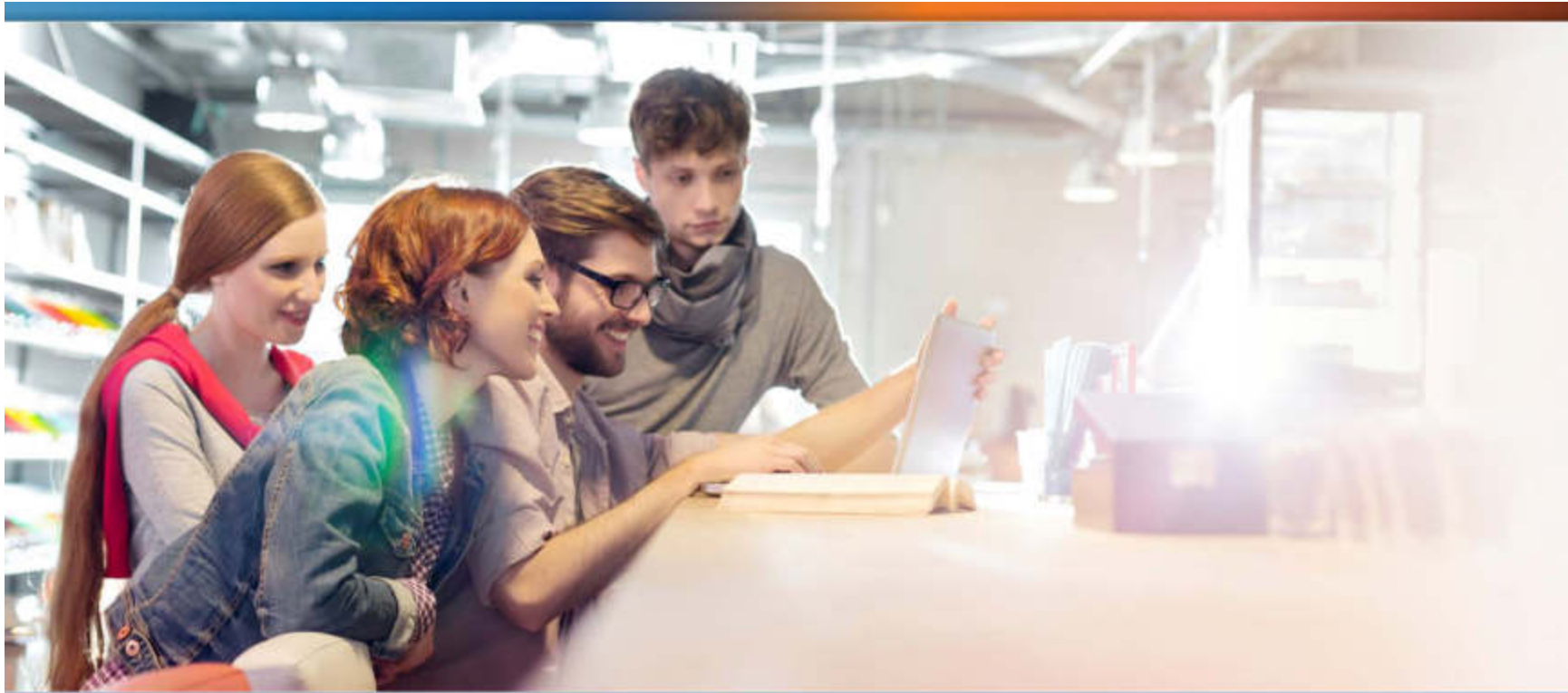





Essential Design Principles for Tableau

Design for Understanding Introduction



Think of yourself as a data architect



Visual encoding elements:
Color
Shape
Size

Assemble visual encoding elements to leverage user's perceptual abilities



Consider
your materials:



Context

Audience(s)

Uses of visualizations

Sales appear to
be going up!

Sales are
going up!



Start with a visual
perception

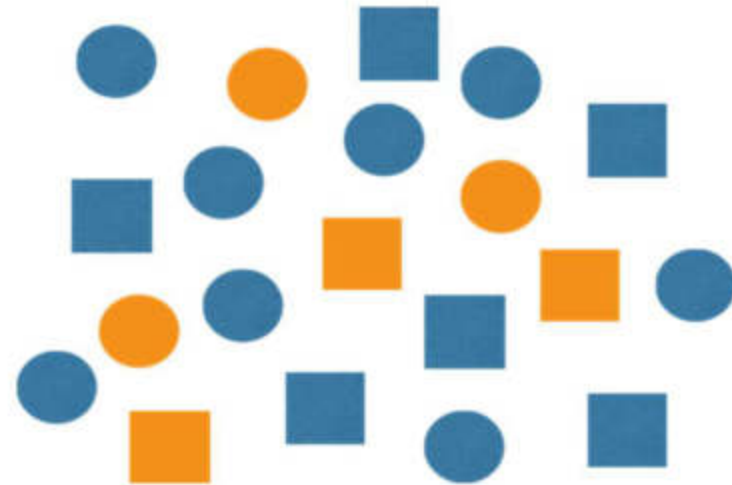
Finish with a clear and
accurate depiction
of the data

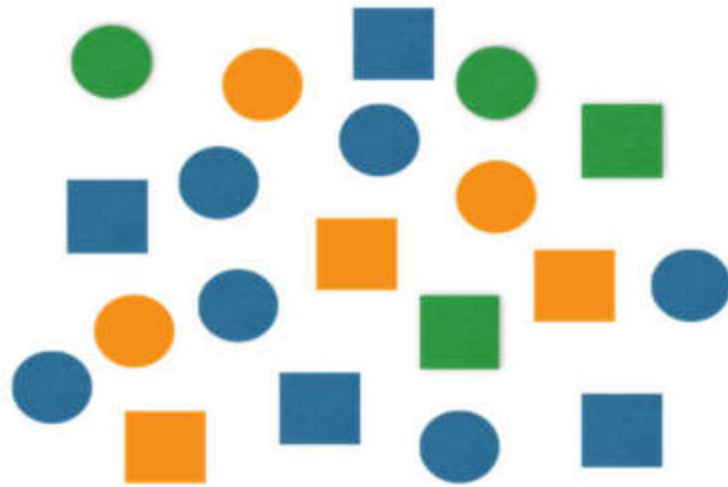
Visual encoding is both art and science



Primary groups
differentiated by color

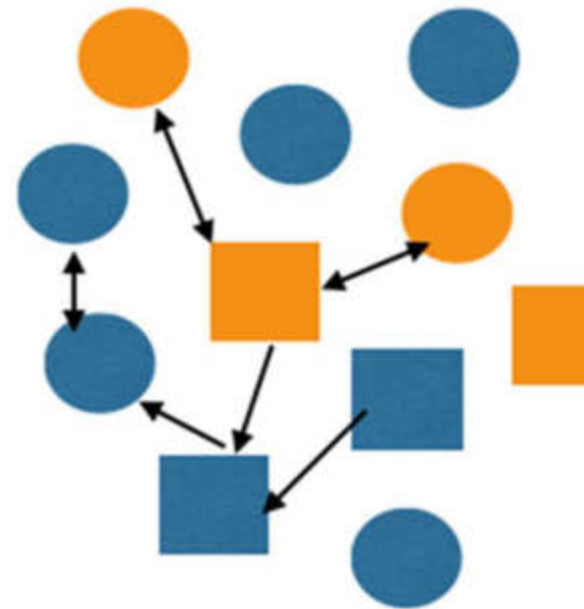
Sub-groups
differentiated by shape





What more could
be added without
overloading the user?

Mix and match design elements to tell compact but detailed stories



Each design element has strengths and weaknesses



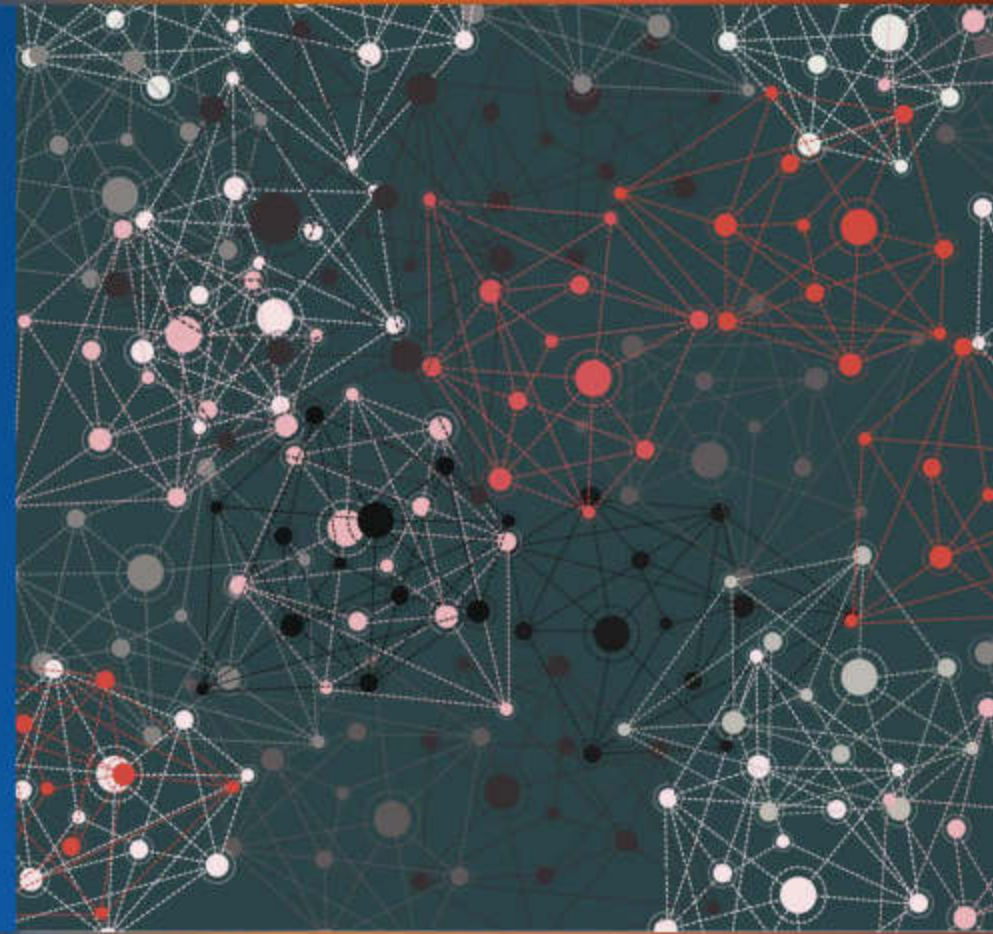


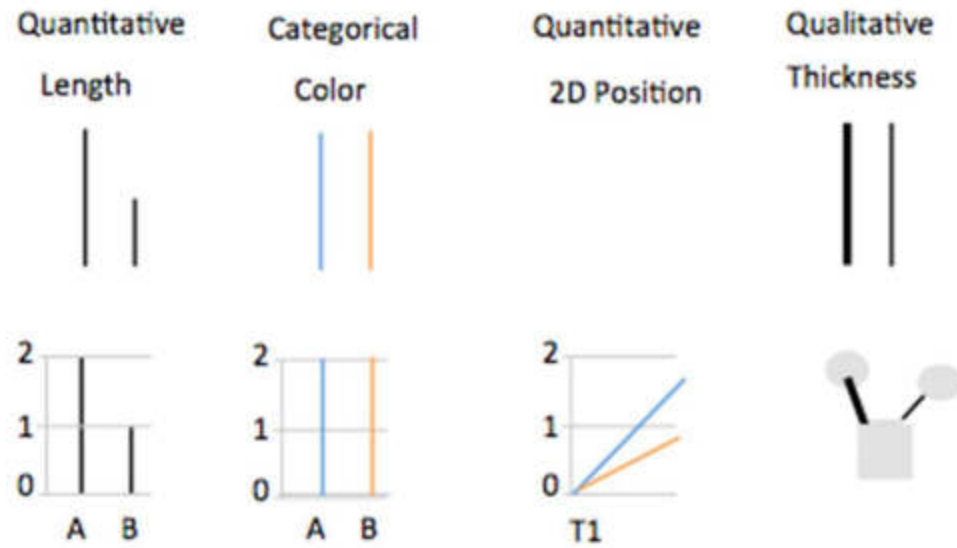
Color helps to make patterns stand out

Color is not helpful for showing precision

Line length and 2D position are better choices for showing precision

Color gives a qualitative sense in certain cases by contrasting darker and lighter colors to indicate levels of activity





Lines can be used in many ways to express different aspects of data



Line length shows
precise quantitative
differences

Line thickness shows
qualitative differences
and relative strength
between entities



Attribute	Quantitative	Qualitative
Line Length	●	
2-D Position	●	
Orientation		●
Line Width		●
Size		●
Shape		●
Curvature		●
Added Marks		●
Enclosure		●
Hue		●
Intensity		●

How many visual attributes can you think of for showing either quantitative or qualitative measures?



Think about how to combine and use encoding elements
for different target audiences



Essential Design Principles for Tableau

Design for Purpose



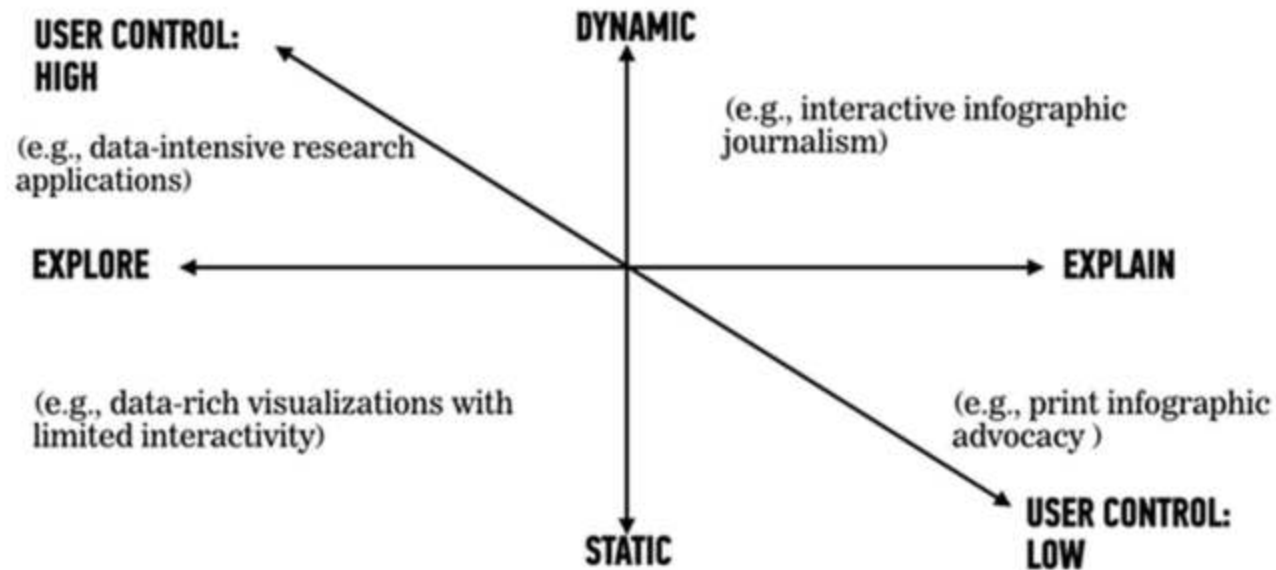
Consider the
characteristics
of your audiences

Consider the context
and purposes of your
users



Are users exploring data, communicating findings, or both?

General framework for determining a visualization's context



Audience's goals
are exploratory:
Visualization and
interface needs more
user control





User controls:

Filtering

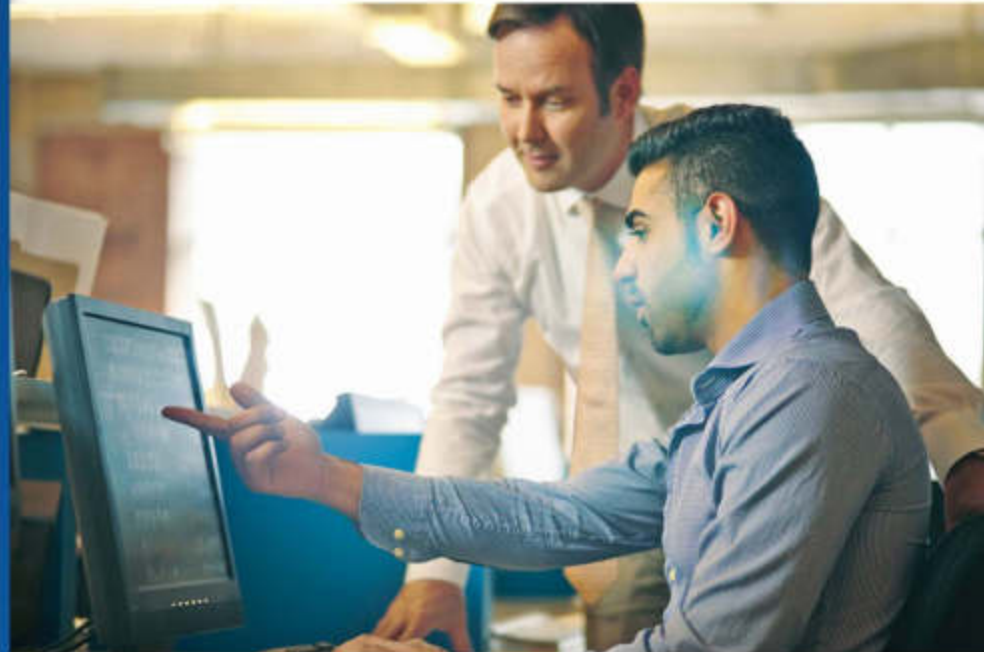
Pivoting

Zooming

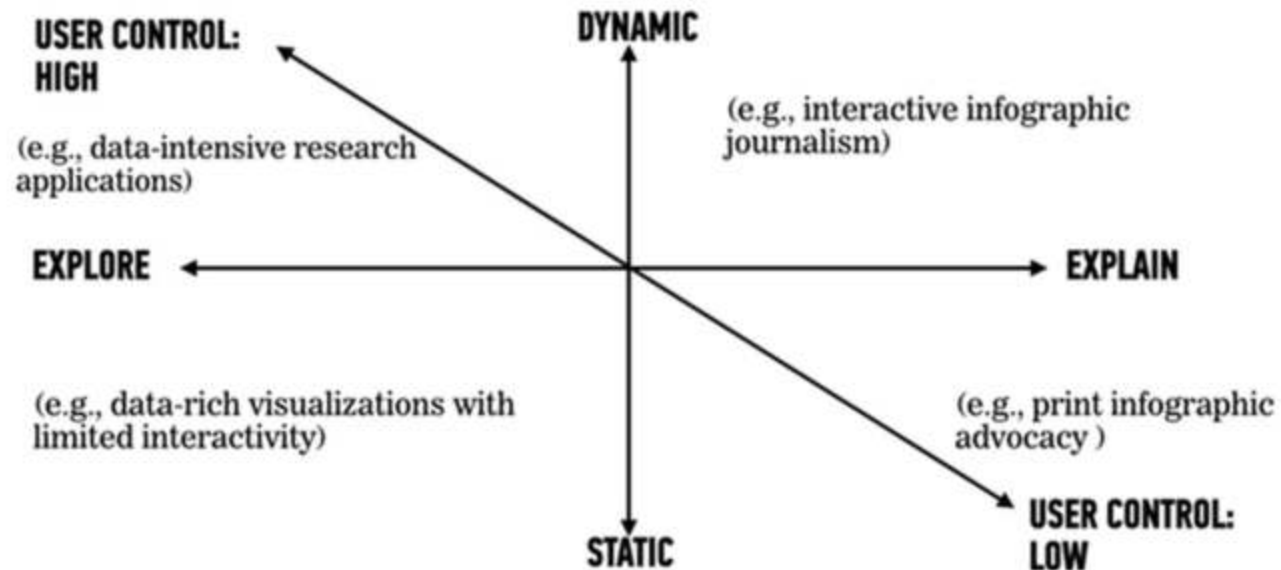
Greater user control
requires users to:

Have more prior subject
matter expertise

Be motivated to
find answers



Explanatory visualizations are simpler and do not require the audience to have prior subject matter expertise





Have a clear message

Quickly get to the point

Not open-ended
discovery or iterative
investigation

Visits	Rank
↓ 50%	10,50



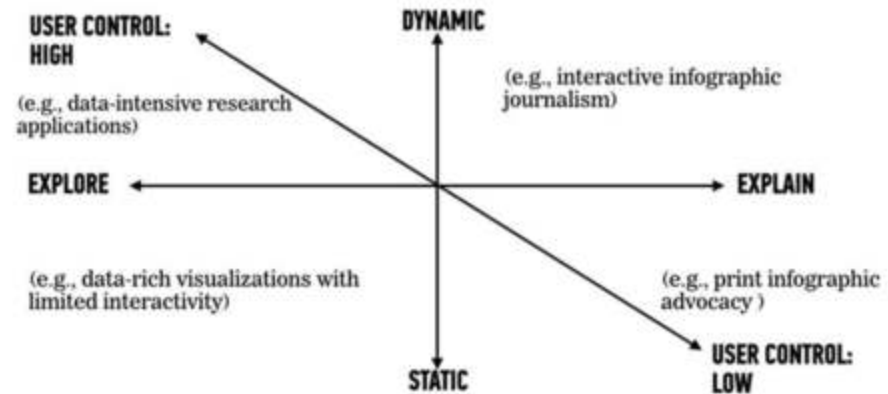
Show key ideas

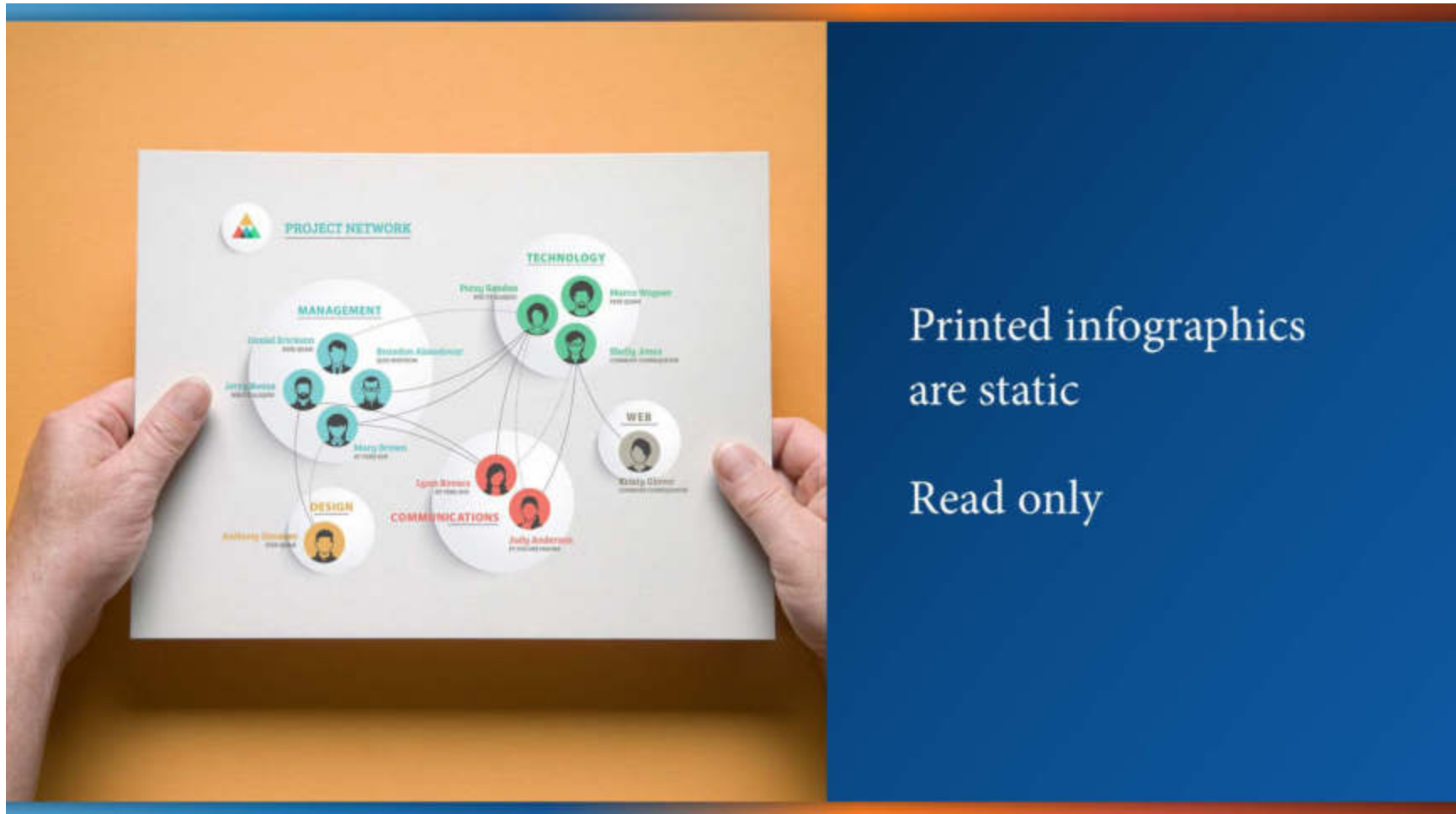
Make them clear, crisp and compelling

Dynamic vs. static visualizations

What level of interactivity does the user have?

Can the user change views?





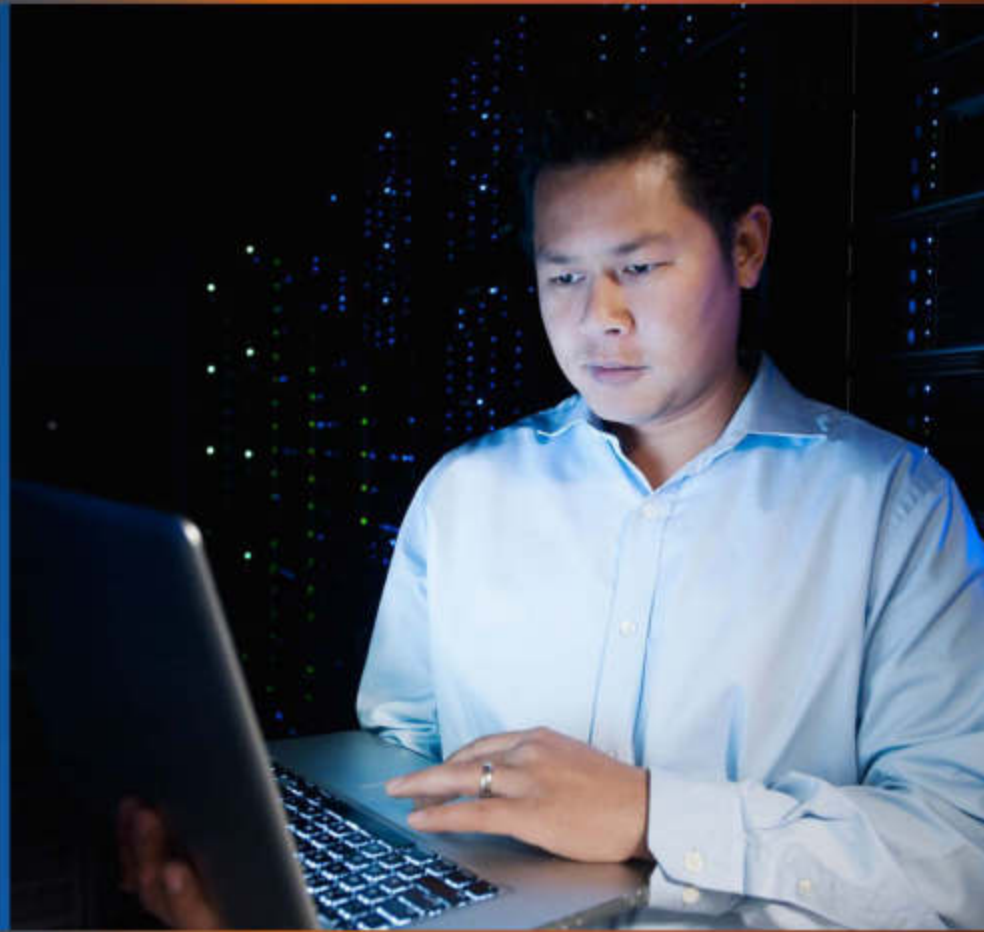
Printed infographics
are static

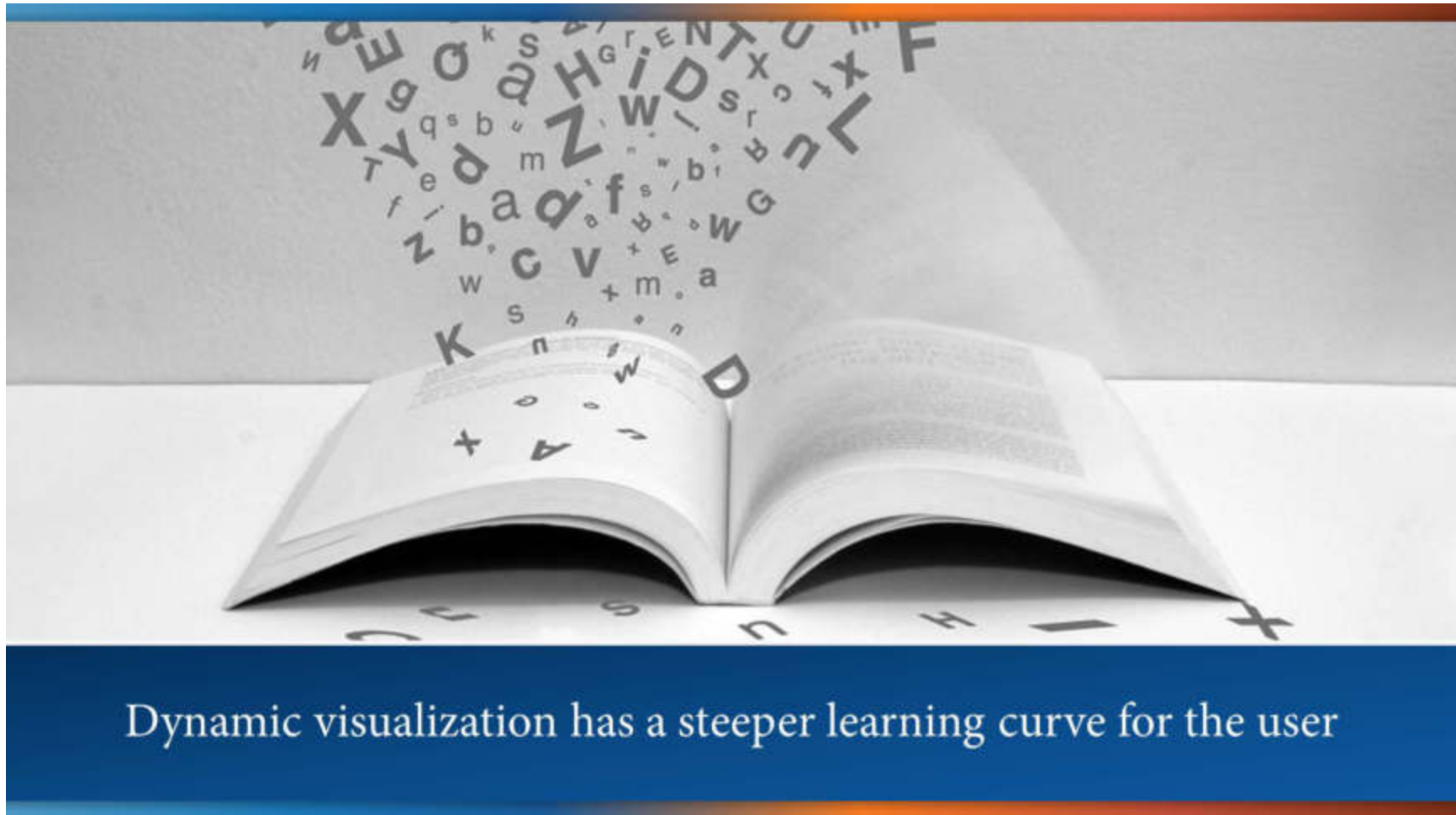
Read only

Cyber network
visualization

Highly interactive
with changeable views

User's engagement
reveals the stories
in the data





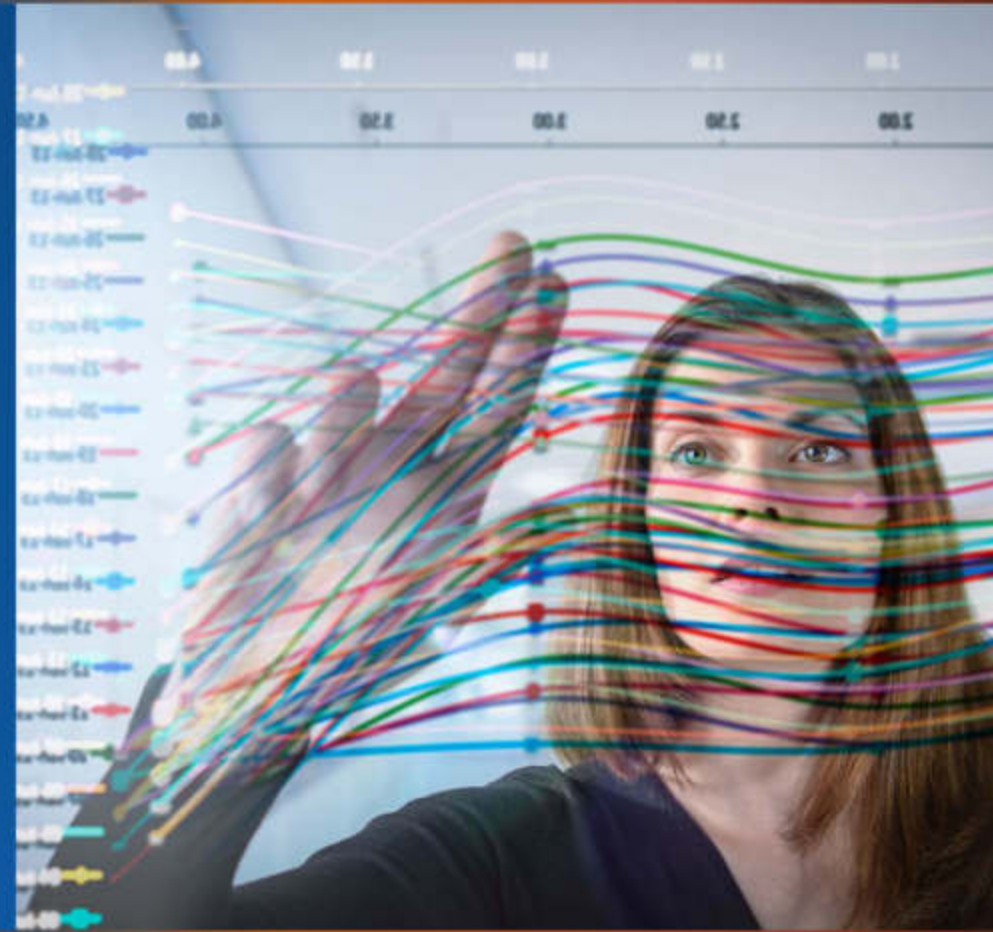
Dynamic visualization has a steeper learning curve for the user



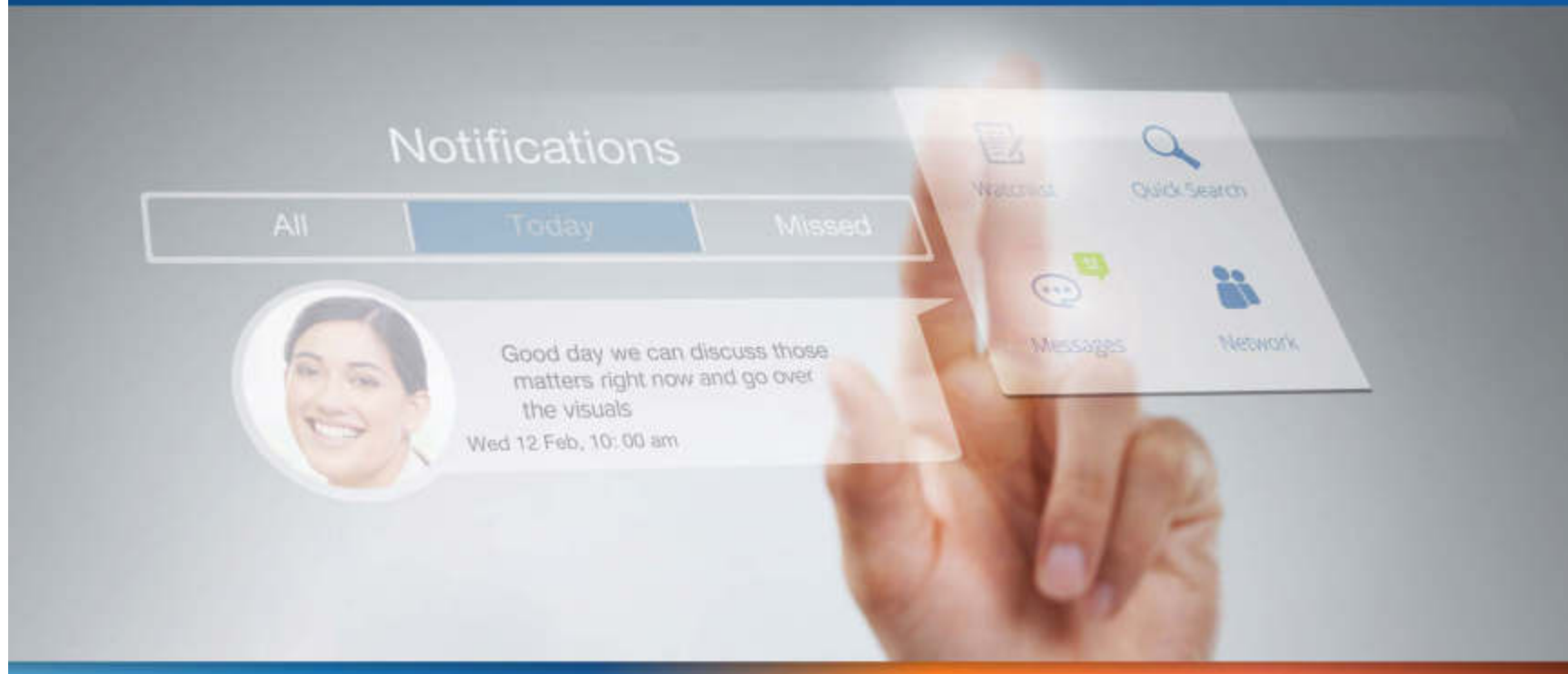
Static visualizations
can be complex

In general complex
visualization benefits
from interactivity

There is a balance point
between complexity
and decluttering
a visualization



Progressive disclosure shows the amount of data that is useful at a given moment in a use-case or scenario

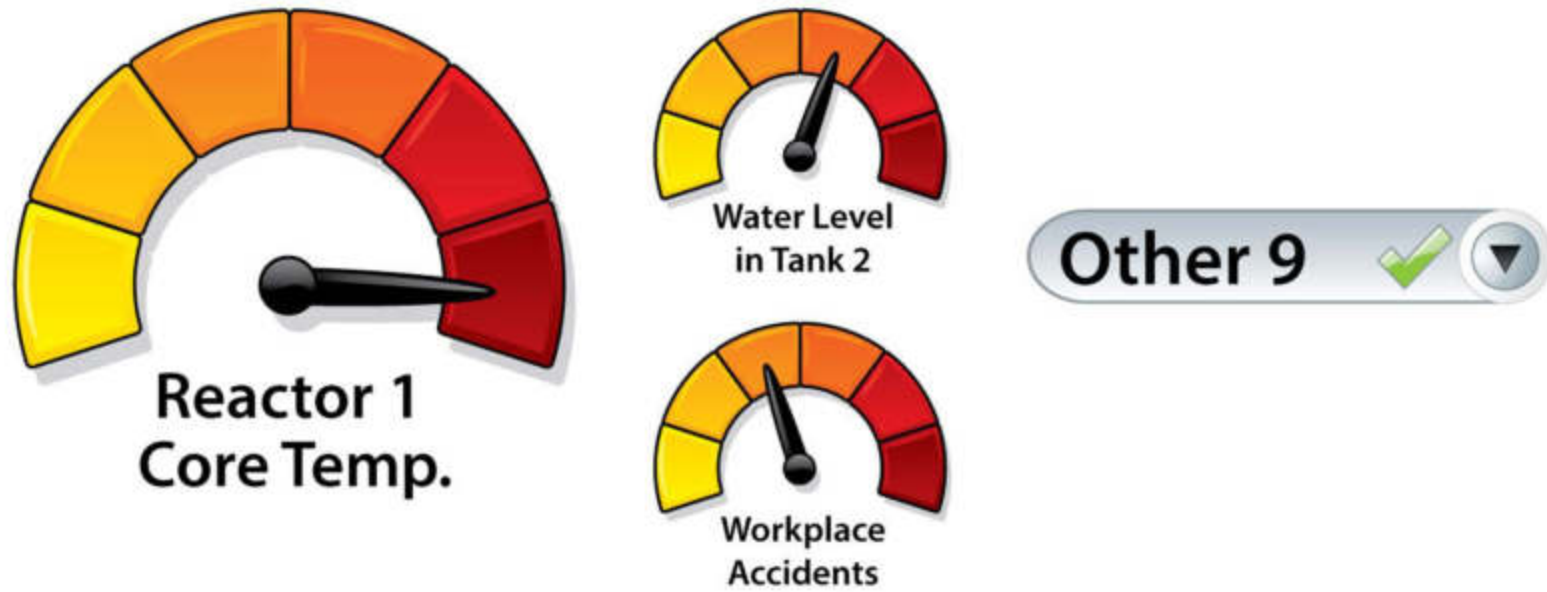


Everything being monitored is displayed
at the same level of visual hierarchy



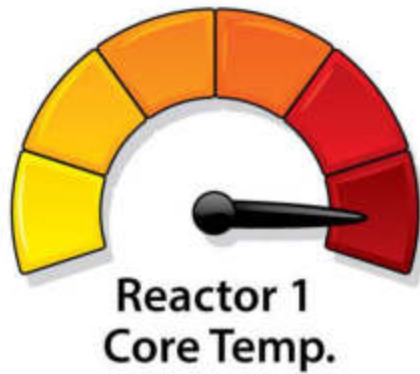
Malfunctioning indicators may get lost among all the dials





Alert users to problems by showing only critical information

Critical System



Normal Systems

Other 9



Users can view
normal systems

Systems of immediate
concern are emphasized

Simplicity is relative
and depends on users'
expertise and needs

"Simplicity is not the absence of clutter, that's a consequence of simplicity. Simplicity is somehow essentially describing the purpose and place of an object and product. The absence of clutter is just a clutter-free product. That's not simple."

Jonathan Ive

Chief Design Officer,
Apple

People create
visualizations for
many purposes

Purpose dictates the
visualization's design





Help users discover
unknowns

Make a case for
a discovery

Consider what level
of detail is appropriate
to meet your user's
particular needs

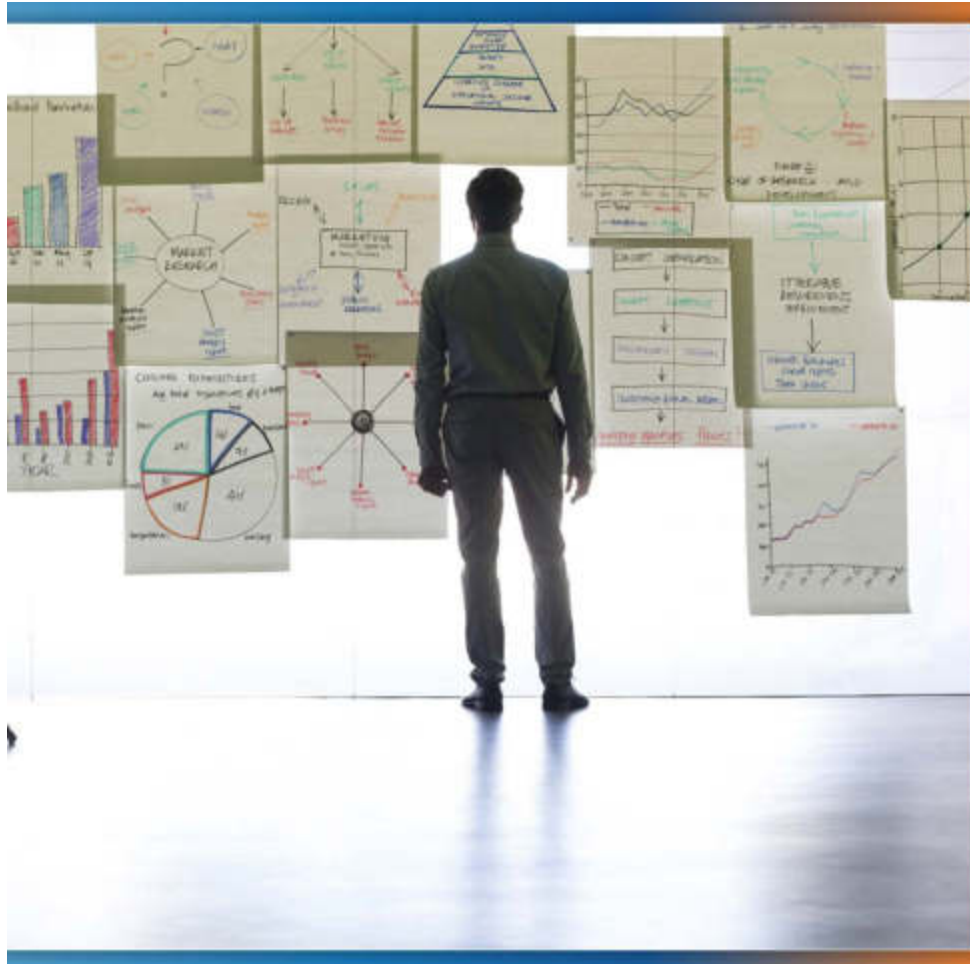
Be simple, not simplistic





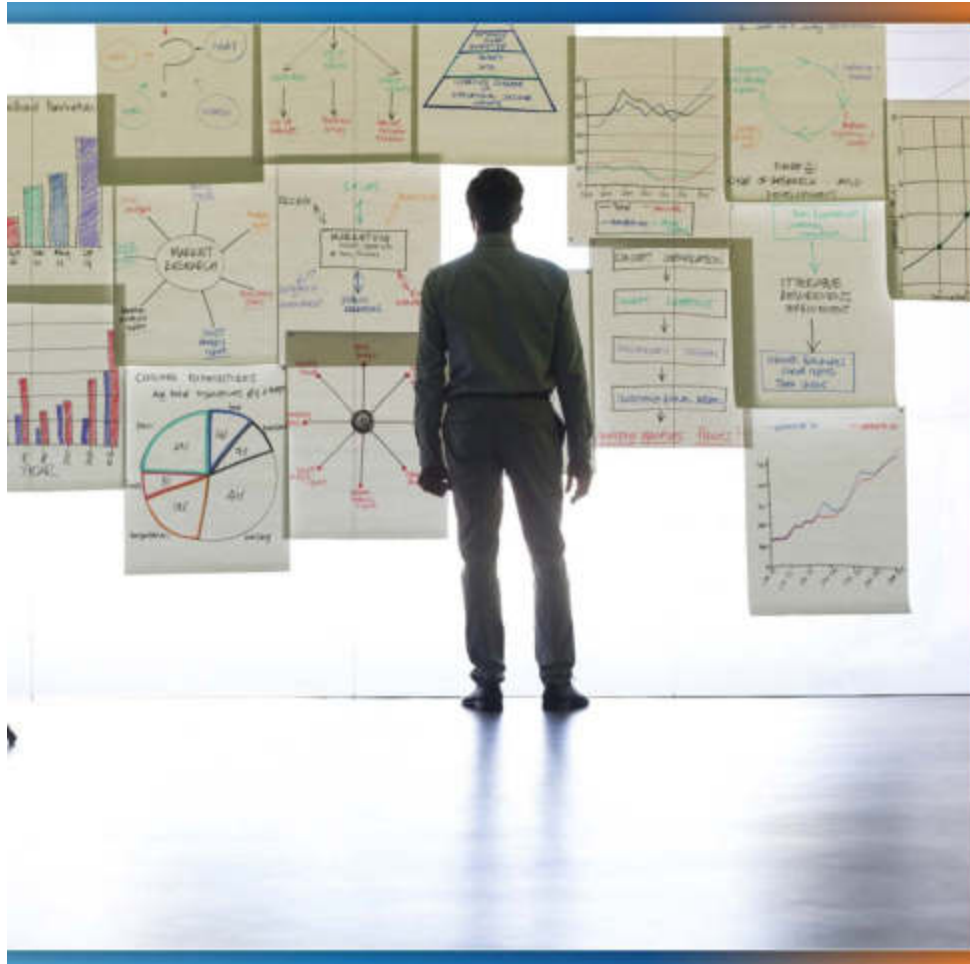
Essential Design Principles for Tableau

Data, Relationships, and Design



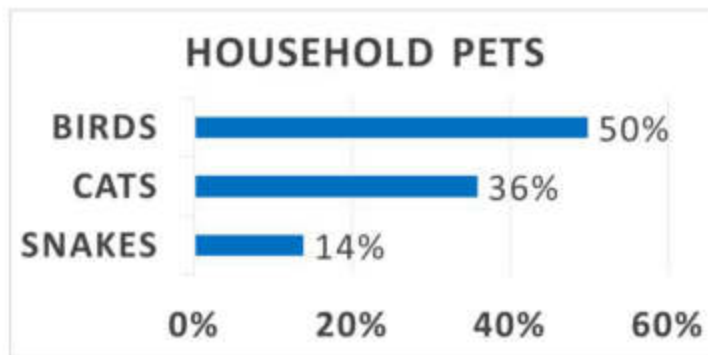
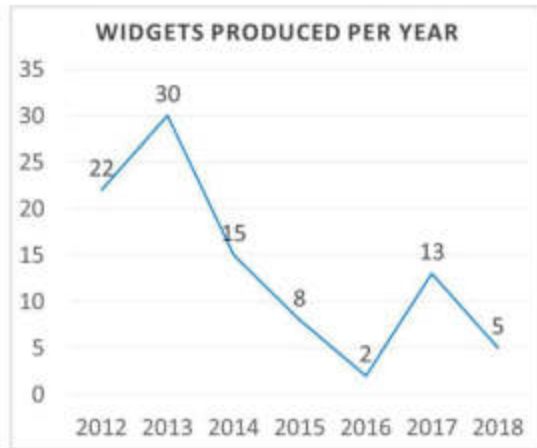
Consider context and uses of data for your audiences

Ways to display data relationships using specific chart types



Know what type of visualization to use and when to use it

Visualizations reveal relationships between dimensions of data



Line charts show change over time

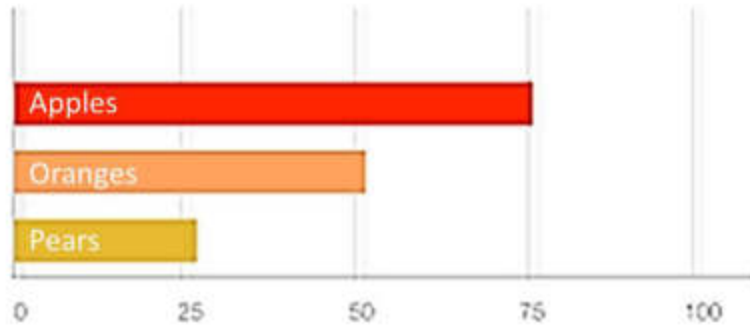
Bar charts show categorical comparisons

One chart type cannot fit all needs

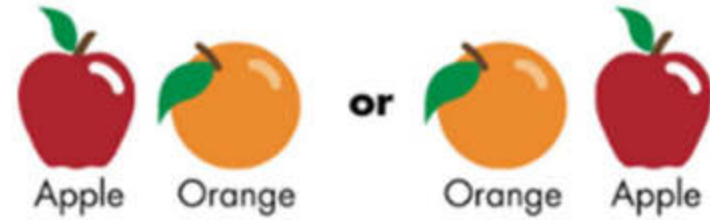


What is the proportion
of apples vs. oranges
sold at Francesca's Fruit
Stand?

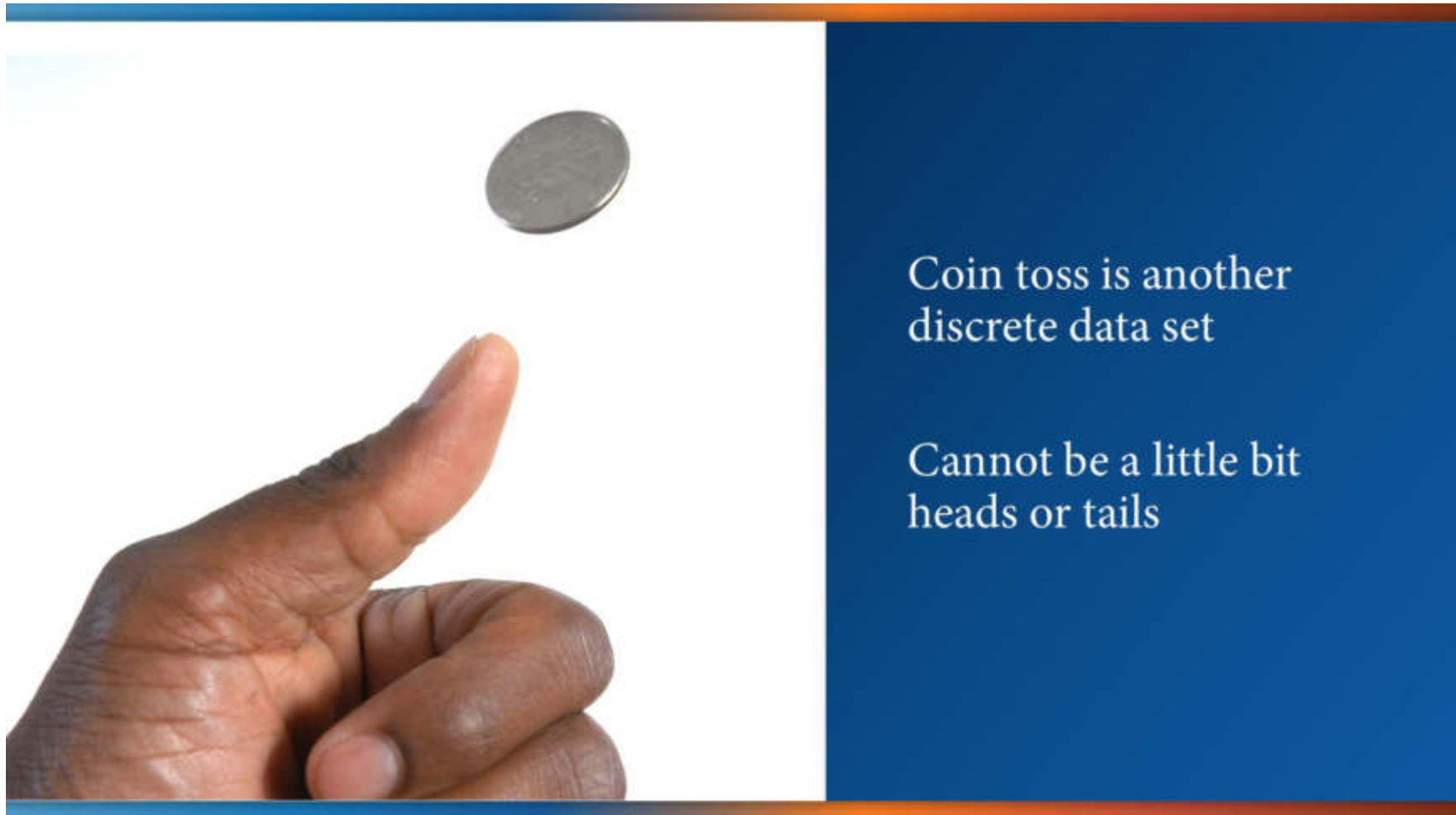
Sales for Oct. 17, 2016

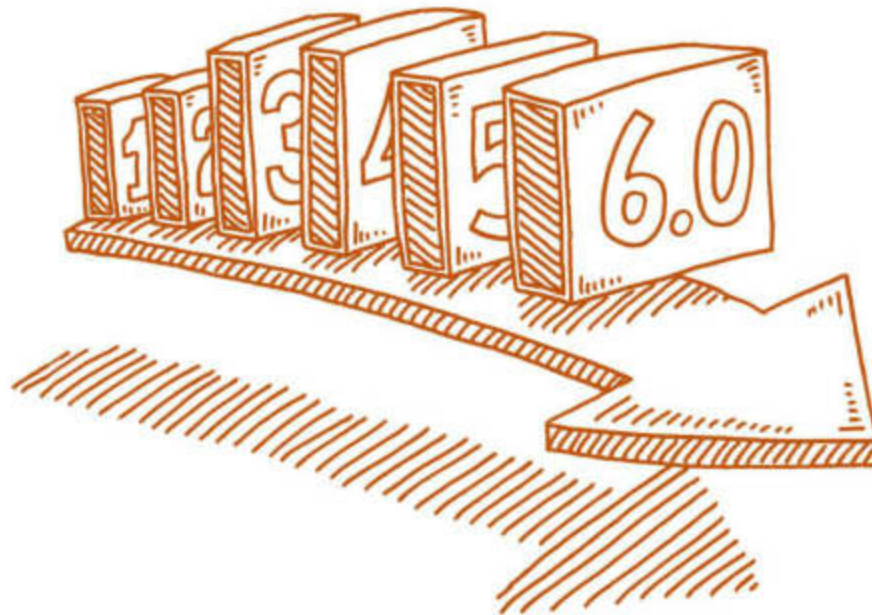


Discrete (unordered) items

... **not** continuous

Apples and oranges are distinct items and represent discrete data

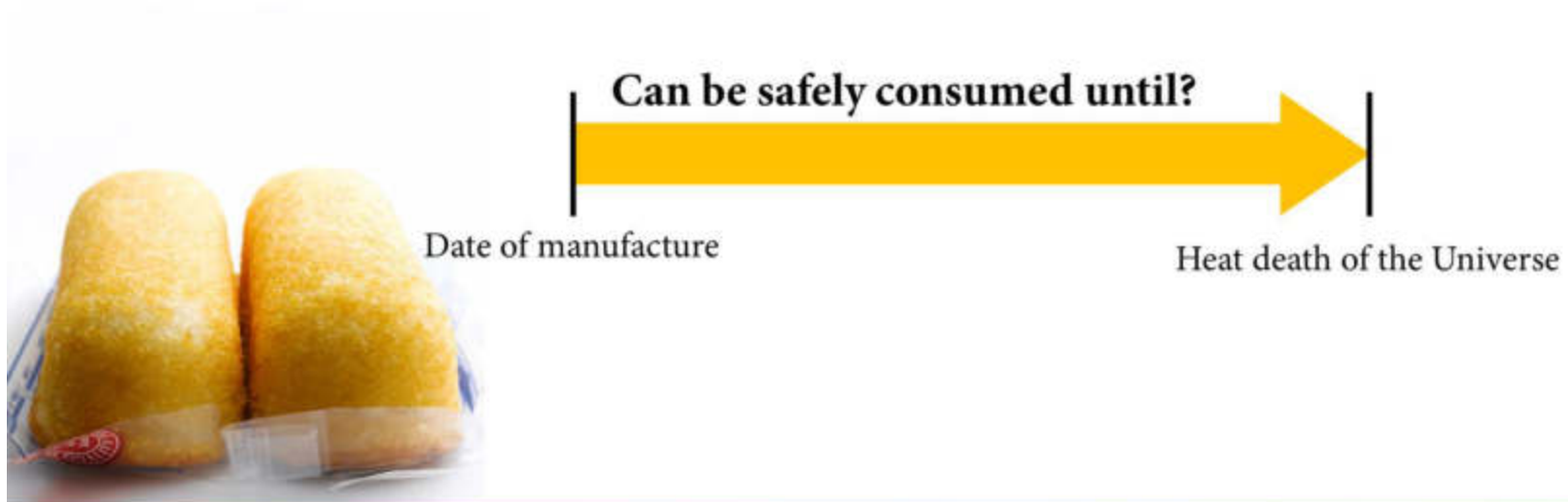




Opposite of
discrete data

Continuous data
represents a connected
range of values

Continuous...



Time is a linear, and therefore continuous, data value

What types of data relationships do you want to display?

Which type of graphic best showcases those relationships?

There may be more than one option available



Primary Types of Data Relationships and Commonly Associated Charts

Data Relationship	Chart
Comparison	• Column chart
Composition (Part-to-whole Relationships)	• Stacked column • Tree map
Correlation	• Scatter plots
Trend	• Line charts
Ranking	• Bar charts
Distributions	• Histograms • Box plots
Geospatial	• Maps



Make visualization
decisions based on:

Data type

Relationships
within the data

The needs of your
intended audience



Essential Design Principles for Tableau

Know Your Audience(s)

Think about your audience:

Needs

Skills

Knowledge

Goals



What are the interests,
needs and goals of your
audience?

How will your
visualization meet those
needs?





Audience needs can range from curiosity to urgent real-time alerts

What level of familiarity should your audience have with this subject?
What level do they actually have?

Novice



User



Expert



What level of detail and information density fits your target audience?



Too much or too little detail are both counterproductive
– depending on who's looking



How much control do users have?

More user control may require more effort and knowledge from the user



Simplicity is relative





Retail analysts may need tools to discern patterns and trends in the data

Goal is to facilitate user's ability to explore the data

Sales presentations will have different goals: conveying specific information simply



Detail is relative

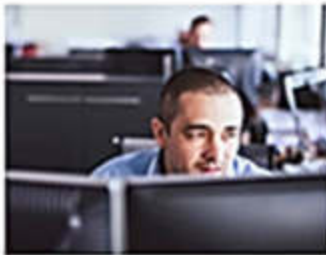




Time scale needs can vary amongst audience members

Personas are collections of user types that capture characteristics, goals and needs of different types of users

Persona 1: Zach



"I need a better way to apply these so-called advanced analysis methods to my company's data sources."

Zach wants to keep a foot in operational security work, but doesn't want the pressure of day-to-day ops. Zach lacks the development skills to create top notch tools, but tries to apply the software he finds to solve his problems. In a few years Zach wants to move into the world of management where he can lead junior analysts.

Role
Sr. Security Analyst/"Hunter"

Organization
Fortune 100 company technology company, based in Denver, CO.

Experience
Zack used to work as a consultant in a large security company.

Education
Bachelors Degree Information Technology
Certifications from SANS

Goals

- Detect advanced intrusion attempts as quickly as possible
- Protect organization network from internet attacks & threats
- Show the bosses his value

Challenges

- Lack of advanced analytical tools
- Struggling with creating usable, re-usable scripts that can apply those advanced analytics
- Large amount of data to dig and carve through to make decisions



Aim for your target audience





Ask questions

Adjust your design

Use personas

Understand and
anticipate your
audience's needs



Essential Design Principles for Tableau

Language, Labeling, and Scales

Key descriptors can:

Clarify

Define what's happening
in the picture

Or, make the picture
more confusing!





Word choice

Familiar descriptors

Ensure understanding
of meaning and context

Choose words
specific to industry
and cultural context

Consider time
and space

Adjust cultural phrases
or expressions



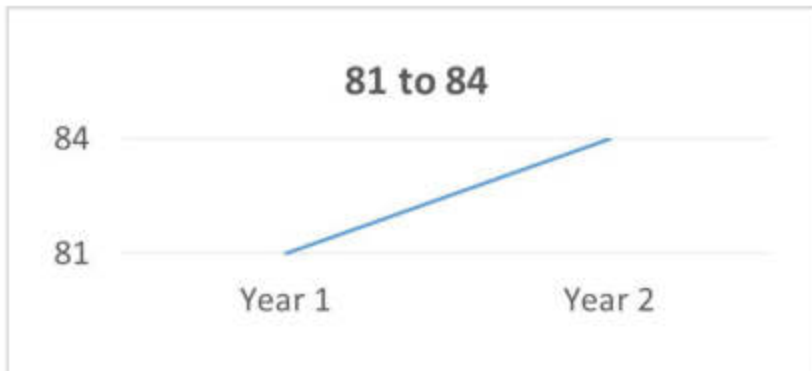
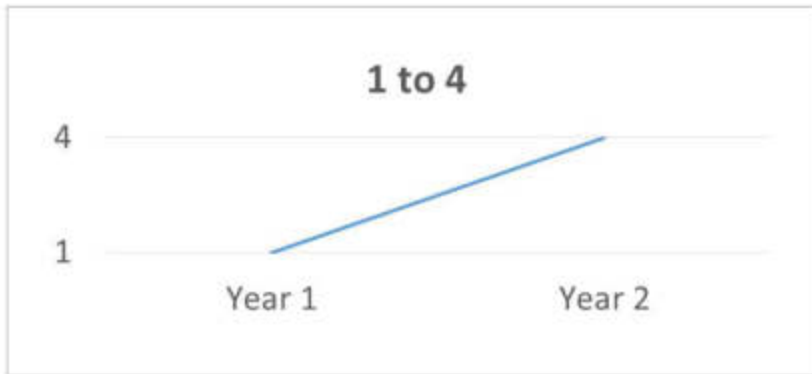
Cryptic terms

Ambiguous labels

Acronyms from
source database

Are all descriptors
clear to end users?





May significantly
impact users'
perception of data

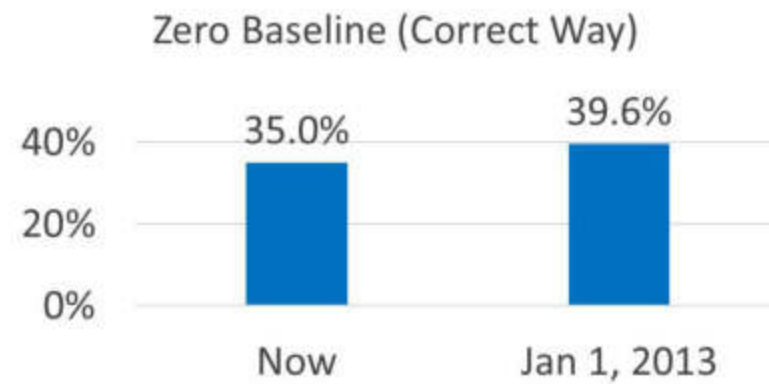
Check:

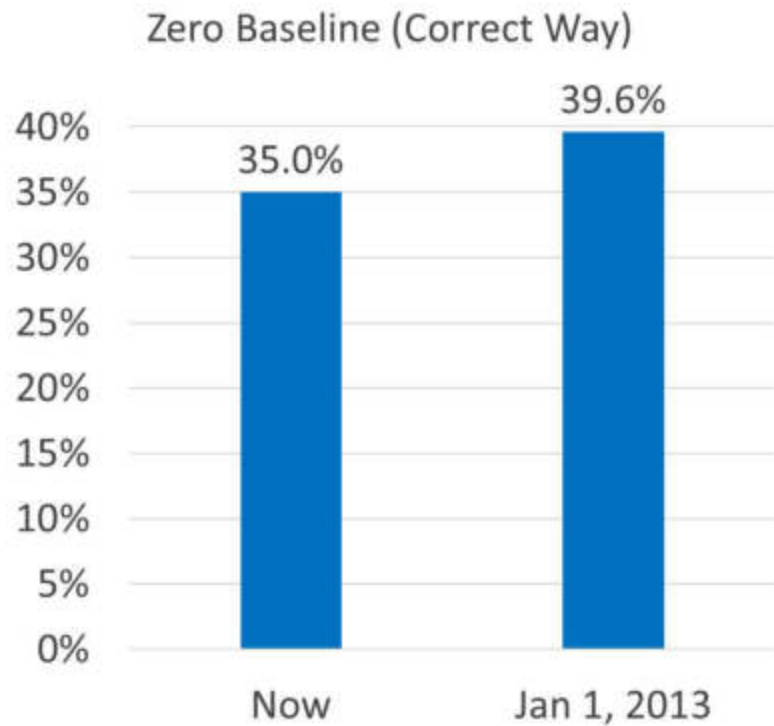
Numeric starting point

Degree of change
based on percentage

When deriving
comparable scales for
different types of data:

Start axes at zero,
if possible





Scale and
comparisons can lead
to visual distortions

Use visuals with words
and numbers to clarify

Choose with thought
and care



Essential Design Principles for Tableau

Multiple, Connected View

Seeing different views is essential for accurately interpreting your data



Seeing an Elephant



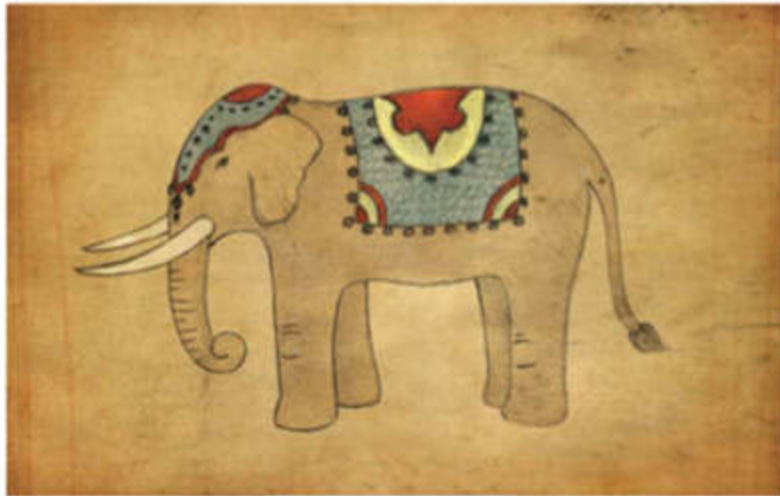
Bone?



Leather?



Rope?



Big Picture

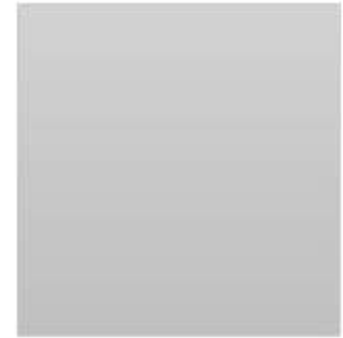
You want users to see all the elephant in their data – the whole image and the parts that make up the whole

This is a circle and a square...or is it?

A



B



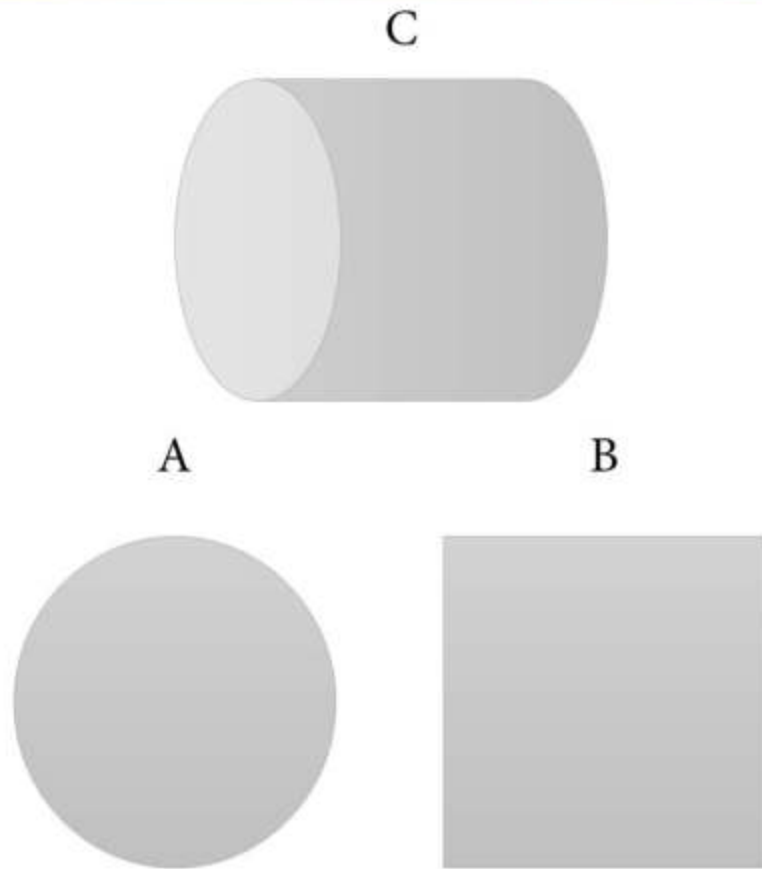


Image C is related
to A and B

A and B are two
different views of C

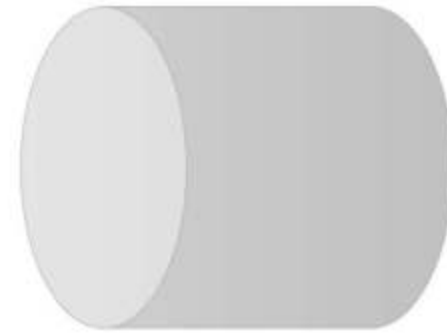
A



B



C



Seeing from multiple perspectives clarifies your understanding
of what you are looking at

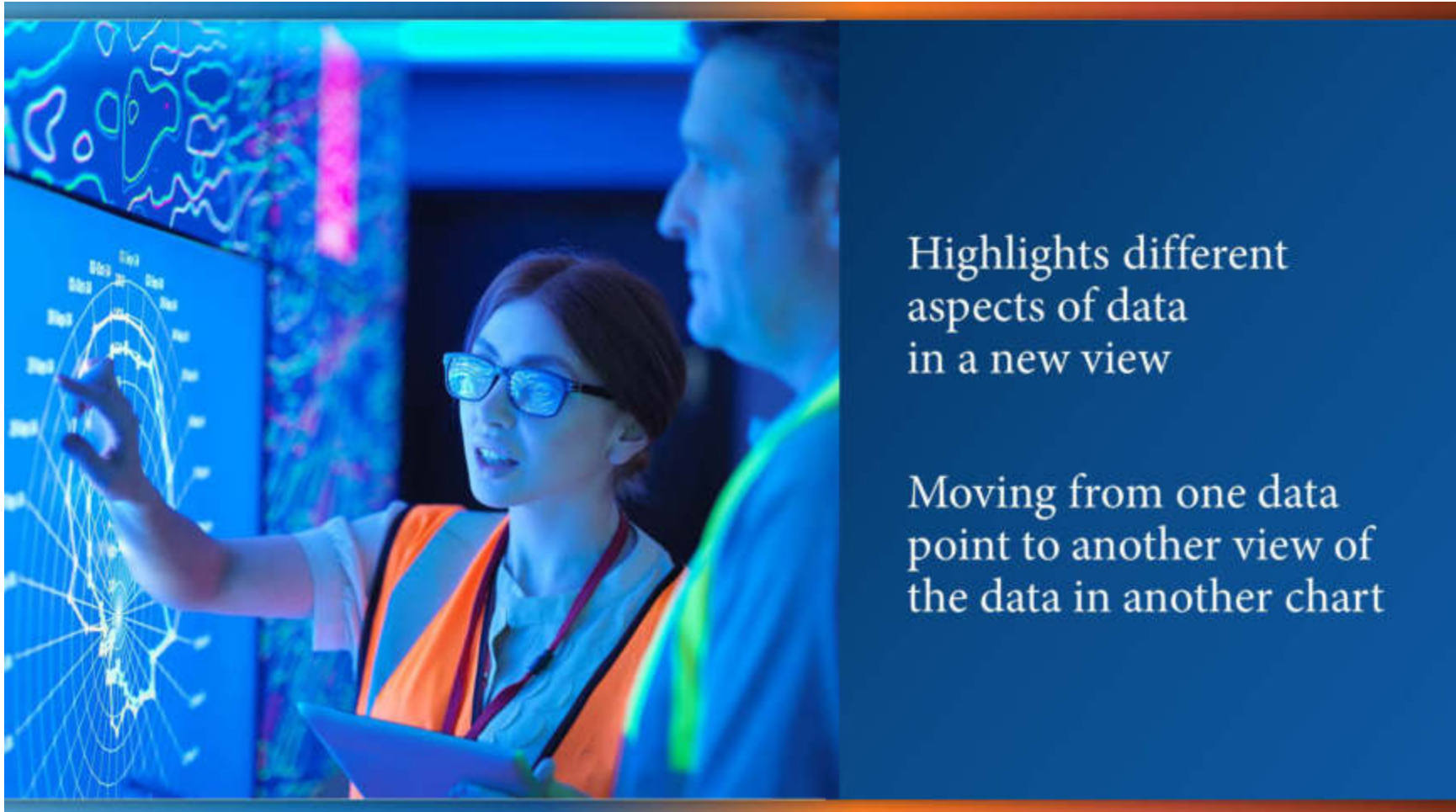


Coordinated views of data visualizations contain a mix of different but related visualizations: charts, scatter plots, maps, etc.



Pivot is viewing a data set in a table and then transforming columns and rows into a new configuration

Can involve additional statistical summarization



Highlights different aspects of data in a new view

Moving from one data point to another view of the data in another chart



Well-designed visualizations allow users to see data from different perspectives

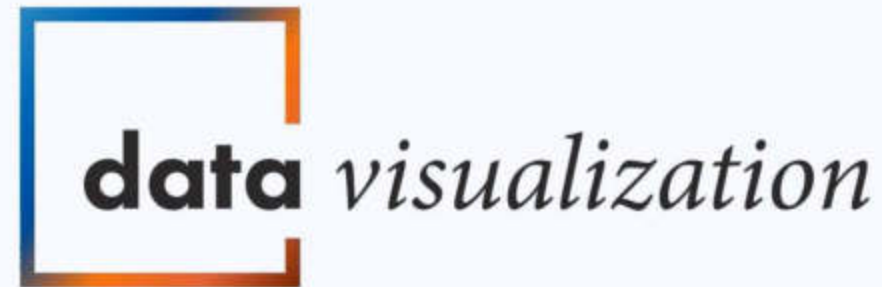
Tools which enable
multiple perspectives:

Coordinated
highlighting

Filtering

Coordination will make
the user's work apparent
and easy to do





Essential Design Principles for Tableau

Static Versus Interactive Visualizations



Consider the context
and workflows where
your designs are used



Static designs
require careful thought
about what is and isn't
being displayed

Users cannot adjust the view



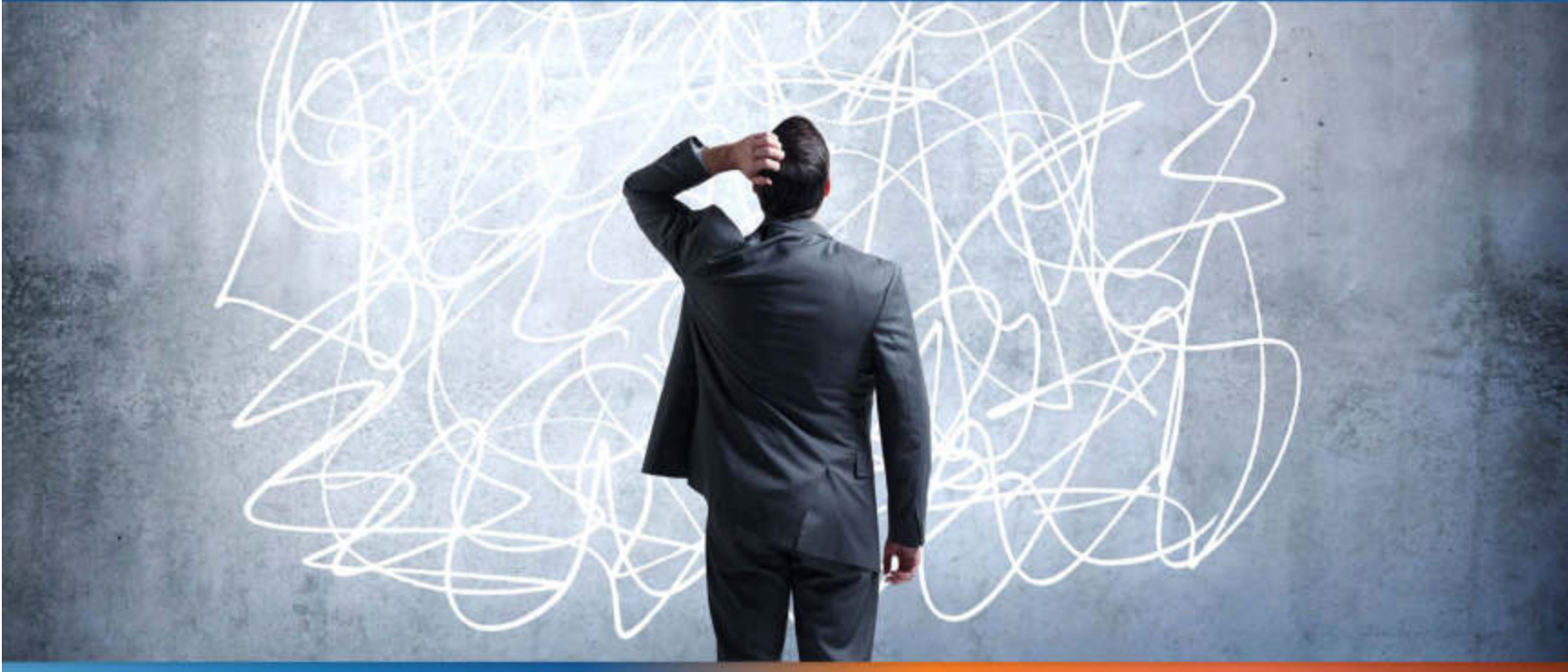
Interactive visualizations have more viewing options

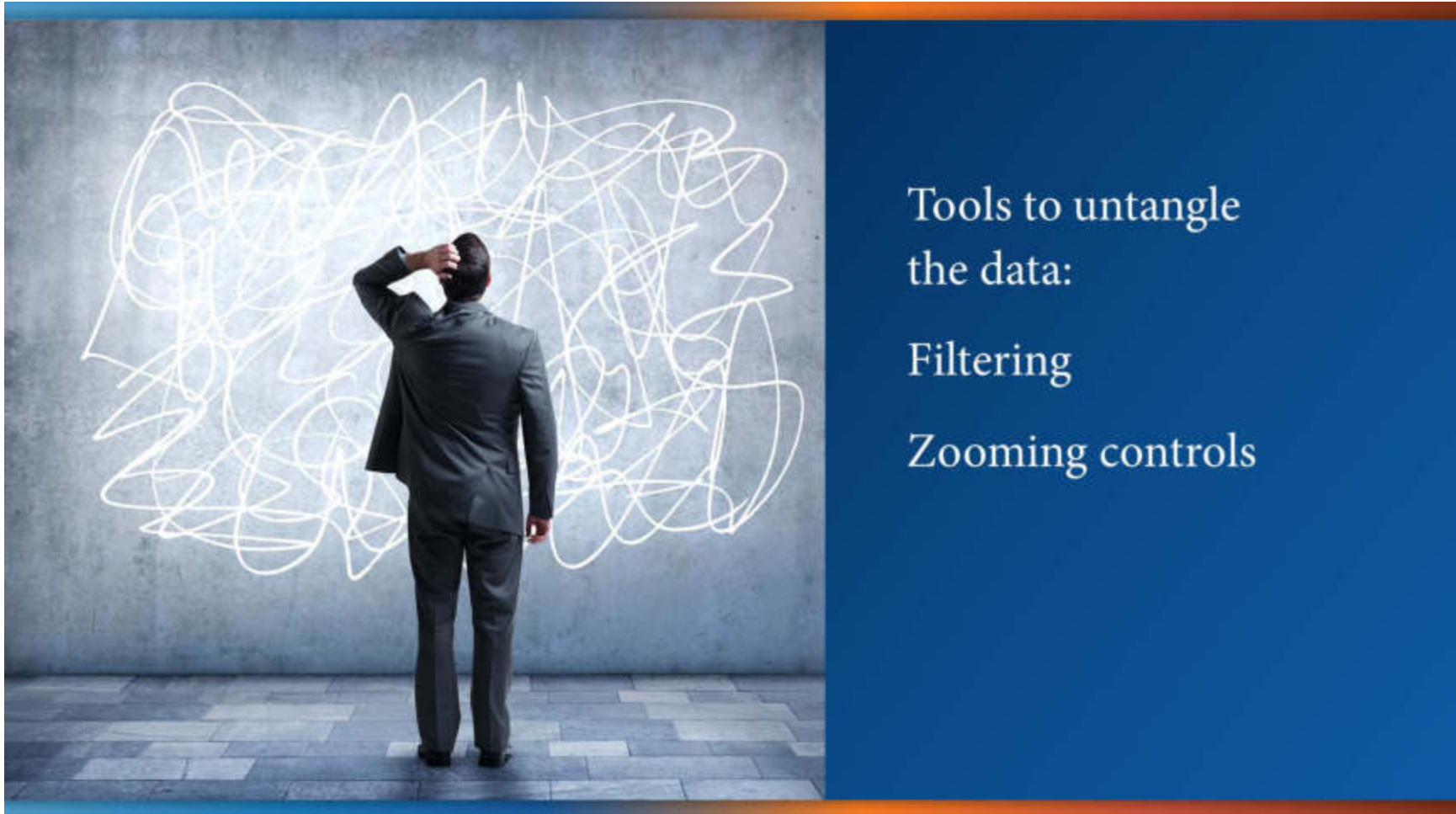
More interactivity
requires users to think
and decide how to
view the data

Users want and need
more interactivity



Large data sets can generate chaotic visualizations





Tools to untangle
the data:

Filtering

Zooming controls

Start with
a big picture view

Then go into details

You can reveal multiple
details within the same
workflow interface



"Overview first, zoom and filter,
then details on demand."

- Ben Shneiderman

This is an iterative process

1. Direct manipulation of graphical objects
2. Exploration and navigation
3. Problem solving and question generation

Colin Ware's
interactive visualization
– interlocking feedback
loops

Direct manipulation
of graphical objects:

Ability to interact with
various visual elements
representing data



Uses of visual elements:

Hover/roll-over
provides additional
details

Input mechanism

Enhance display

Pivot point for
new exploration



Direct data manipulation should have a purpose
and meet the needs of users





Crowded and overlapped graphics are hard to interact with

Outlining, highlighting, rollovers, and image zooming help users select items

Exploration and navigation lets users quickly find information



The interface
should help users:

Enter

Orient themselves

Move toward

Discover new paths

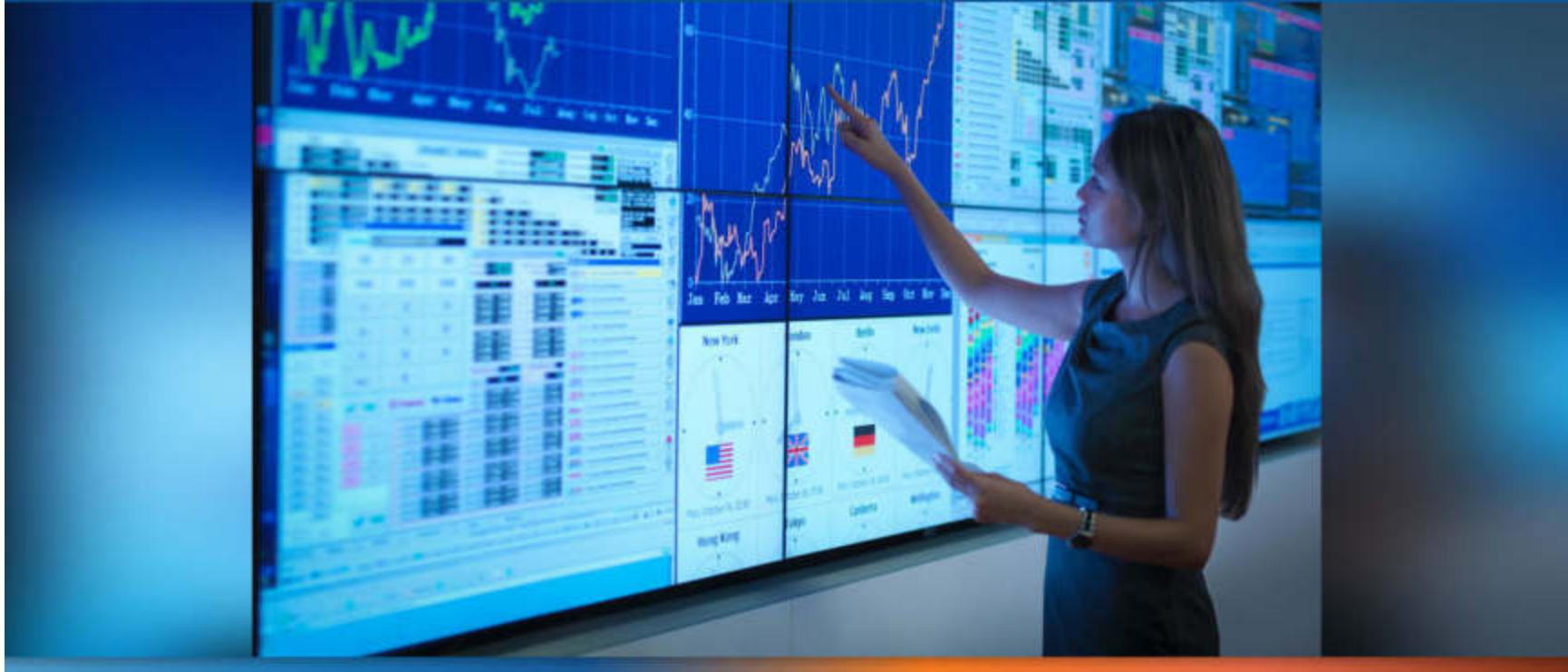




Keeping context,
back-tracking and
trailblazing are all
important as users
explore data

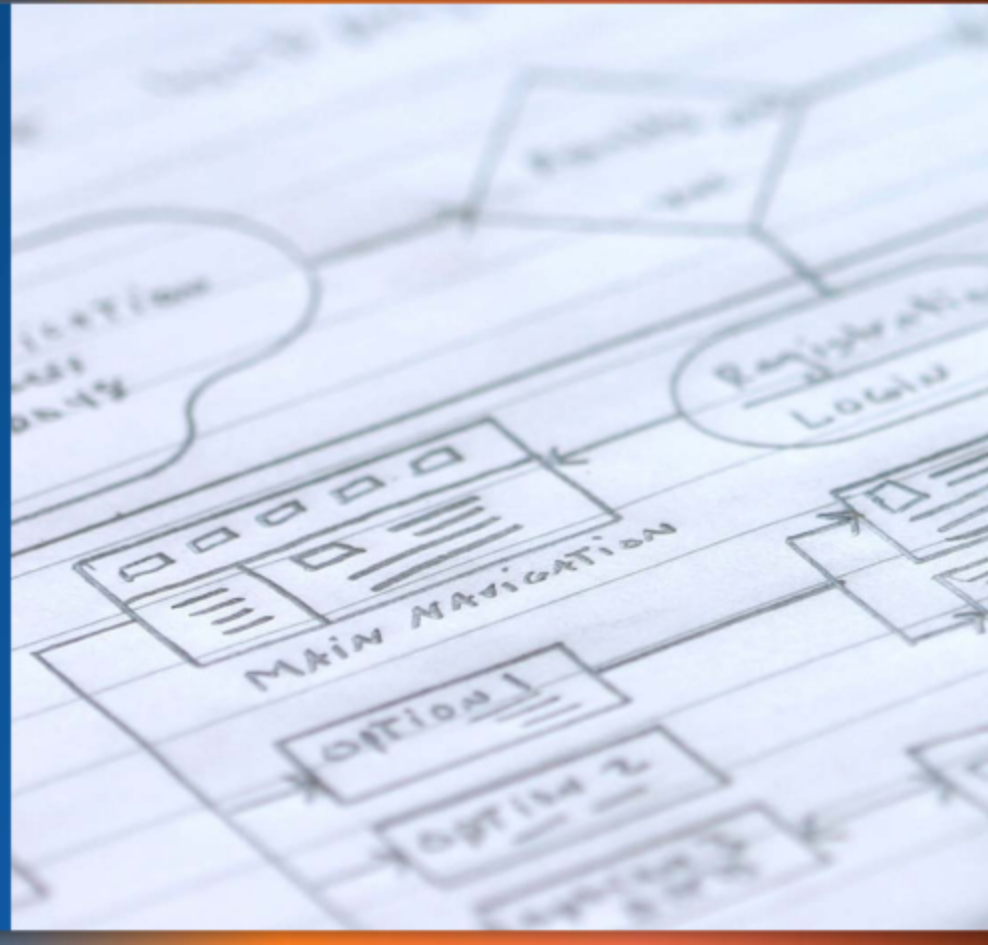
Bread crumbs show the path the user has followed

Data visualizations should solve problems and generate questions

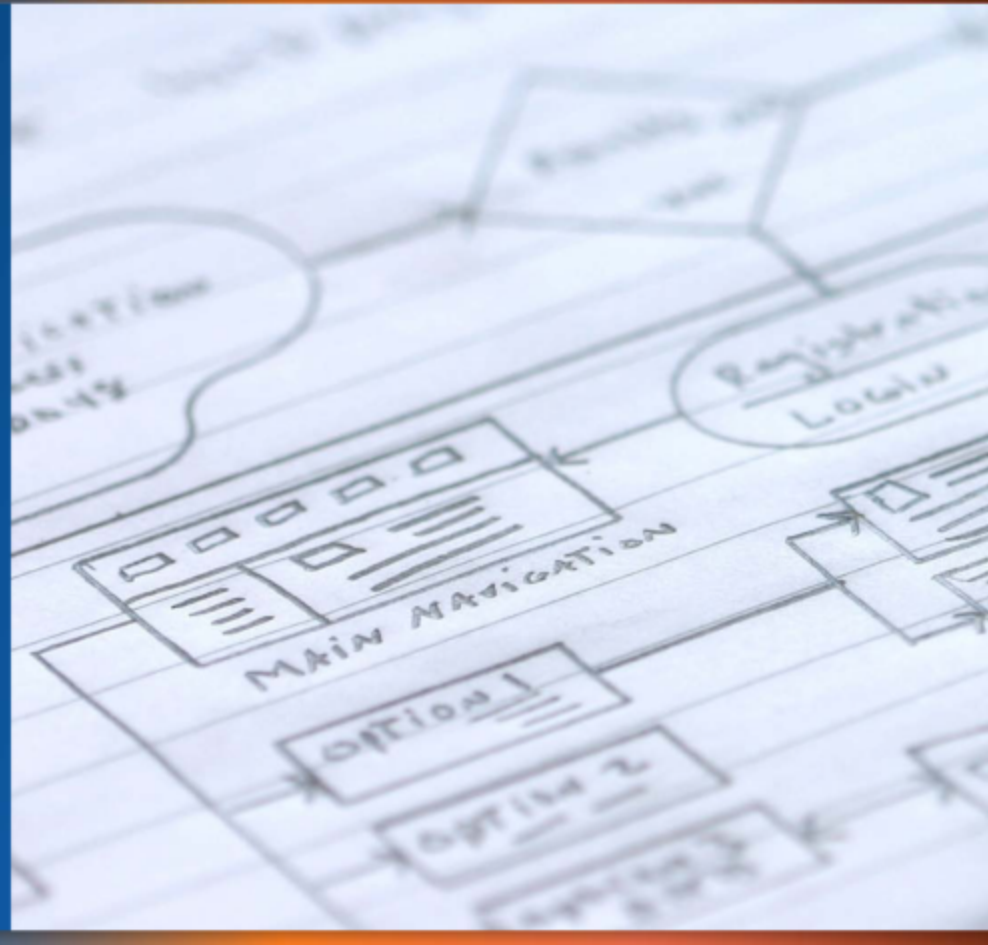


Visuals and navigation
should help users
solve problems

Understand your
audience's needs
and goals



Use problem solving,
workflow maps, and
storyboarding to design
useful visualizations





Consider the user's
needs for:

Direct manipulation
of data

Navigation

Problem solving
question generation

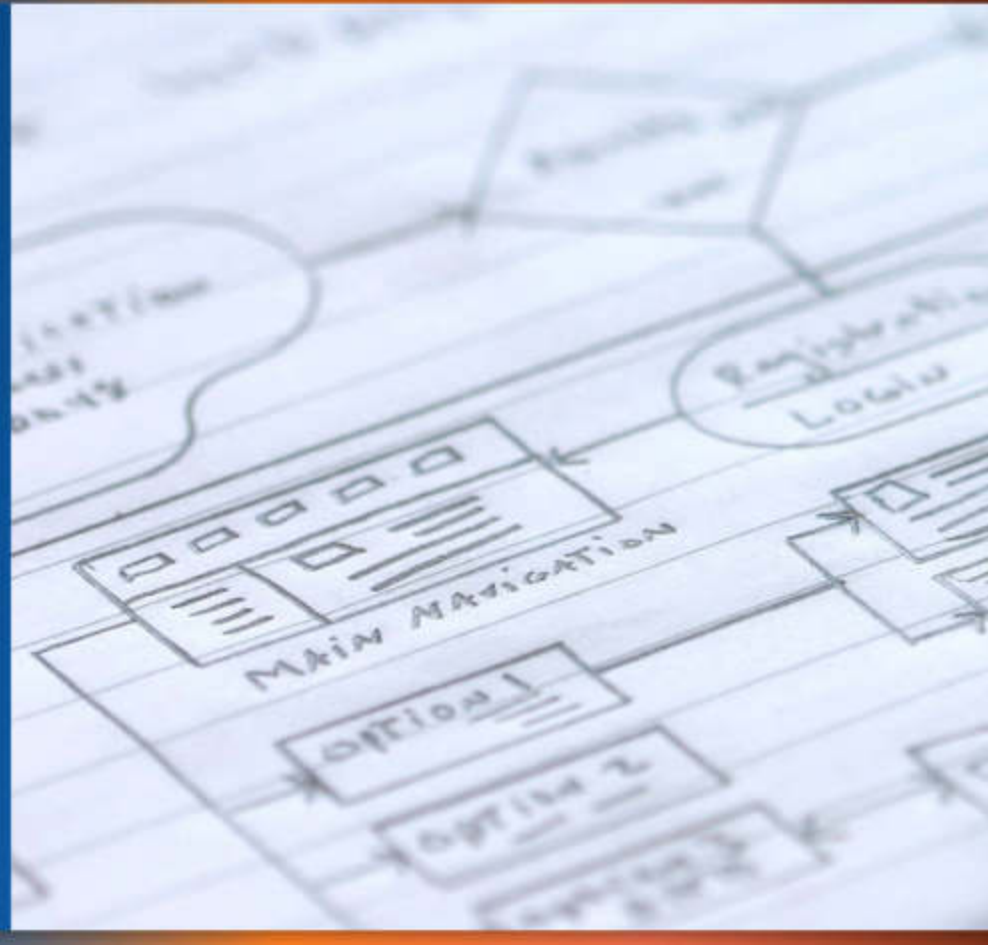
Good design can be immersive



You are a data architect

Users move through visualizations like people walking through a building

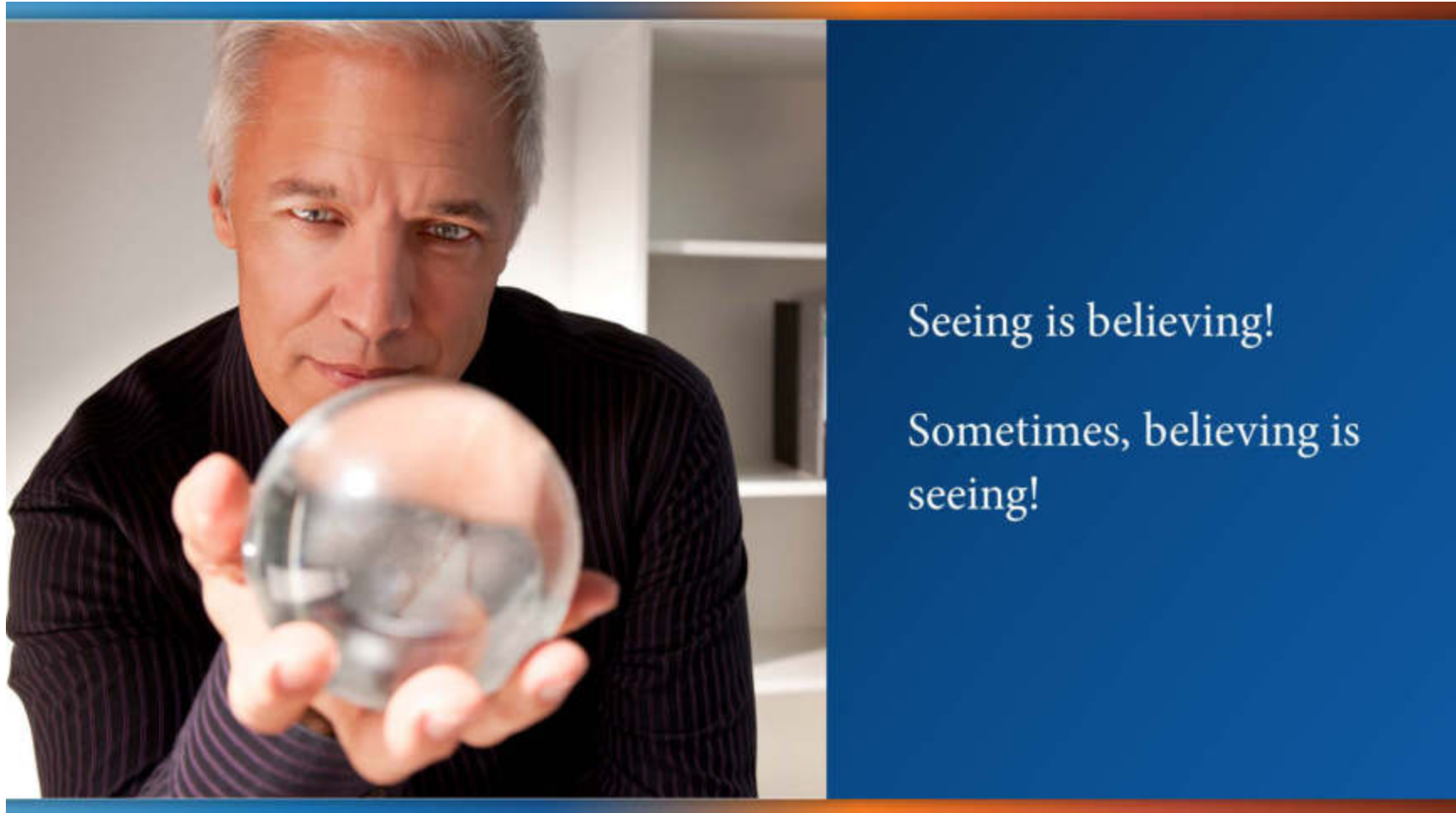
Visualizations, like buildings, are built based on user's needs





Essential Design Principles for Tableau

Visual Lies and Cognitive Bias



Seeing is believing!

Sometimes, believing is seeing!

Beliefs, biases and
mental models can
distort interpretation

Data visualizations
should reveal patterns
clearly and accurately



Don't introduce
distortions through
design

Prevent false conclusions
based on biases

Clarify data to lead users
to correct conclusions





The right data in right
form is not enough

Know your users

Design to meet their
needs simply, directly,
and completely



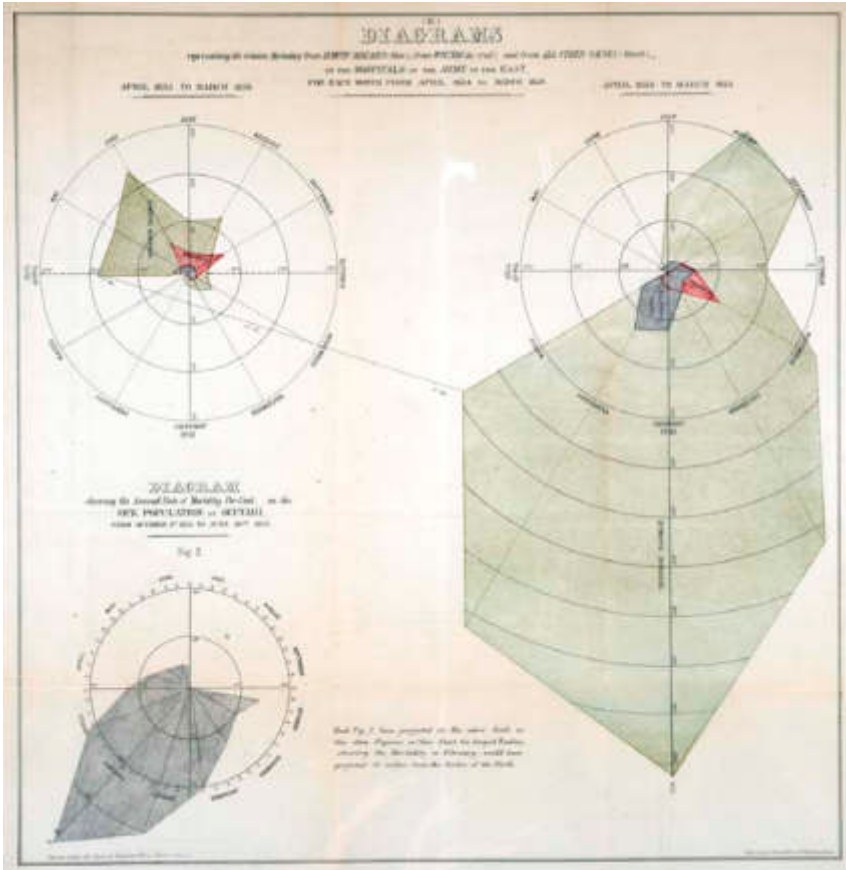
Source: http://libweb5.princeton.edu/visual_materials/maps/websites/thematic-maps/quantitative/medicine/medicine.html

Florence Nightingale
Nurse
Social reformer
Data visualizer



Source: http://libweb5.princeton.edu/visual_materials/maps/websites/thematic-maps/quantitative/medicine/medicine.html

“...affect thro’ the Eyes’
what we fail to convey to
the public through their
word-proof ears.”



Mortality rates of British soldiers from all causes

More soldiers were dying of preventable causes than battle

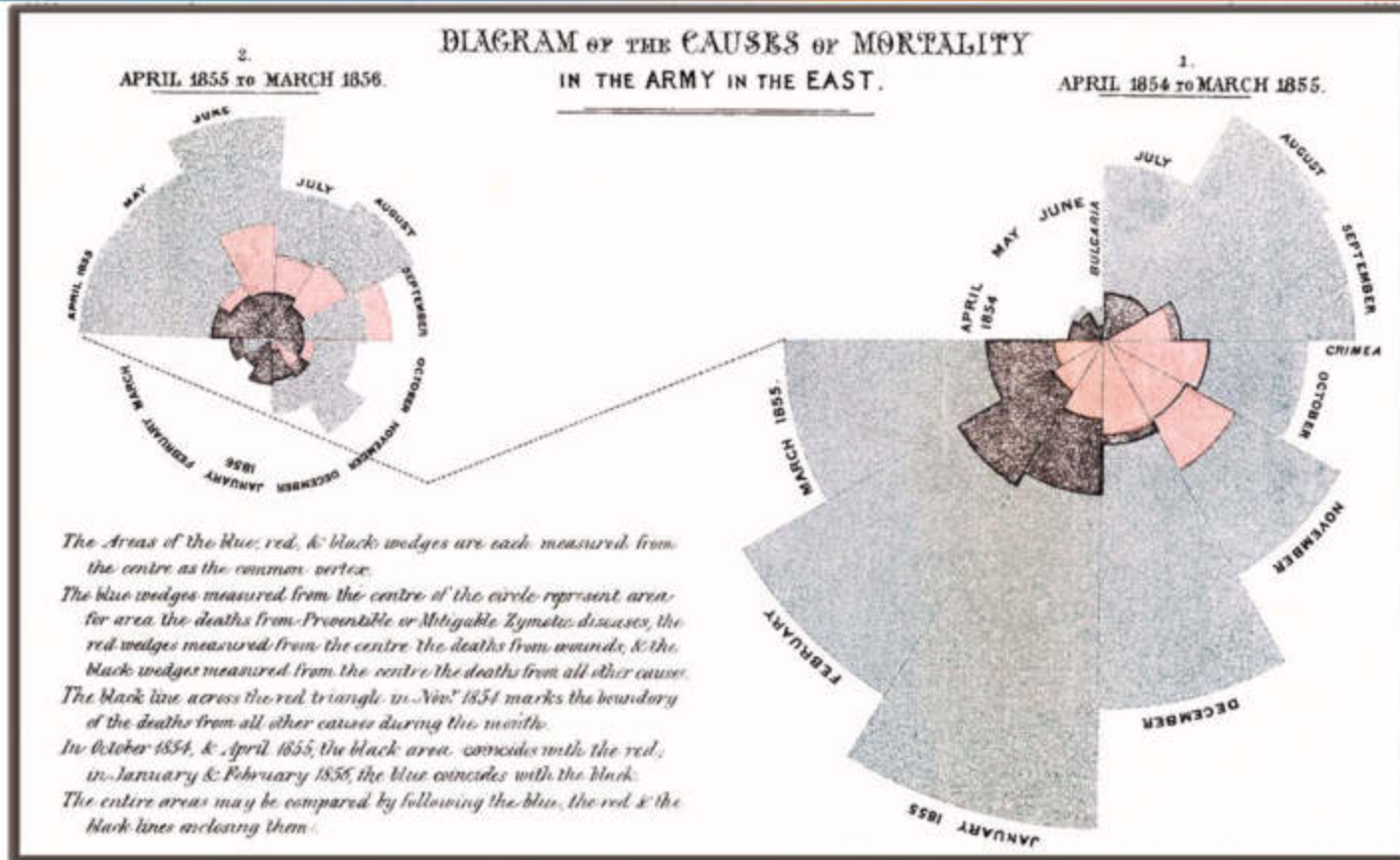


Diagram of the Causes of Mortality in the East by Florence Nightingale (public domain) https://en.wikipedia.org/wiki/Florence_Nightingale#/media/File:Nightingale-mortality.jpg



Design choices can
create distortions

Or counteract cognitive
biases

Anticipate and respond
to common audiences
biases

Recall intro video
demonstrating
survivorship bias

They were forgetting
critical damage





Such thinking is difference between life and death

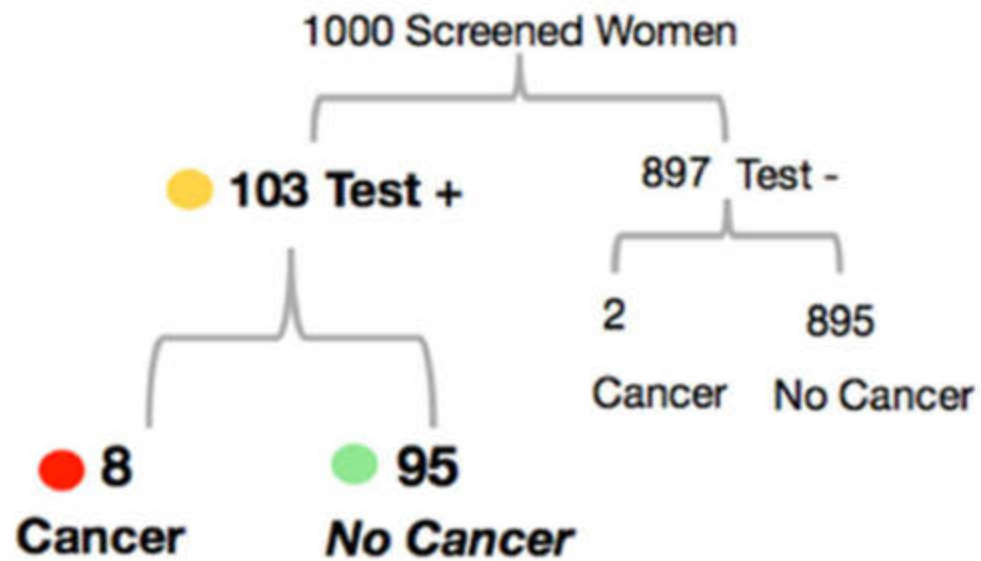
Visualize unseen potential damage for non-returning planes

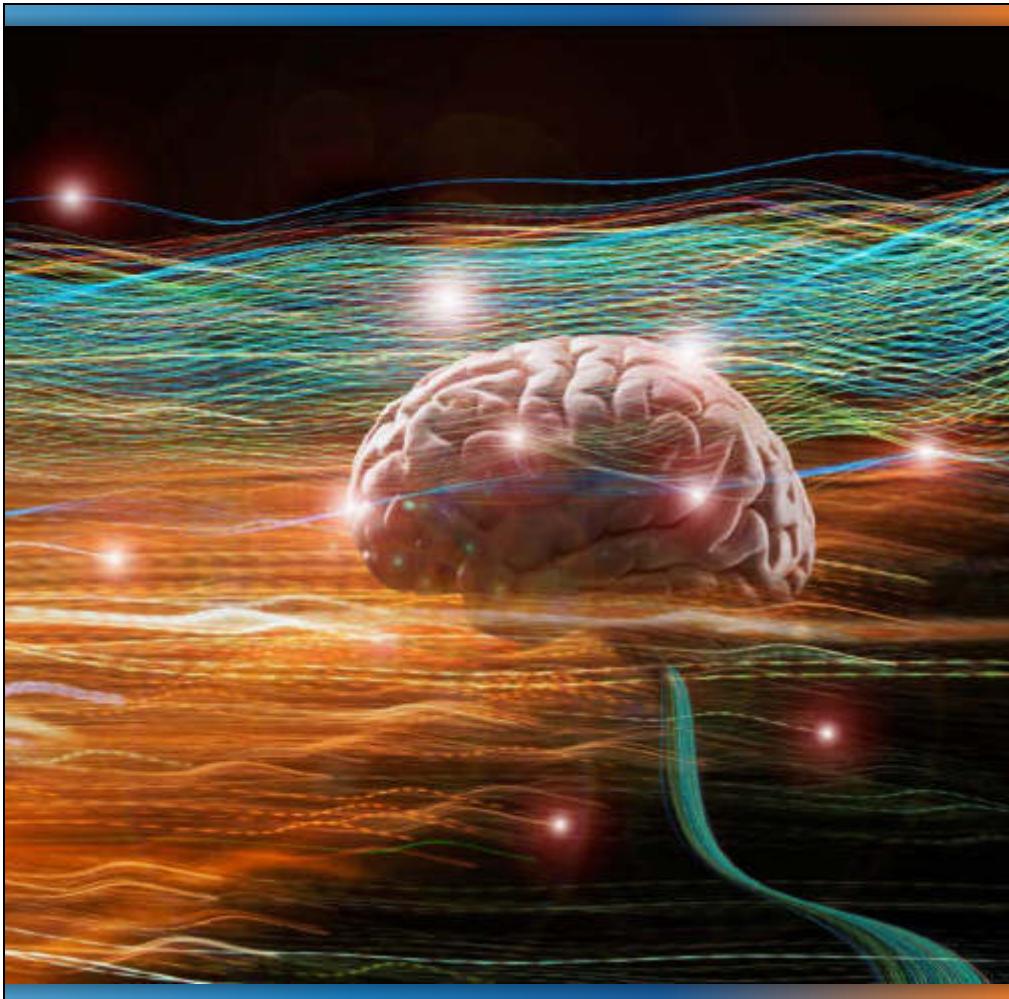
Show multiple view of data for returning planes



Does Nancy have cancer?

	Has Breast Cancer	Doesn't Have Breast Cancer	Total
Positive Mammogram	(a) 8	(b) 95	103
Negative Mammogram	(c) 2	(d) 895	897
Total	10	990	1000





Human brain hardwired
for visualization

Visual language of
elements used to
communicate meaning

Consider audience's
needs and abilities to
decide on design

Transform data into:
Clear
Accurate
Meaningful
Insights in people's
mind

