Data Visualization

The importance of principled design

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The need for sound principles

Visualization is intuitive!

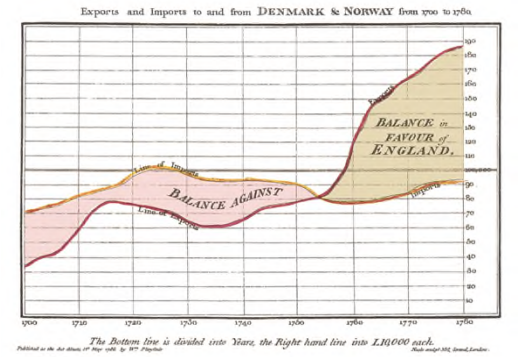
I already know how to do it and my audience already understands how to interpret it.

OK.

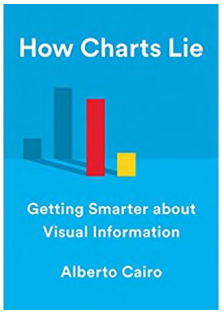
So what color is this dress?

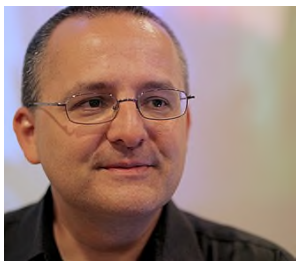
Visual perception might be complicated.

So is the science behind getting it right.



INTERNAL USE ONLY





INTERNAL USE ONLY

If a picture says a thousand words, that just means it can lie at scale.

INTERNAL USE ONLY

Principles

Keys to Making Great Visualizations:

What is the Message!

Know How the Brain Processes

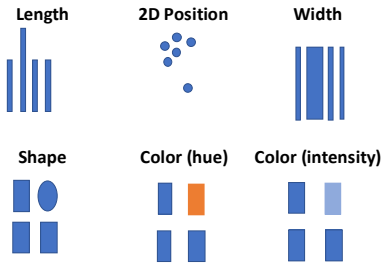
Declutter

Focus Attention

Ask Yourself Throughout:

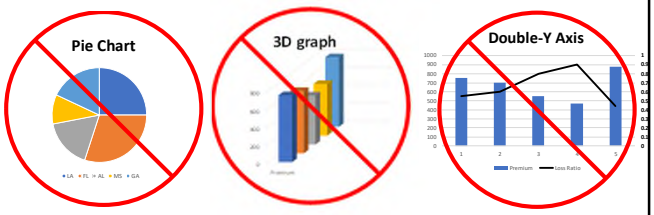
“What is the Message?”

Visual Processing Speed: 'Pre-attentive Attributes'



See also: Gestalt Principles (Proximity, Similarity, Enclosure, Closure, Continuity, Connection)

Never choose:



...Instead try:
(stacked) bar graph for shares

...Instead try:
2-dimensional only

...Instead try:
Graph bar and line separately

Declutter:

Use the 'ink' for data, not non-data!

No gridlines

No border

Fewer x-axis and y-axis tickmarkers

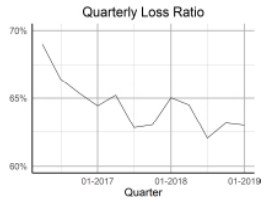
Axis labels – streamline text, and no 90-degree orientation for Y label

No legend – rather, directly label data within graph, with color coding to data

No Subheaders (e.g. precise nature of data or yrs used etc. moved to footnote)

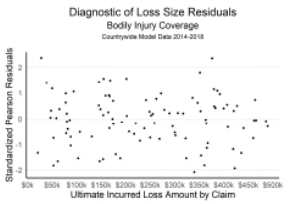
Gray out axis lines and other chart-junk; ok to gray less important data

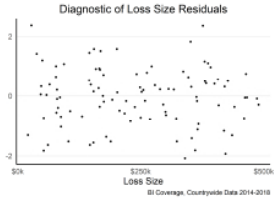
Declutter: Remove Gridlines



INTERNAL USE ONLY

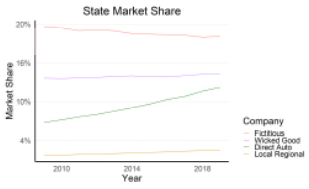
Declutter: Reduce Text

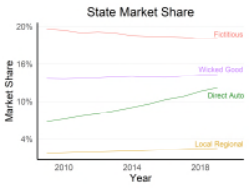




INTERNAL USE ONLY

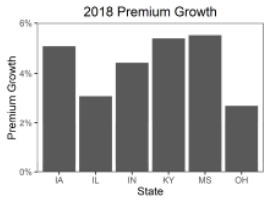
Declutter: Legends

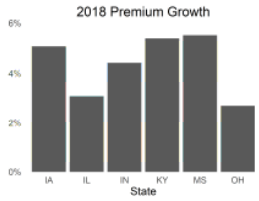




INTERNAL USE ONLY

Declutter: Remove axis ticks/graph border





Focus Attention, Text Version:

None: Direct Auto is increasing market share the fastest!

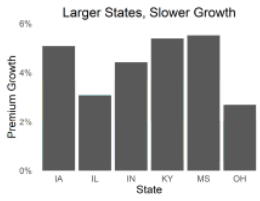
Size: Direct Auto is increasing market share the fastest!

Bold: **Direct Auto** is **increasing** market share the **fastest**!

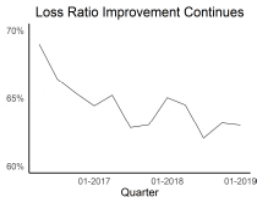
Color: Direct Auto is increasing market share the fastest!

Gray: Direct Auto is increasing market share the fastest!

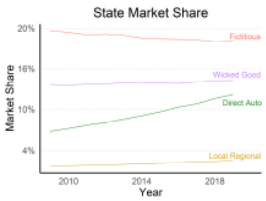
Focus Attention: Color

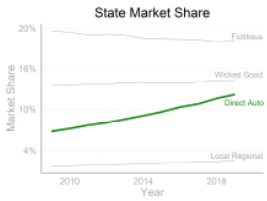


Focus Attention: "Takeaway" Titles

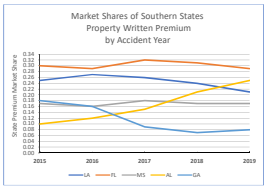


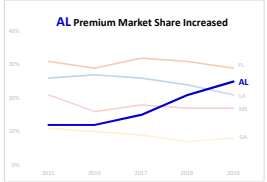
Focus Attention: Gray less important content





Message, Declutter, and Focus Attention:



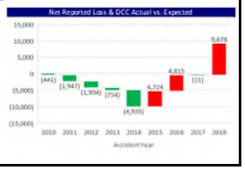


Reserving Example

- Visualize "key decision points" throughout reserve review
- Sample example
- Units in thousands

Actual vs. Expected

Incremental Net Reported Loss & DCC			
AY	Expected	Actual	Act
2010	303	(138)	(441)
2011	1,591	(356)	(1,947)
2012	2,770	866	(1,904)
2013	2,434	1,680	(754)
2014	9,446	4,511	(4,935)
2015	18,315	23,039	4,724
2016	40,535	45,350	4,815
2017	57,180	57,169	(11)
2018	57,740	67,418	9,678



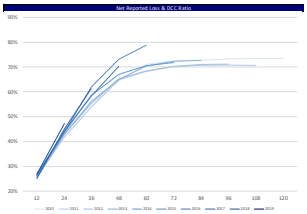
- Bar chart easier to read than table
- "Waterfall" provides by year and total amounts

Diagnostics

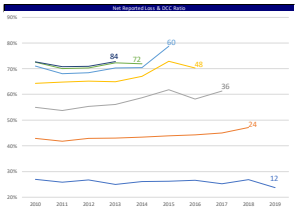
Net Reported Loss & DCC Ratio										
AY	12	24	36	48	60	72	84	96	108	120
2010	27.0%	42.8%	54.9%	64.4%	71.0%	72.5%	72.7%	73.2%	73.5%	73.4%
2011	25.9%	41.8%	53.7%	64.7%	68.2%	70.1%	70.7%	70.8%	70.7%	
2012	26.7%	42.9%	55.3%	65.2%	68.4%	70.3%	70.9%	71.2%		
2013	25.1%	43.0%	56.1%	64.9%	70.3%	72.3%	72.8%			
2014	26.2%	43.5%	58.6%	67.0%	70.5%	71.8%				
2015	26.3%	43.8%	61.8%	73.0%	78.8%					
2016	26.6%	44.2%	58.3%	70.3%						
2017	25.1%	45.0%	61.3%							
2018	26.9%	47.2%								
2019	23.8%									

- Requires significant mental energy to process
- What is the highest ratio at any given evaluation period?
- Are ratios stable? Increasing? Decreasing?

Diagnostics



- Each line represents one AY
- Difficult to see individual years
- Difficult to see differences at earlier evaluations
- With "better" coloring can see trend over time



- Each line represents one evaluation period
- Difficult to see differences at later evaluations
- Helps identify when to "believe" development pattern

Development Factor Triangle

	Net Reported Loss & DCC Age-to-Age Factors									
AY	12-24	24-36	36-48	48-60	60-72	72-84	84-96	96-108	108-120	120-Ult
2010	1.588	1.283	1.172	1.102	1.022	1.003	1.007	1.003	1.000	1.001
2011	1.616	1.286	1.205	1.053	1.028	1.009	1.001	0.999		
2012	1.606	1.288	1.179	1.049	1.027	1.009	1.004			
2013	1.713	1.306	1.157	1.083	1.028	1.007				
2014	1.661	1.348	1.143	1.052	1.018					
2015	1.667	1.410	1.181	1.080						
2016	1.664	1.317	1.206							
2017	1.793	1.362								
2018	1.757									
Sel	1.738	1.363	1.177	1.072	1.025	1.008	1.004	1.001	1.000	1.001

- Requires significant mental energy to process
- Not easy to tell where selection falls within history

Development Factor Triangle

	Net Reported Loss & DCC Age-to-Age Factors									
AY	12-24	24-36	36-48	48-60	60-72	72-84	84-96	96-108	108-120	120-Ult
2010	1.588	1.283	1.172	1.102	1.022	1.003	1.007	1.003	1.000	1.001
2011	1.616	1.286	1.205	1.053	1.028	1.009	1.001	0.999		
2012	1.606	1.288	1.179	1.049	1.027	1.009	1.004			
2013	1.713	1.306	1.157	1.083	1.028	1.007				
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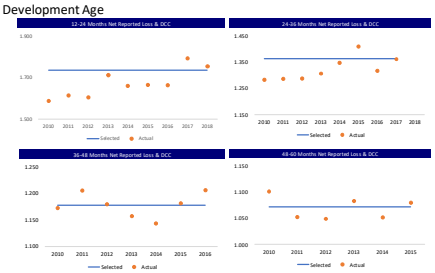
2018	1.757									
Sel	1.738	1.363	1.177	1.072	1.025	1.008	1.004	1.001	1.000	1.001

- Coloring helps easily identify a trend
- But still not easy to tell where selection falls within history

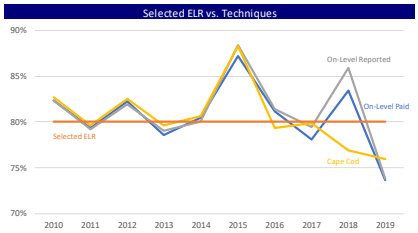
Development Factor Triangle

Visuals by Development Age



- Shows trends in actuals along with selection
- Can take up a lot of space per page

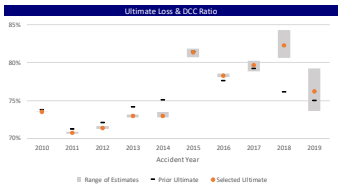
ELR Selection



- Quickly determine appropriateness of different techniques
- Concern for AY 2019?

Method Selections

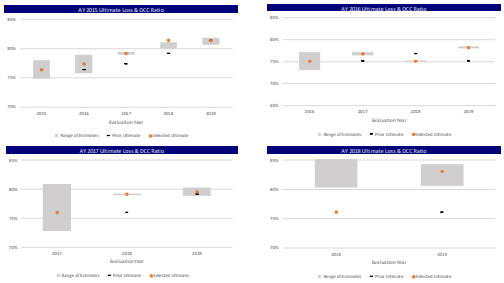
Ultimate Loss & DCC							
AY	Prior Ultimate	Paid Chain Ladder	Reported Chain Ladder	Paid BF	Reported BF	Selected Ultimate	Change in Ultimate
2010	73.7%	73.5%	73.5%	73.5%	73.5%	73.5%	(853)
2011	71.2%	70.8%	70.7%	70.9%	70.7%	70.7%	(1,773)
2012	72.0%	71.3%	71.2%	71.6%	71.2%	71.4%	(2,333)
2013	74.2%	72.8%	73.2%	73.0%	73.2%	73.0%	(4,194)
2014	75.0%	73.1%	72.8%	73.5%	72.8%	72.9%	(7,376)
2015	81.4%	80.8%	81.8%	80.7%	81.8%	81.3%	(306)
2016	77.6%	78.0%	78.2%	78.5%	78.4%	78.1%	1,997
2017	79.2%	78.8%	80.2%	79.3%	80.2%	79.5%	1,153
2018	76.1%	81.8%	84.3%	80.6%	82.4%	83.0%	23,023
2019	75.0%	73.6%	73.8%	79.2%	78.0%	76.2%	3,755
							13,095



Visual makes it easier to

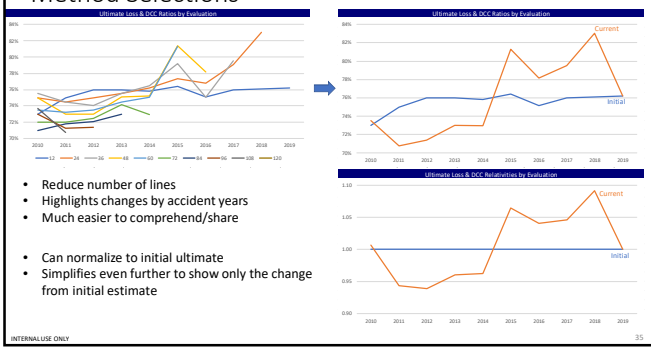
- see trend/change by year
- identify selection within range
- see increase/decrease vs. prior estimate

Method Selections



- How has a year changed over time?
- Have selections have stayed in same location within range?

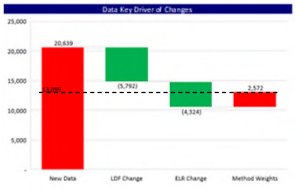
Method Selections



- Reduce number of lines
- Highlights changes by accident years
- Much easier to comprehend/share

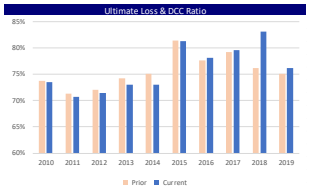
- Can normalize to initial ultimate
- Simplifies even further to show only the change from initial estimate

Summary of Changes



- Shows the "how" of the total change in estimate
- Can help drive the story to tell

- Highlights prior and current estimates
- Easy to see adverse change in more recent years as well as change over time



Test Time!

Question #1

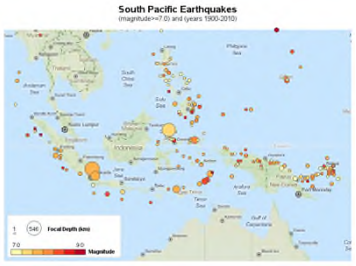
☹ 1 2 😐 3 4 ☺ 5

Question #2

☹ 1 2 😐 3 4 ☺ 5

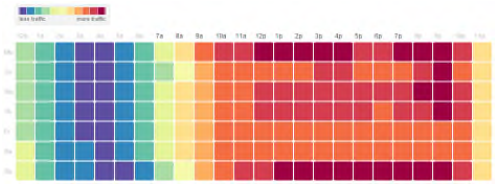
Question #3

☹ 1 2 😐 3 4 ☺ 5



Question #4

☹ 1 2 😐 3 4 ☺ 5



Question #5

☹ 1 2 😐 3 4 ☺ 5

Thank you