How to choose a chart type

(It’s trickier than you think…)

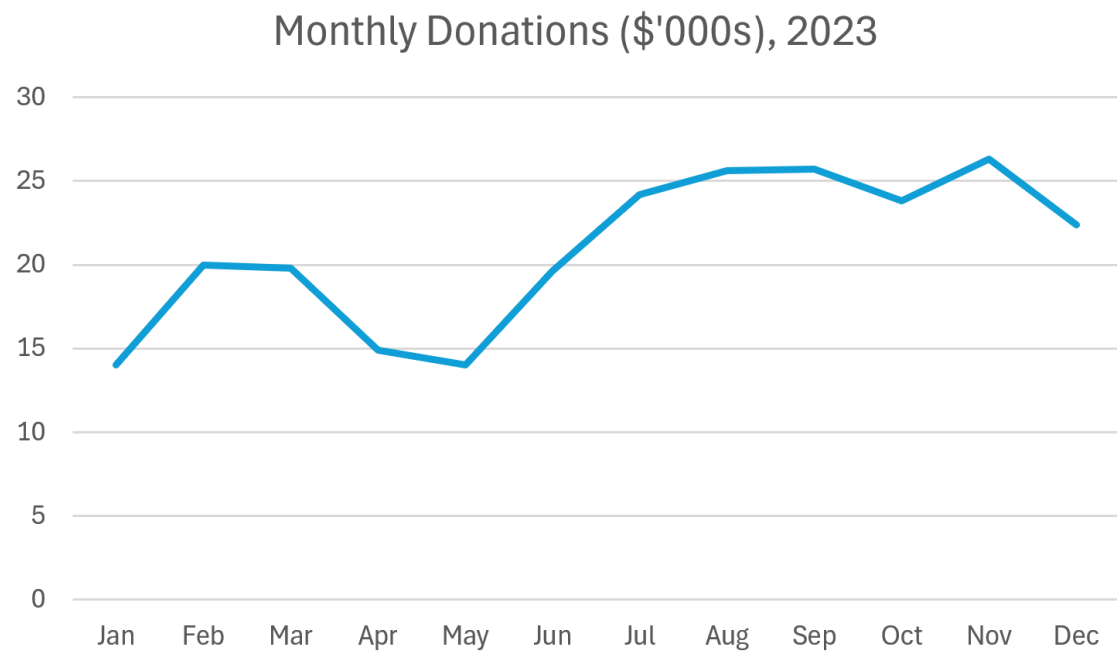
Practical Reporting Inc.

When it comes to choosing a chart type, can we use simple rules of thumb?

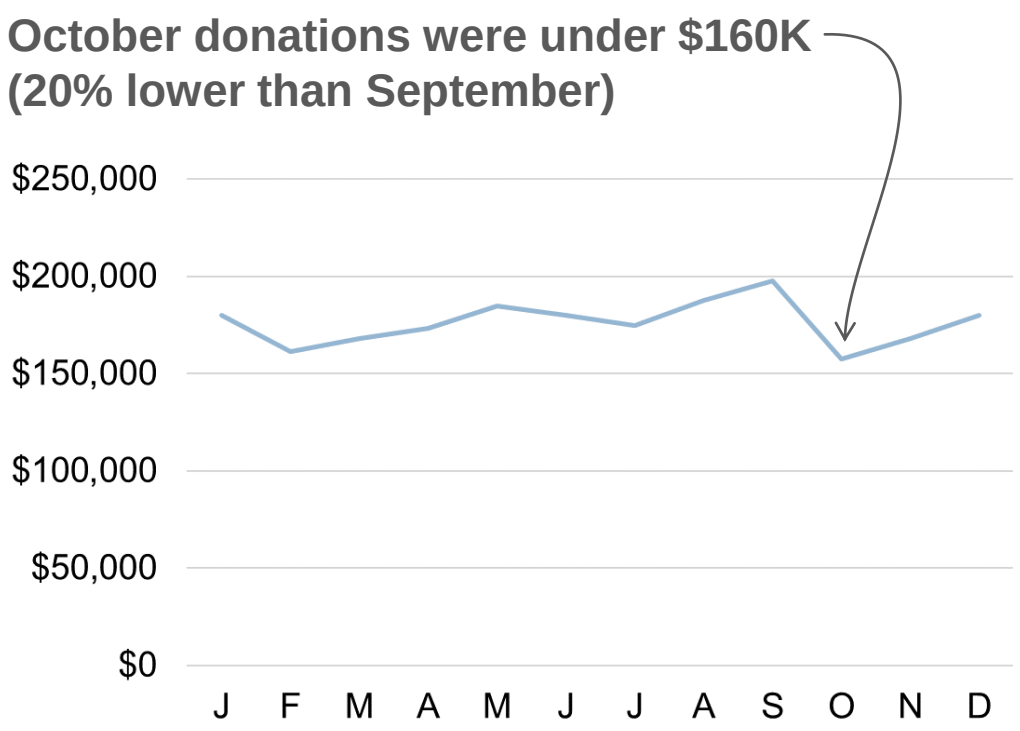
- For example…
  - “To show the breakdown of a total, use a pie chart.”
  - “To show values with locations, use a map.”
  - “To show data over time, use a line chart.”

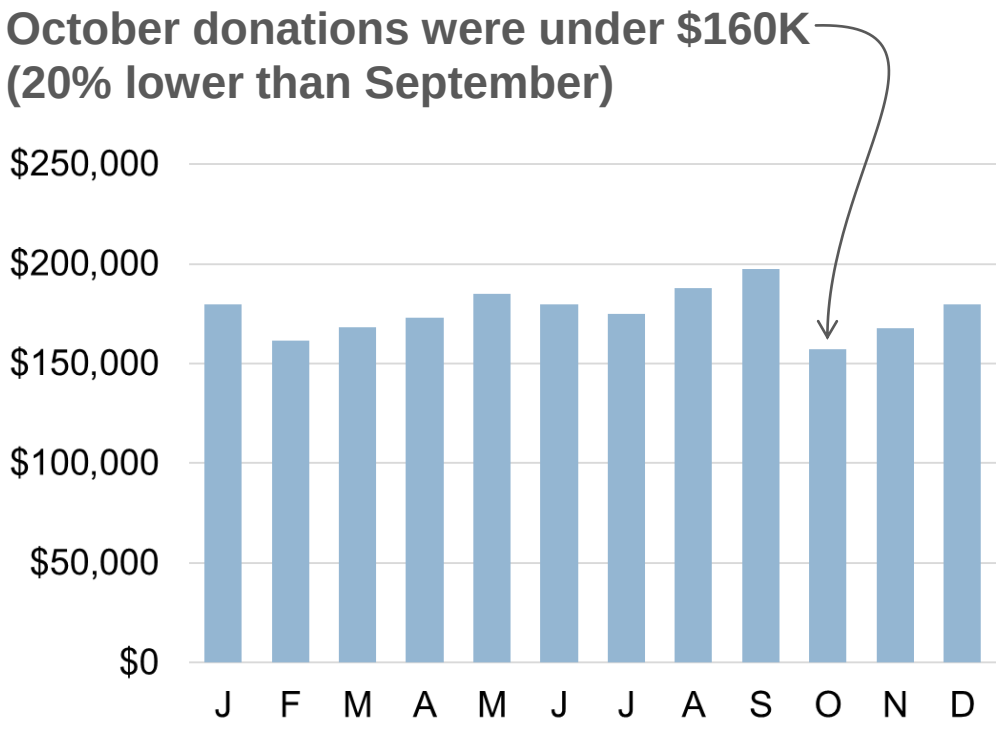
Monthly Donations ($’000s), 2023

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
14.0	20.0	19.8	14.9	14.0	19.6	24.2	25.6	25.7	23.8	26.3	22.4

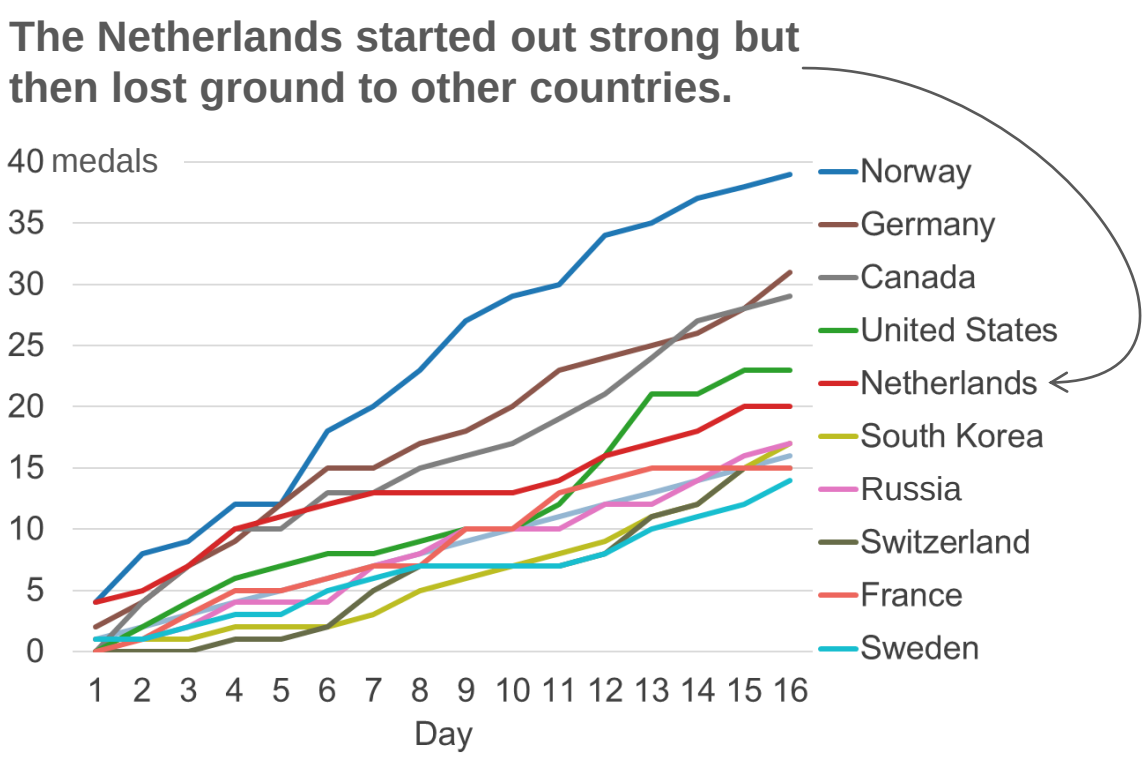


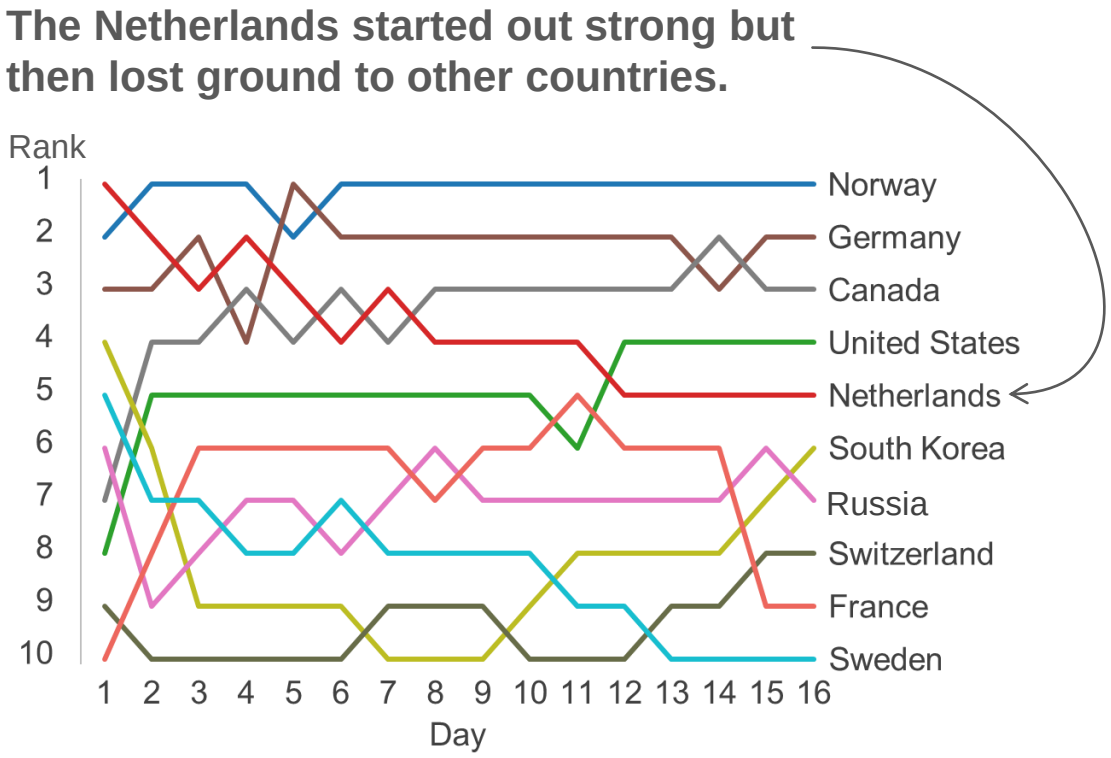
Bars draw attention to individual time periods rather than overall pattern of change (main purpose of chart in this case).

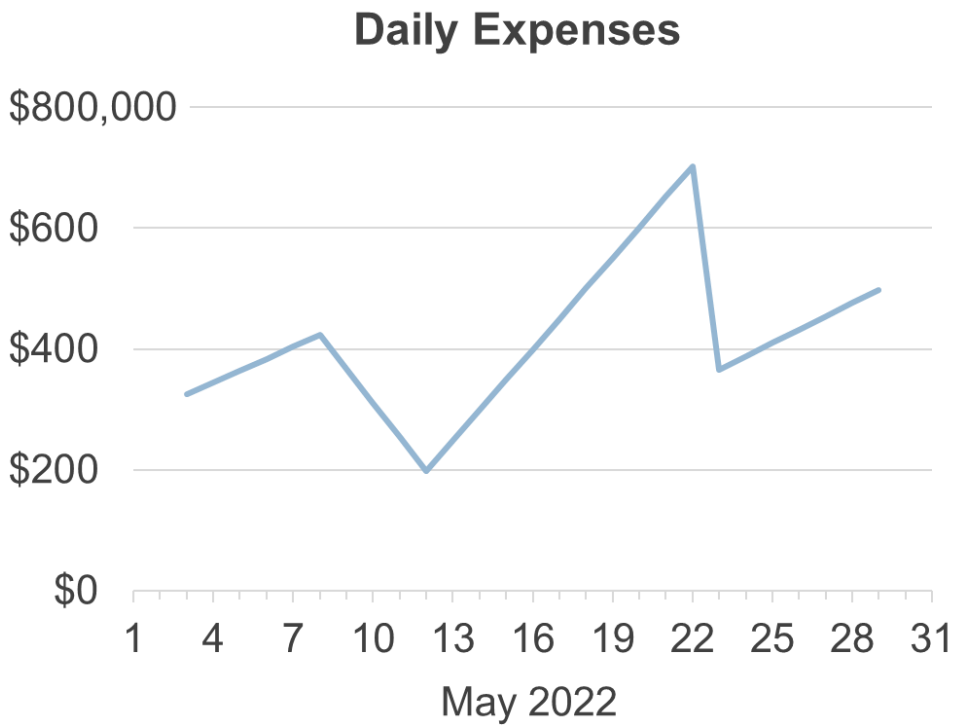


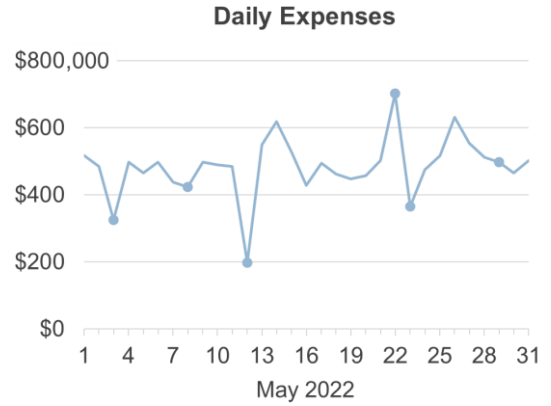


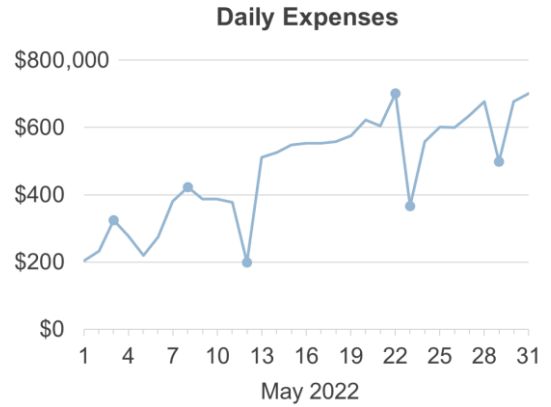
A "bumps chart" better shows how rank changed over time.

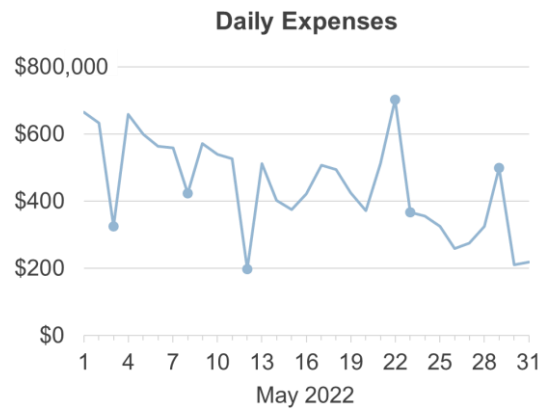




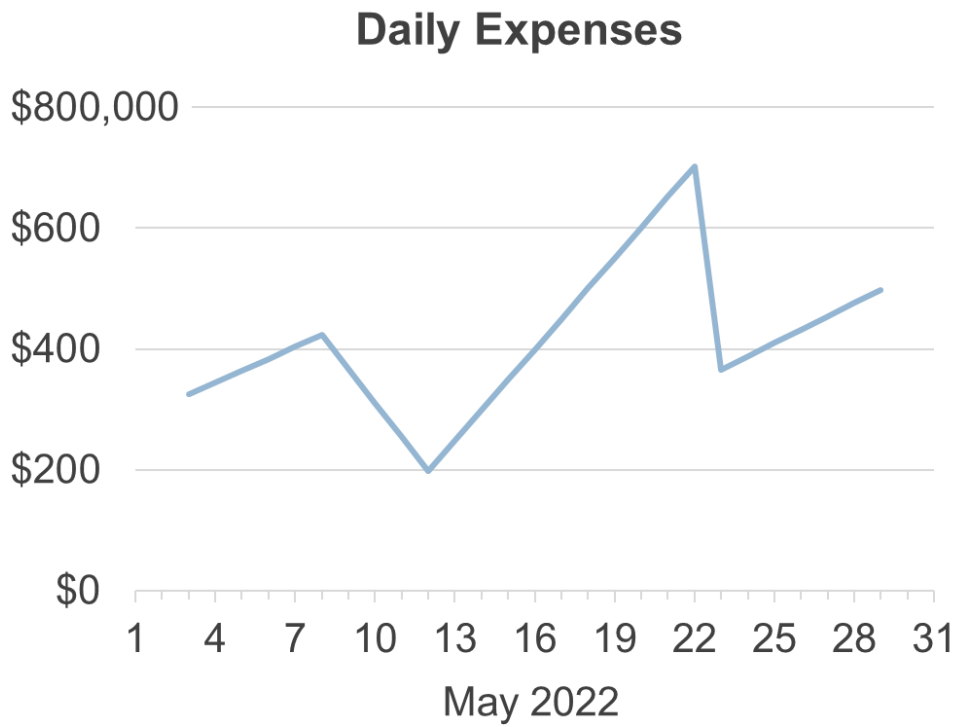

Daily Expenses
$800,000
$600
$400
$200
$0
1 4 7 10 13 16 19 22 25 28 31
May 2022


Daily Expenses
$800,000
$600
$400
$200
$0
1 4 7 10 13 16 19 22 25 28 31
May 2022

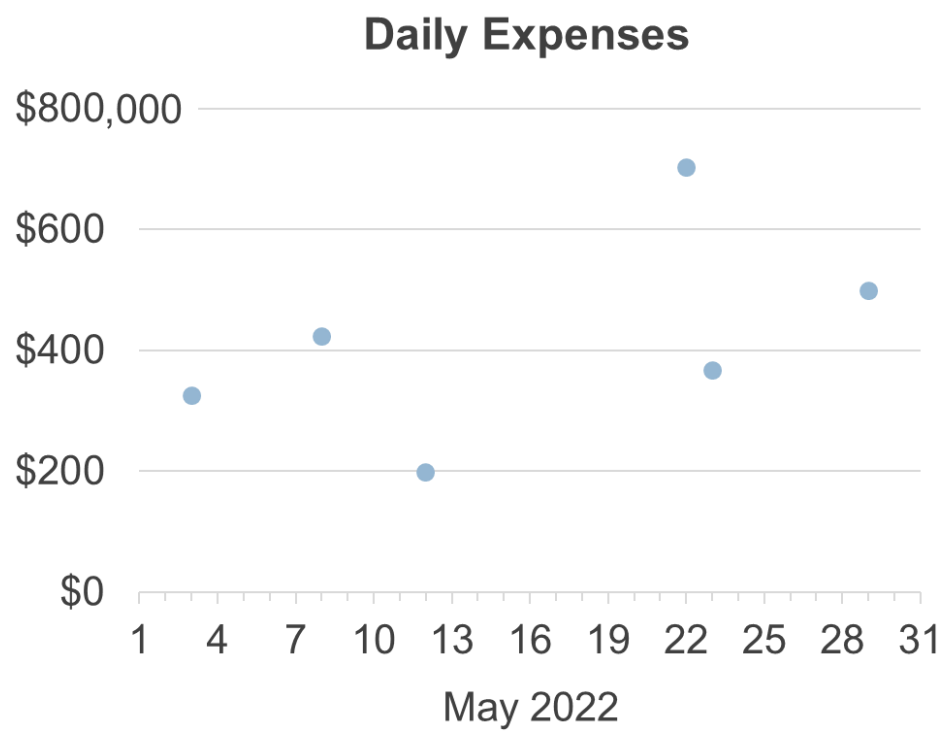

Daily Expenses
$800,000
$600
$400
$200
$0
1 4 7 10 13 16 19 22 25 28 31
May 2022


Daily Expenses
$800,000
$600
$400
$200
$0
1 4 7 10 13 16 19 22 25 28 31
May 2022

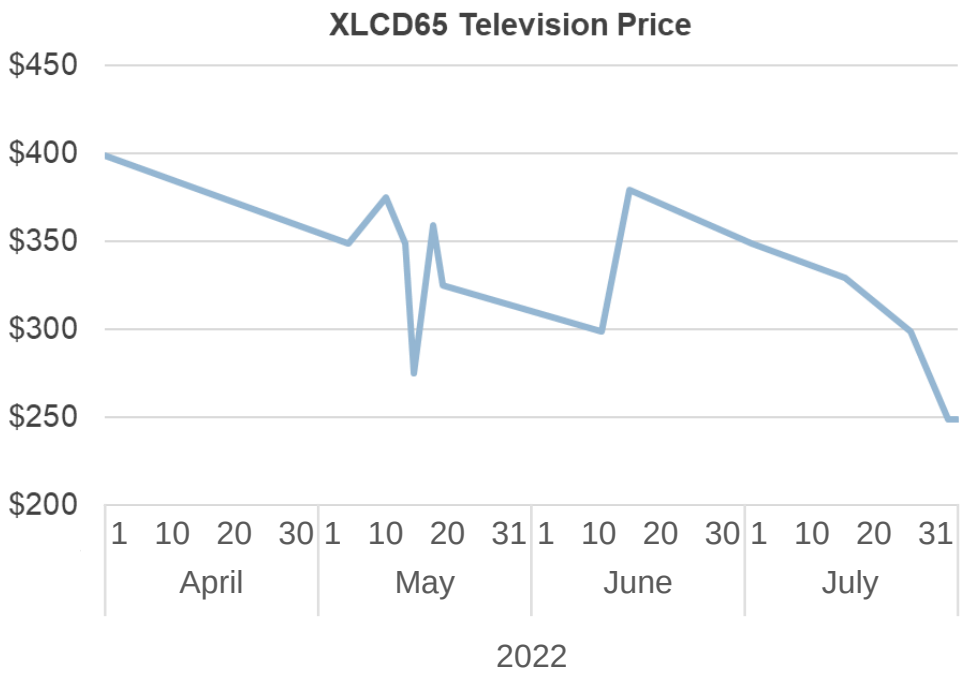
(X) Misleading! Suggests that we know what pattern of change was, but we don't have enough data to say!



(✓) A "dot plot" MUST be used when we don't have enough data to know pattern of change.

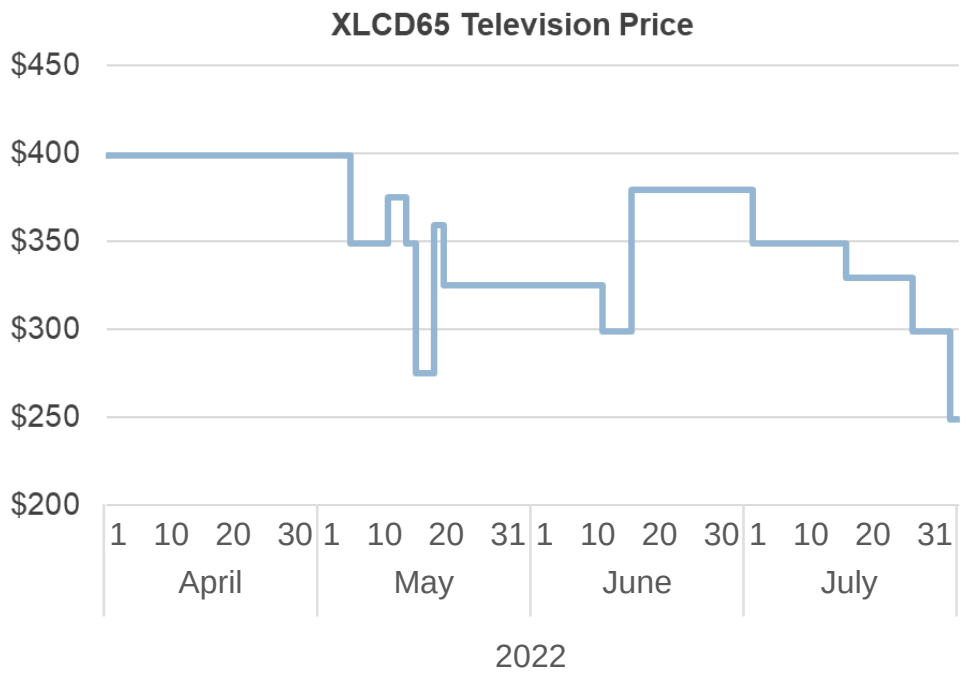


(X) Looks like there was a price at the beginning of April ($400), and then no price until the beginning of May ($350), or, worse...



(X) ...some readers may interpret this to mean that the price *steadily declined* from the beginning of April to the beginning of May, which it did NOT.

(✓) A "step chart" represents these values accurately.

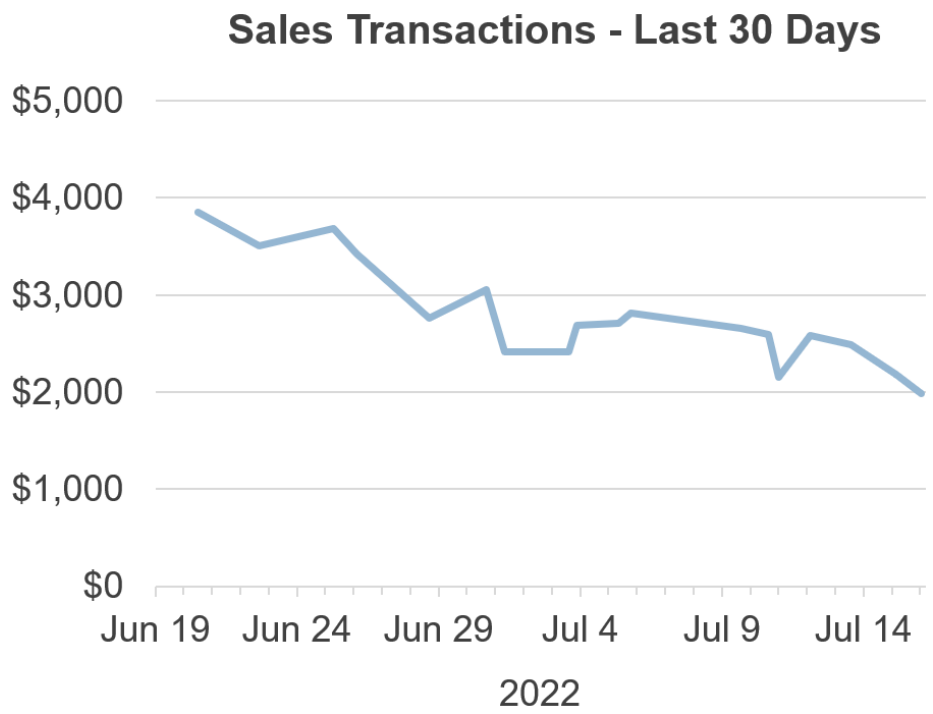


When to use step charts

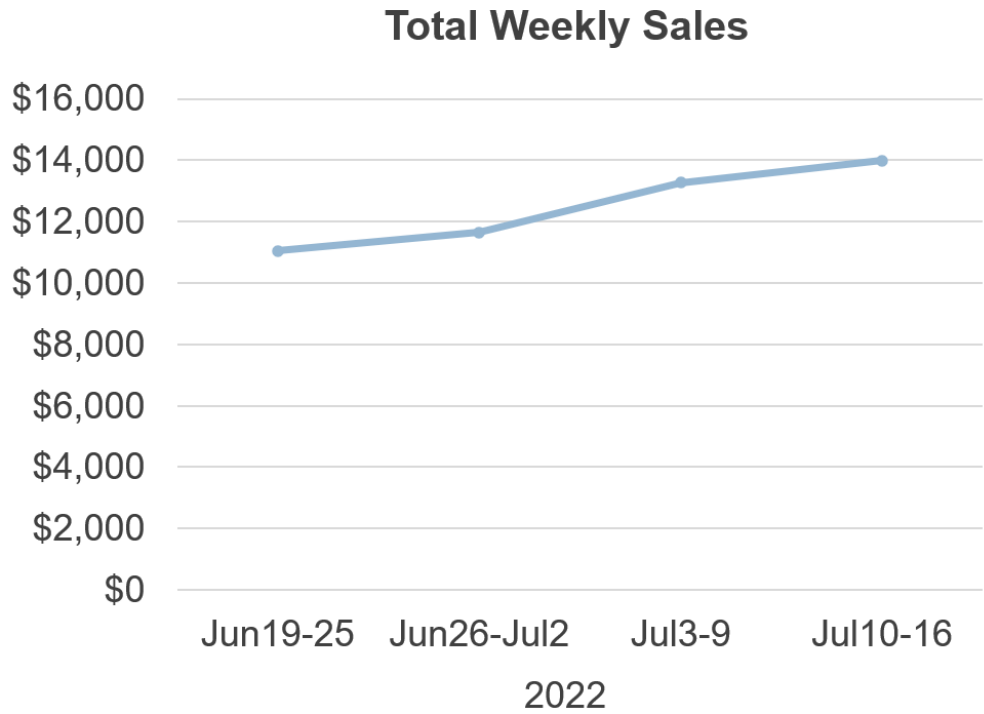
- When the values in your data…
  1. Occur at **irregular** intervals of time.
  2. **Persist** until the next value occurs.

- For example…
  - The balance of a bank account
  - The inventory level of a product
  - The current high bid for an auction item
  - The long jump distance world record

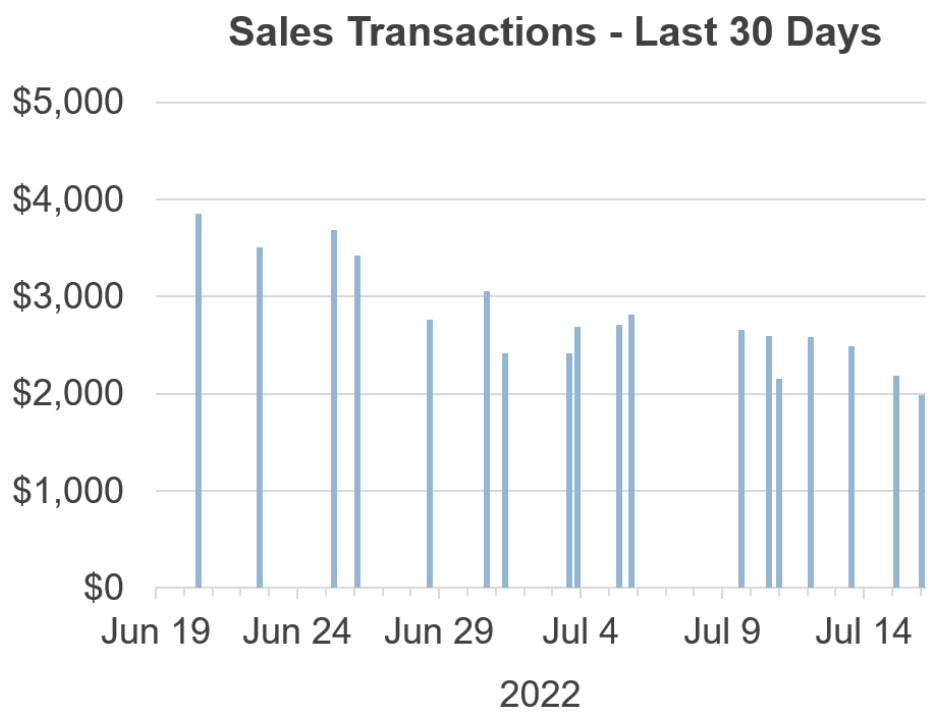
(X) This is misleading! Looks like sales were declining.



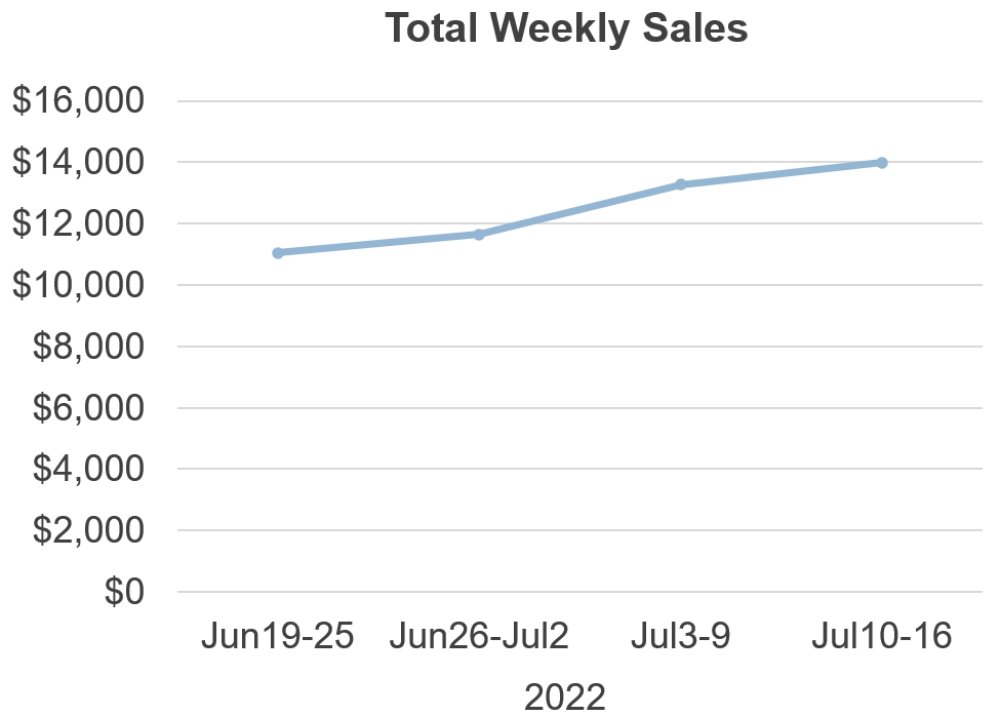
If the individual transactions are aggregated, e.g., as weekly totals, we see that they're actually increasing.



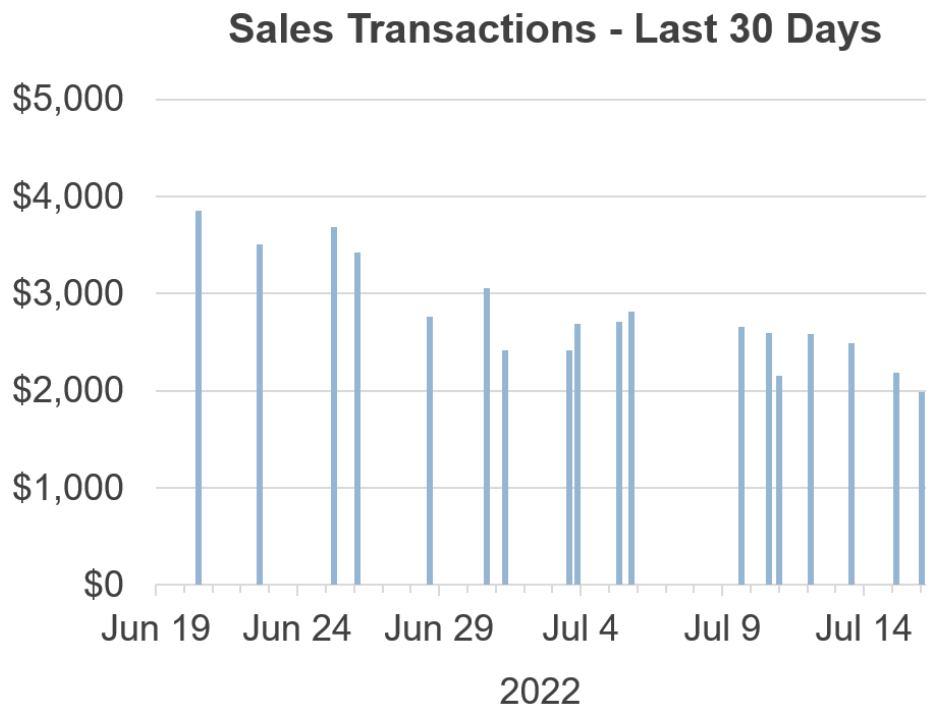
(✓) A "thin bar" chart



If the individual transactions are aggregated, e.g., as weekly totals, we see that they're actually *increasing*.



(✓) A "thin bar" chart



- Use thin bar charts when…
  1. Need to show **individual values**, not aggregations (weekly totals, daily averages, etc.).
  2. Values occur at **irregular** intervals of time.
  3. Values **aren't** persistent.

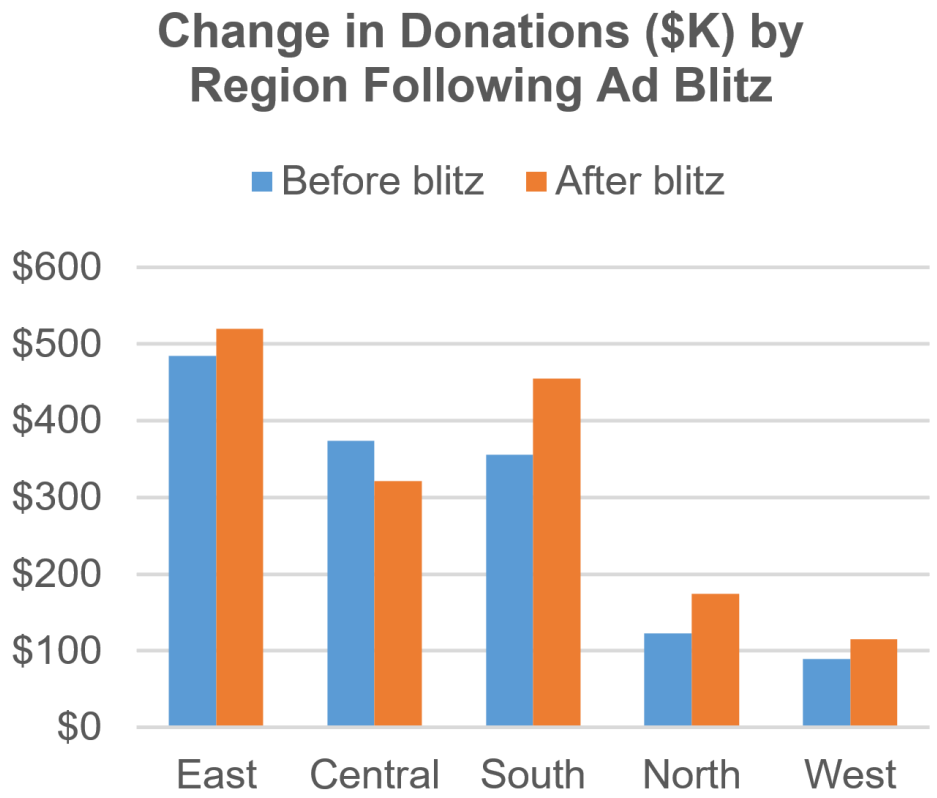
Charts for comparing two time periods

Donations ($K) by Region

	Before ad blitz	After ad blitz
East	485	520
Central	374	321
South	356	455
North	123	174
West	89	115

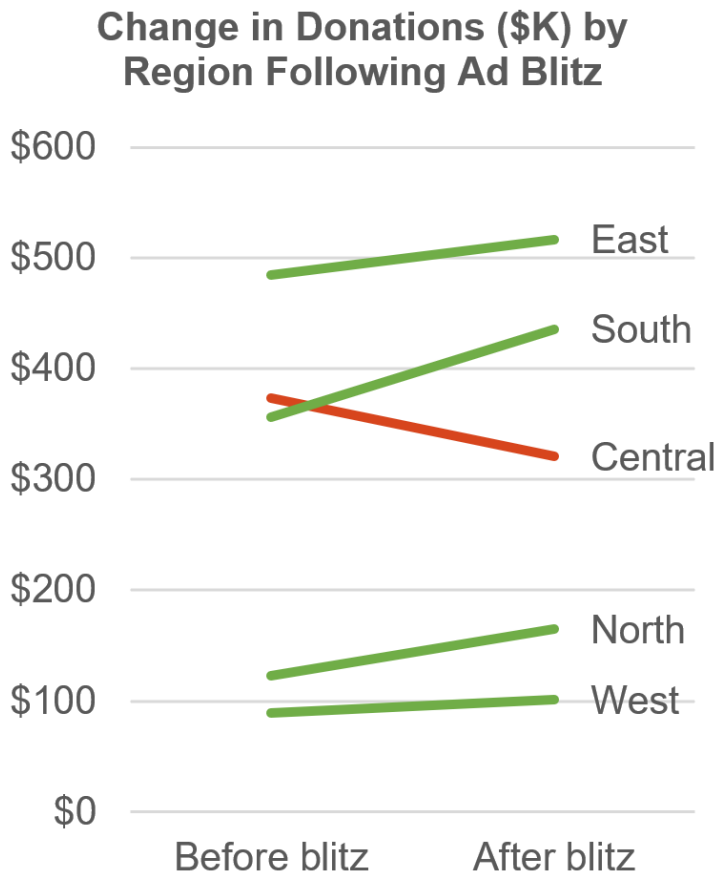
Charts for comparing two time periods

(!) *Clustered bars generally aren't a good way to show changes between two time periods.*

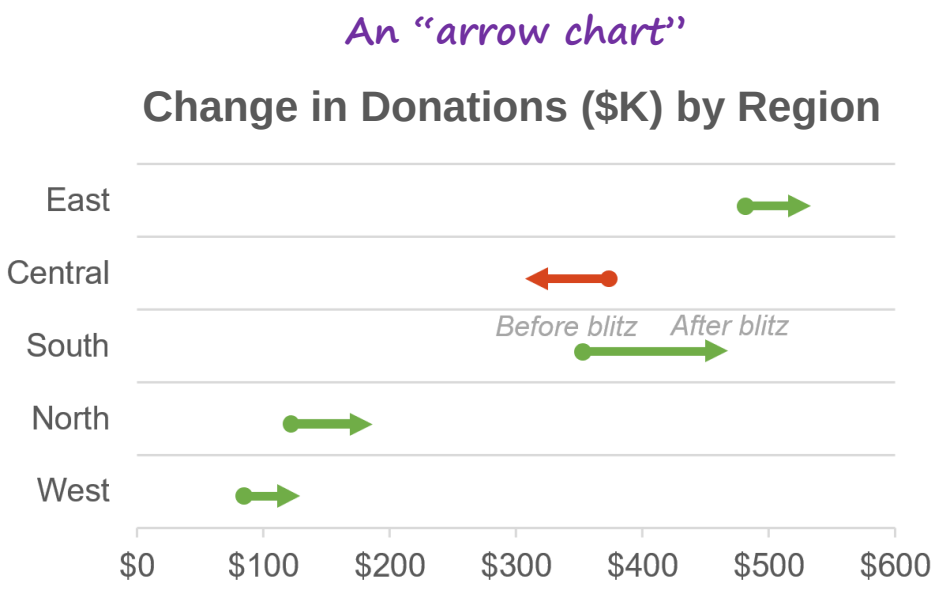


Charts for comparing two time periods

A "slope chart"

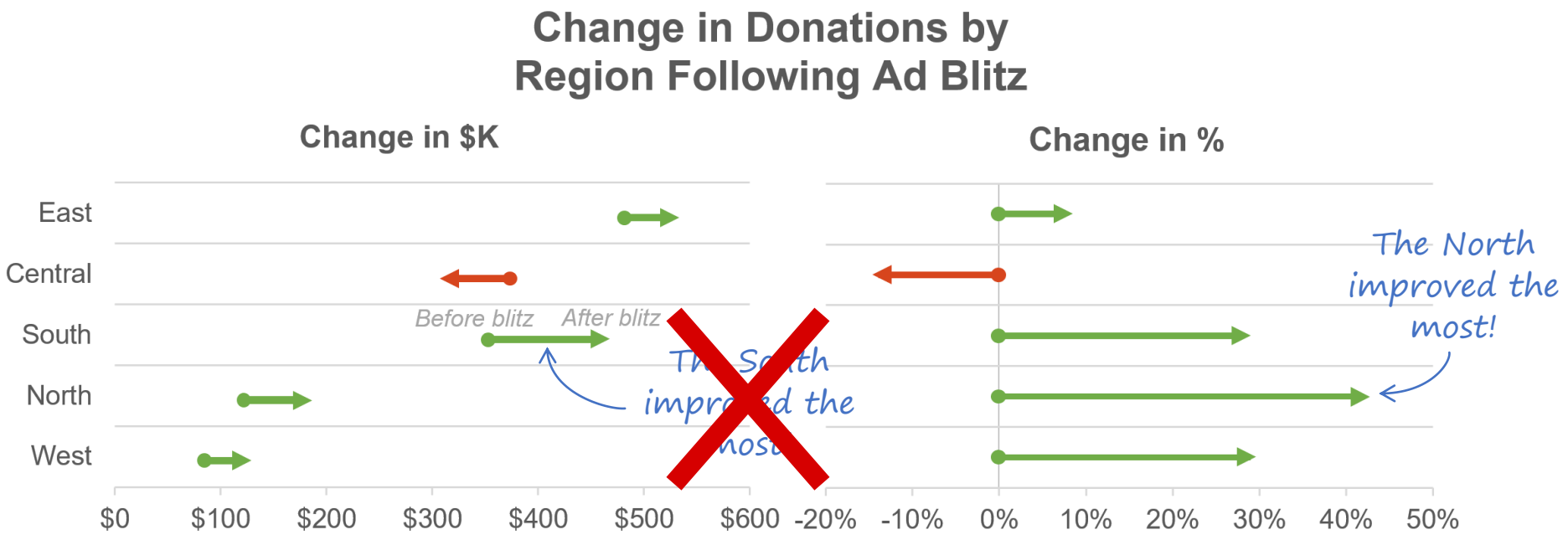


Charts for comparing two time periods

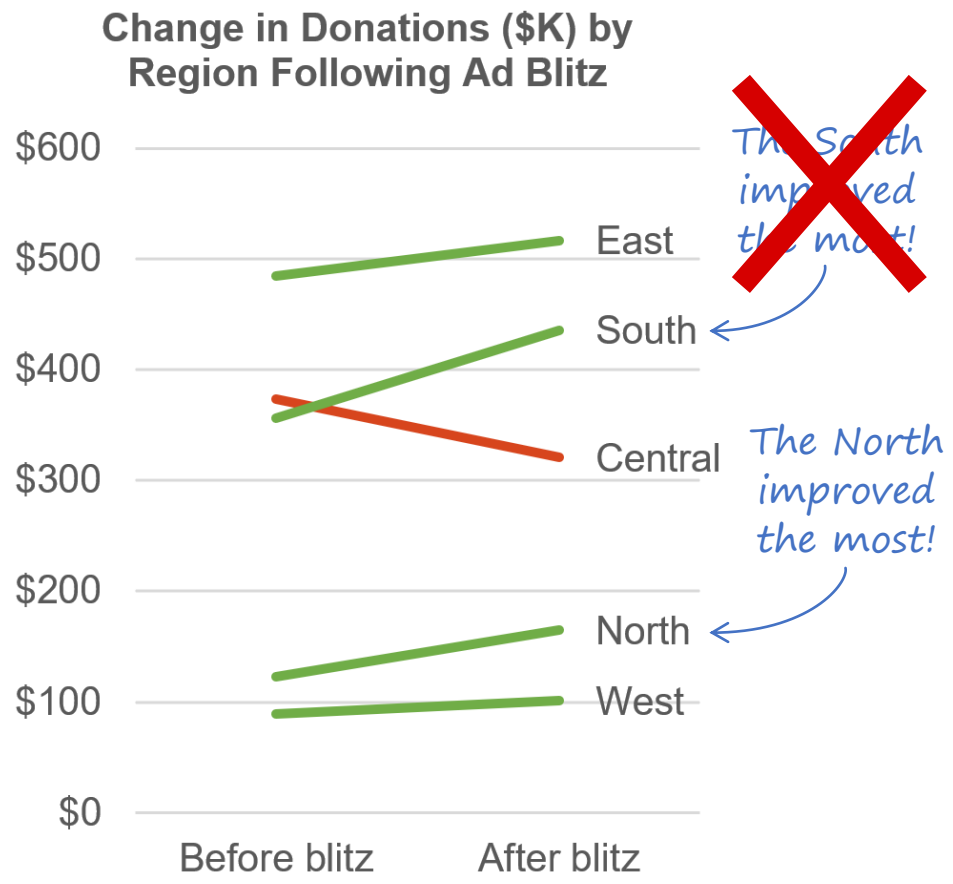


Charts for comparing two time periods

(✓) Arrow charts can show both absolute and relative change.

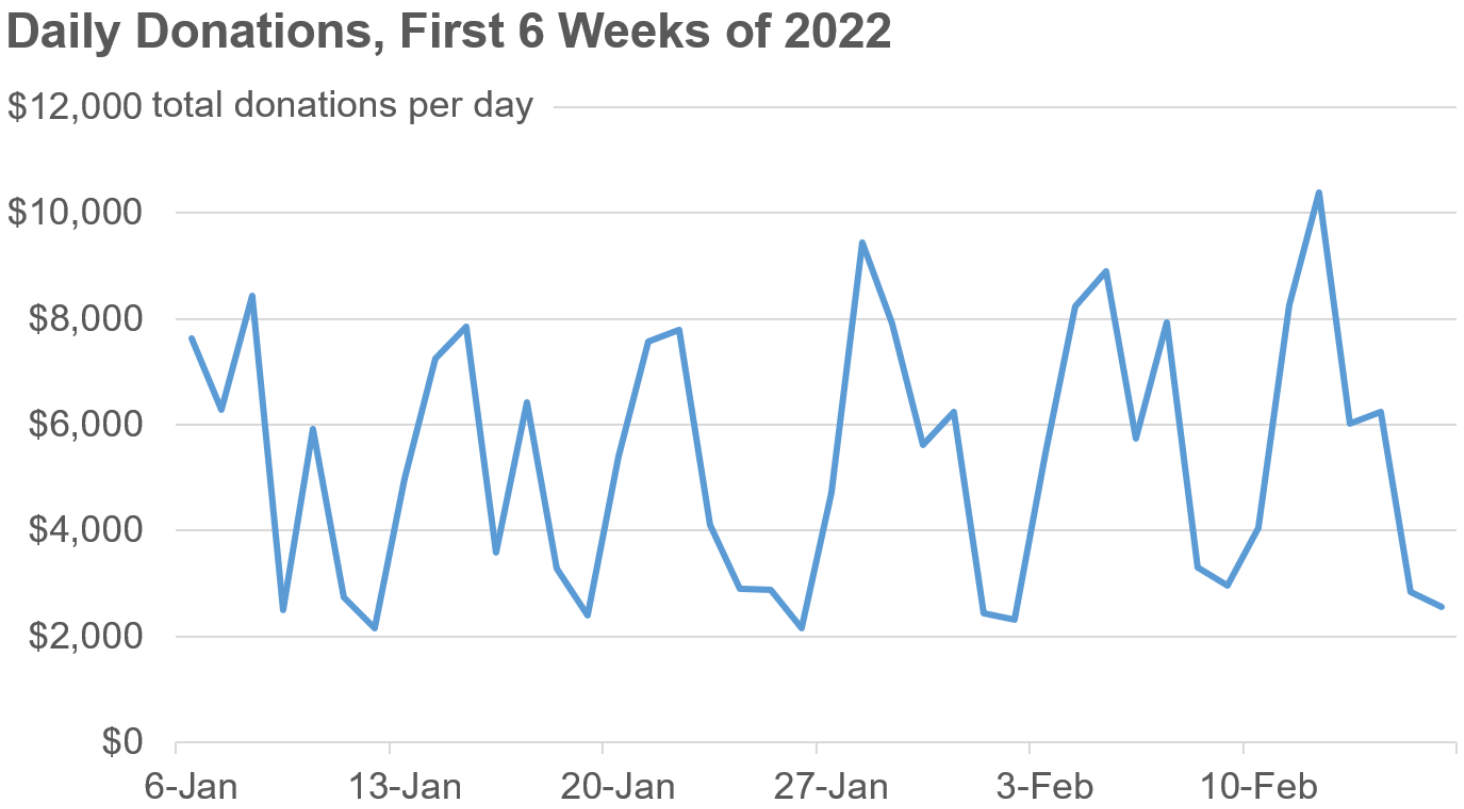


Charts for comparing two time periods



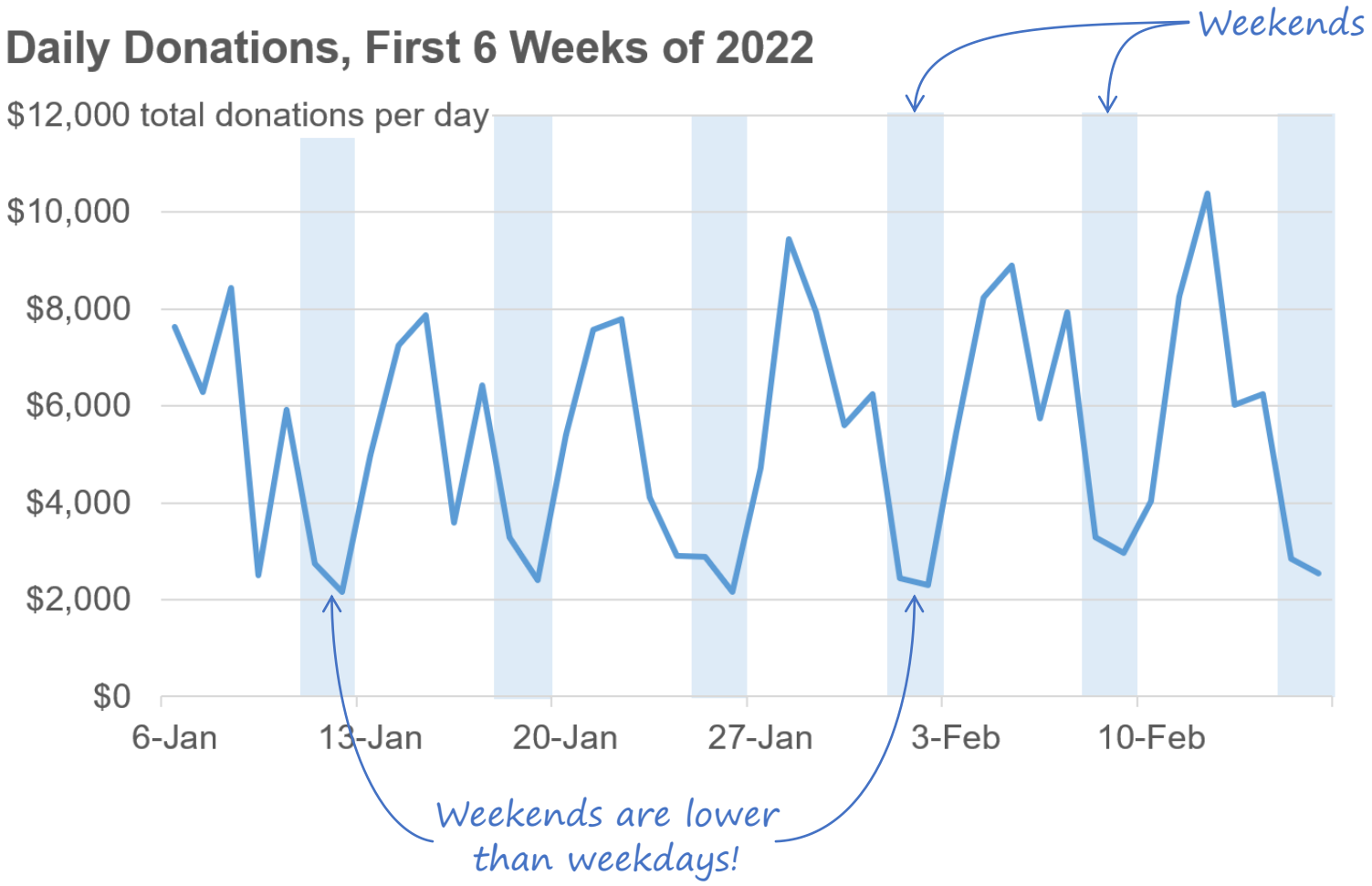
(!) Slope charts make changes among small values look small, even if they're large, so I avoid using them.

Showing cyclical (e.g., seasonal) time series



(!) Standard line charts don't show insights about cyclical data very clearly.

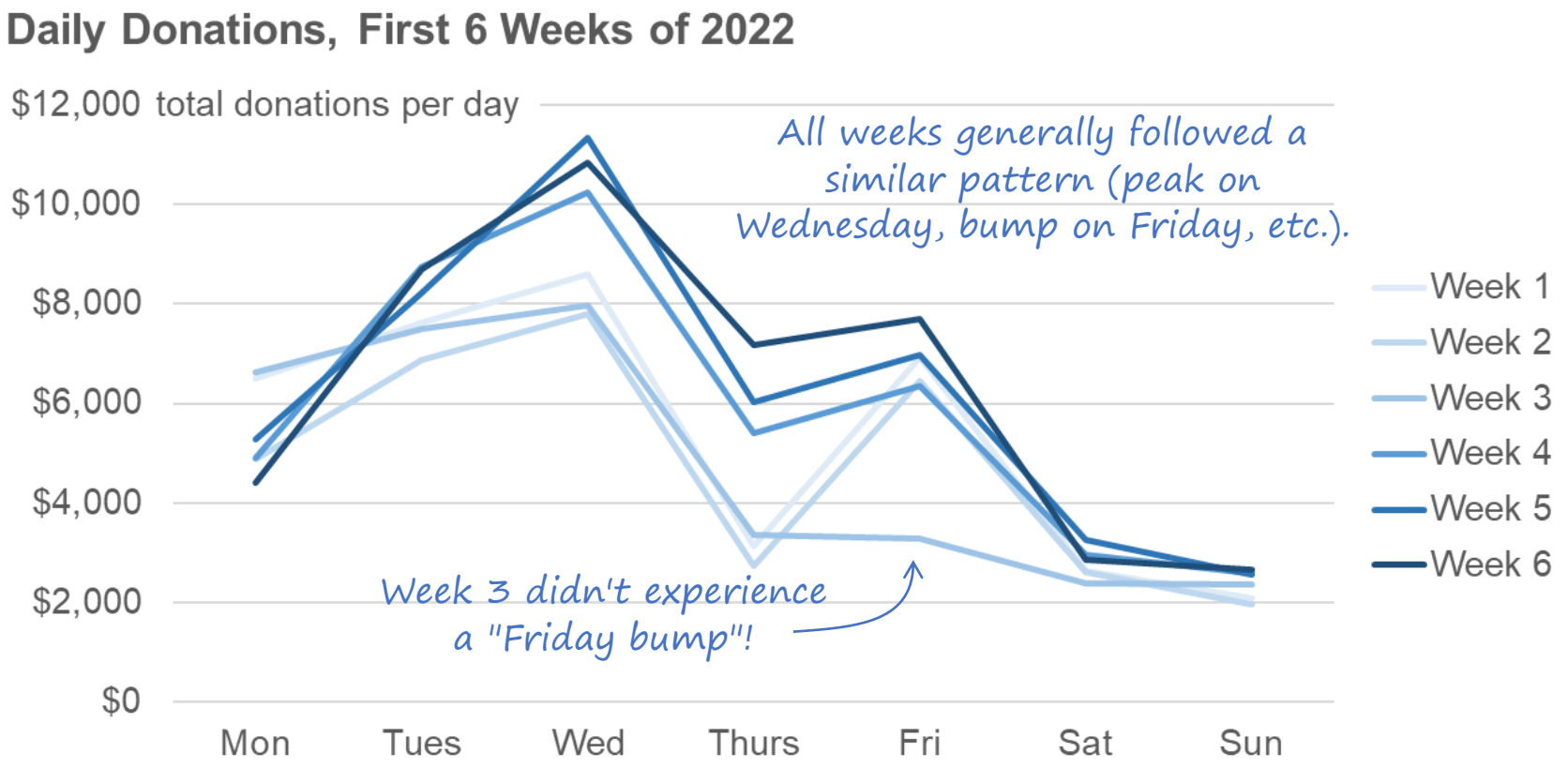
Showing cyclical (e.g., seasonal) time series



(✓) Visually marking off cycle periods (e.g., weekends) can help make cycles more obvious.

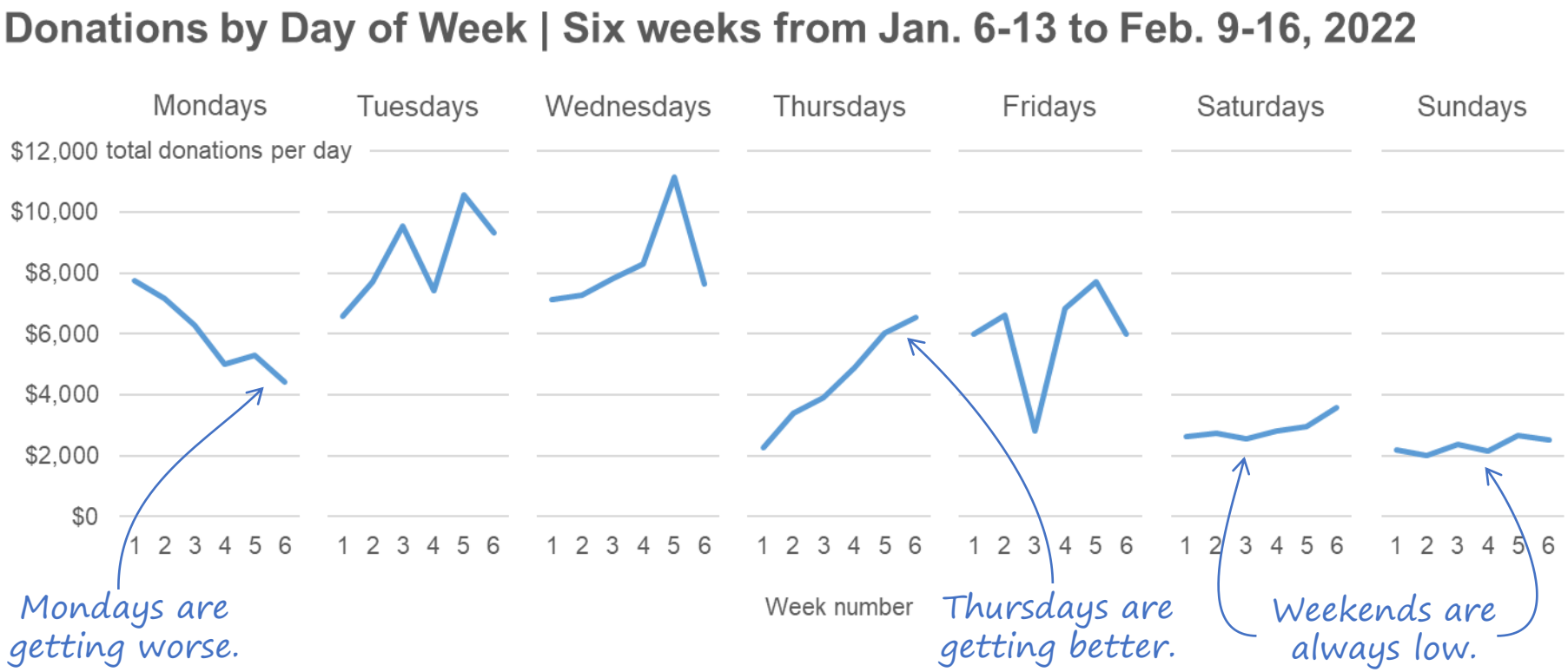
Showing cyclical (e.g., seasonal) time series

An "overlapping cycles" chart

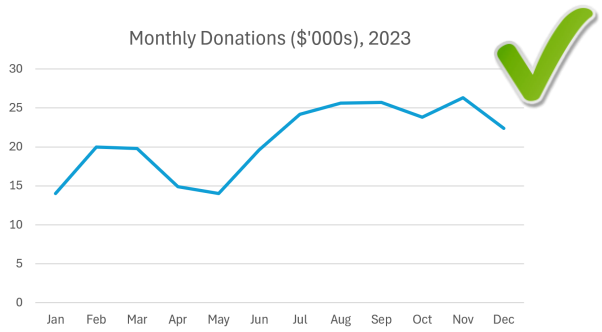


Showing cyclical (e.g., seasonal) time series

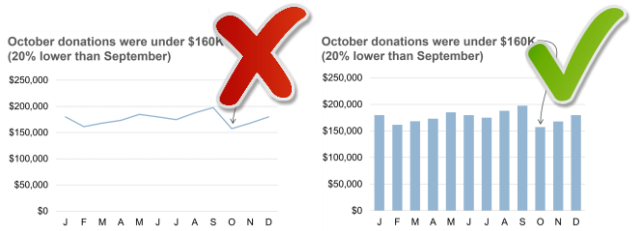
A "cycle plot"

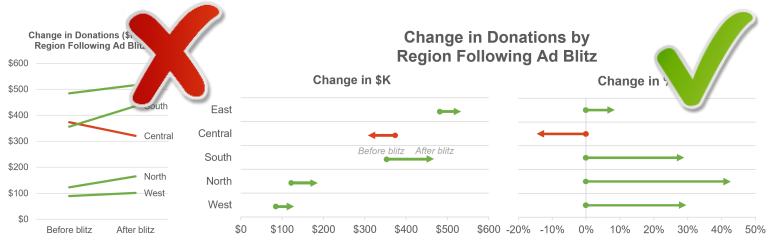


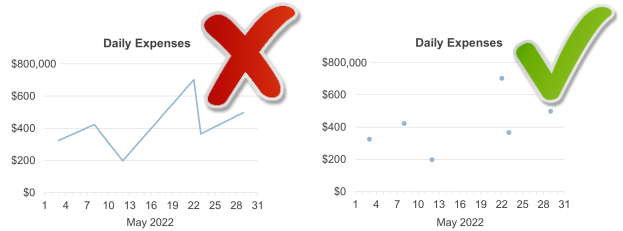
So, *sometimes*, standard line charts are the best way to show data over time…

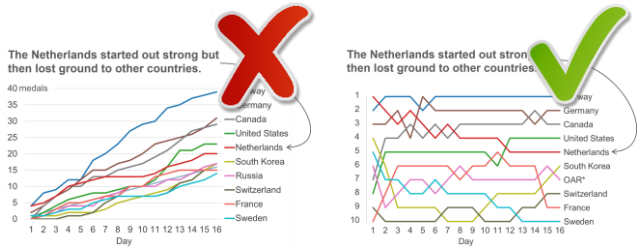


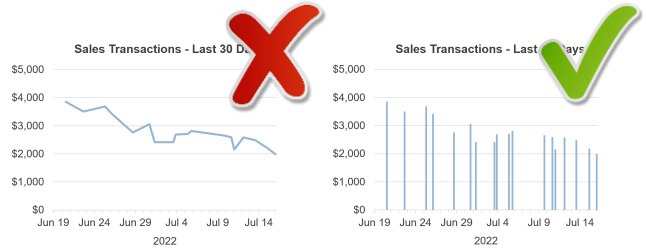
…but often they're *not*.

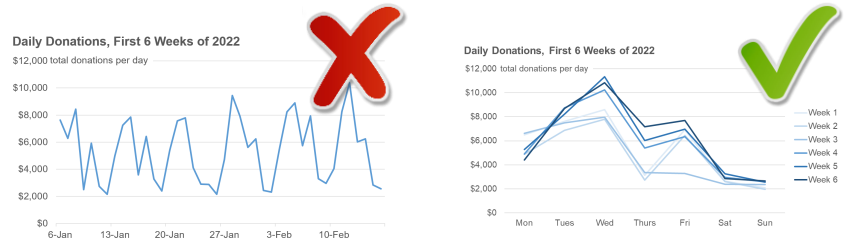


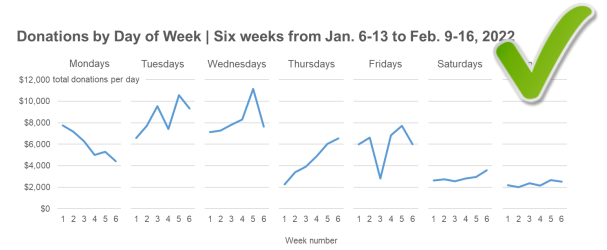












…which is probably why many experienced chart creators feel that choosing a chart type…

- …is too complex/nuanced to codify as specific guidelines, i.e., that any guidelines will have so many exceptions that they will be almost useless.

- …requires judgment and intuition that can only be acquired through extensive (years?) practice and experience.

Choosing a chart type to show data over time

Start here

Two time periods?

Yes

Arrow chart

No

Enough values to estimate pattern of change?

No

Dot plot

Yes

Values occur at regular intervals of time?

Yes

Values persistent?

Yes

Step chart

No

Need to feature…

Individual values

Thin bar chart

No

Summary values for regular intervals of time

Data cyclical and need to feature cycles?

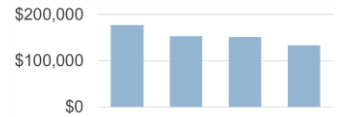
No

More important to feature…

Patterns of change

Standard line chart

Individual period(s)



Bar chart

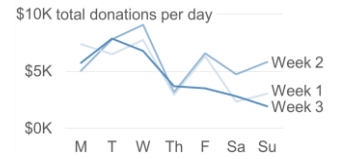
Changes in rank

Bumps chart

Yes

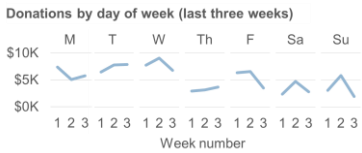
Need to…

Compare cycles



Overlapping cycles chart

Show patterns within periods



Cycle plot

Choosing a chart type to show data over time

Based on nature of data

Based on purpose of chart

Start here

Two time periods?

Yes

Arrow chart

No

Enough values to estimate pattern of change?

No

Dot plot

Yes

Values occur at regular intervals of time?

No

Values persistent?

Yes

Step chart

No

Need to feature…

Individual values

Thin bar chart

Summary values for regular intervals of time

Yes

Data cyclical and need to feature cycles?

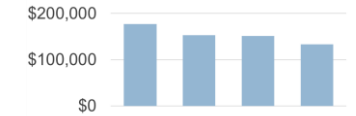
No

More important to feature…

Patterns of change

Standard line chart

Individual period(s)



Bar chart

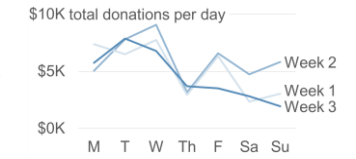
Changes in rank

Bumps chart

Yes

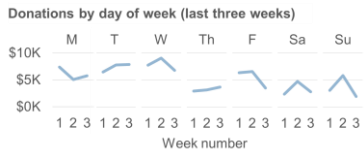
Need to…

Compare cycles



Overlapping cycles chart

Show patterns within periods



Cycle plot

Choosing a chart type to show data over time

Based on nature of data

Based on purpose of chart

Start here

Two time periods?

Yes

Central
South
North
$0 $200 $400

Arrow chart

No

Enough values to estimate pattern of change?

No

140
120
100
80

Dot plot

Yes

Values occur at regular intervals of time?

Yes

Values persistent?

Yes

$500
$400
$300
$200

Step chart

No

Need to feature…

Individual values

$6K
$4K
$2K
$0K

Thin bar chart

Summary values for regular intervals of time

Data cyclical and need to feature cycles?

No

More important to feature…

Patterns of change

$300,000
$200,000
$100,000
$0

Standard line chart

Individual period(s)

$200,000
$100,000
$0

Bar chart

Changes in rank

1
2
3
Todd
Mary
Stewart

Bumps chart

Yes

Need to…

Compare cycles

$10K total donations per day
$5K
$0K
Week 2
Week 1
Week 3
M T W Th F Sa Su

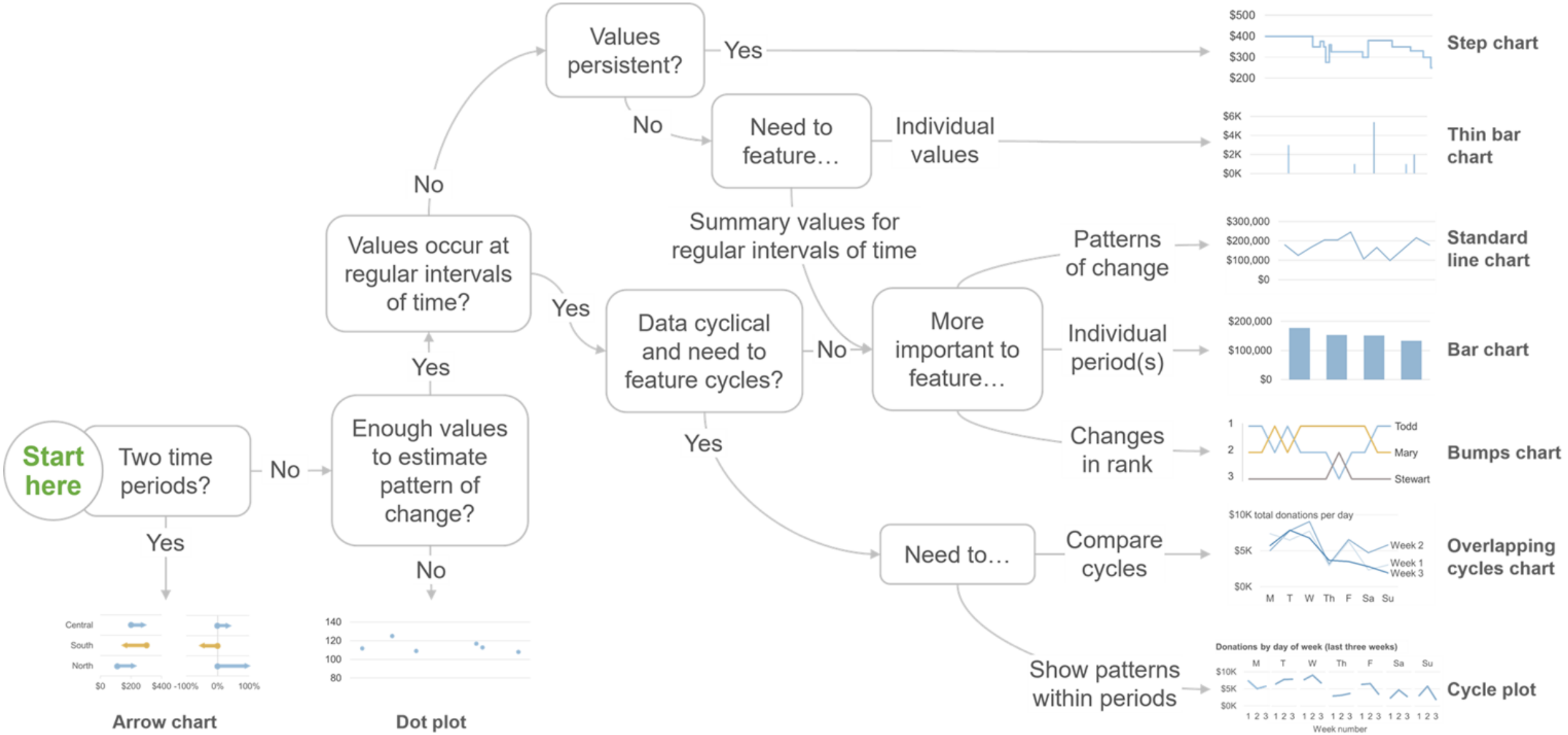
Overlapping cycles chart

Show patterns within periods

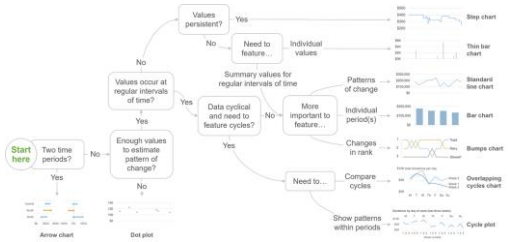
Donations by day of week (last three weeks)
$10K
$5K
$0K
M T W Th F Sa Su
1 2 3 1 2 3 1 2 3 1 2 3 1 2 3 1 2 3 1 2 3
Week number

Cycle plot

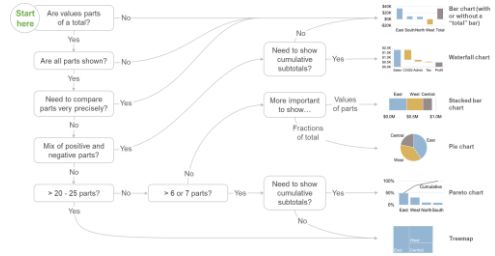
Choosing a chart type to show data over time



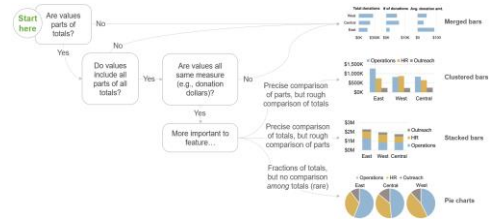
Data over time



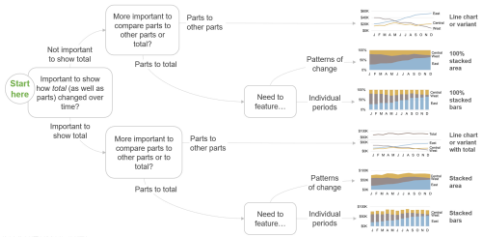
Breakdown of single total



Breakdown of multiple totals



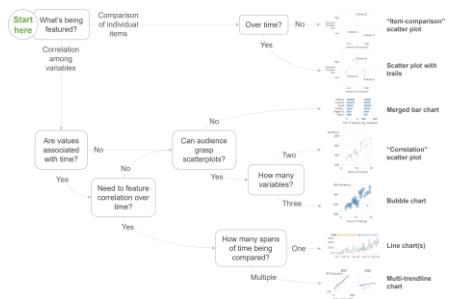
Breakdown of total over time



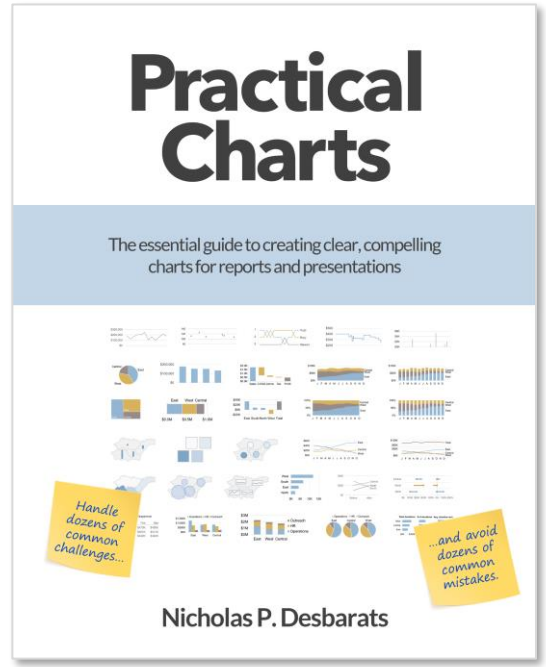
Single distribution

Multiple distributions

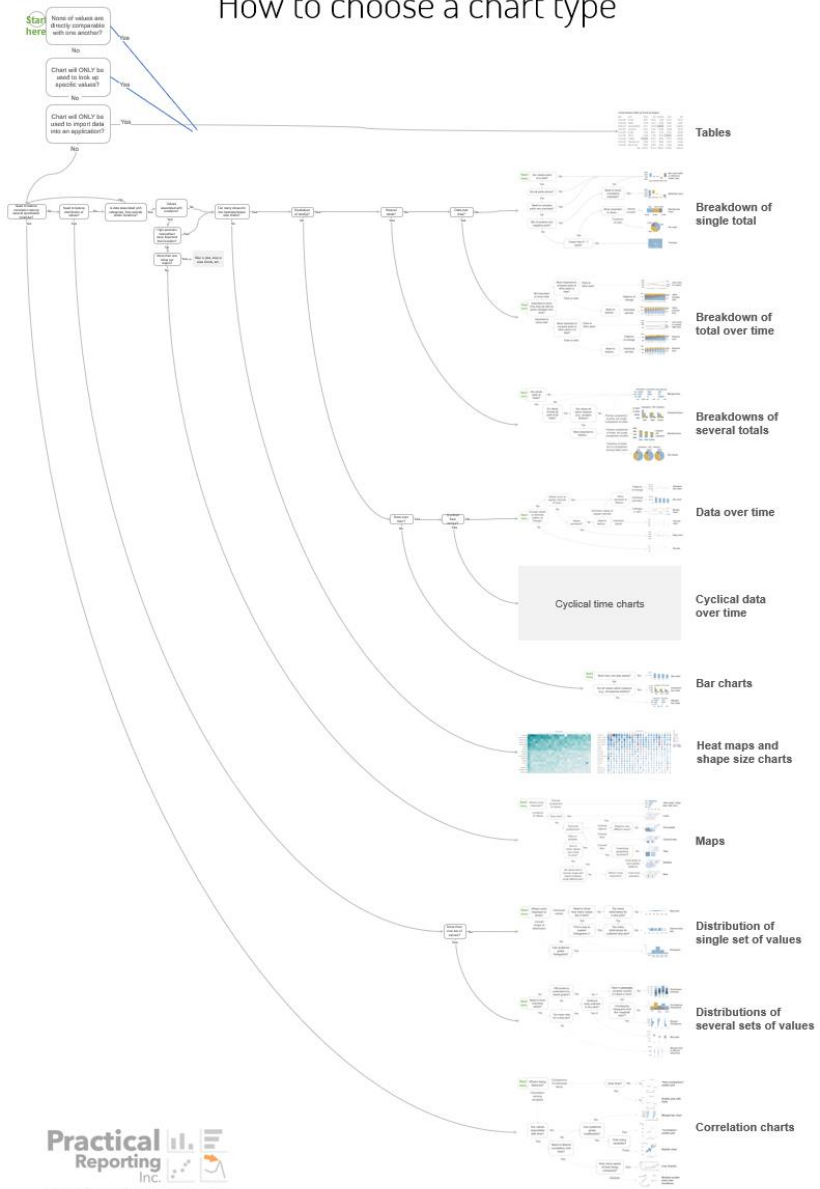
Relationships among variables



Maps



How to choose a chart type



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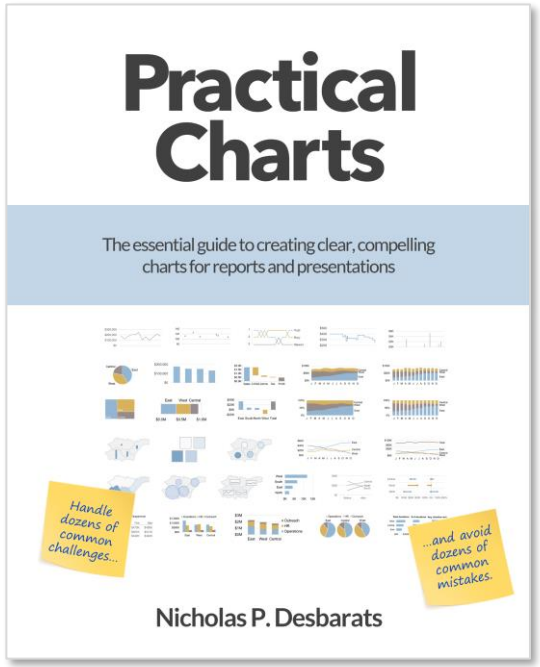
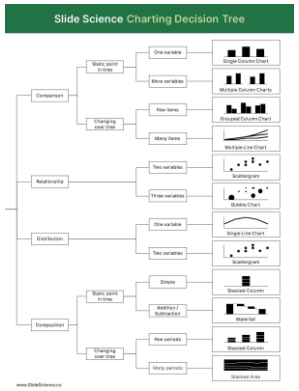
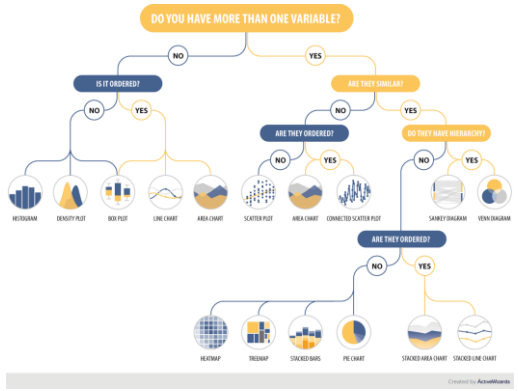
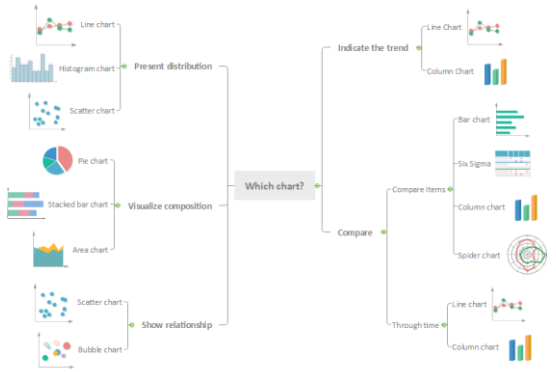
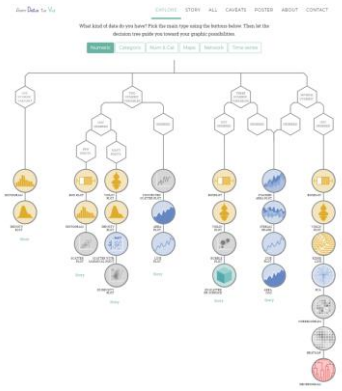


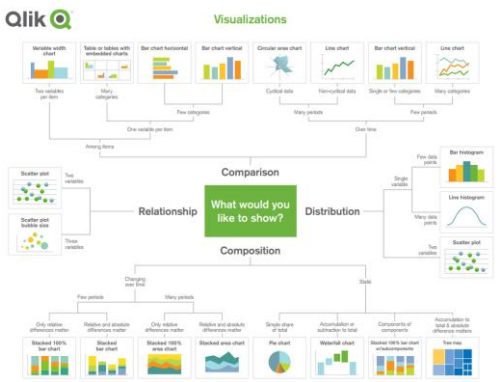
“I’ve seen chart-chooser diagrams before…”

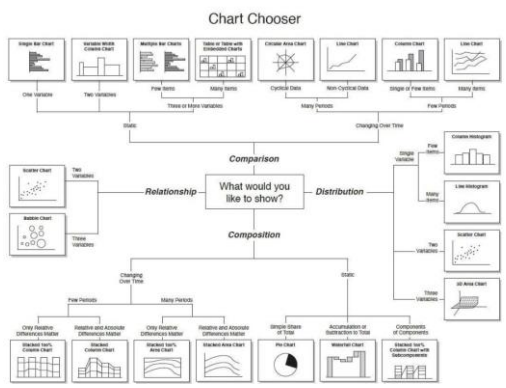


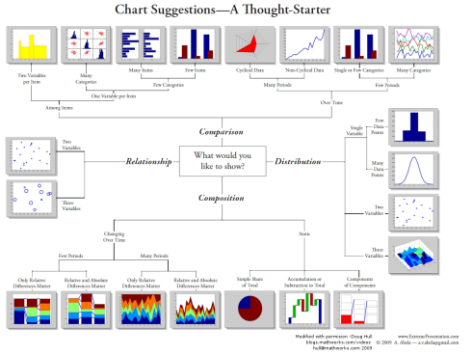


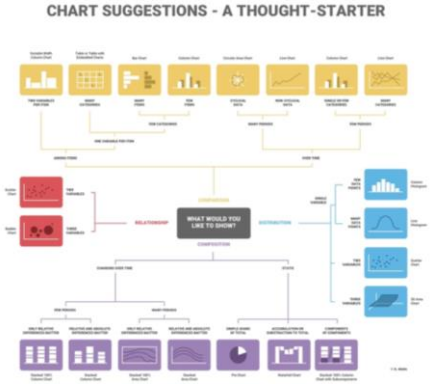




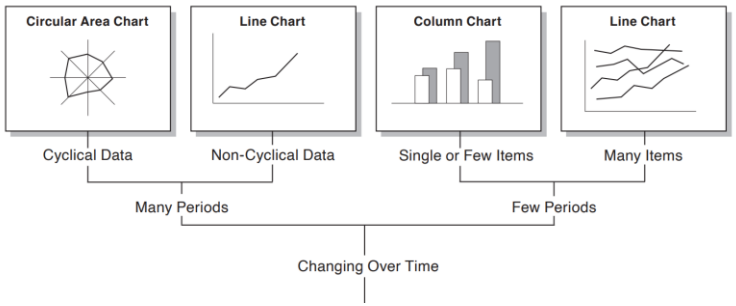




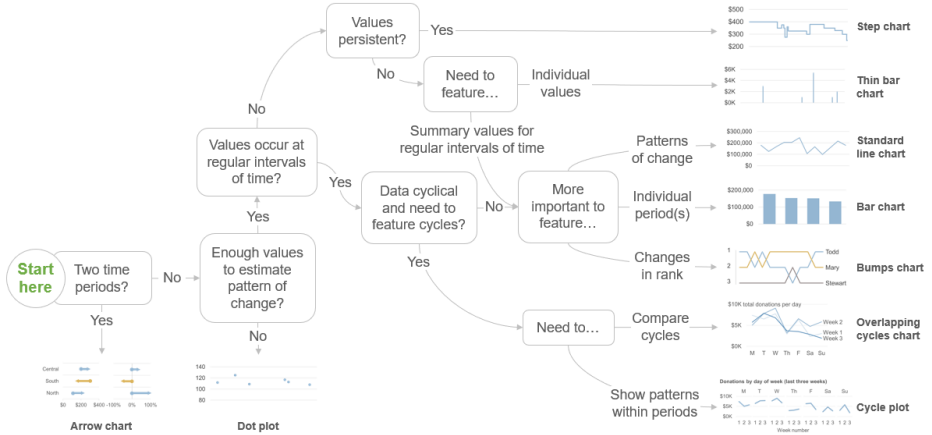




Conventional chart-chooser diagrams

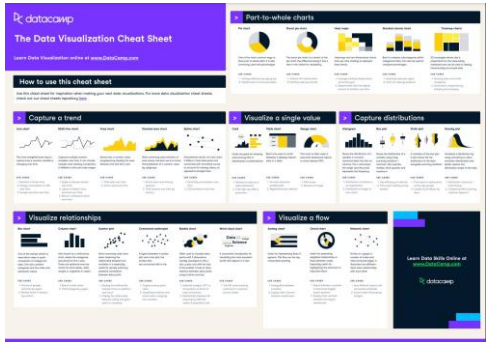


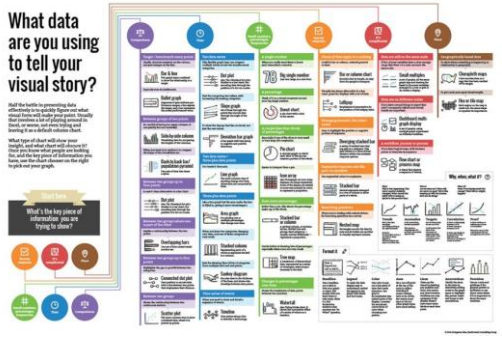
- Many common situations not accounted for (missing values, persistent values, etc.).
- Many essential chart types not included (step charts, arrow charts, etc.).
- **Can (and often does) point to obviously poor chart type choices;** requires user to have highly developed “chart judgment” to use “safely.”

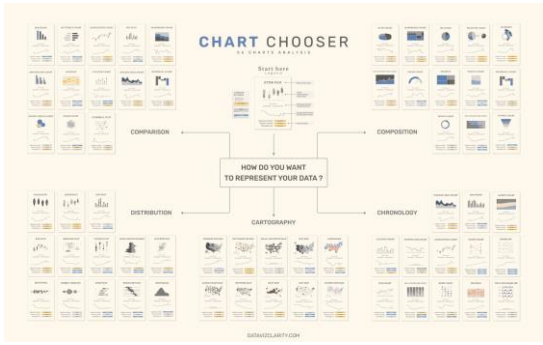


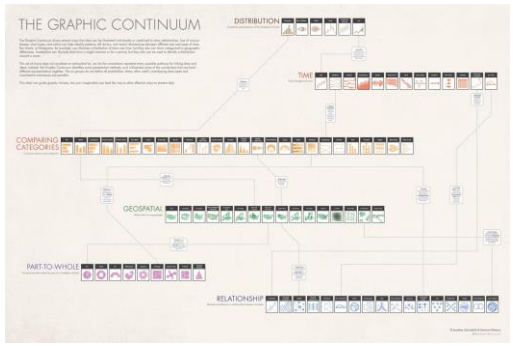
- All common situations accounted for.
- All essential chart types included.
- **Reliably points to good chart type choices,** regardless of “chart judgment” level of chart creator.

What about chart-chooser catalogs/taxonomies?









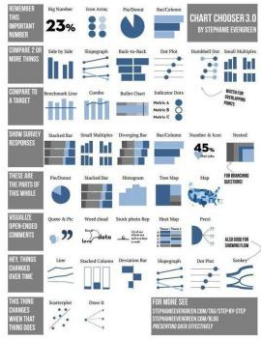
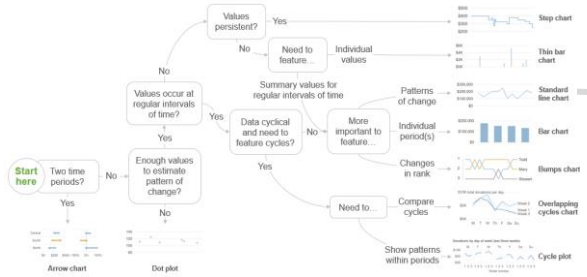


Chart-chooser catalogs/taxonomies

“Standard line charts”

- “Good choice when showing data over time.”
- “Can show several time series.”
- “Familiar/easy to read.”



Use a standard line chart when…

- There aren’t many missing values.
- There are more than two time periods.
- Values occur at regular intervals of time.
- Values aren’t persistent.
- Featuring patterns of change is more important than featuring individual time periods.
- Featuring changes in quantity is more important than featuring changes in rank.
- Chart doesn’t look like “spaghetti.”

Comparison of chart type selection methods

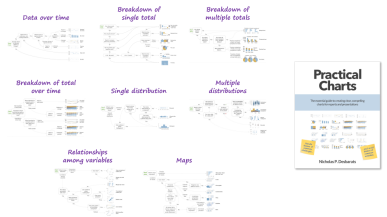
Easy

Hard

Rules of thumb

Chart type catalogs/taxonomies

Conventional chart-chooser diagrams

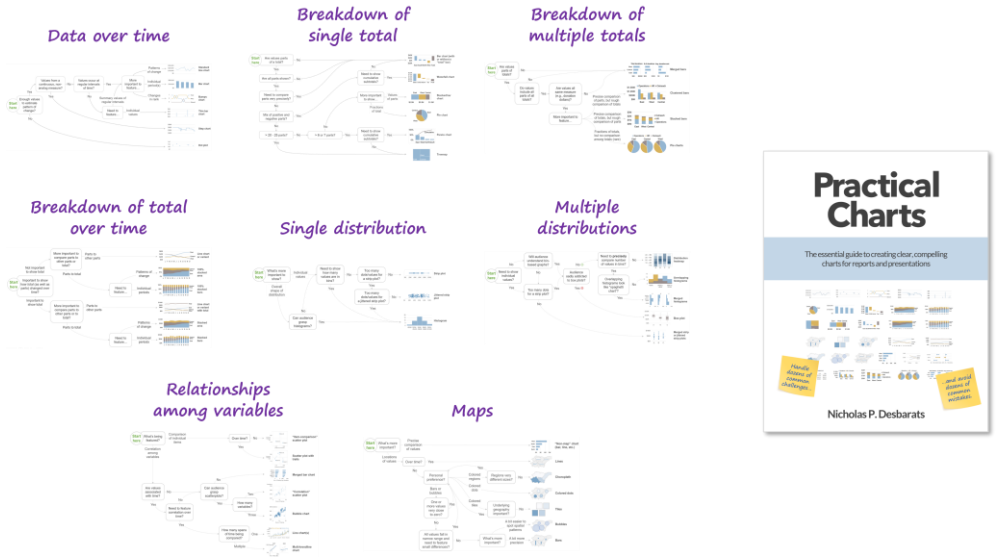


Years of experience

Poor chart type choices

Good chart type choices

BTW, these aren't "rules"! (They're guidelines.)



- These are "training wheels" that allow chart creators to learn quickly and avoid "falling over."
- Experts might have good reasons to deviate from these decision trees at times (which is fine!)
- First step in knowing when to "break the rules" is to "learn the rules" (except I hate that term).

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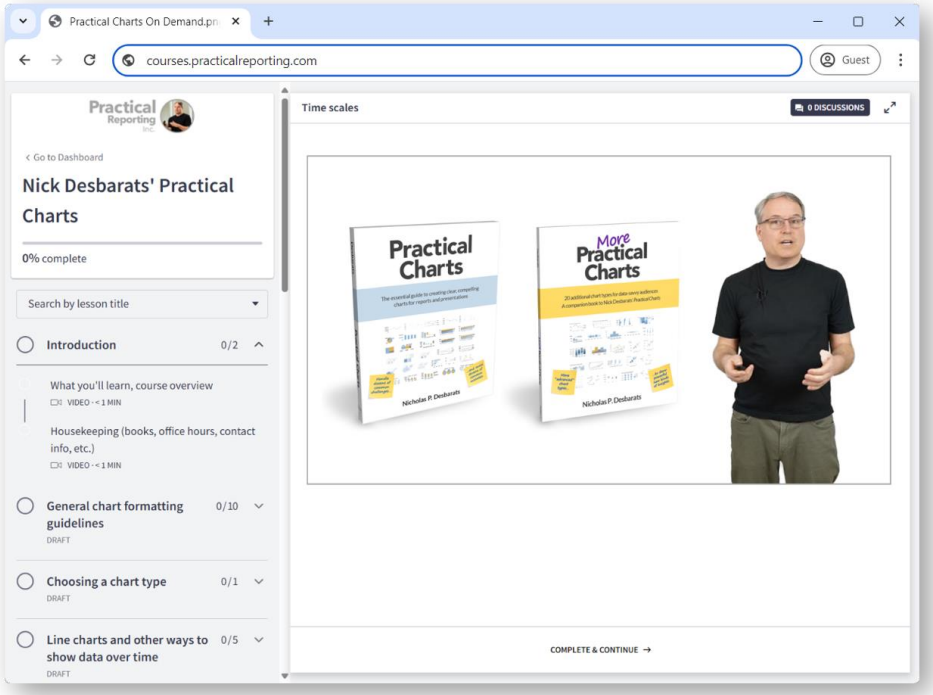

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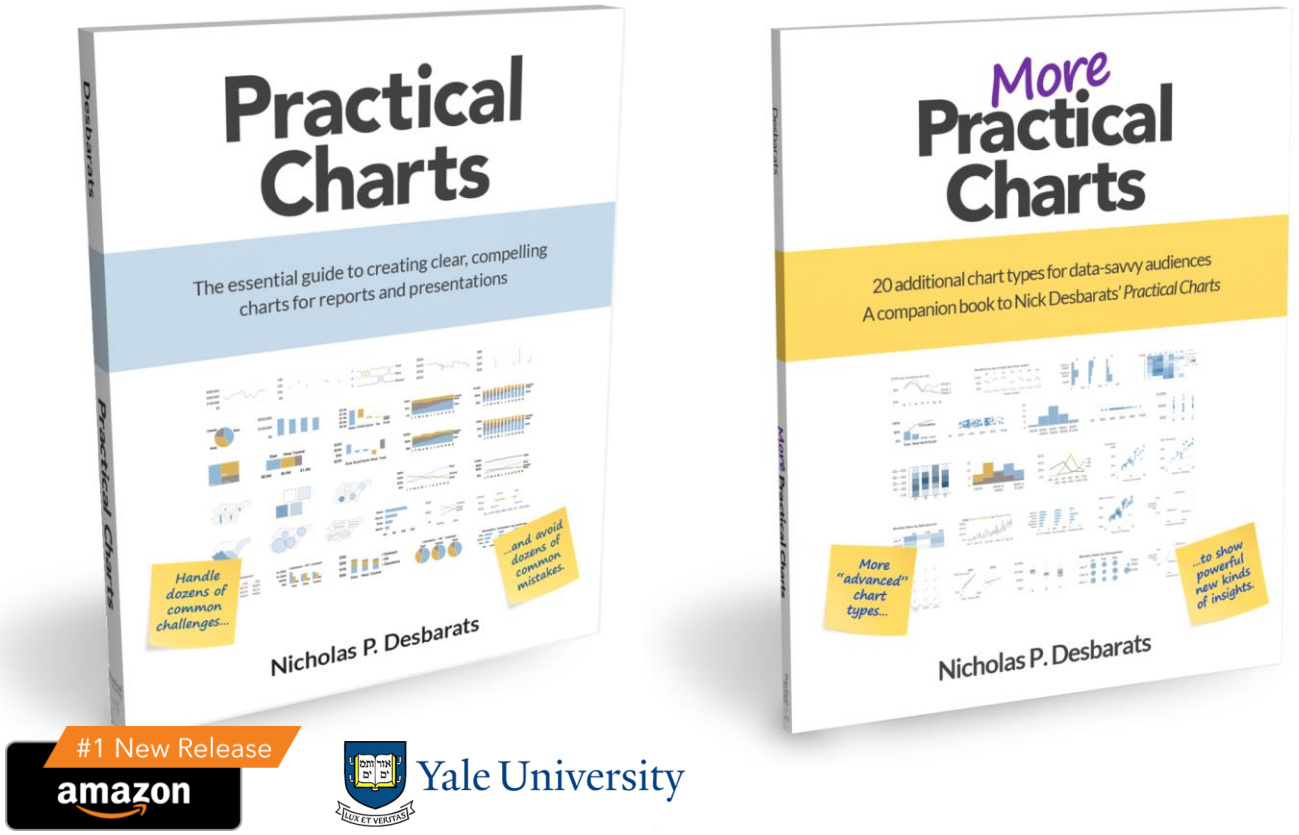

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