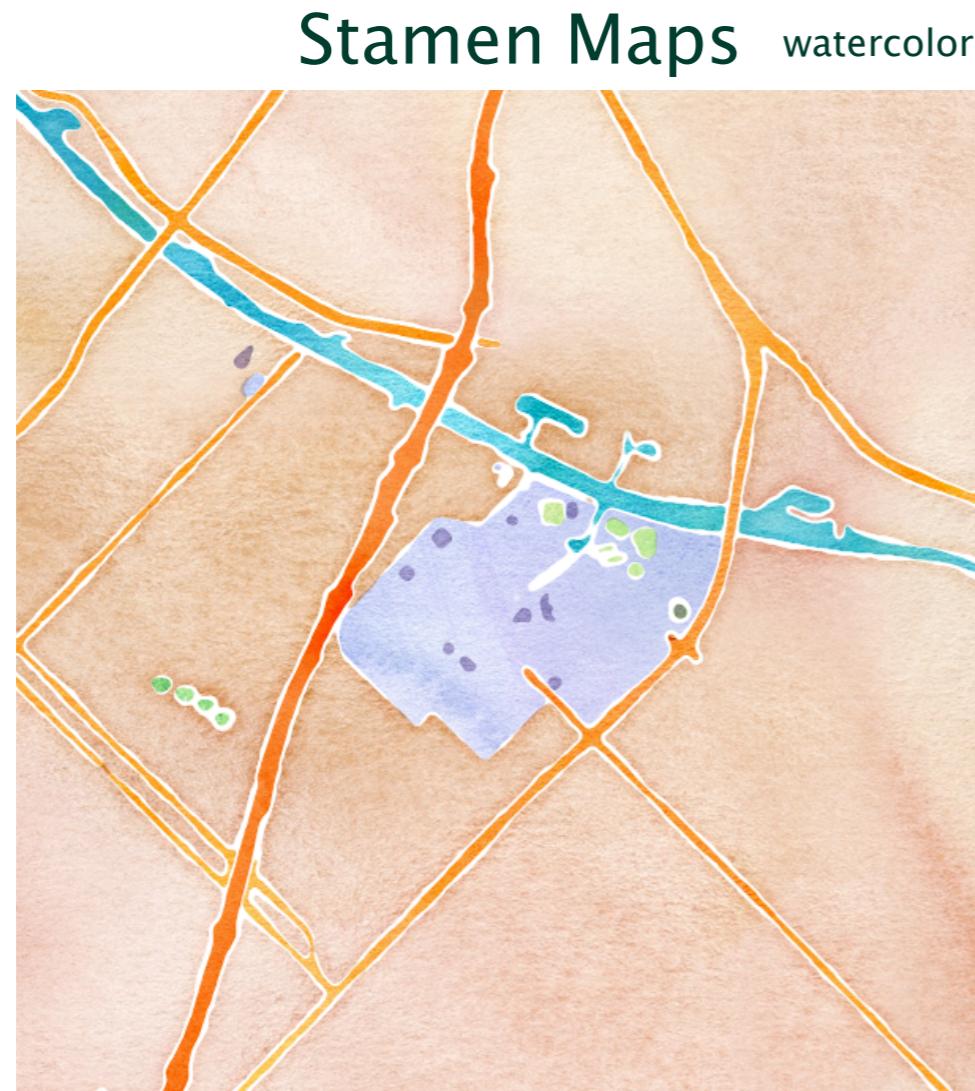
get_map arguments

location - Map dependent

zoom - Map zoom 2–20 integer (2 ≈ continent, 20 ≈ building)

maptype -

Terrain map also available

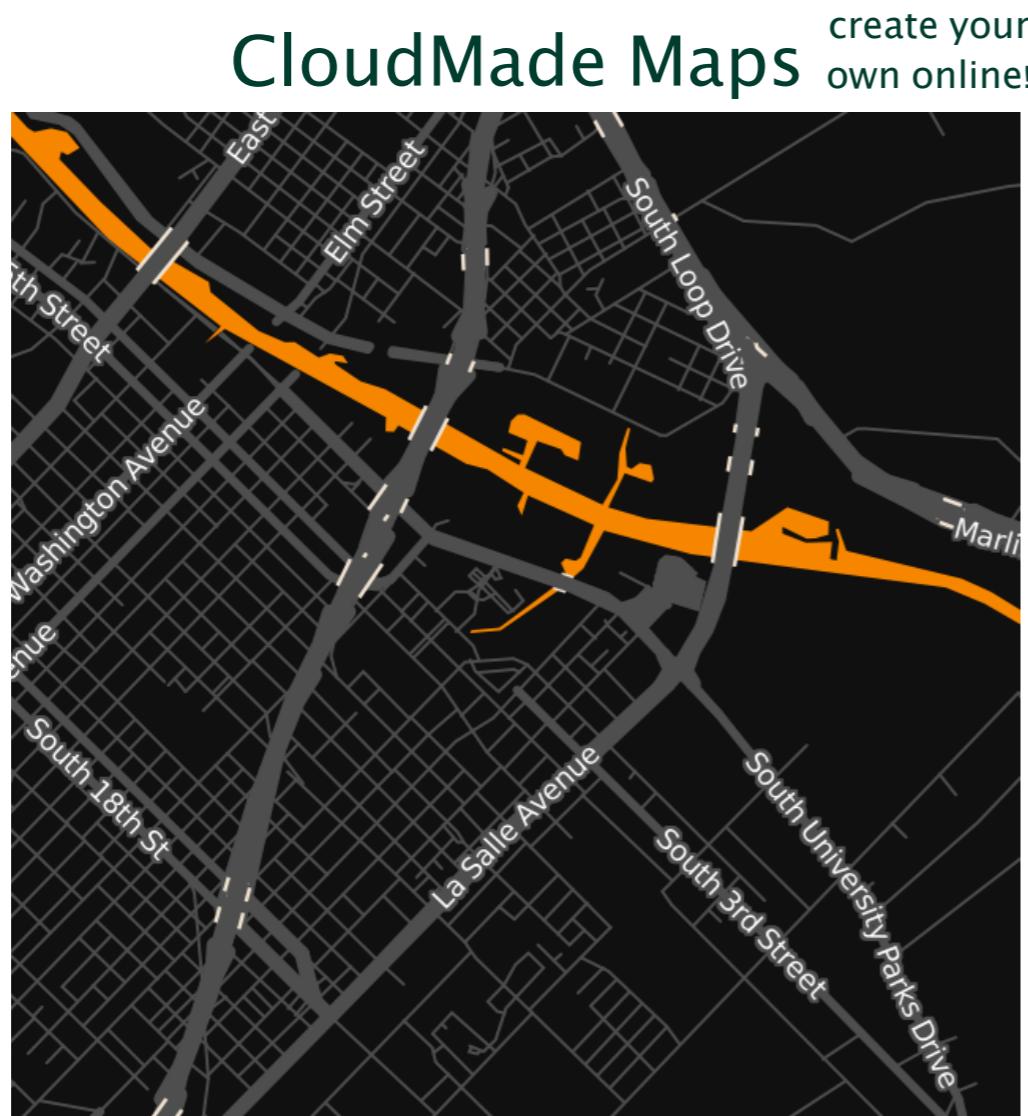


get_map arguments

location - Map dependent

zoom - Map zoom 2–20 integer (2 ≈ continent, 20 ≈ building)

maptype -

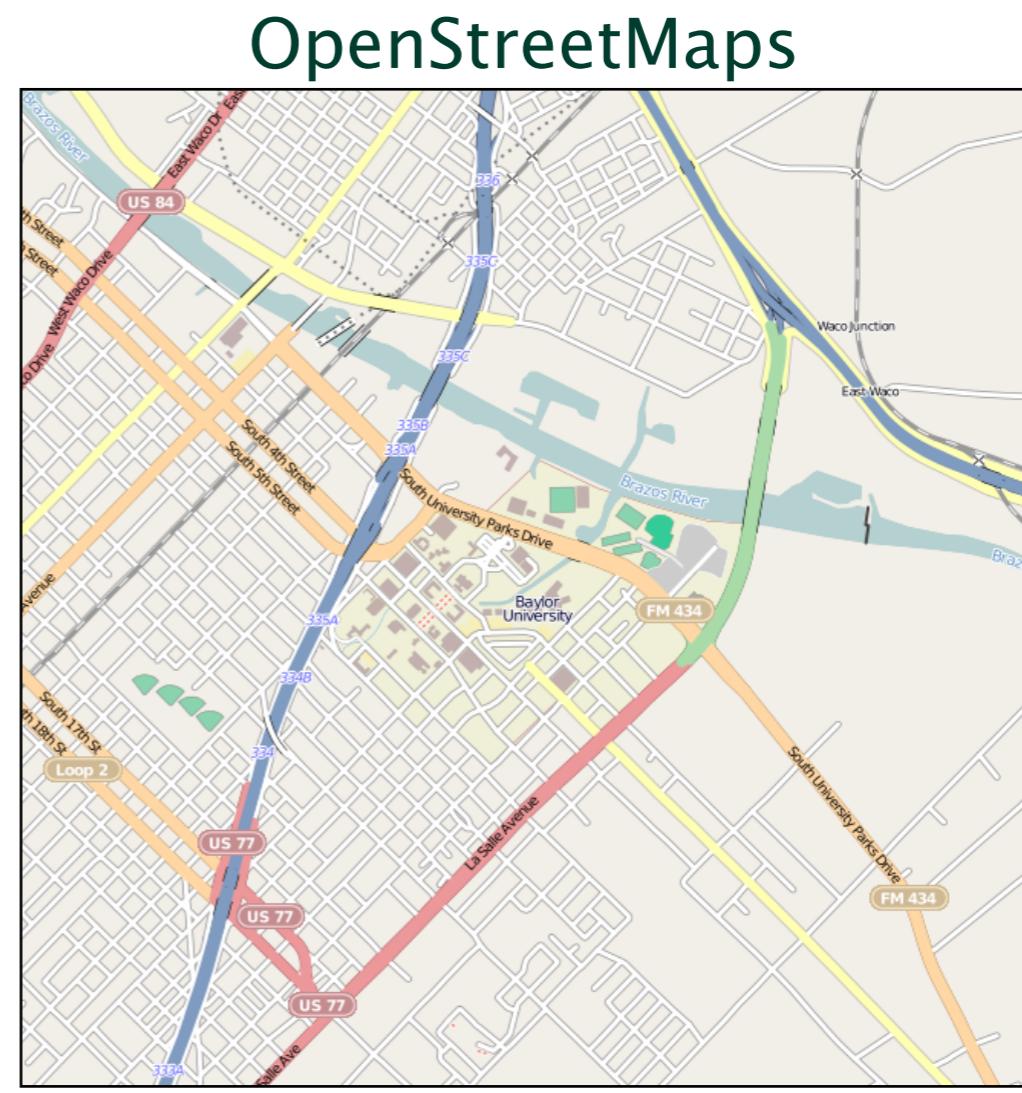
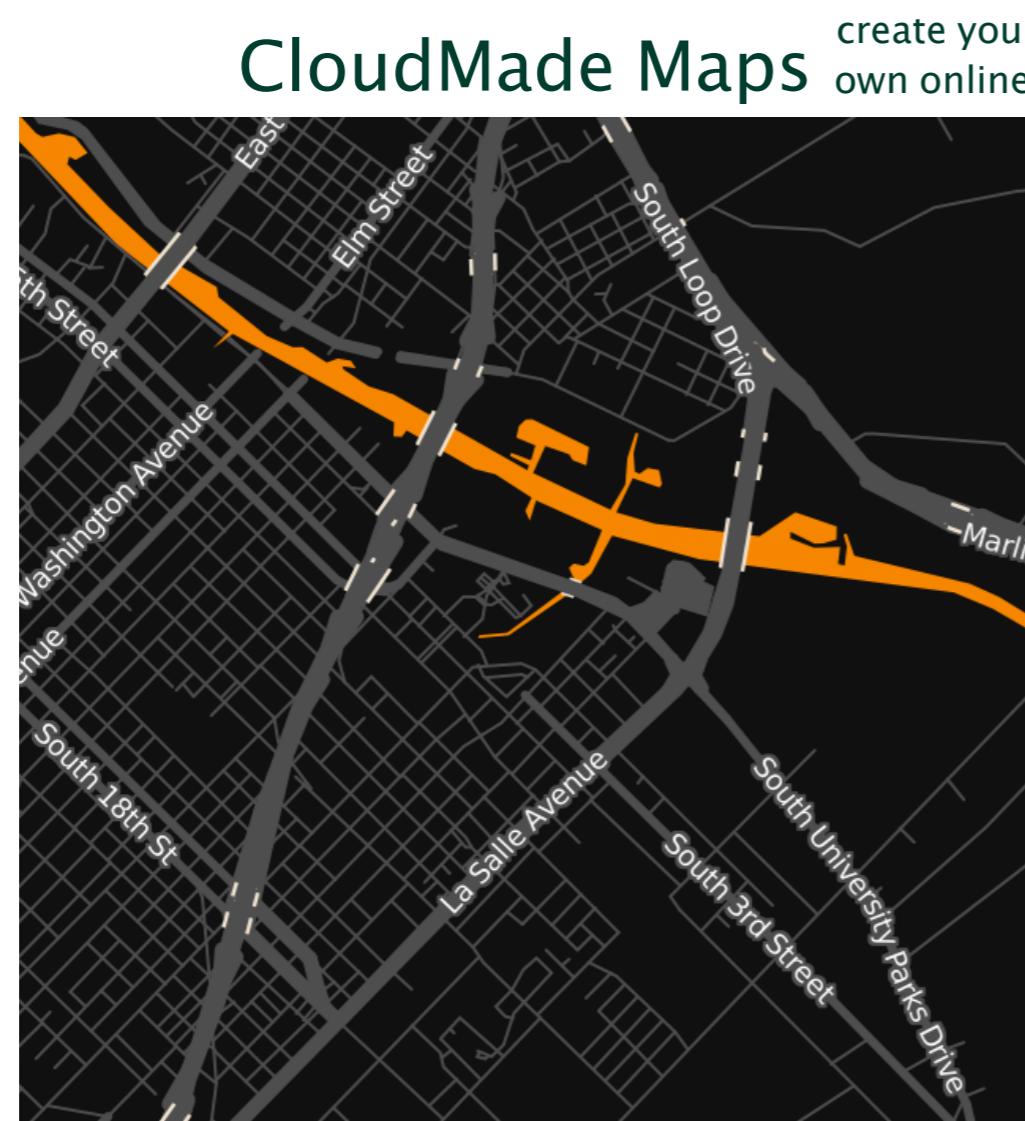


get_map arguments

location - Map dependent

zoom - Map zoom 2–20 integer (2 ≈ continent, 20 ≈ building)

maptype -



ggmap arguments

ggmap - What you got from get_map

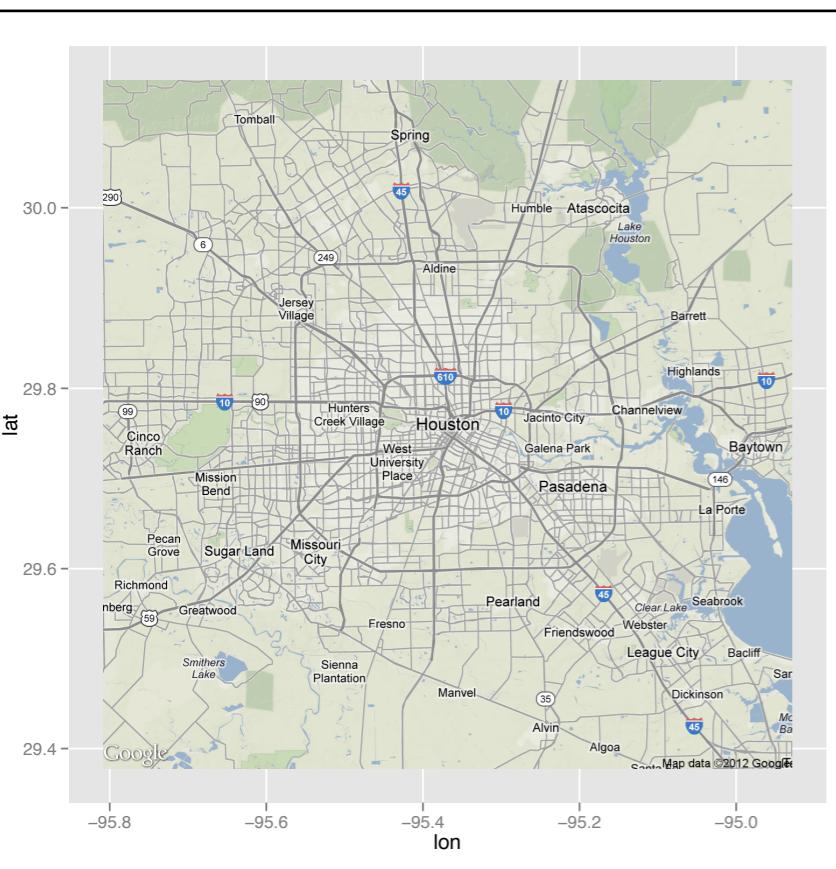
extent - How big the map should be relative to the device

ggmap arguments

`ggmap` - What you got from `get_map`

`extent` - How big the map should be relative to the device

`extent = 'normal'`

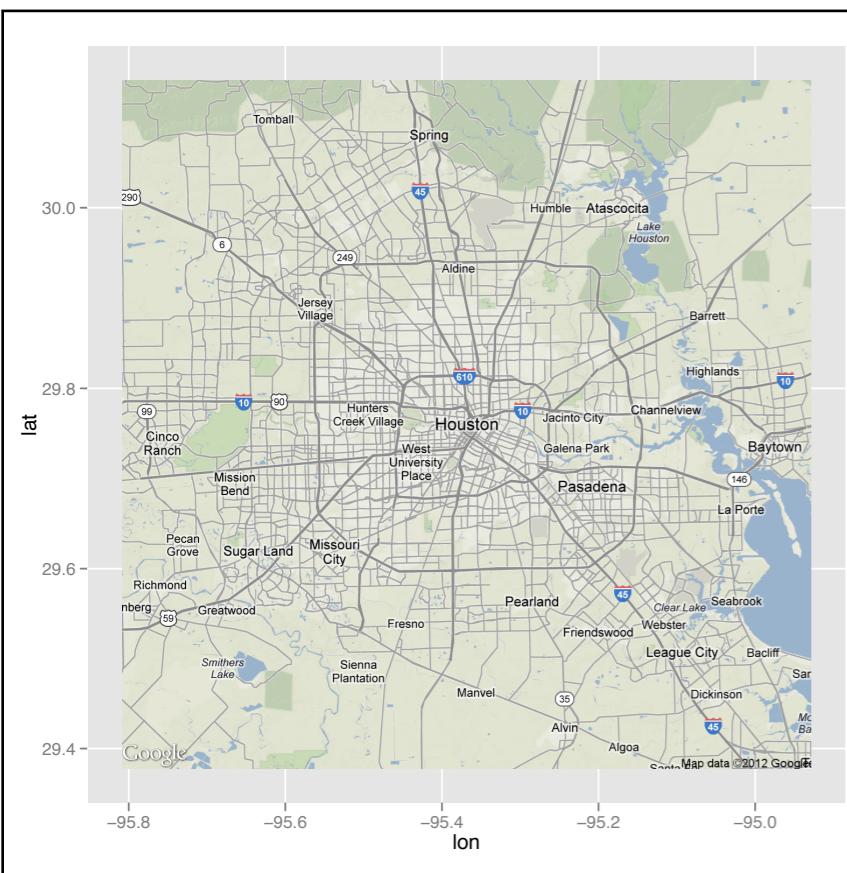


ggmap arguments

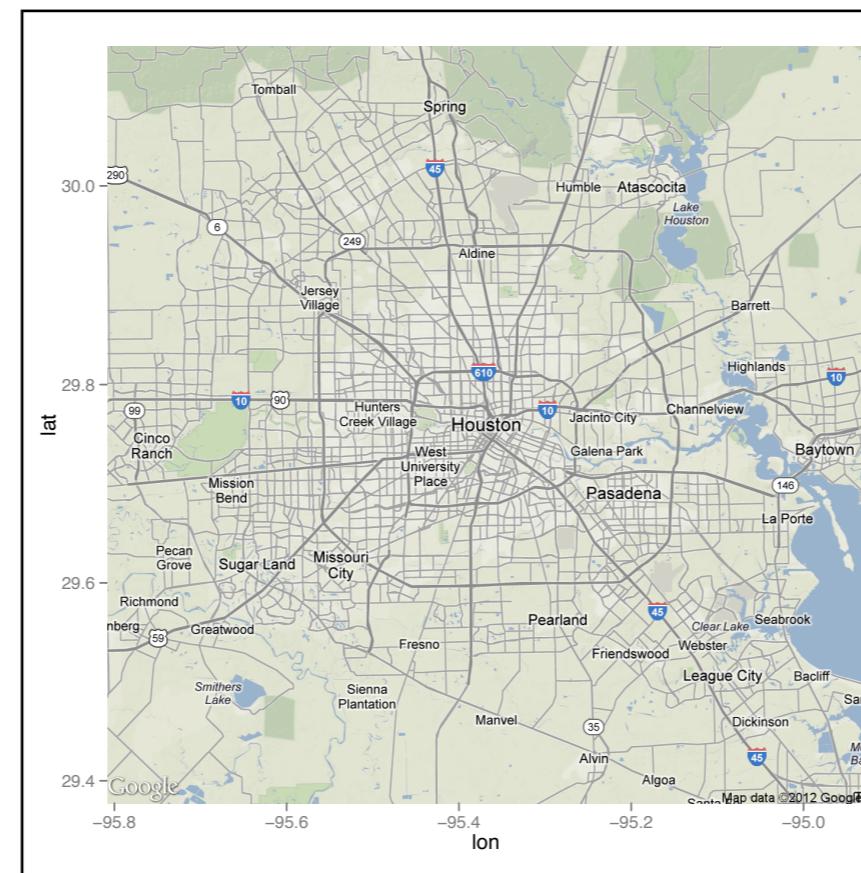
`ggmap` - What you got from `get_map`

`extent` - How big the map should be relative to the device

`extent = 'normal'`



`extent = 'panel'`

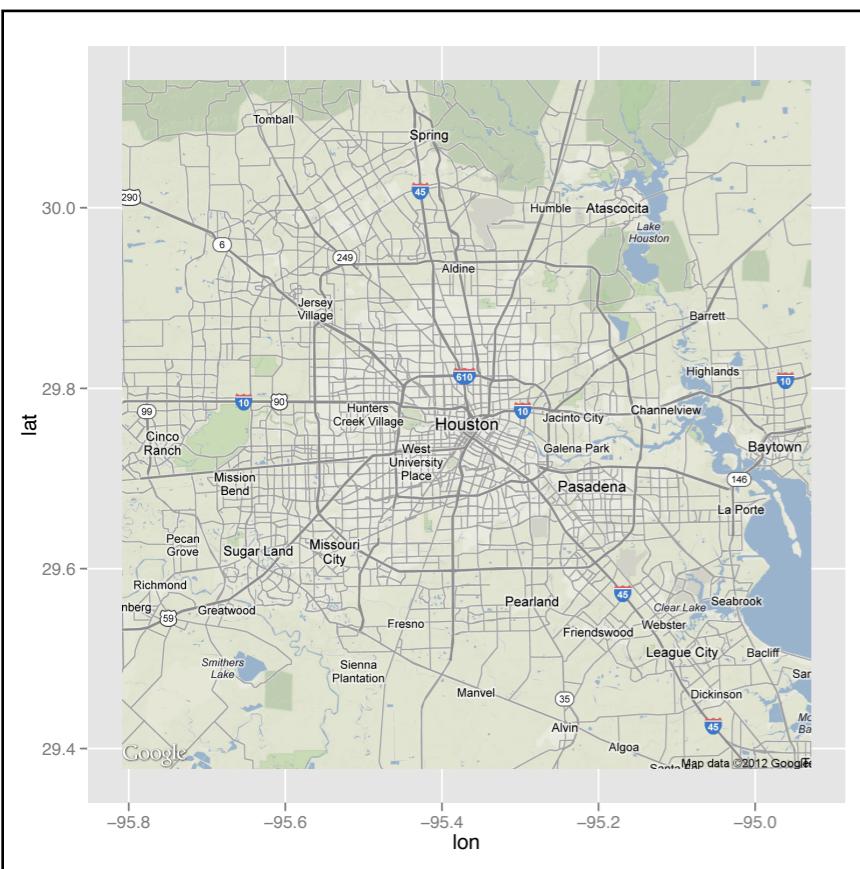


ggmap arguments

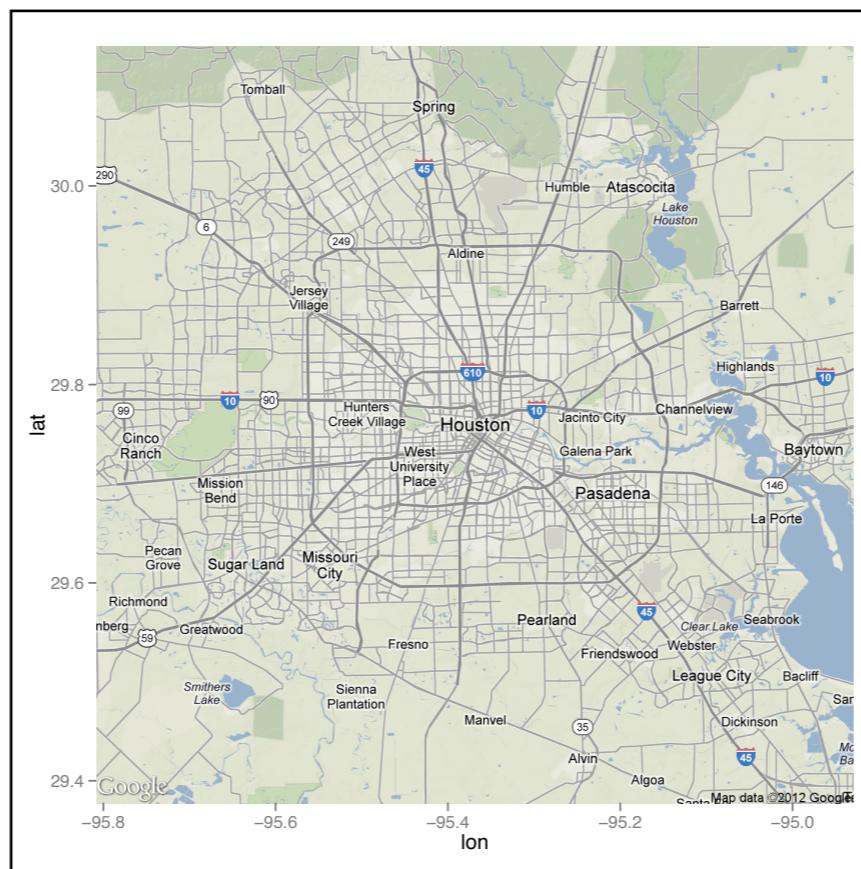
`ggmap` - What you got from `get_map`

`extent` - How big the map should be relative to the device

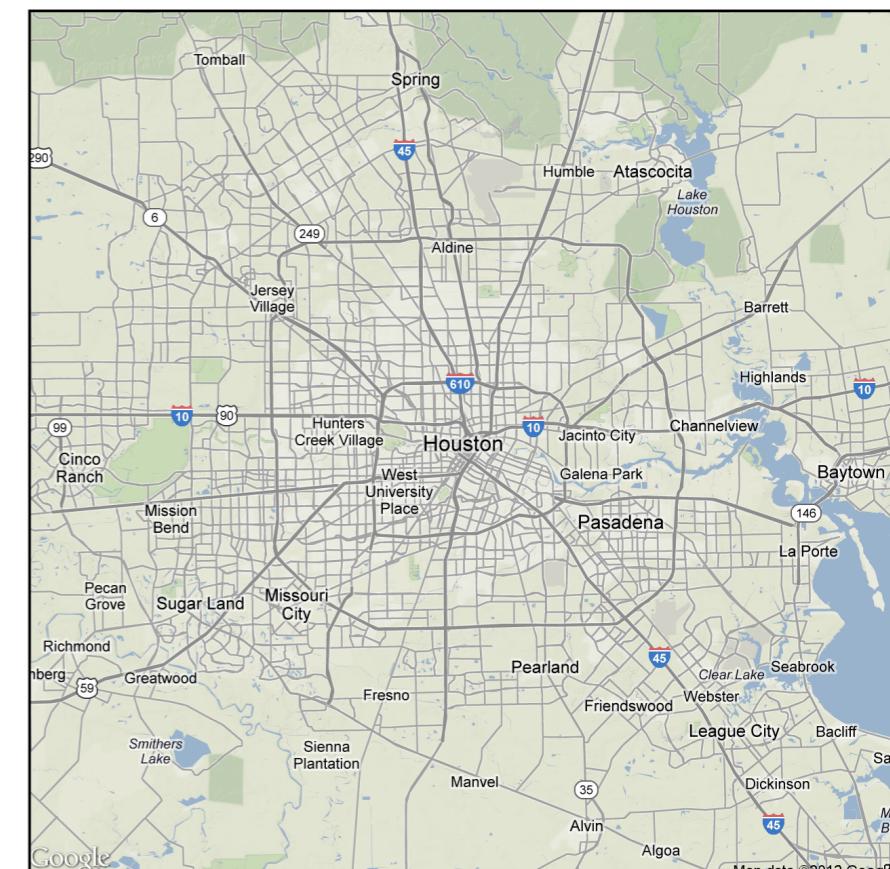
`extent = 'normal'`



`extent = 'panel'`



`extent = 'device'`



ggmap arguments

ggmap - What you got from get_map

extent - How big the map should be relative to the device

ggmap arguments

`ggmap` - What you got from `get_map`

`extent` - How big the map should be relative to the device

`base_layer` - A call which allows for the map but another base layer

ggmap arguments

`ggmap` - What you got from `get_map`

`extent` - How big the map should be relative to the device

`base_layer` - A call which allows for the map but another base layer

`maprange` - Similar to extent

ggmap arguments

`ggmap` - What you got from `get_map`

`extent` - How big the map should be relative to the device

`base_layer` - A call which allows for the map but another base layer

`maprange` - Similar to `extent`

`legend` - Position of legend (very useful for inset legends)

ggmap arguments

`ggmap` - What you got from `get_map`

`extent` - How big the map should be relative to the device

`base_layer` - A call which allows for the map but another base layer

`maprange` - Similar to `extent`

`legend` - Position of legend (very useful for inset legends)

`darken` - Add a tint layer

Adding layers to the base layer

The crime data set contains lat/longs of crimes that occurred in Houston in 2010.

Adding layers to the base layer

```
> # only violent crimes
> violent_crimes <- subset(crime,
+   offense != 'auto theft' &
+   offense != 'theft' &
+   offense != 'burglary'
+ )
>
> # rank violent crimes
> violent_crimes$offense <-
+   factor(violent_crimes$offense,
+   levels = c('robbery', 'aggravated assault',
+   'rape', 'murder')
+ )
>
> # restrict to downtown
> violent_crimes <- subset(violent_crimes,
+   -95.39681 <= lon & lon <= -95.34188 &
+   29.73631 <= lat & lat <= 29.78400
+ )
>
```

The crime data set contains lat/longs of crimes that occurred in Houston in 2010.

In this example we look at **violent crimes in downtown Houston.**

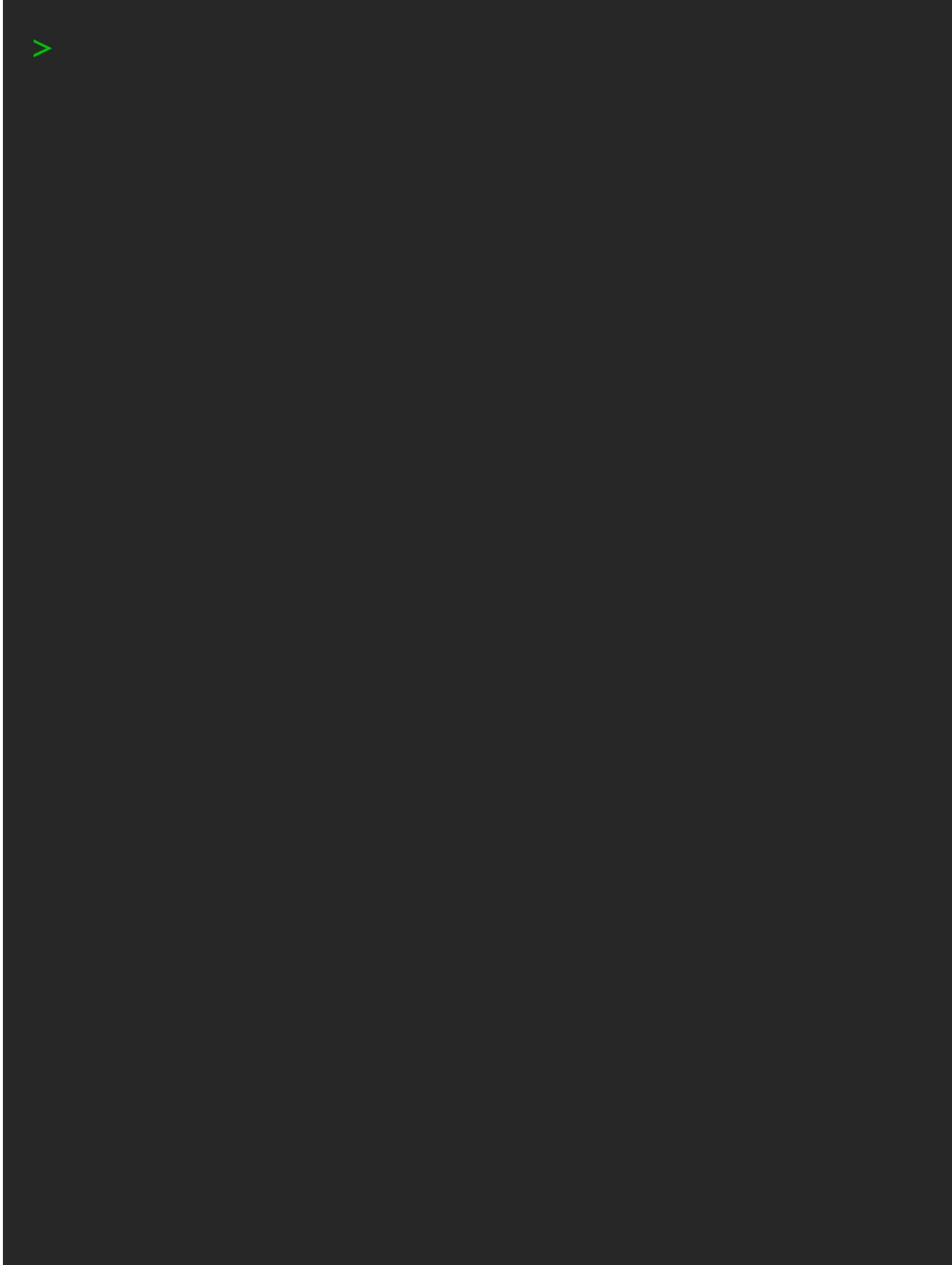
Adding layers to the base layer



Adding layers to the base layer



```
>
```

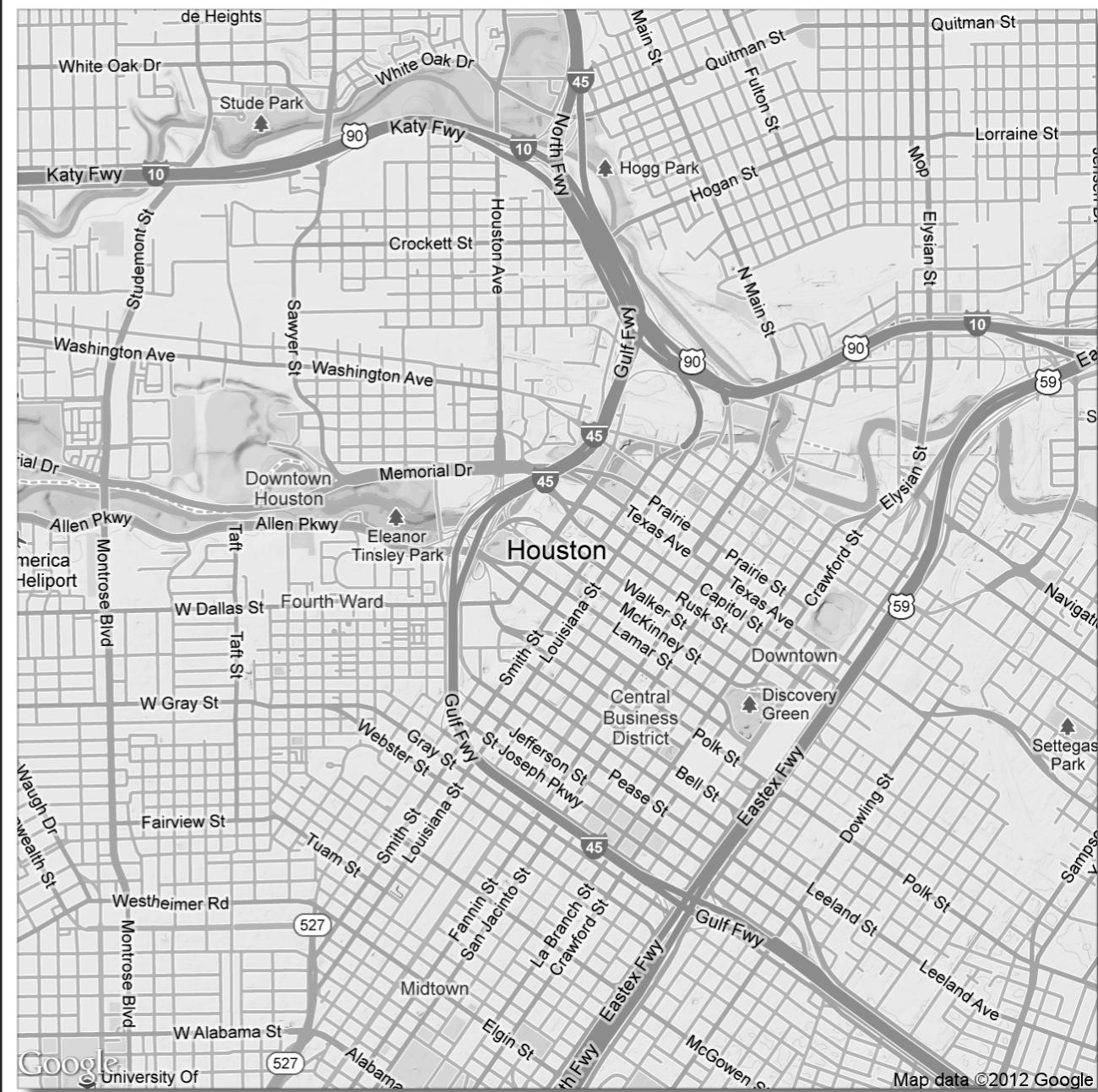


Adding layers to the base layer

```
> HoustonMap <- qmap('houston', zoom = 14,  
+   color = 'bw', legend = 'topleft')  
>
```

Adding layers to the base layer

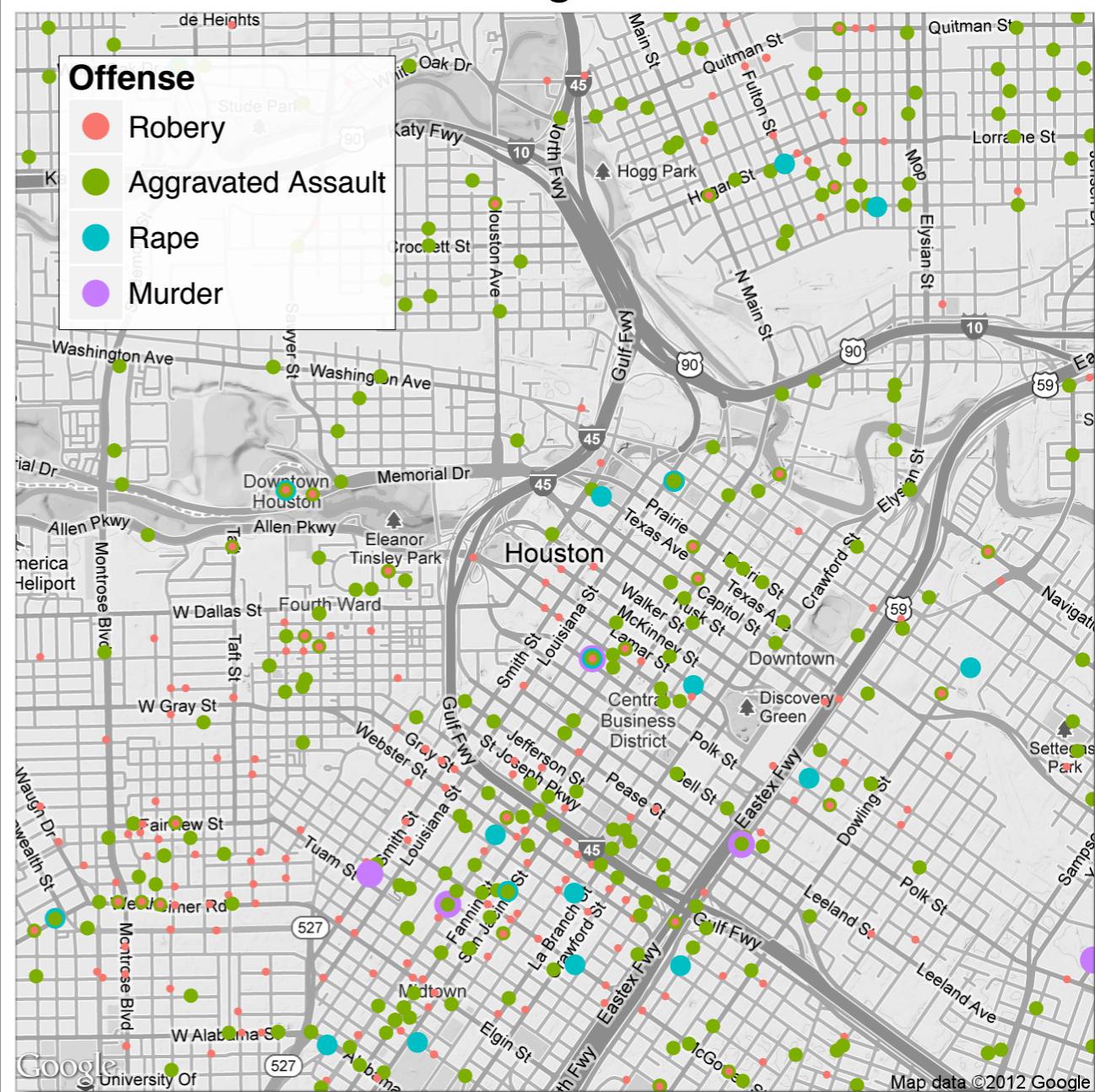
```
> HoustonMap <- qmap('houston', zoom = 14,
+   color = 'bw', legend = 'topleft')
> HoustonMap
>
```



Adding layers to the base layer

```
> HoustonMap <- qmap('houston', zoom = 14,
+   color = 'bw', legend = 'topleft')
> HoustonMap
> HoustonMap +
+   geom_point(
+     aes(x = lon, y = lat, size = offense,
+         colour = offense),
+     data = violent_crimes
+   )
>
```

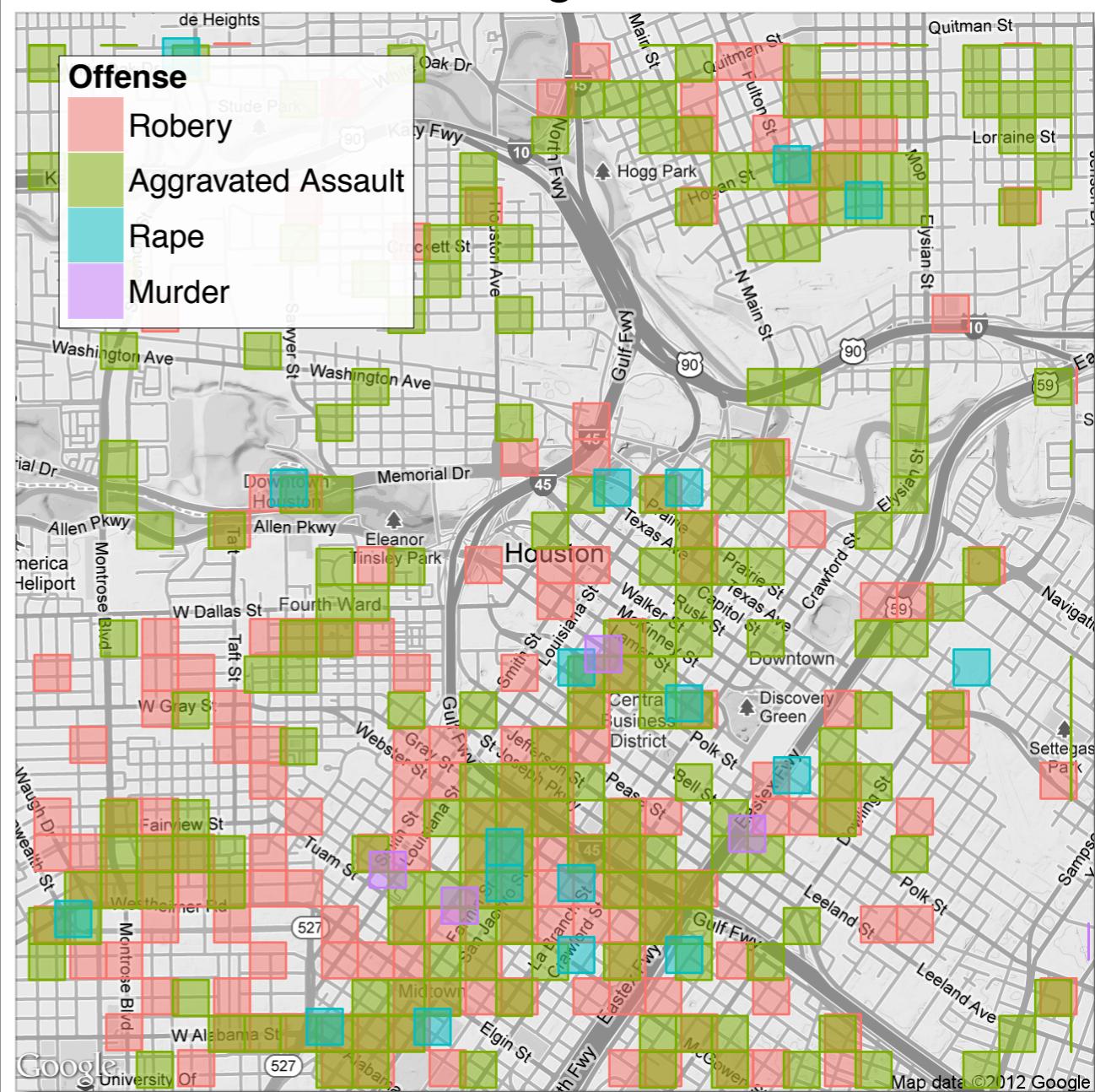
This plot contains some styling changes not shown in the code.



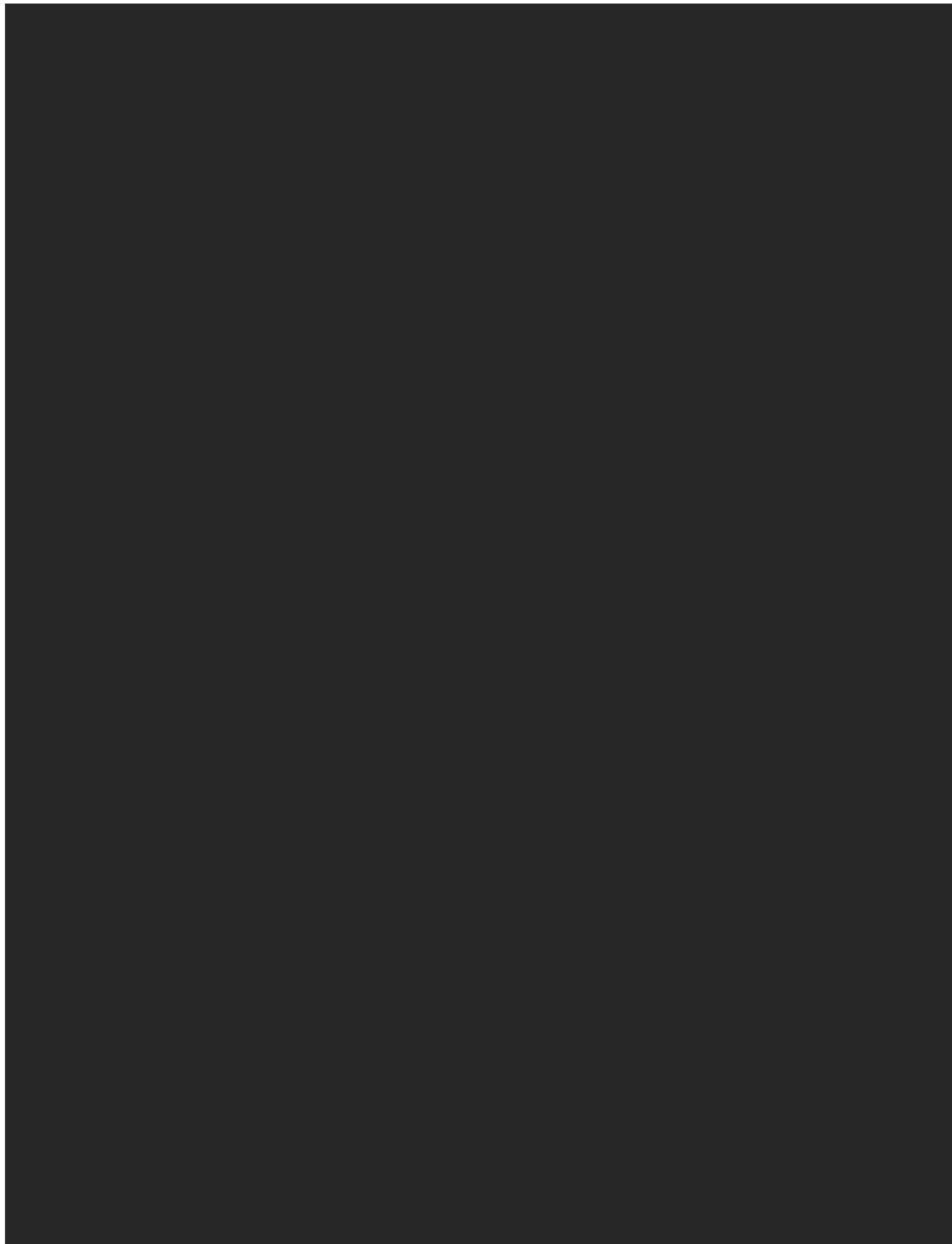
Adding layers to the base layer

```
> HoustonMap <- qmap('houston', zoom = 14,
+   color = 'bw', legend = 'topleft')
> HoustonMap
> HoustonMap +
+   geom_point(
+     aes(x = lon, y = lat, size = offense,
+         colour = offense),
+     data = violent_crimes
+   )
> HoustonMap +
+   stat_bin2d(
+     aes(x = lon, y = lat,
+         colour = offense, fill = offense),
+     size = .5, bins = 30, alpha = 1/2,
+     data = violent_crimes
+   )
>
```

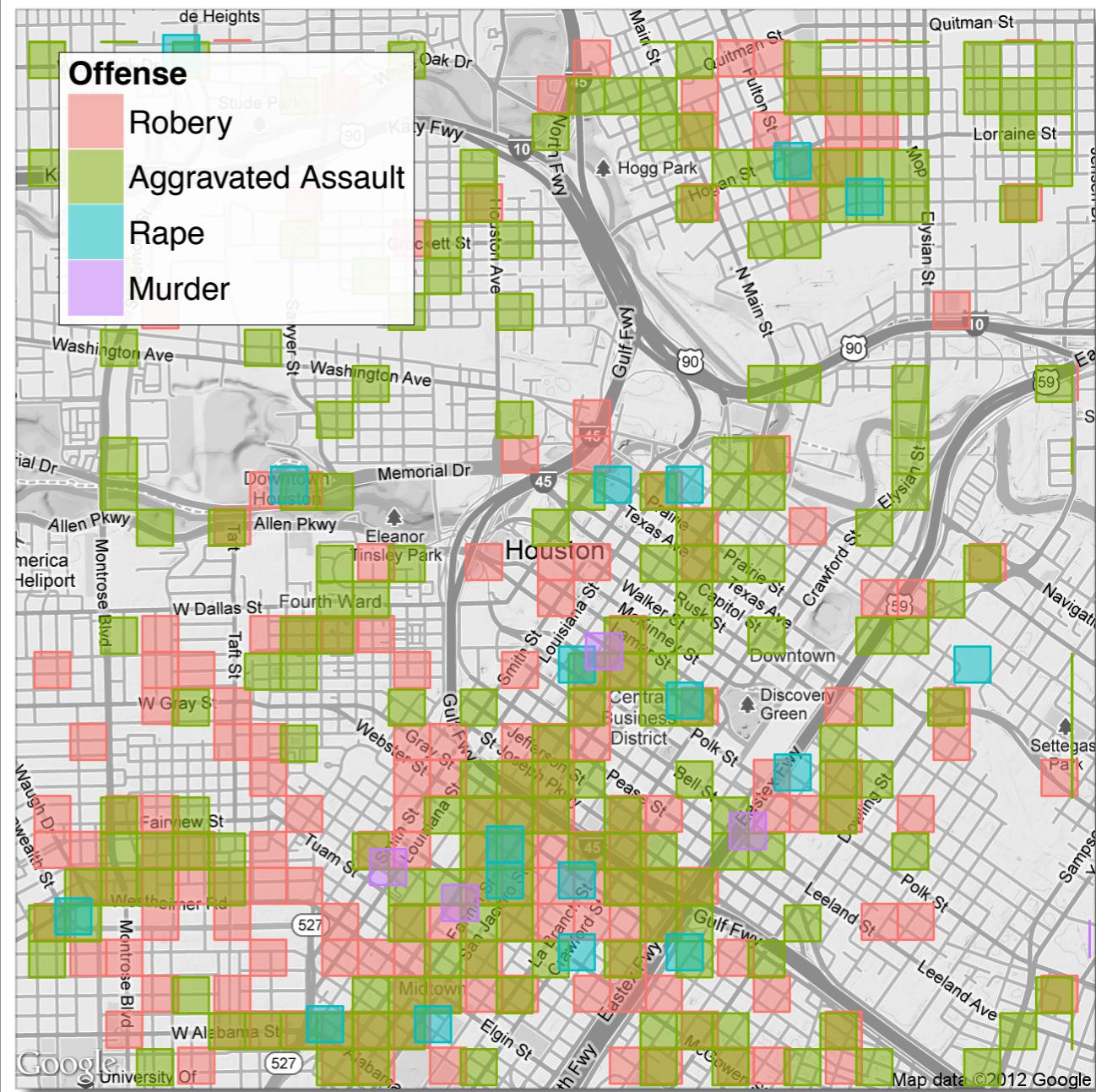
This plot contains some styling changes not shown in the code.



Adding layers to the base layer



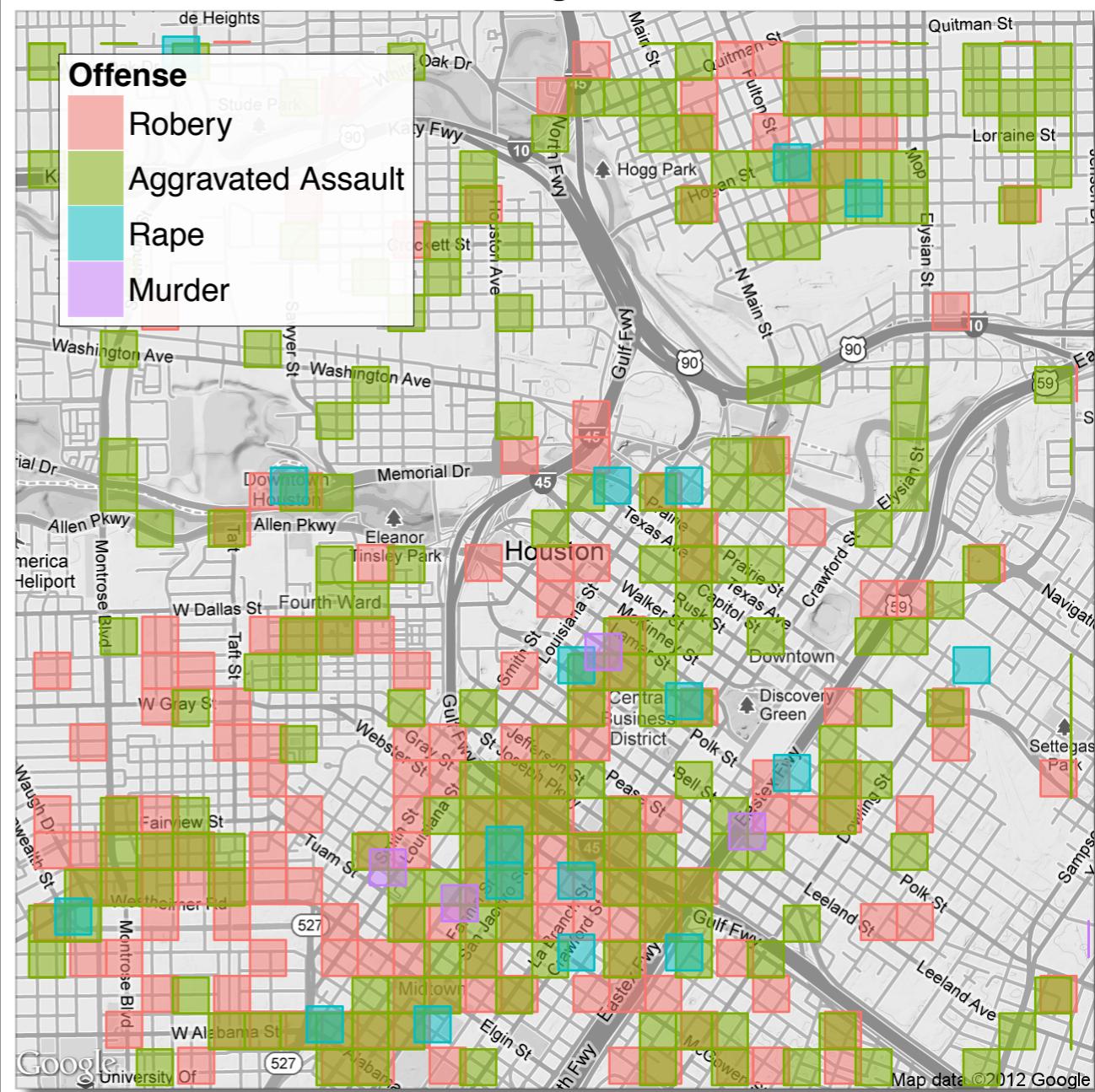
This plot contains some styling changes not shown in the code.



Adding layers to the base layer

>

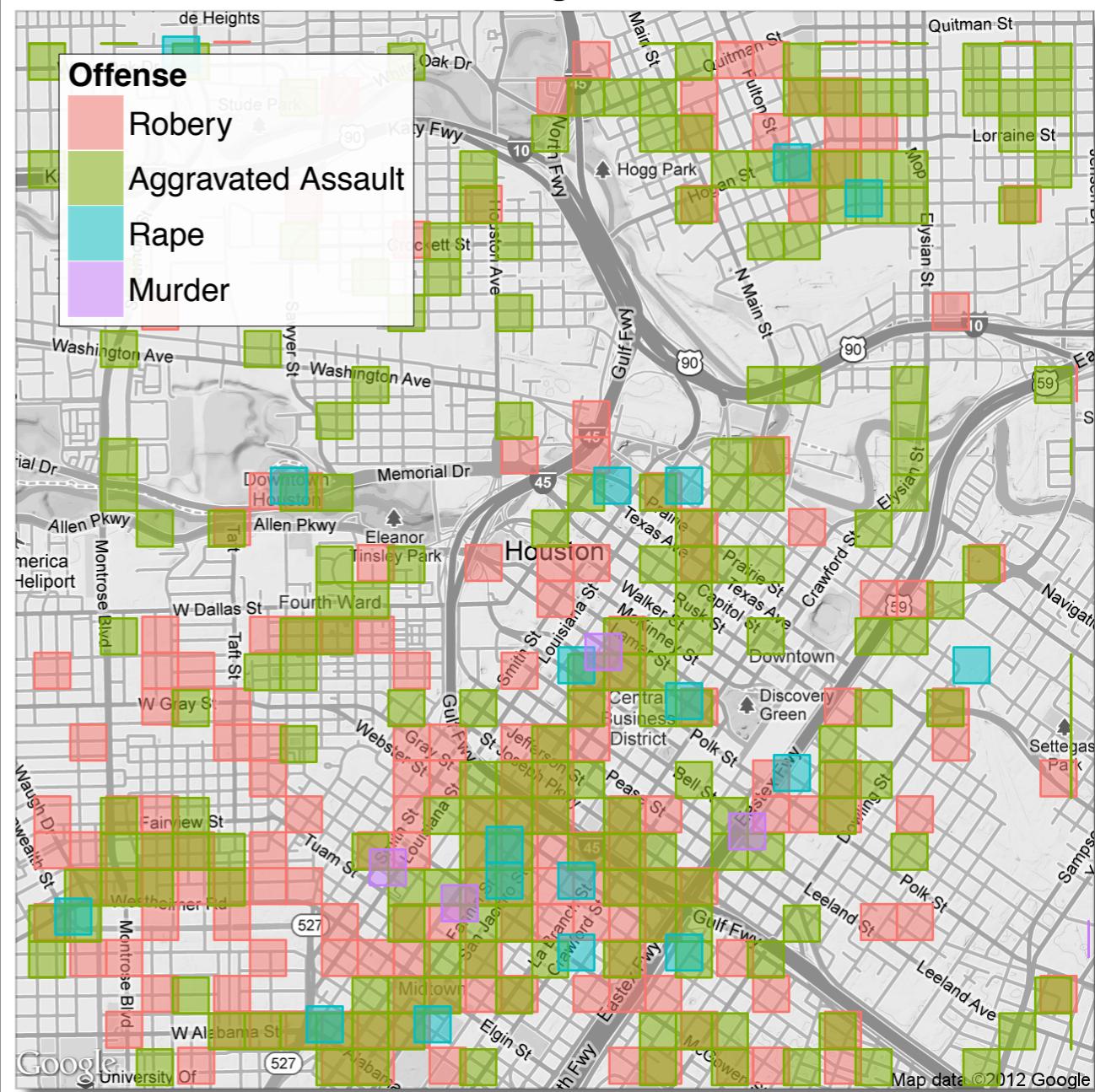
This plot contains some styling changes not shown in the code.



Adding layers to the base layer

```
> houston <- get_map('houston', zoom = 14)
>
```

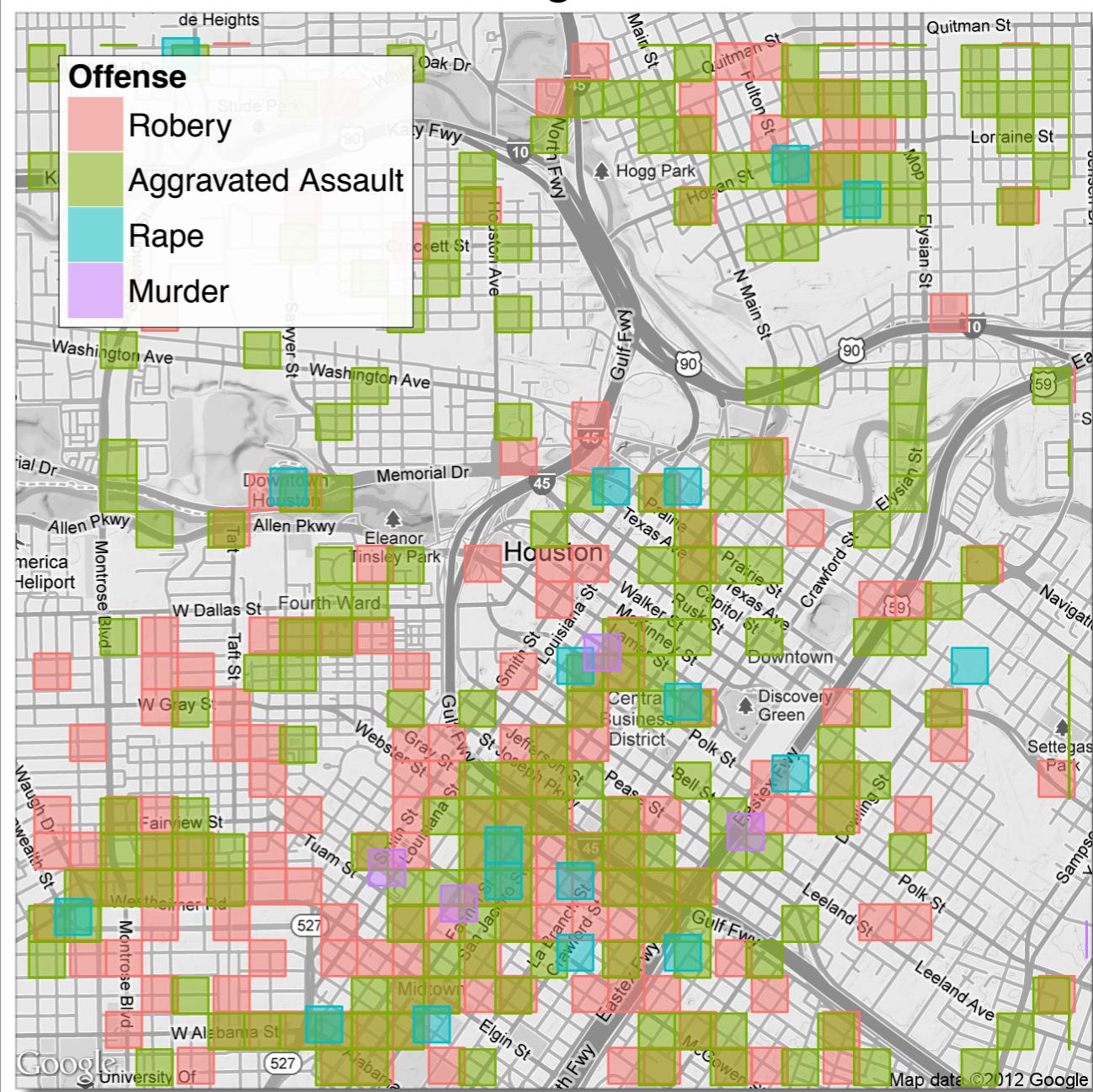
This plot contains some styling changes not shown in the code.



Adding layers to the base layer

```
> houston <- get_map('houston', zoom = 14)
> HoustonMap <- ggmap(houston,
+   extent = 'device', legend = 'topleft')
>
```

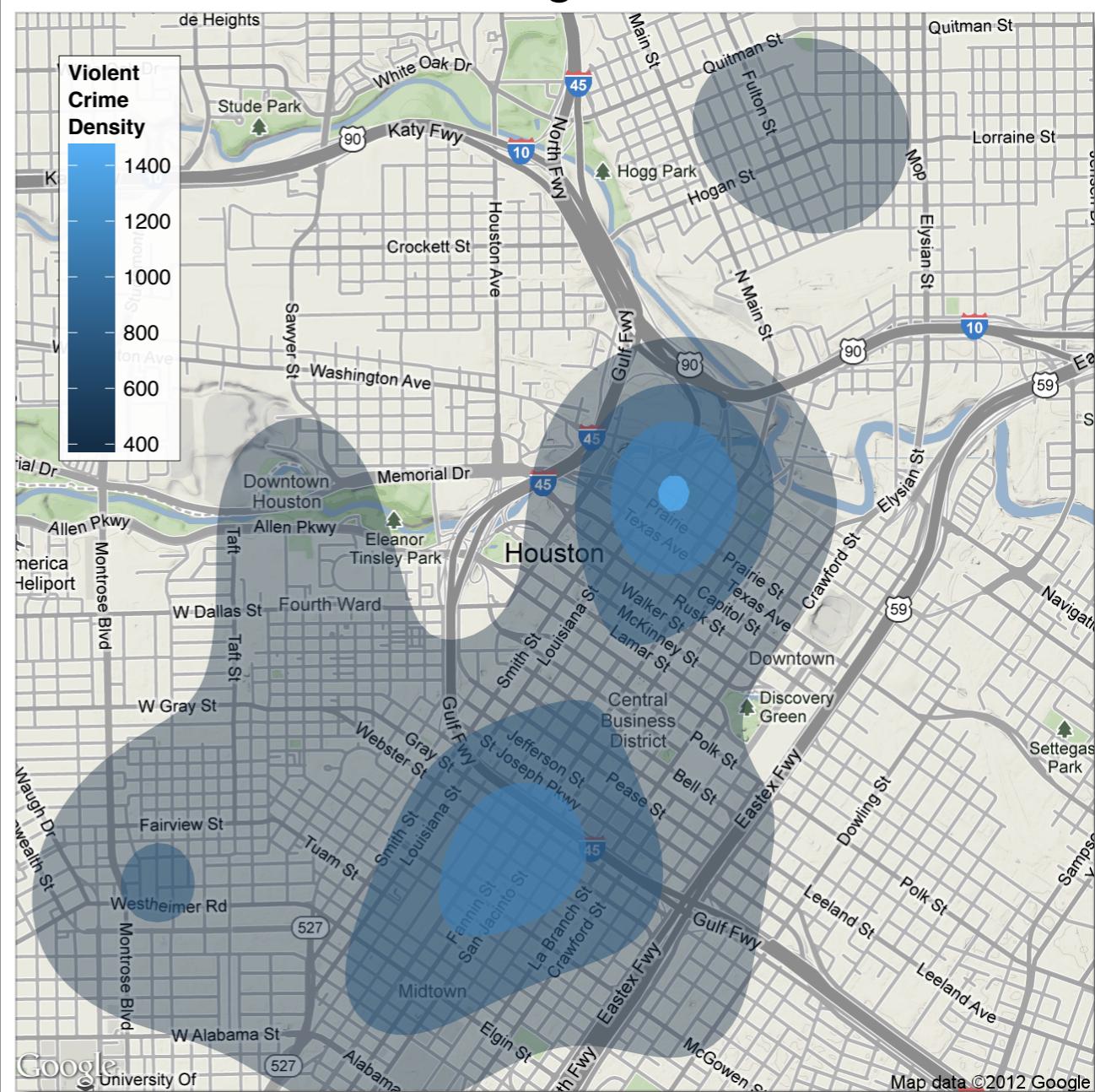
This plot contains some styling changes not shown in the code.



Adding layers to the base layer

```
> houston <- get_map('houston', zoom = 14)
> HoustonMap <- ggmap(houston,
+   extent = 'device', legend = 'topleft')
> HoustonMap +
+   stat_density2d(
+     aes(x = lon, y = lat,
+         fill = ..level.., alpha = ..level..),
+     size = 2, bins = 4,
+     data = violent_crimes,
+     geom = 'polygon')
+ )
>
```

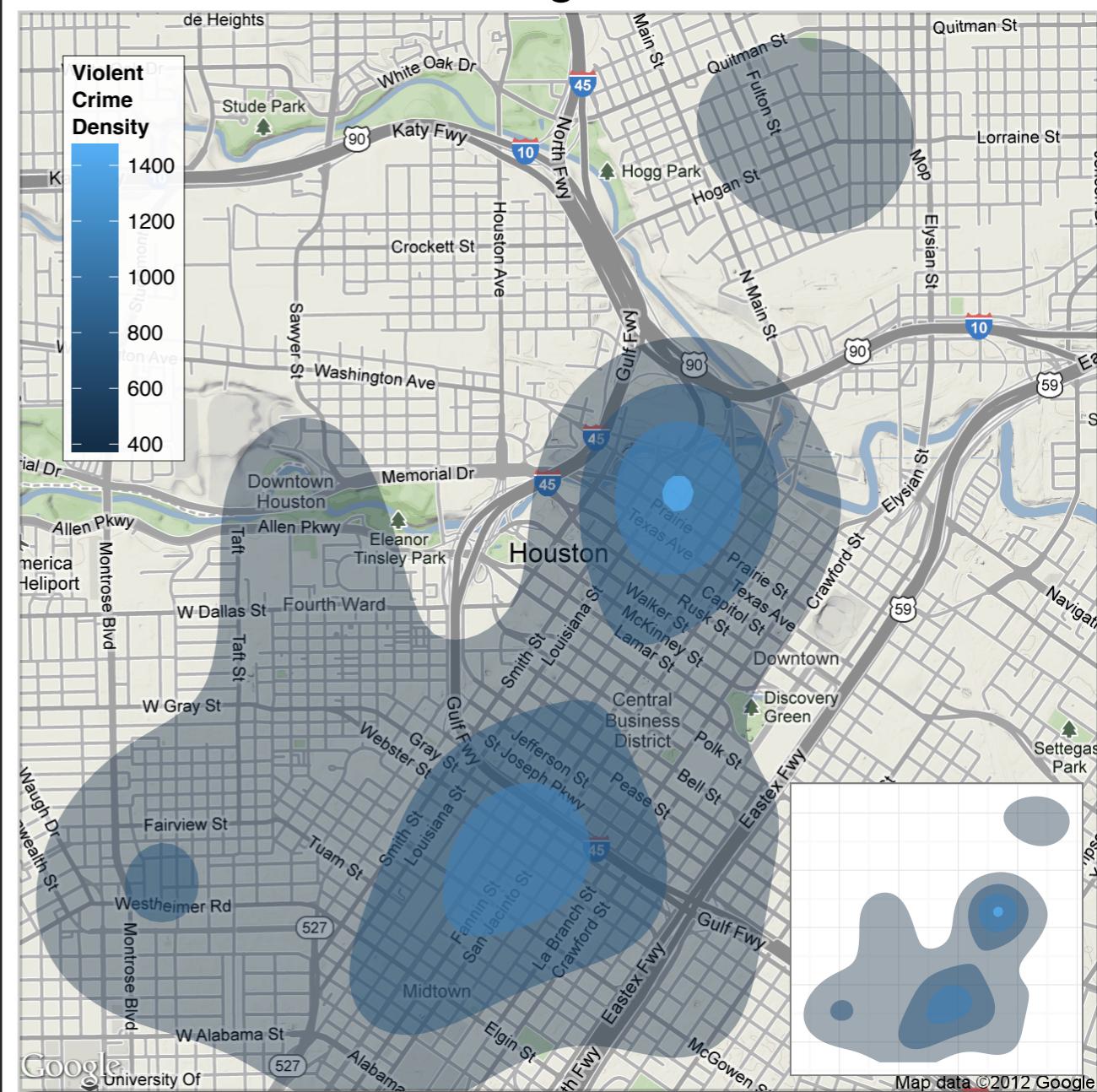
This plot contains some styling changes not shown in the code.



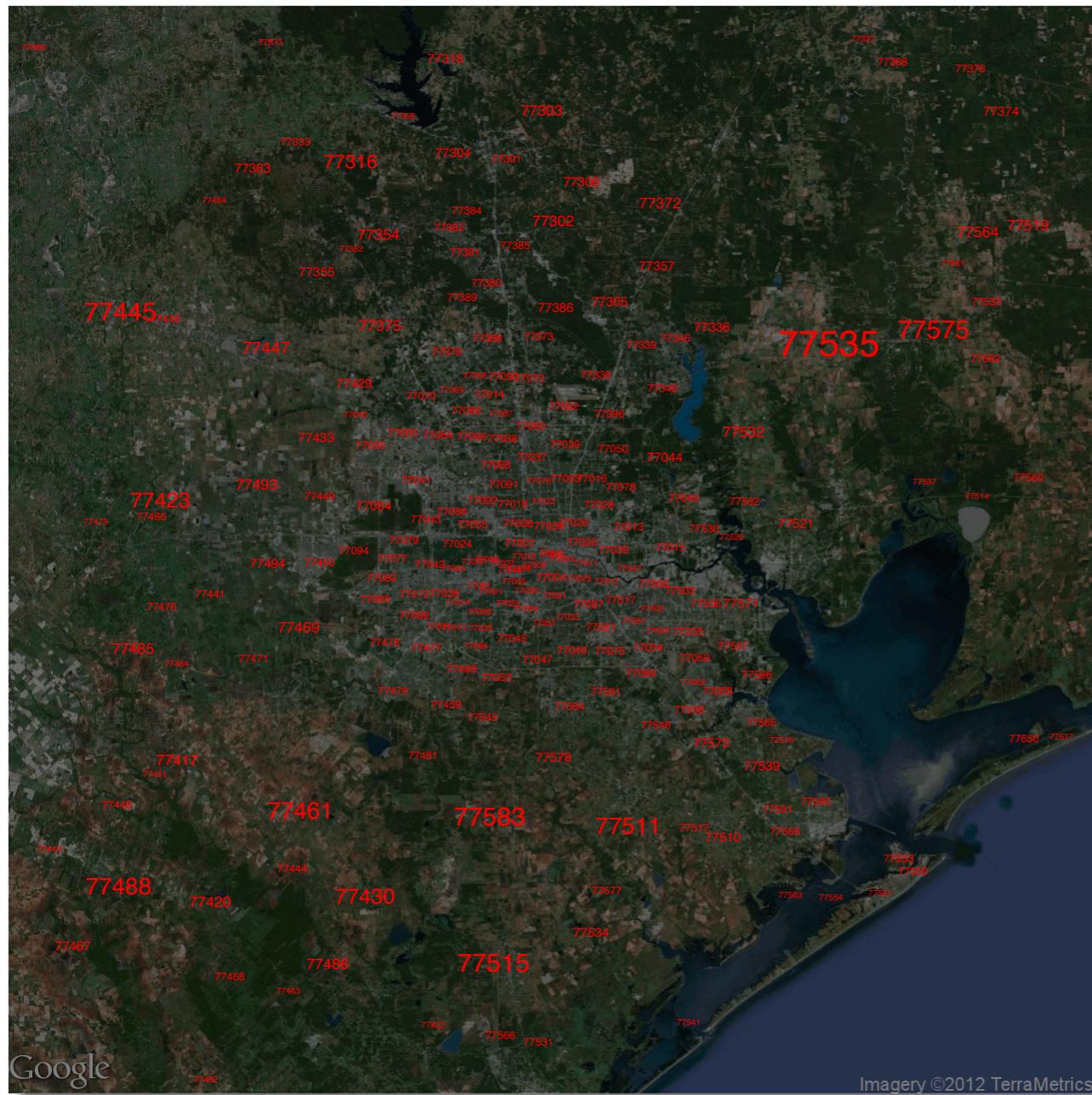
Adding layers to the base layer

```
> houston <- get_map('houston', zoom = 14)
> HoustonMap <- ggmap(houston,
+   extent = 'device', legend = 'topleft')
> HoustonMap +
+   stat_density2d(
+     aes(x = lon, y = lat,
+         fill = ..level.., alpha = ..level..),
+     size = 2, bins = 4,
+     data = violent_crimes,
+     geom = 'polygon')
+ )
> # using the 'inset' function...
```

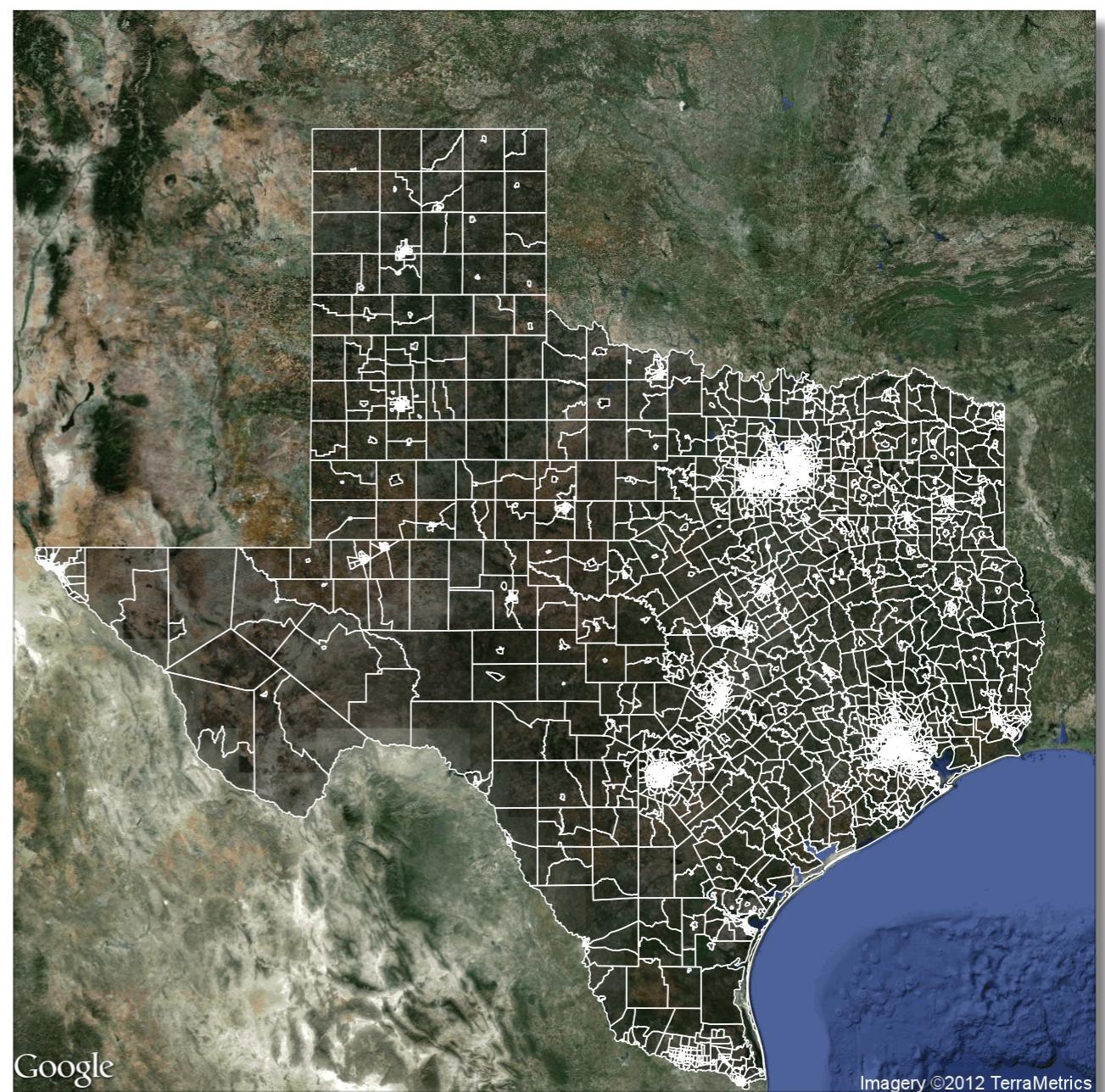
This plot contains some styling changes not shown in the code.



Zip codes sized by area with darken



Shape file of census tract boundaries



ggmap's utility functions



ggmap's utility functions

geocode -



ggmap's utility functions

geocode -

```
> geocode('vanderbilt university')
  lon      lat      type    loctype      address
1 -86.80443 36.14426 university approximate [long address]

  north     south      east      west postal_code      country
1 36.15327 36.13525 -86.78842 -86.82044      37240 united states

  administrative_area_level_2 administrative_area_level_1
1                           davidson                         tennessee

  locality      street streetNo point_of_interest
1 nashville    west end      ave        2305           <NA>
```



ggmap's utility functions

geocode -
and revgeocode!

```
> geocode('vanderbilt university')
  lon      lat      type    loctype      address
1 -86.80443 36.14426 university approximate [long address]

  north     south      east      west postal_code      country
1 36.15327 36.13525 -86.78842 -86.82044      37240 united states

  administrative_area_level_2 administrative_area_level_1
1                               davidson                         tennessee

  locality       street streetNo point_of_interest
1 nashville      west   end    ave           2305          <NA>
```



ggmap's utility functions

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  administrative_area_level_2 administrative_area_level_1
1                               davidson                         tennessee

  locality          street streetNo point_of_interest
1 nashville        west   end    ave           2305             <NA>
```

mapdist -



ggmap's utility functions

geocode -
and revgeocode!

```
> geocode('vanderbilt university')
  lon      lat      type    loctype      address
1 -86.80443 36.14426 university approximate [long address]

  north     south      east      west postal_code      country
1 36.15327 36.13525 -86.78842 -86.82044      37240 united states

  administrative_area_level_2 administrative_area_level_1
1                               davidson                         tennessee

  locality          street streetNo point_of_interest
1 nashville        west end       ave         2305           <NA>
```

mapdist -

```
> mapdist('baylor university, waco', 'vanderbilt university')
  from      to      m      km
1 baylor university, waco vanderbilt university 1235584 1235.584

  miles seconds minutes hours
1 767.7919   44522  742.0333 12.36722
```



ggmap's utility functions

geocode -
and revgeocode!

```
> geocode('vanderbilt university')
  lon      lat      type    loctype      address
1 -86.80443 36.14426 university approximate [long address]

  north     south      east      west postal_code      country
1 36.15327 36.13525 -86.78842 -86.82044      37240 united states

  administrative_area_level_2 administrative_area_level_1
1                               davidson                         tennessee

  locality          street streetNo point_of_interest
1 nashville        west end       ave         2305           <NA>
```

mapdist -

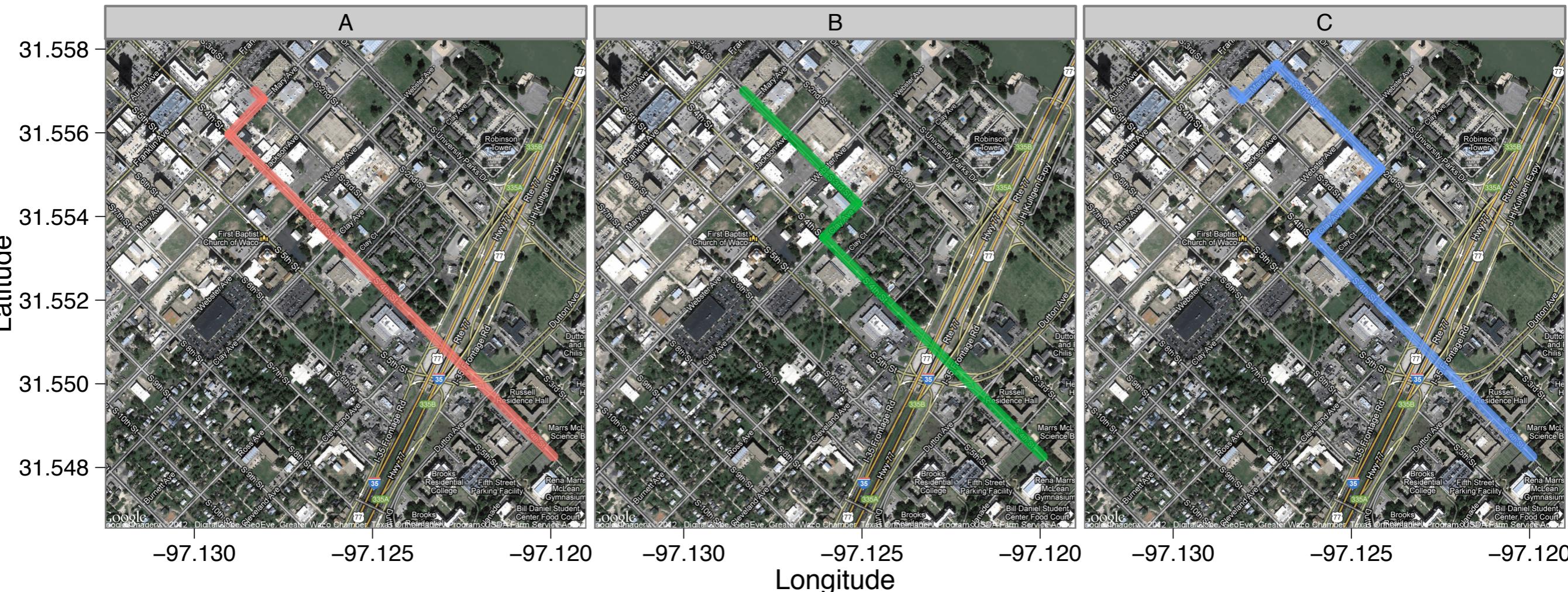
```
> mapdist('baylor university, waco', 'vanderbilt university')
  from      to      m      km
1 baylor university, waco vanderbilt university 1235584 1235.584

  miles seconds minutes hours
1 767.7919   44522  742.0333 12.36722
```

route -



Route  A  B  C



Happy mapping!!

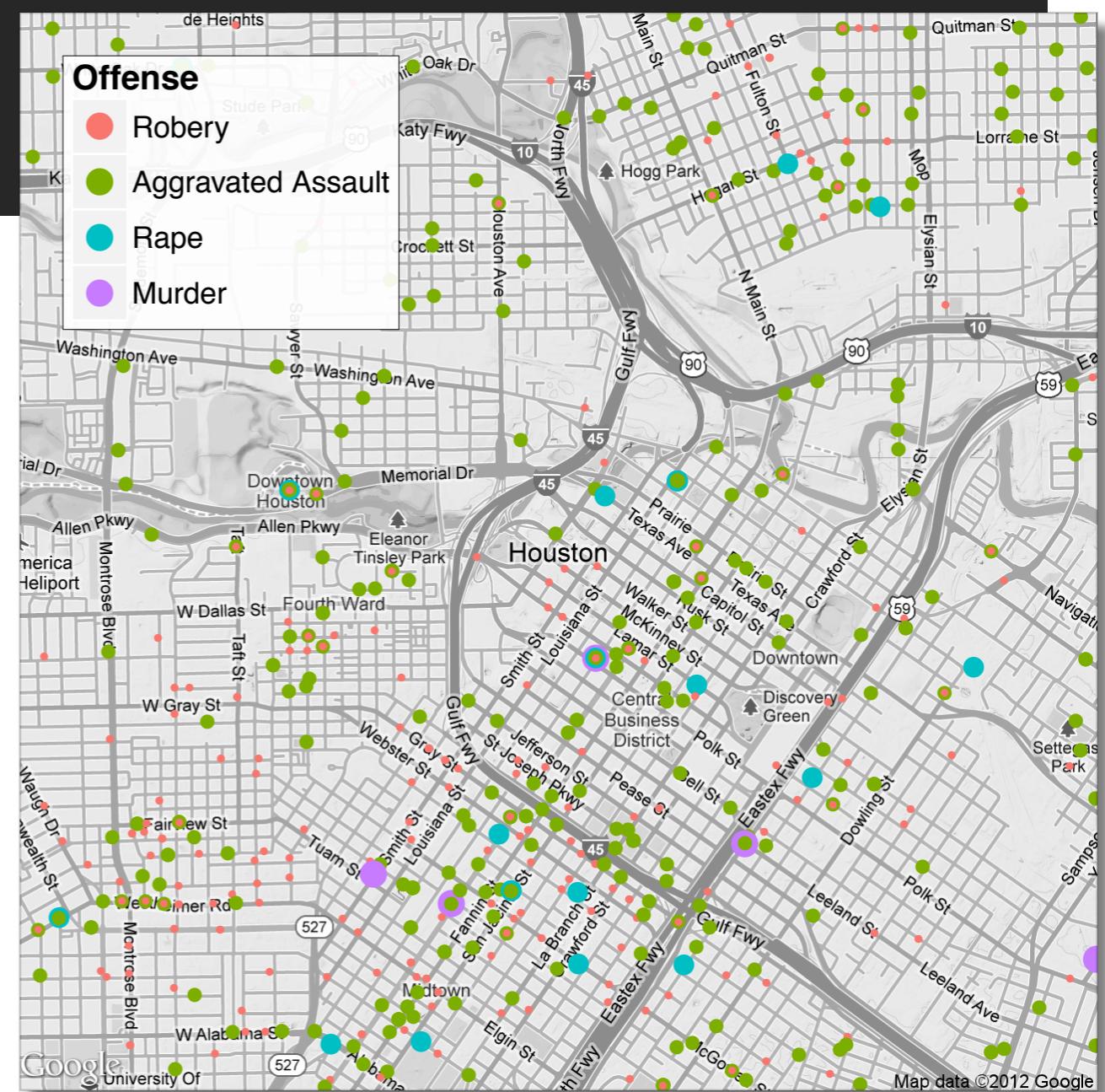


Stamen Maps Watercolor

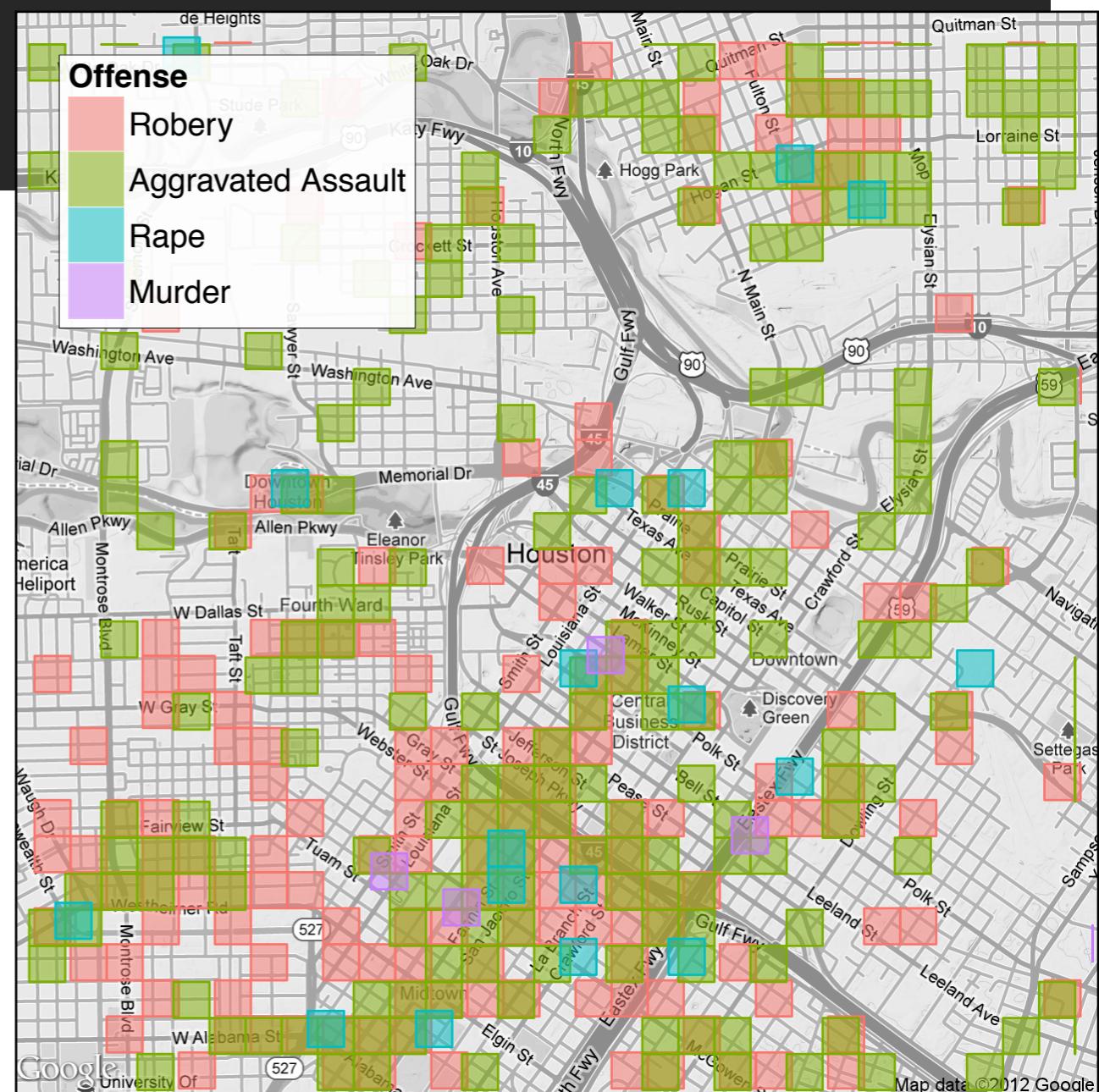
david.kahle@gmail.com

<http://sites.google.com/site/davidkahle/>

```
library(grid)
HoustonMap +
  geom_point(aes(x = lon, y = lat, colour = offense, size = offense), data = violent_crimes) +
  scale_colour_discrete('Offense', labels = c('Robbery','Aggravated Assault','Rape','Murder')) +
  scale_size_discrete('Offense', labels = c('Robbery','Aggravated Assault','Rape','Murder'),
    range = c(1.75,6)) +
  guides(size = guide_legend(override.aes = list(size = 6))) +
  opts(
    legend.key.size = unit(1.8,'lines'),
    legend.title = theme_text(size = 16, face = 'bold'),
    legend.text = theme_text(size = 14)
  ) +
  labs(colour = 'Offense', size = 'Offense')
```



```
HoustonMap +
  stat_bin2d(aes(x = lon, y = lat, colour = offense, fill = offense),
             size = .5, bins = 30, alpha = 1/2, data = violent_crimes) +
  scale_colour_discrete('Offense',
    labels = c('Robbery', 'Aggravated Assault', 'Rape', 'Murder'),
    guide = FALSE) +
  scale_fill_discrete('Offense', labels = c('Robbery', 'Aggravated Assault', 'Rape', 'Murder')) +
  opts(
    legend.text = theme_text(size = 15, vjust = .5),
    legend.title = theme_text(size = 15, face='bold'),
    legend.key.size = unit(1.8,'lines')
  )
)
```



```
HoustonMap +
  stat_density2d(aes(x = lon, y = lat, fill = ..level.., alpha = ..level..),
    size = 2, bins = 4, data = violent_crimes, geom = 'polygon') +
  scale_fill_gradient('Violent\nCrime\nDensity') +
  scale_alpha(range = c(.4, .75), guide = FALSE) +
  guides(fill = guide_colorbar(barwidth = 1.5, barheight = 10))
```

