

Visualization

- Main goal is to tell the story (data + model)
- Is the story clear?
- Are the data clear?
- Asking "How can I make the story or data clear?" is more useful than asking "What type of plot should I make?"
- The elements of the grammar help with this perspective

Visualization

- All data plots are built from **marks** and **channels**
- Different combinations of marks and channels are more **effective** for visual perception than others
- Best practice: **evidence based**

Marks

Points



0D

Lines



1D

Polygons
Areas



2D

Channels

Position

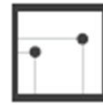
→ Horizontal



→ Vertical



→ Both



Color



Shape



Tilt



Size

→ Length



→ Area



→ Volume



Combining



mark:
line
channel 1
quantitative:
vertical
position
channel 2
category:
horizontal
position



mark:
point
channel 1
quantitative:
vertical
position
channel 2
quantitative:
horizontal
position



+
channel 3
category:
color



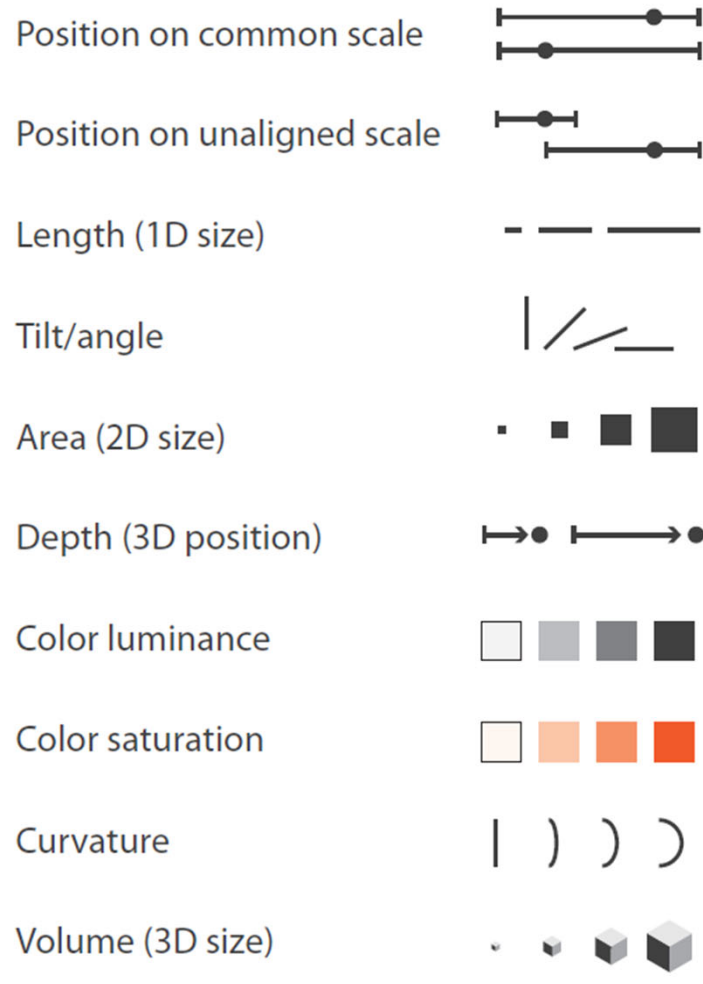
+
channel 4
quantitative:
size

Fundamental principles

- **Expressiveness:** visual encoding should express all, and only, info in the variable
 - ordered data: **magnitude** channels
 - unordered data: **identity** channels (should not imply ordering)
- **Effectiveness:** code the most important data features with the most effective channels

Effectiveness of channels

➔ Magnitude Channels: Ordered Attributes



➔ Identity Channels: Categorical Attributes

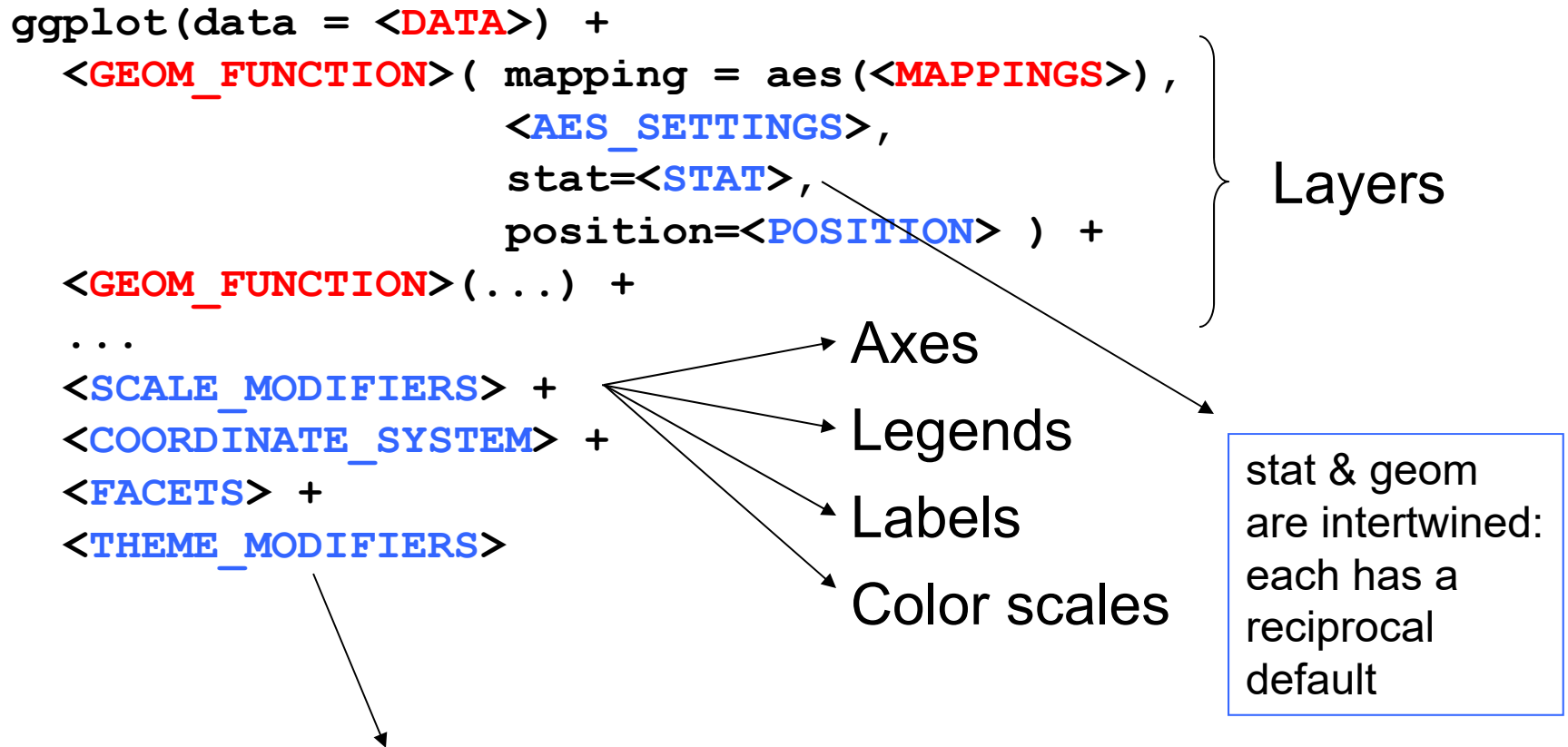


Summary Wickham paper

- Marks: **geom** (geometric object): points, lines, polygons, ...
- Channels: **aes** (aesthetic) x, y, shape, color
- **Mapping**: map data to channels of marks
- Scales: one per aes
- Statistics (summarizing function)
- Coordinate system (one per plot)
- Annotations
- Facets

Layer

ggplot template



Fonts, background, margins, tick styles, borders, etc

Cheatsheet: <https://www.rstudio.com/resources/cheatsheets> (visualization)

ggplot inheritance

```
ggplot() +  
  geom_point(data=mpg, mapping=aes(x=displ, y=hwy)) +  
  geom_smooth(data=mpg, mapping=aes(x=displ, y=hwy))
```

```
ggplot(data=mpg, mapping=aes(x=displ, y=hwy)) +  
  geom_point() +  
  geom_smooth()
```

layers inherit

