

Original Proposed Content

Title: Effective Data Visualization for Actuaries

Session Description:

Actuaries often need to regularly communicate trends, diagnostics, and findings to stakeholders (other actuaries, their business partners, or clients).

Two questions arise:

- How do we create visualizations that let actuaries focus on interpreting rather than doing?
- How do we re-structure these visualizations to tell a better story?

In this session Brian and I will examine some common actuarial analysis problems (e.g. loss development, trend/inflation, mix shift exhibits, and model diagnostics) through the lens of visualization. Using R's ``ggplot2`` package, we'll show how these visualizations can be improved to better communicate the story. For example, reserve loss development can be manipulated with ``dplyr`` to show cumulative losses on the x-axis and incremental amounts on the y-axis to better highlight the loss development factor. After demoing a few visualization examples, we'll show how some formatting tricks can be used to make your visualizations look polished.

Learning Objectives:

1. Demonstrate when alternative representations of common actuarial visualizations are helpful
2. Basic use of the ``ggplot2`` package
3. When and how to use non-data formatting to customize a visualization for your audience

Session Format: Concurrent Session, 50-60 minutes

Theme: Navigate

Applicable Areas: Actuarial Toolkit: Programming Software, Data Manipulation Tools, and Data Visualization Tools

Knowledge Level: Level 2: General Knowledge of the Subject (6-9 years)

Interactive Elements: There will be one or two discussion prompts, as well live voting to compare different means of visualizing data analysis

To Be Removed. For Reference Only.



Effective Data Visualization for Actuaries

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Jordan Bonner



Effective Data Visualization for Actuaries

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Visualizations should:

- **Be Easily Interpreted**
- **Tell a Story**



Agenda

- **Data Storytelling**
- **Actuarial Visualization**
- **Automating Actuarial Exhibits**



Icebreaker Examples

A slide or two that are difficult to interpret,
then a slide or two that are easy to interpret?



REVISITING COMMON ACTUARIAL EXHIBITS



Common Actuarial Exhibits

- Loss Development Triangles
- Trend Selection
- Rate Indications
- Mix Shift Exhibits
- Model Diagnostics



Loss Development Triangles



Loss Development Triangles



Trend Selection



Trend Selection



Rate Indications



Rate Indications



Mix Shift



Mix Shift



Model Diagnostics

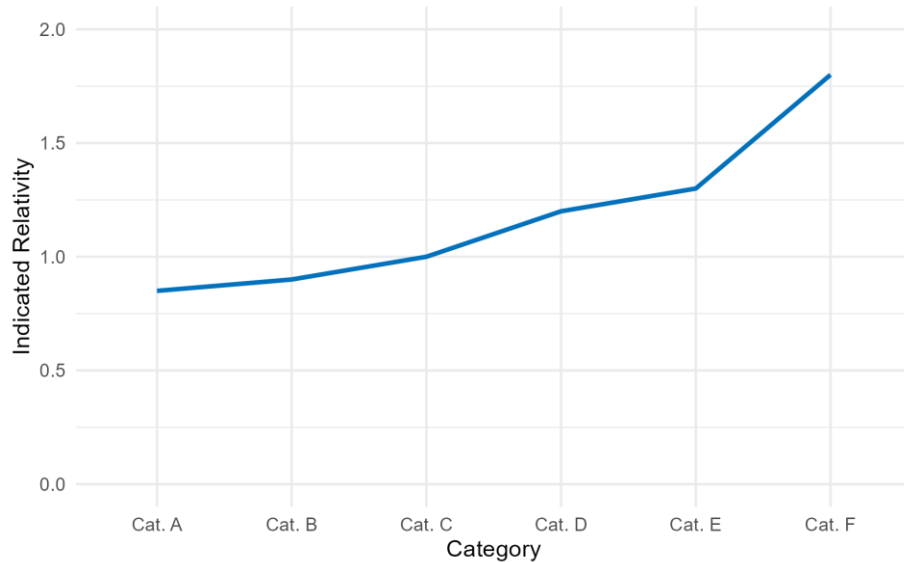


Model Diagnostics

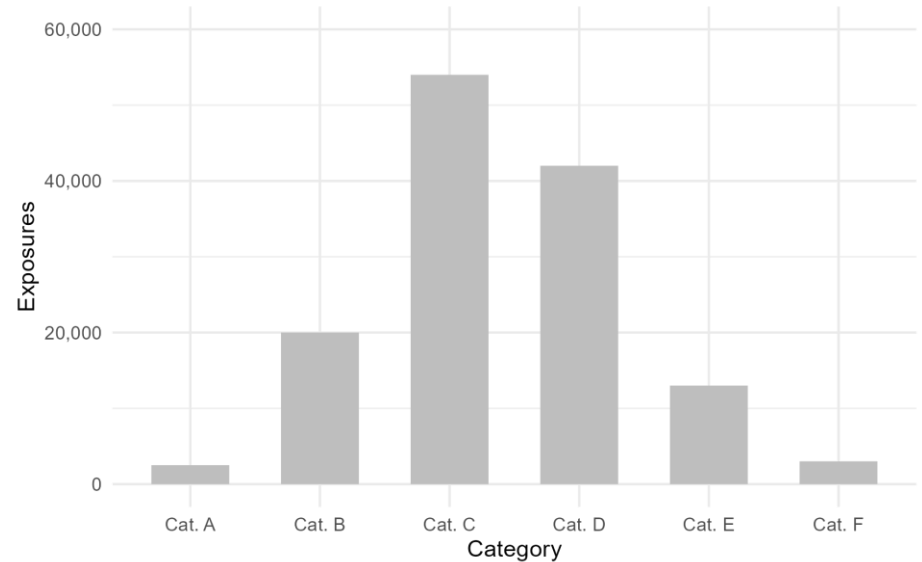


Two Axes vs Two Charts

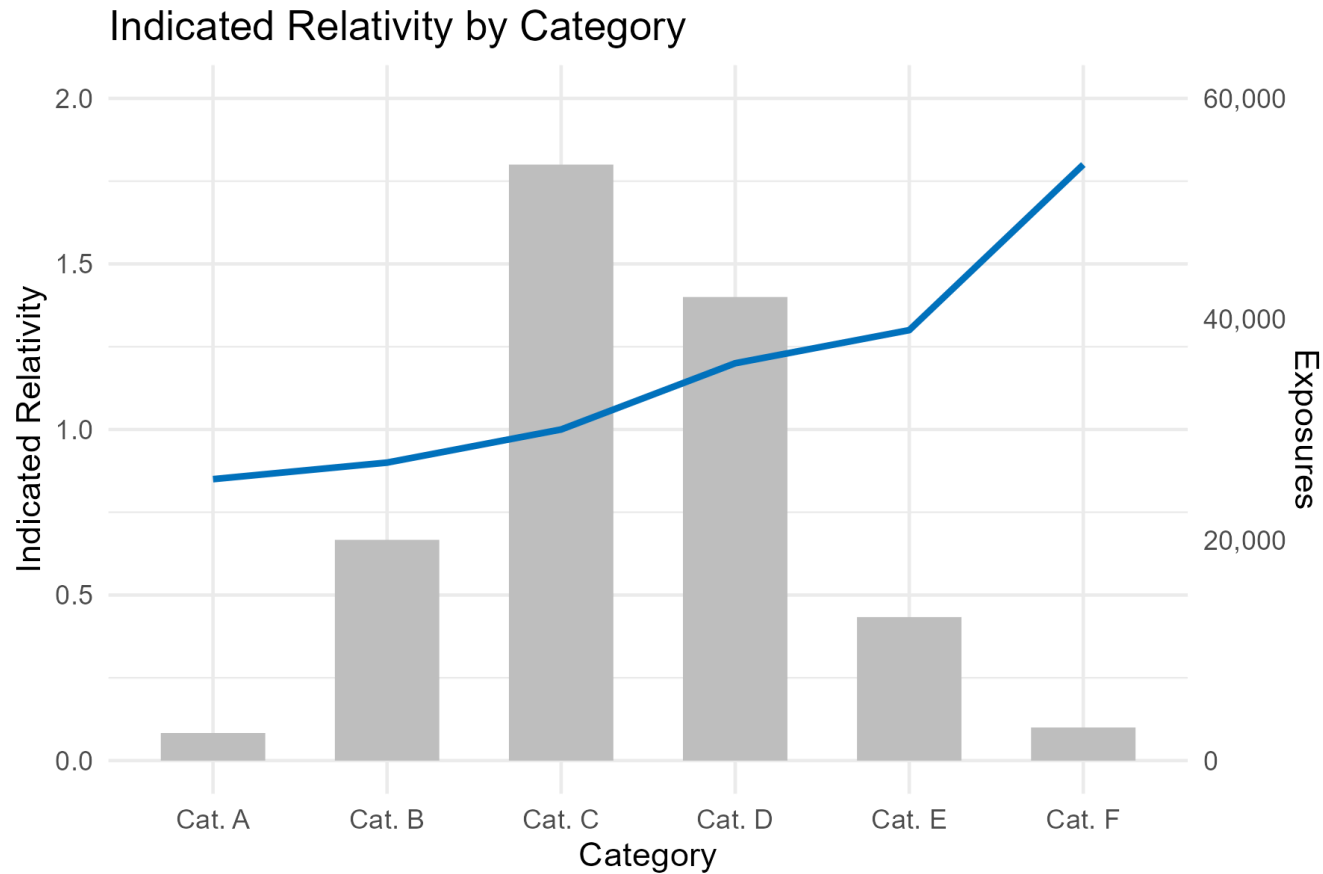
Indicated Relativity by Category



Indicated Relativity by Exposure Count & Category



Two Axes vs Two Charts

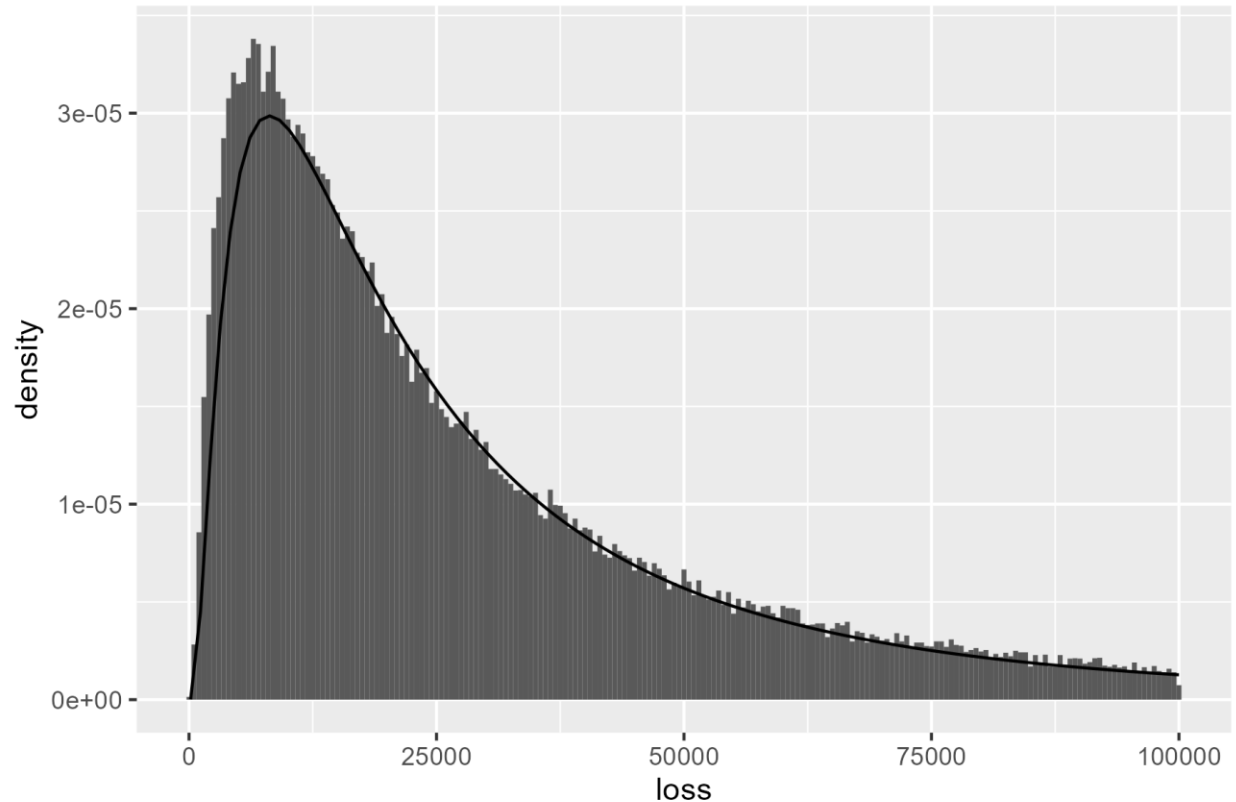


AUTOMATING ACTUARIAL EXHIBITS



Initial Example: Fitted Severity

How can we
improve upon
this chart?

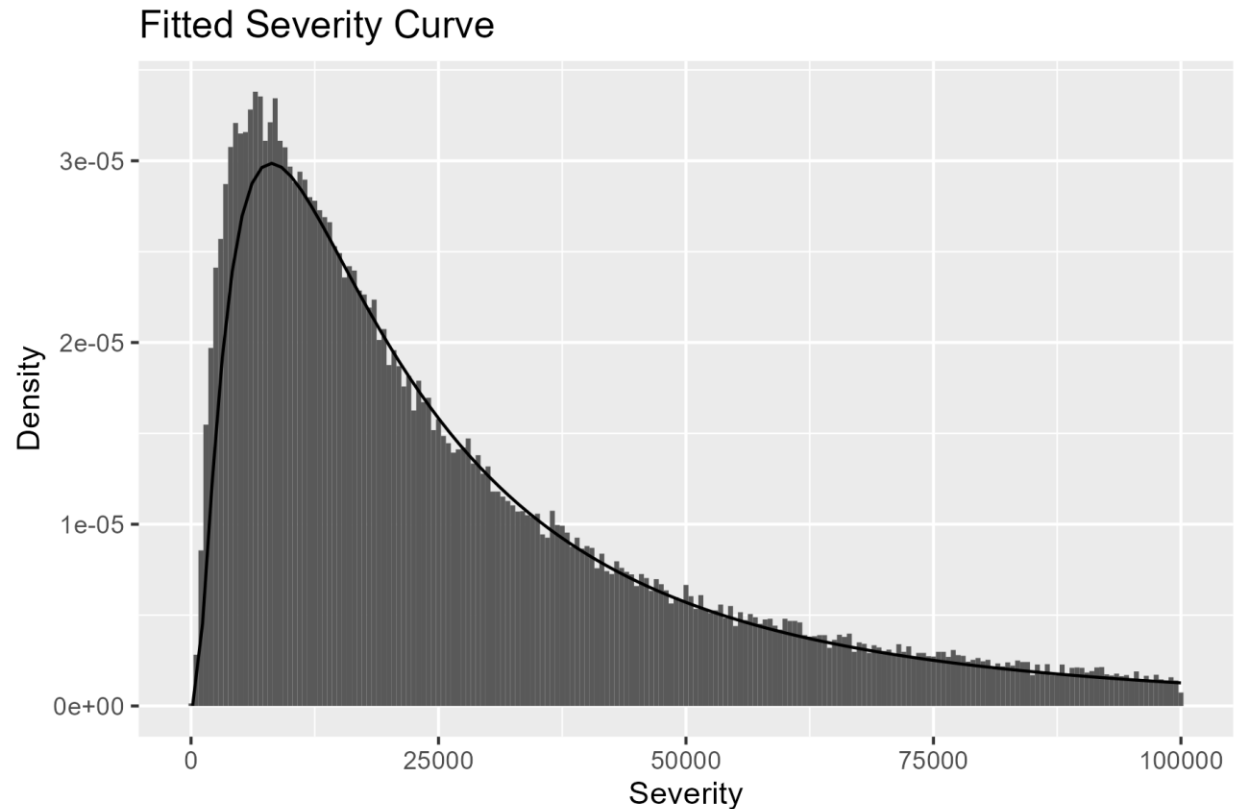


```
P <- data |>  
  geom_histogram(aes(x = loss, after_stat(density))) +  
  stat_function(fun = dlnorm,  
               args = list(meanlog = 10, sdlog = 1.0))
```



Titles & Renaming Variables

Adding a title
and variable
names goes a
long way.



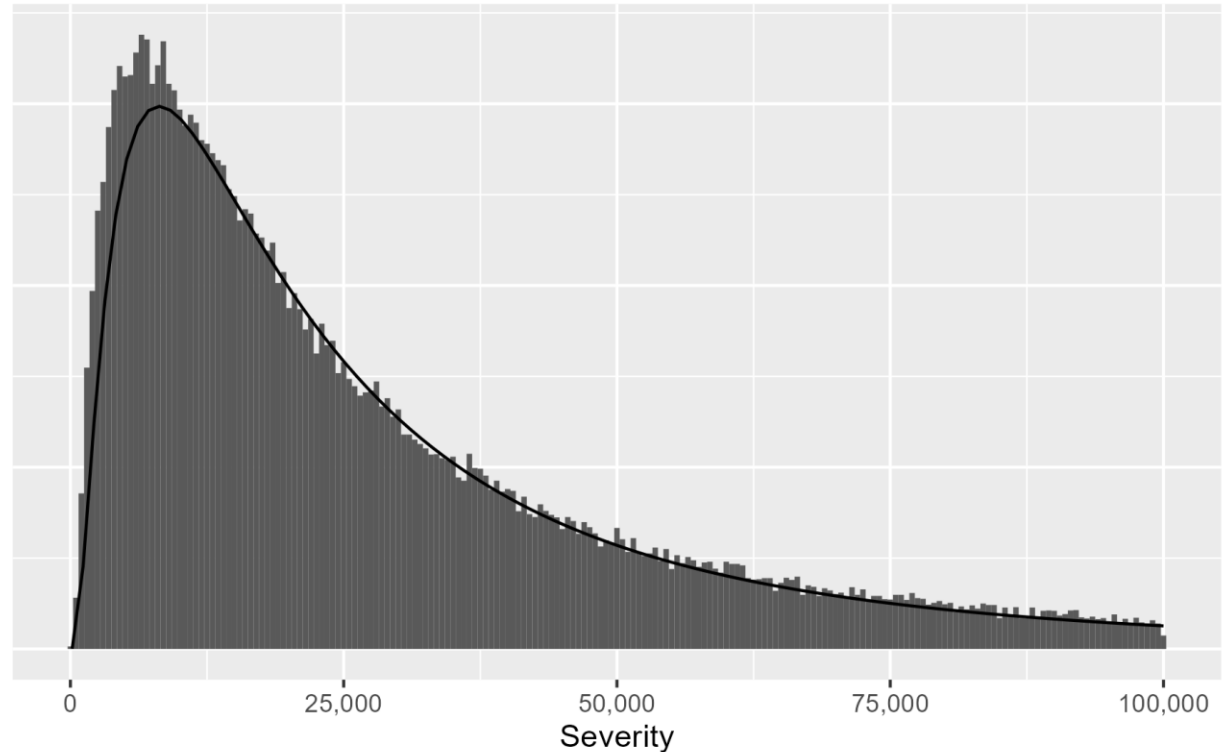
```
P <- p +  
  labs(  
    x = "Severity",  
    y = "Density",  
    title = "Fitted Severity Curve"  
  )
```



Cleaning Axes

We can
change the x-
axis labels
and remove
the y-axis.

Fitted Severity Curve



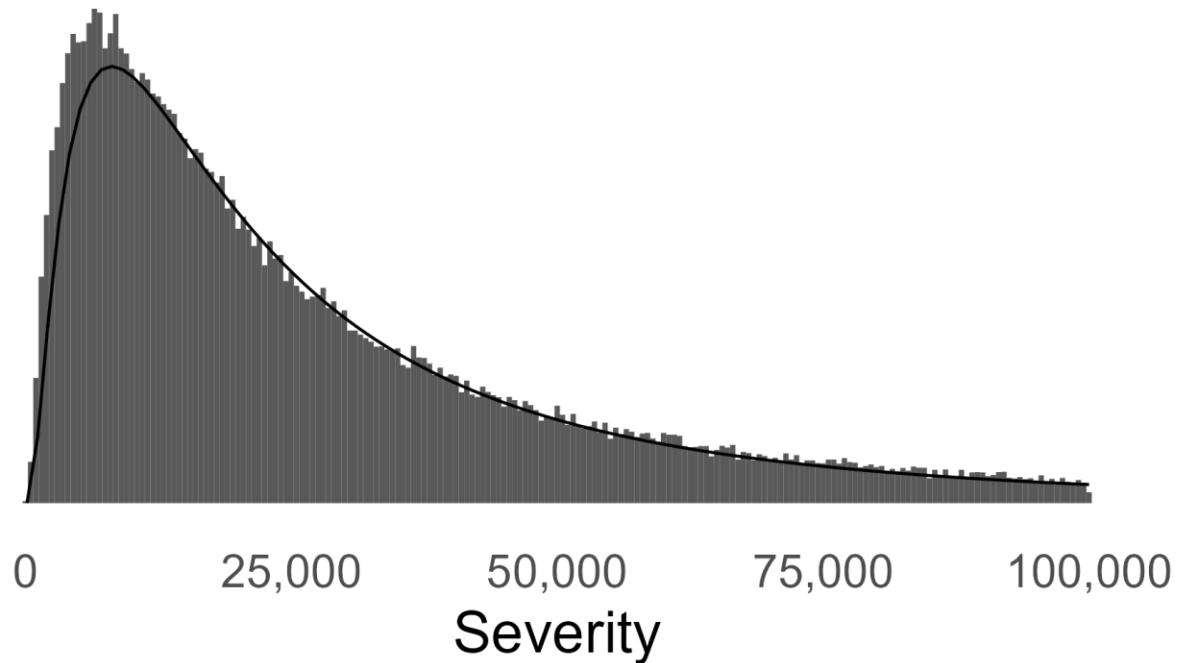
```
P <- p +  
  scale_x_continuous(labels = scales::comma) +  
  theme(axis.text.y = element_blank(),  
        axis.ticks.y = element_blank(),  
        axis.title.y = element_blank())
```



Text Size & Theme

Fitted Severity Curve

We can
increase text
size and
select a
simpler
theme.



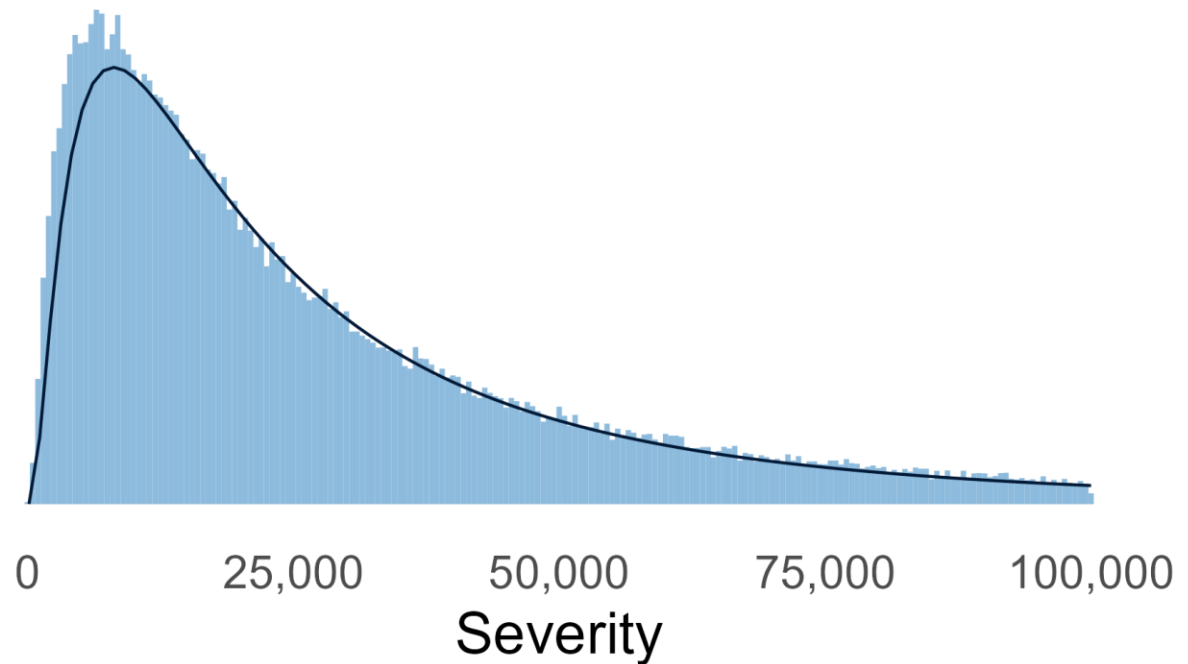
```
P <- p +  
  theme_minimal(base_size = 20) +  
  theme(panel.grid.major = element_blank(),  
        panel.grid.minor = element_blank()) +  
  scale_x_continuous(labels = scales::comma) +  
  theme(axis.text.y = element_blank(),  
        axis.ticks.y = element_blank(),  
        axis.title.y = element_blank())
```



Color

Fitted Severity Curve

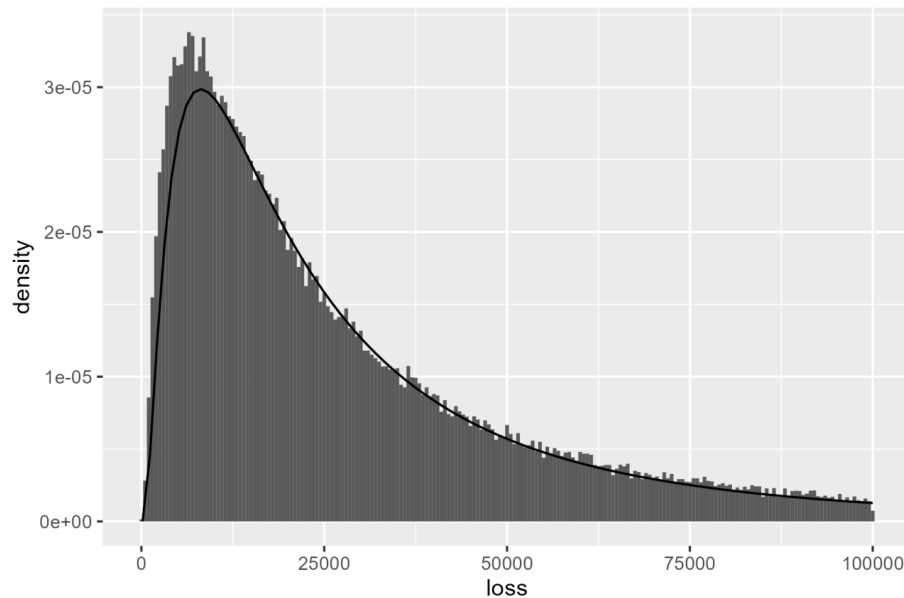
We can also
update the
color, if
desired.



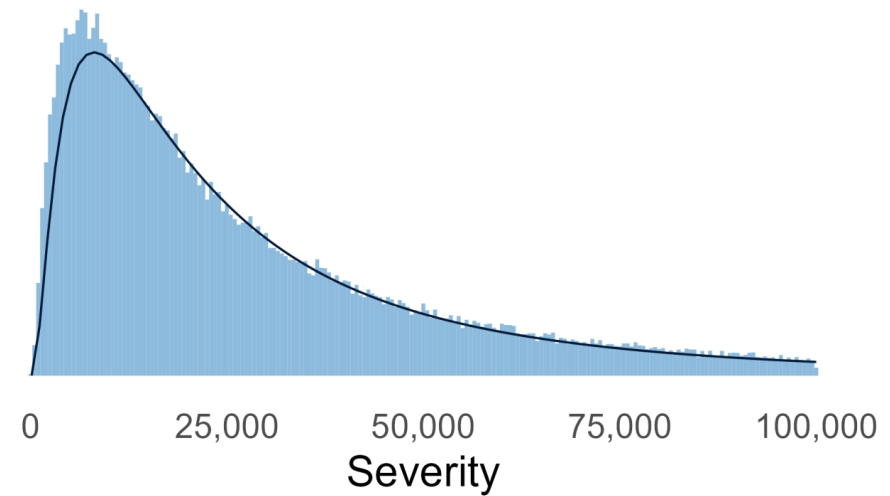
```
...  
  geom_histogram(aes(x = loss, after_stat(density)),  
                 fill = pal_CAS["light_blue"]) +  
  stat_function(fun = dlnorm,  
               args = list(meanlog = 10, sdlog = 1.0),  
               color = pal_CAS["dark_blue"]) +  
  ...
```



Comparison



Fitted Severity Curve

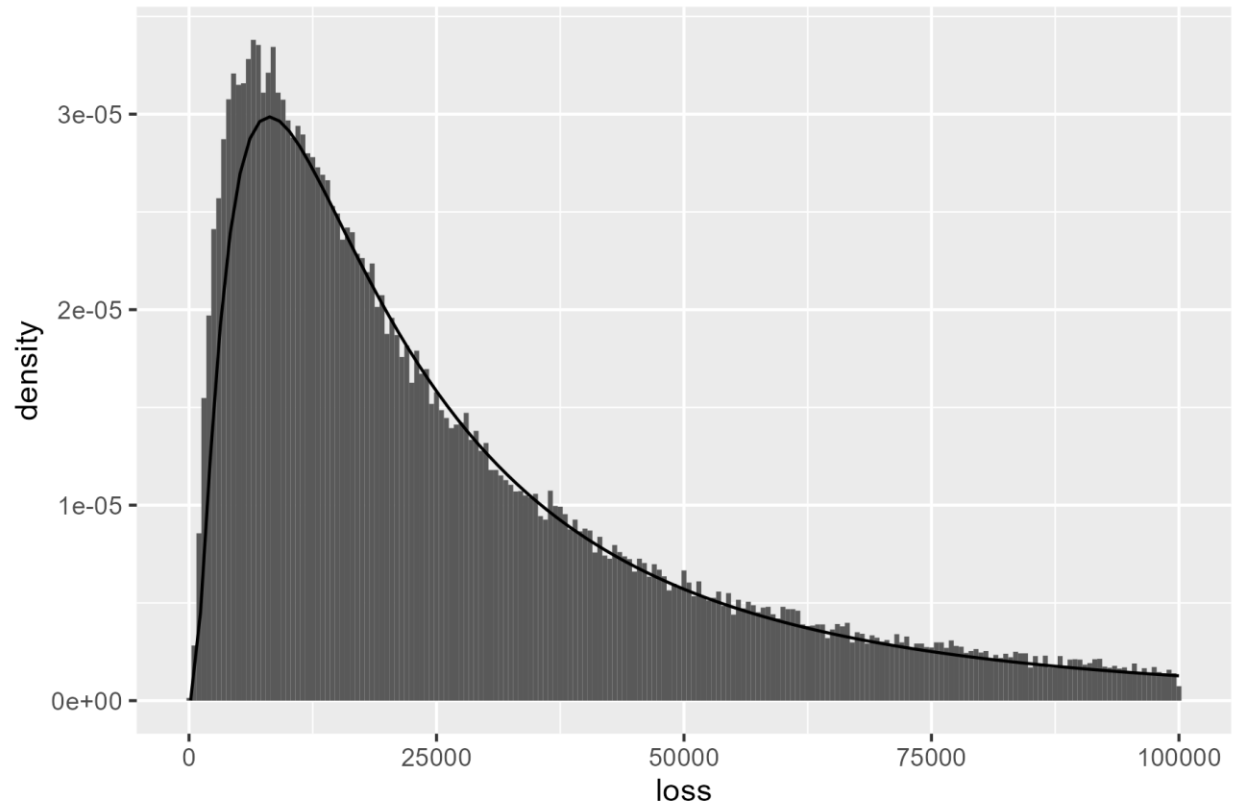


PRACTICAL FORMATTING TRICKS



Initial Example: Fitted Severity

How can we
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this chart?

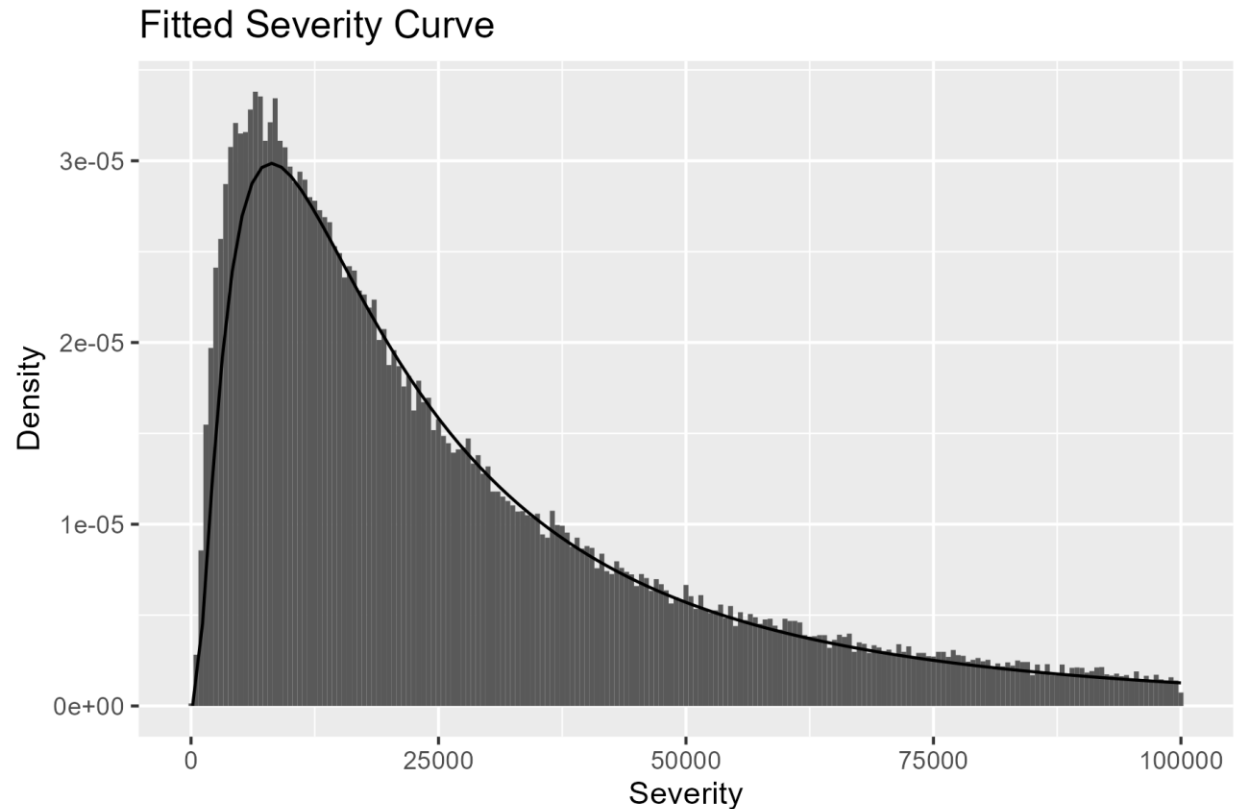


```
P <- data |>  
  geom_histogram(aes(x = loss, after_stat(density))) +  
  stat_function(fun = dlnorm,  
               args = list(meanlog = 10, sdlog = 1.0))
```



Titles & Renaming Variables

Adding a title
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long way.



```
P <- p +  
  labs(  
    x = "Severity",  
    y = "Density",  
    title = "Fitted Severity Curve"  
  )
```

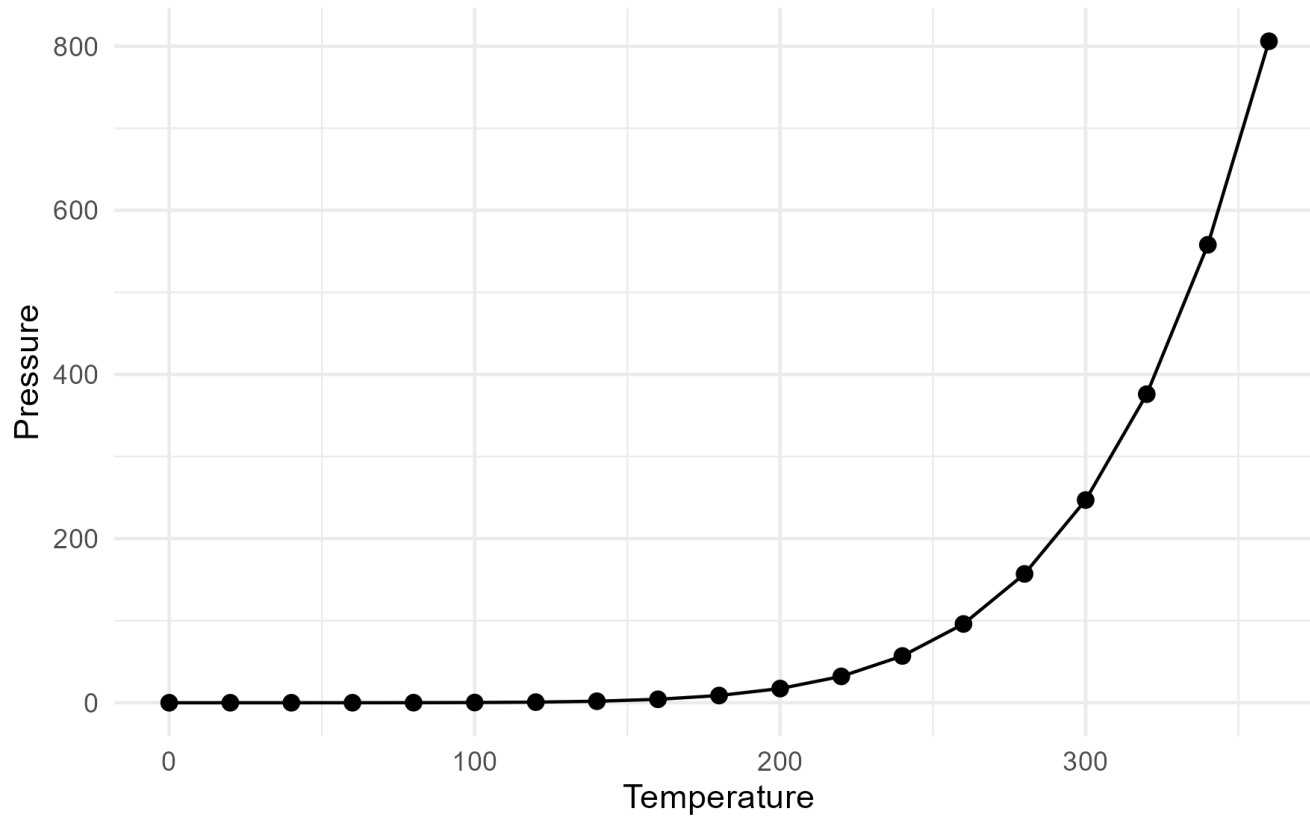


APPENDIX

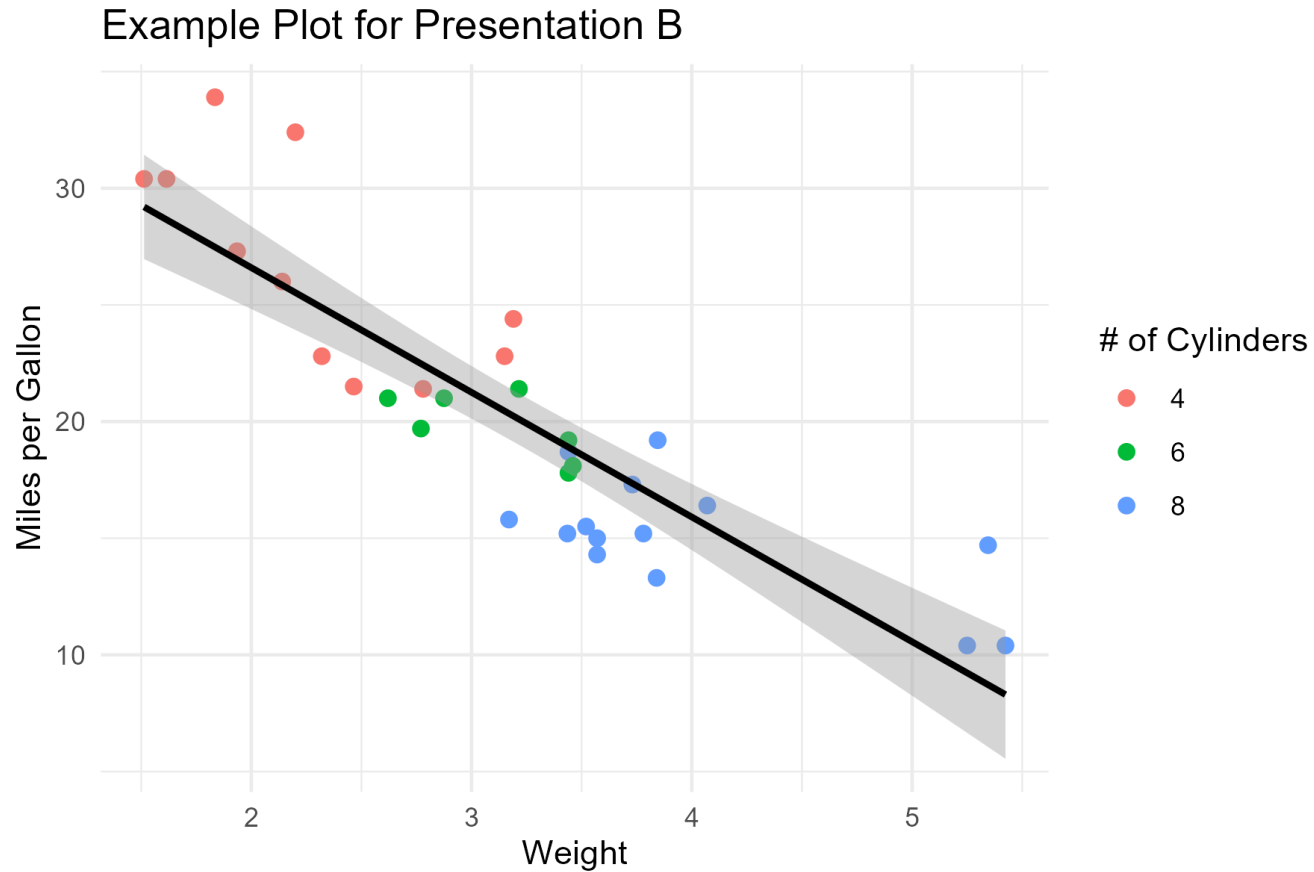


Example Plot A

Example Plot for Presentation A



Example Plot B



Example Plot C

