Constraints and Opportunities for Expressive Information Design

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Outline

- **Expressive information design**
- My **background**, **methods**, and **values**
- **Focus** section 1: *Considerations and tools for expressive information design*
- **Focus** section 2: *Expressive information design for mobile devices*
- **Ongoing** and **future** research
- Why **SIAT**?

Coverage of Topics & Publications

Considerations and tools for expressive information design:

- *Timeline Storyteller* C7 | *DataToon* C8 | *Charticulator* J7 | *ChartAccent* C5 | *Timelines Revisited* J6 | *TimeLineCurator* J4

Visualization task analysis:

- *A Typology of Abstract Visualization Tasks* J1 | *Visualizing Dimensionally-Reduced Data* W3

Empirical evaluation:

- *Data-Driven Stories* BC1 | *Visualization Authoring Systems* W5 | *Variants of Multi-Series Bar Charts* C6 |
- *Overview: A Document Mining Tool for Journalists* J2

Visualization for mobile devices:

- *Ranges Over Time* J8 | *Animation vs. Small Multiples* WP*

Visualization for resource conservation:

- *Workflows for Energy Portfolio Analysis* J5

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Expressive Information Design

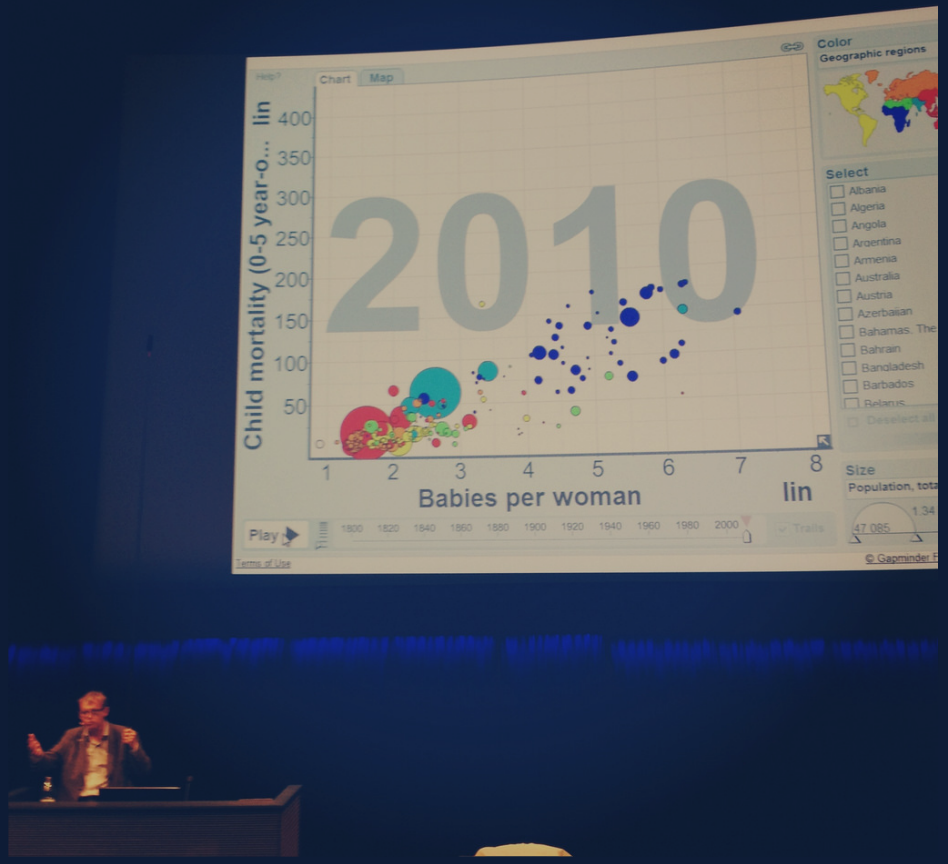
From the perspective of an **information visualization** researcher.

Expressive Information Design

- Combining **visualization**, **annotation**, and **explanation** to **present** information to an audience.
- Thinking systematically about **tasks**, **design choices**, and **constraints**.
- Identifying ways to **assess** alternative design choices.

Presenting Information to the Public

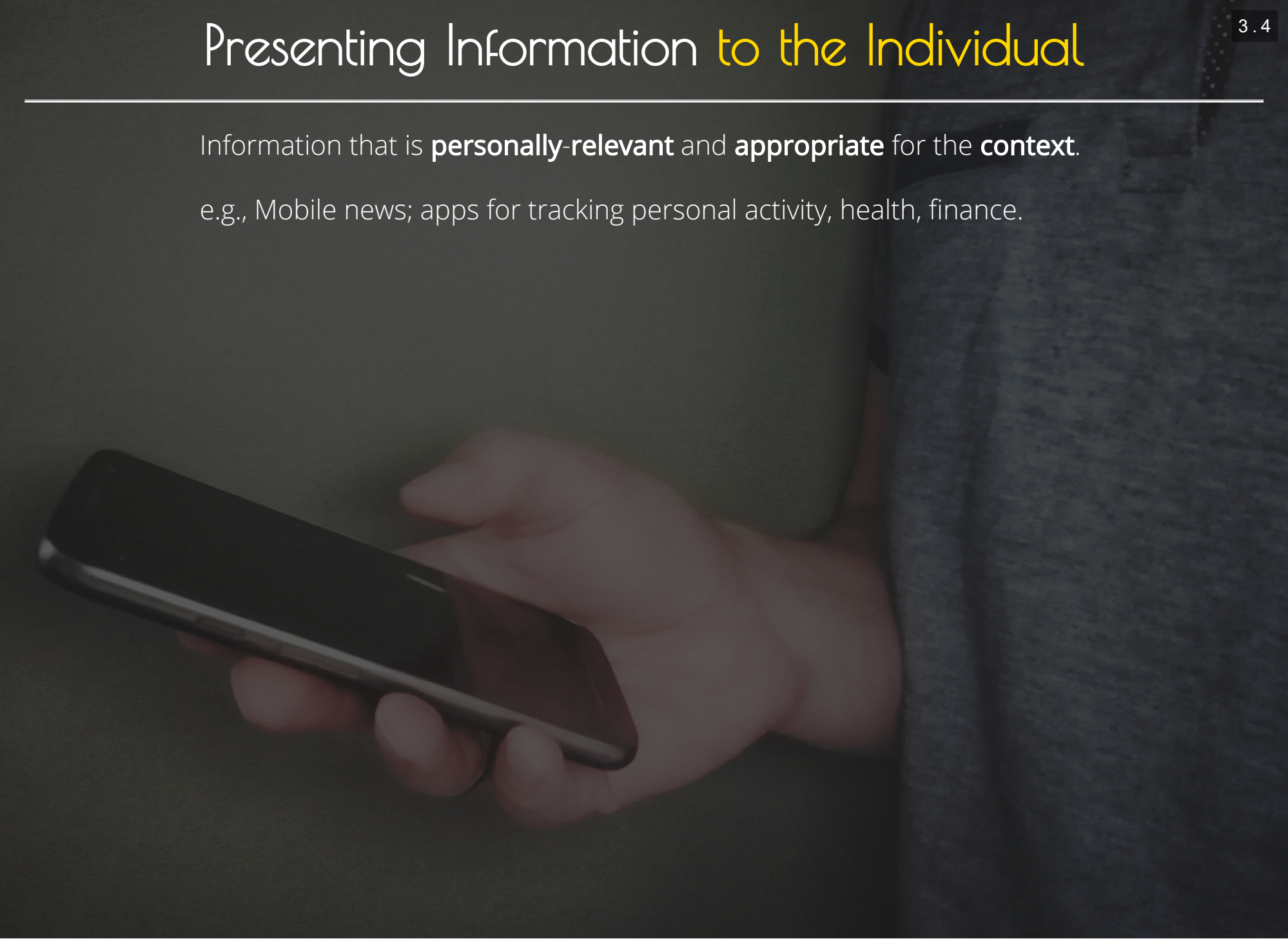
e.g., Hans Rosling's TED presentations about global economic and public health indicators.



Presenting Information to the Individual

Information that is **personally-relevant** and **appropriate** for the **context**.

e.g., Mobile news; apps for tracking personal activity, health, finance.

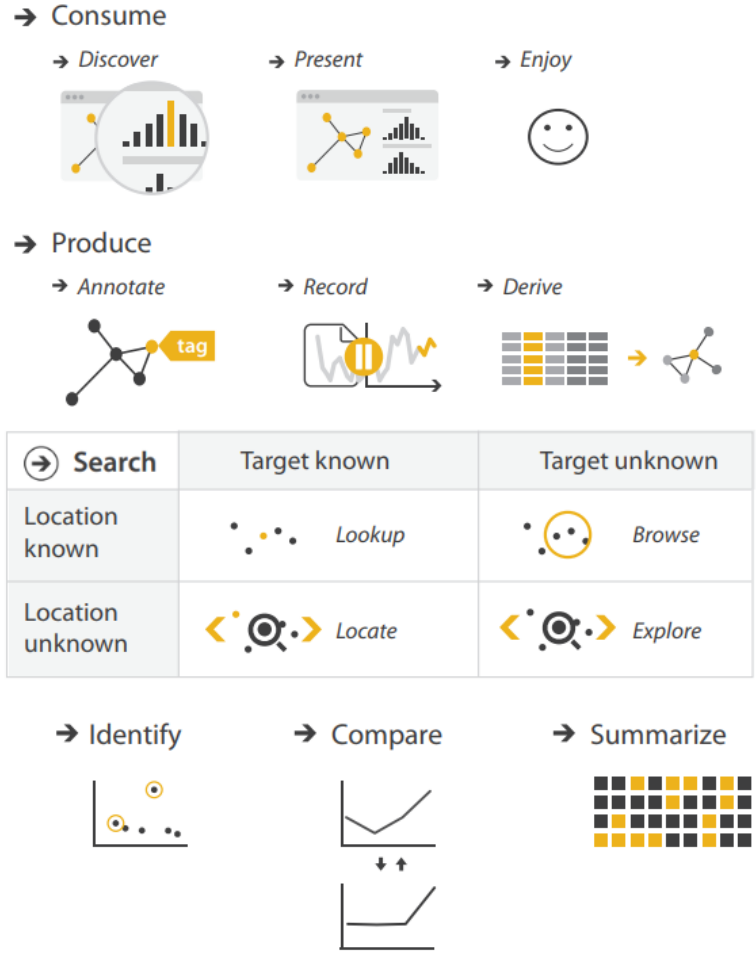


Aspects of Expressive Information Design

Thinking systematically about **tasks**, **design choices**, and **constraints**.

Thinking Systematically about Tasks

A Multi-Level Typology of Abstract Visualization Tasks. **Brehmer** and Munzner. In *IEEE Transactions on Visualization and Computer Graphics* (InfoVis 2013).



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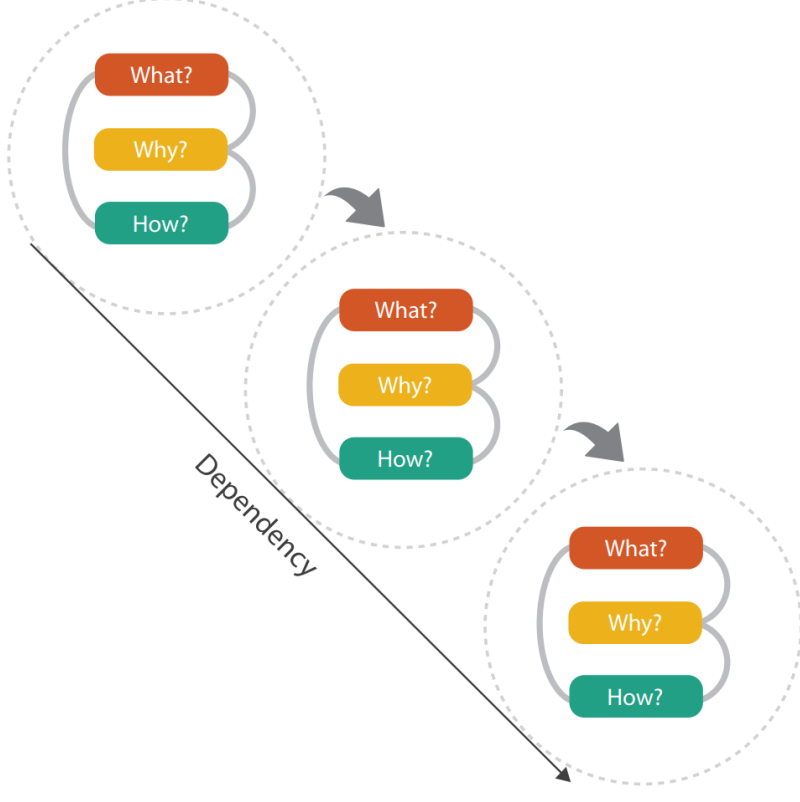
The **most cited IEEE InfoVis paper since 2013**, with more than 280 citations*.



Thinking Systematically about Design Choices

Identifying the dimensions of **design spaces** that characterize:

... ways to **visually represent** data,

... ways to **interact** with these representations,

... ways to **highlight** and **annotate** them, and

... ways to **combine visual** content with **textual** explanation.

In an expressive information design tool, how do you present these choices?

e.g., Low-level visual encoding choices (shape, color, ...) or chart templates (bar, line, ...)

Constraints on Expressivity

Constraints imposed by **authors**, by the **audience**, or by the **context**.

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Resources: enabling expressive information design for those on a deadline.

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Literacy: anticipating the visual and data literacy of the audience.

Device: anticipating the audience's viewing experience.

My Background, Methods, & Values

My Background

2011 - 2016: PhD **Computer Science** specializing in **Information Visualization**

2009 - 2011: MSc **Computer Science** specializing in **Human-Computer Interaction**

2004 - 2009: Bachelor of **Computing** specializing in **Cognitive Science**

Design & Research Methods

Design & Implementation:

· User interface design | Visualization design & development | Toolkit development

Qualitative Research:

· Visualization design studies* | Requirements analysis | Chart reproduction studies
· Chauffeured demos | Content analysis | Post-deployment usage analysis

Quantitative Research:

· Laboratory experiments | Crowdsourced experiments | Statistical analysis

The Value of Democratizing Information Design

How can I enable under-served groups of people to...

Expressively **visualize** their data?

Produce and **present** compelling data-driven stories?

Make personal **decisions** grounded in data?

The Value of Democratizing Information Design

Situating my research within the academic visualization community.

Considering applications of visualization **beyond** those in **professional data analysis**.

e.g., Why are **journalists** and **educators** presenting information using **business intelligence** tools?

e.g., What are the **best practices** for the visual display of **personal-relevant** information on a **phone**?

The Value of Connecting Research & Practice

Disseminating visualization **research** into **practice**, and **vice versa**.

Promoting and studying the **adoption** of deployed information design tools and research prototypes.

Collecting examples of information design **produced by practitioners**.

Fostering a **dialogue** between **researchers** and **practitioners** (e.g., OpenVisConf, VisInPractice)*.

Outline

· What is **expressive information design**?

· My **background**, **methods**, and **values**

· **Focus** section 1: *Considerations and tools for expressive information design*

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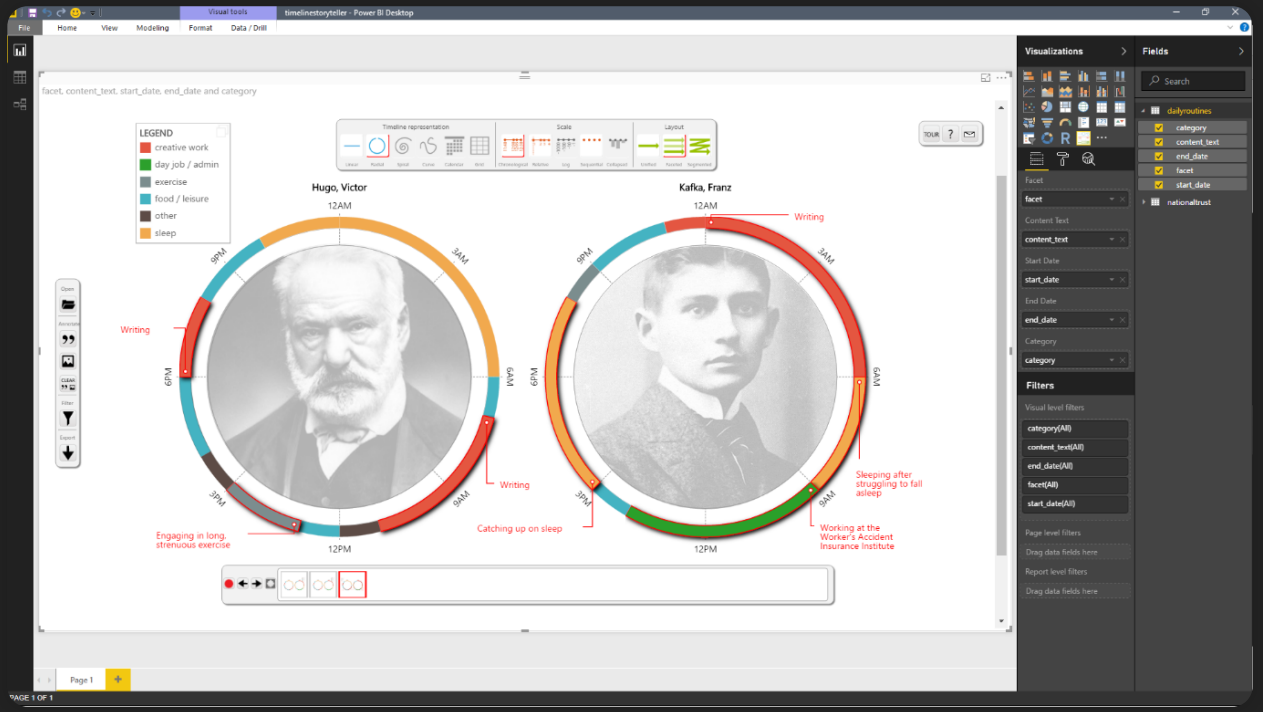
· Why **SIAT**?

The Daily Routines of Famous Creative People

Expressive Information Design with Timelines

Timeline Storyteller: The Design & Deployment of an Interactive Authoring Tool for Expressive Timeline Narratives.
Brehmer, Lee, Henry Riche, Tittsworth, Lytvynets, Edge, and White. In Proc. *Comp. + Journalism* 2019.



timelinestoryteller.com | github.com/Microsoft/timelinestoryteller

Timelines Revisited

Timelines Revisited: A Design Space and Considerations for Expressive Storytelling.
Brehmer, Lee, Bach, Henry Riche, and Munzner. In *IEEE TVCG* (presented at InfoVis 2017).

Timelines are visual representations of categorical event sequences.

How have people drawn timelines over the course of history?

The **visualization research community** has focused on their use in data analysis.

How have **practitioners** used them for storytelling?

What Happened When?

In what sequence did the events occur?

How long did the events last?

How long between event **A** and event **B**?

Did **A** and **B** co-occur or repeat?

When did **A** and **B** occur relative to event **C**?

A Timeline Design Space

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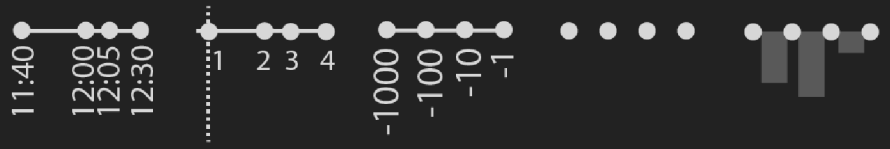
Representation

Scale



Layout

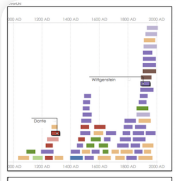
Timelines Revisited: The Research Process

1. Collecting and categorizing **145** timelines and timeline tools to establish the dimensions.
   - Sources included: *Cartographies of Time* (Rosenberg & Grafton), *Visualization of Time-Oriented Data* (Aigner *et al.*), *Making Timelines* (Groeger).

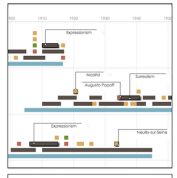
2. Validating the dimensions of the design space with **118** additional timelines (**263** total).
   - Sources included: visual.ly, the Kantar Information is Beautiful Showcase, massvis.mit.edu.

3. Implementing points in the design space with **28** representative datasets.
   - e.g., Conflicts, epidemics, lifespans, head of state tenures, news stories, natural disasters, publication records, geological history.

A set of purposeful, interpretable, & generalizable timeline designs at timelinesrevisited.github.io.



Narrative point: present chronology, duration of events.
Perceptual task: bar length and position judgment.
Comment: supported by most tools.



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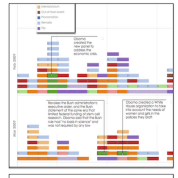

Narrative point: compare chronology, duration, periodicity of events between segments.
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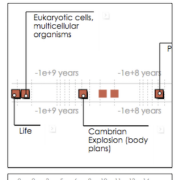
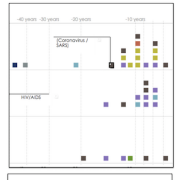
Narrative point: compare relative chronology, duration of events between facets; present relative synchronicities.
Perceptual task: bar length and position comparisons.



Narrative point: present chronology of a timeline with emphasis on recent events.
Perceptual task: bar position judgment.
Comment: do not start story with log scale.



Narrative point: compare chronologies with emphasis on recent events between facets; show synchronicity.
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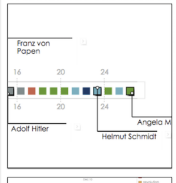

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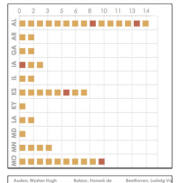
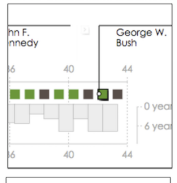
Perceptual task: bar position judgments.
Comment: wide aspect ratio.



Narrative point: (accurately) compare lengths of sequences between facets.
Perceptual task: bar position comparisons.
Comment: effectively a bar chart.



Narrative point: present a sequence of events with distribution of time elapsed between events.
Perceptual task: bar length and position judgments.
Comment: non-uniform chronological distributions.

Narrative point: present chronology, duration of events.
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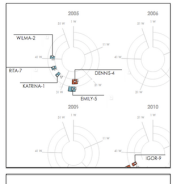

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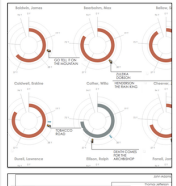

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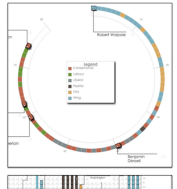
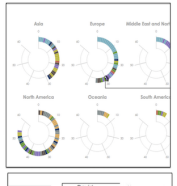
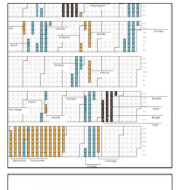


Narrative point: present a sequence of events.
Perceptual task: arc position judgments.
Comment: square aspect ratio.



Narrative point: (approximately) compare lengths of sequences between facets.
Perceptual task: arc length comparisons.

Narrative point: compare chronology, duration, periodicity of events over centuries, decades.
Perceptual task: count and position judgments.
Comment: only supports consecutive events.



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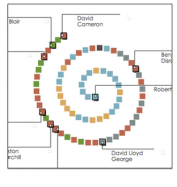

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Perceptual task: area judgment.
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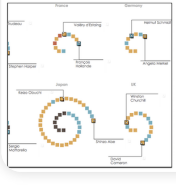

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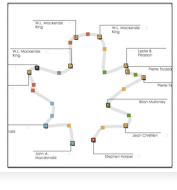

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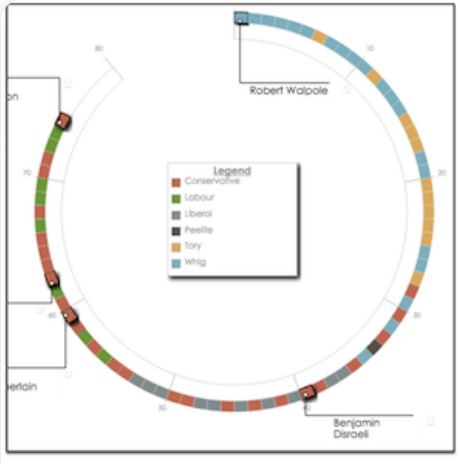
Thinking Systematically About Tasks & Design Choices



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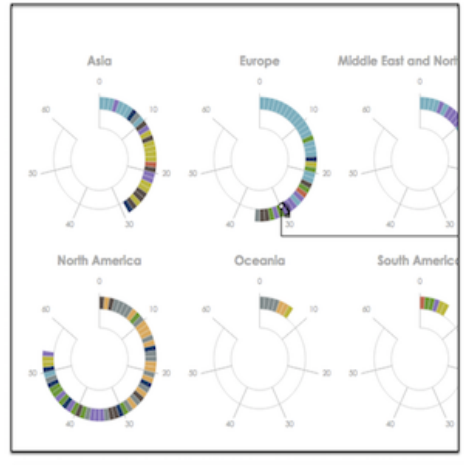

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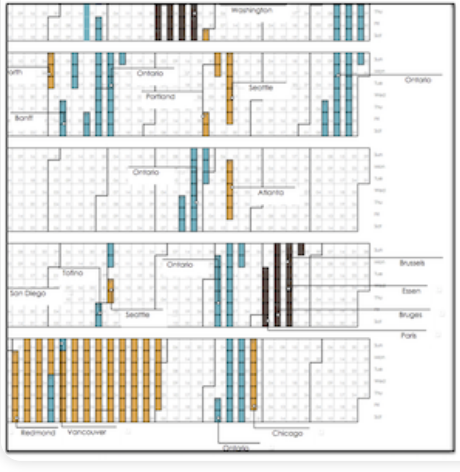

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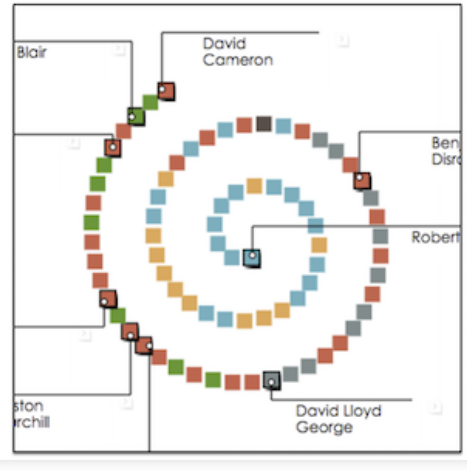

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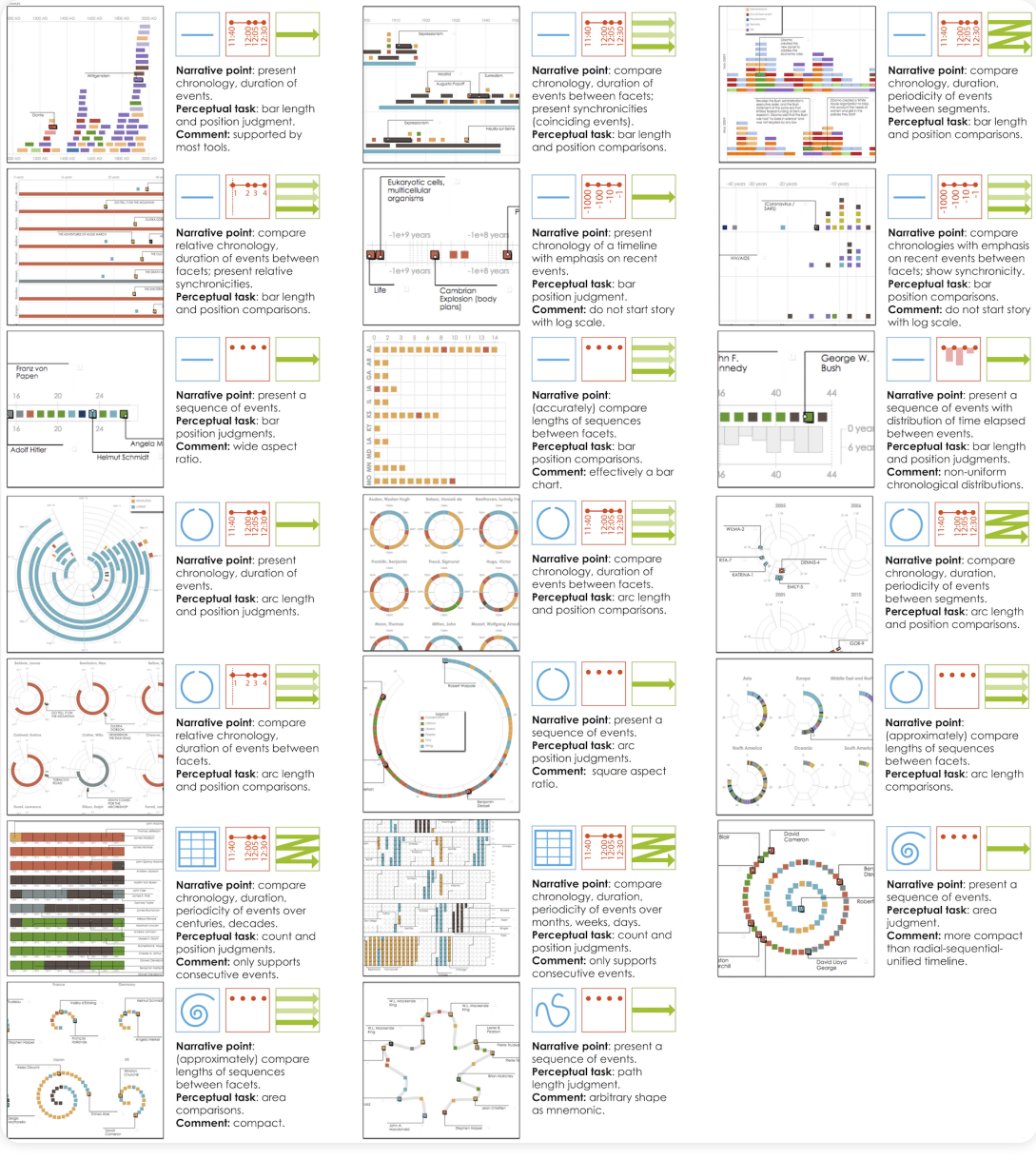
Using our Timeline Design Space



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Expressive Storytelling with Timelines

Timelines Revisited: A Design Space and Considerations for Expressive Storytelling.
Brehmer, Lee, Bach, Henry Riche, and Munzner. In *IEEE TVCG* (presented at InfoVis 2017).

Provide **alternative representations** for time, and

Provide **alternative** time **scales**.

Anticipate **chronological** or **non-chronological** narratives.

Incrementally **reveal** visual elements, selectively **highlighting** and **annotating** to direct attention.

Timeline Storyteller

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timelinestoryteller.com | github.com/Microsoft/timelinestoryteller

Evaluating Timeline Storyteller

A controlled **laboratory study** to assess expressivity seemed to be **inappropriate**.

How do people use it **with their own data**?

How does the content they produce **reflect** our timeline **design space**?

Promoting Timeline Storyteller to Practitioners

I demonstrated it at the **Tapestry Conference** and **OpenVisConf** in 2017.

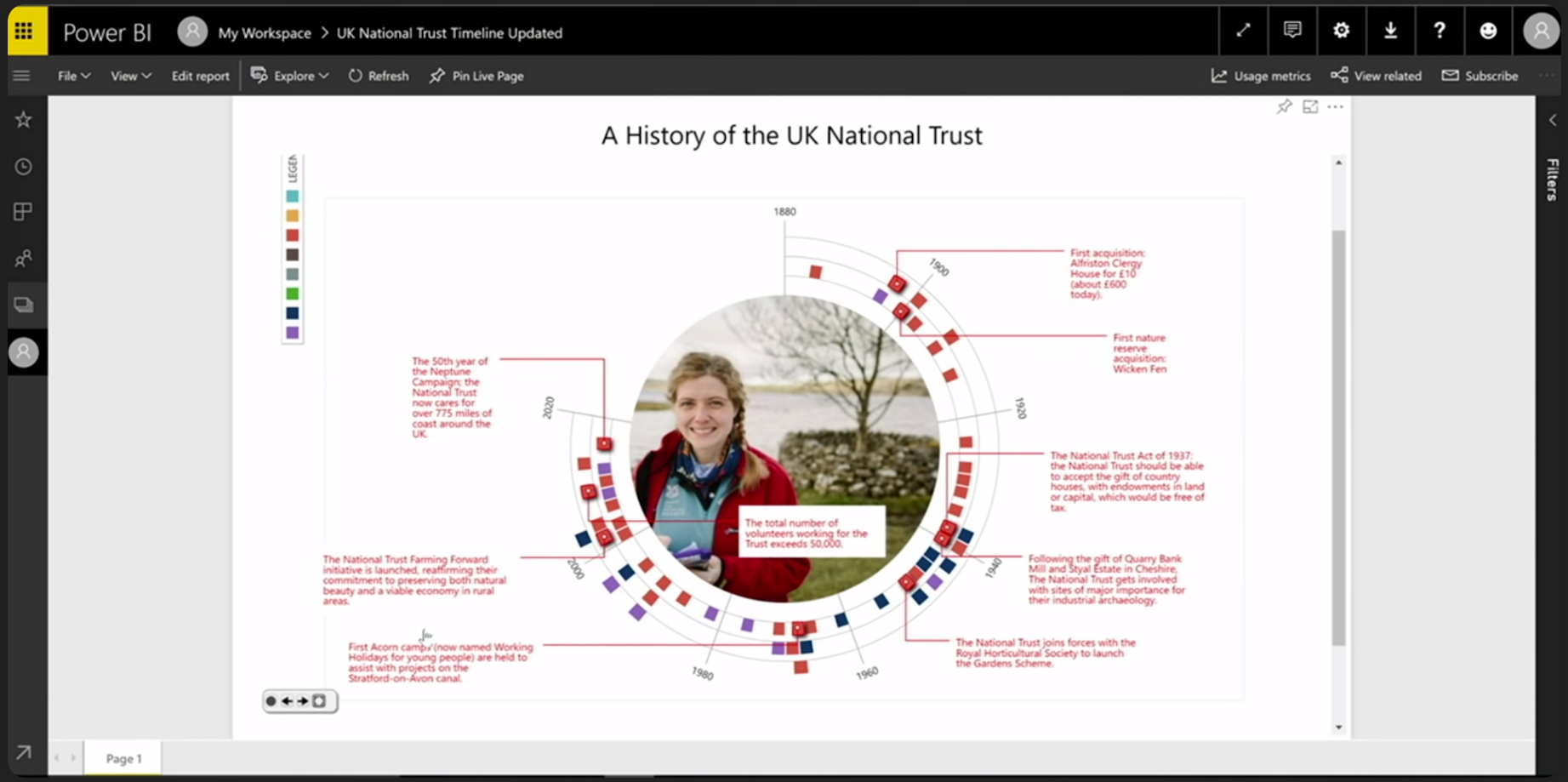
My co-author (White) used it in his 2017 **Dublin Data Summit** keynote.

Microsoft's Data Journalism Team demonstrated it at the 2017 **Future of Storytelling Summit**.

I wrote about it on the official **Power BI Blog**.

I co-produced a tutorial and interview for the **Power BI YouTube channel**.

Promoting Timeline Storyteller (cont.)



A customer demonstrated it in the opening keynote of the 2017 **Data Insights Summit**.

Timeline Storyteller: Collecting Usage Data

I collected **exported content** from the web version.

I collected entries from a **data storytelling contest** with the Power BI user community.

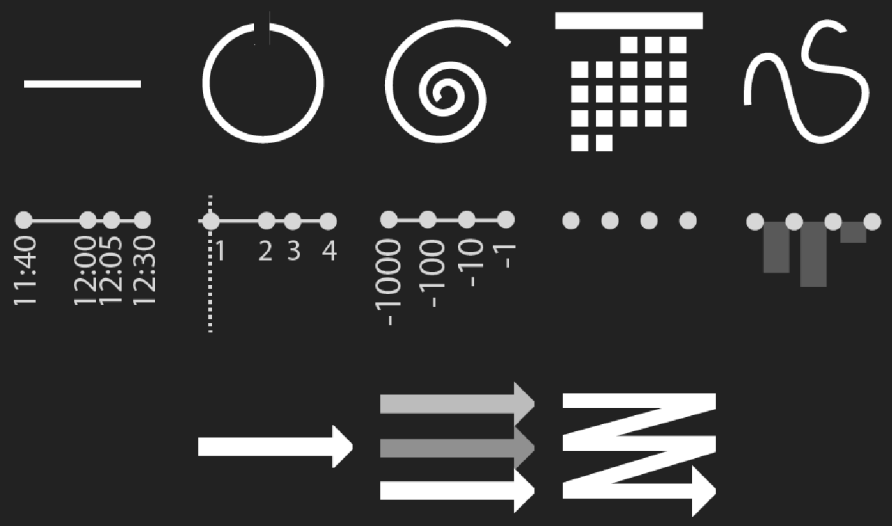
I tracked **download metrics** of the Power BI desktop version.

Timeline Storyteller: Content Analysis

223 unique items of exported content from the web version (subject to author consent).

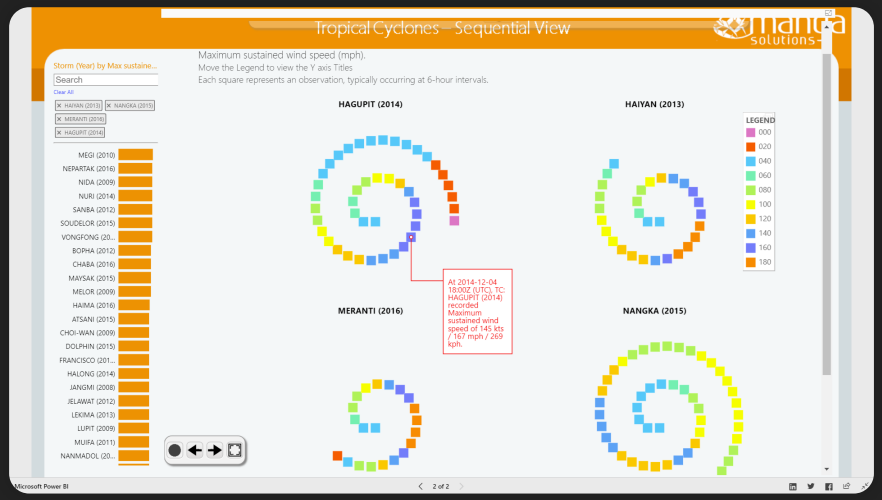
The corpus spanned my timeline design space - with a couple of exceptions.

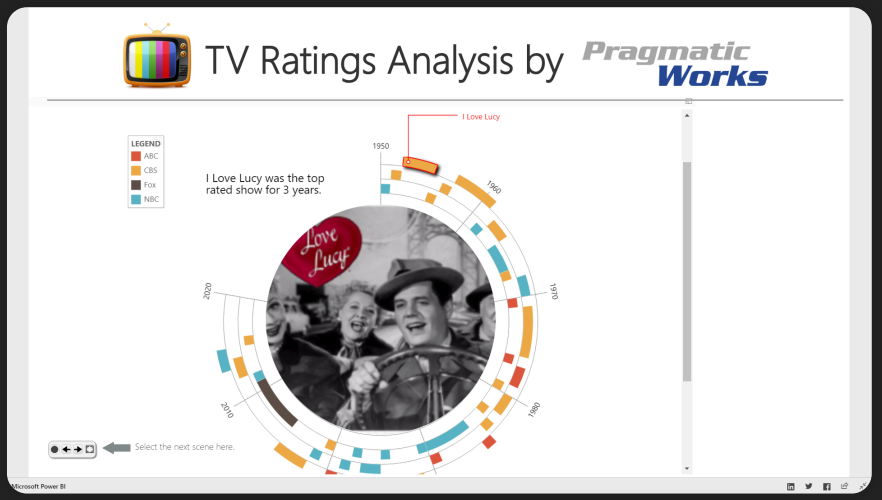
The **Linear** representation and **Chronological** time scale were most common.



Timeline Storyteller: Content Analysis (cont.)

Example entries from the Power BI user community **data storytelling contest**:





Tropical Cyclones by Manga Solutions. | *TV Network Ratings* by Pragmatic Works.

Timeline Storyteller: Usage Metrics*

Over **36,000 downloads** of the Power BI version.

Over **51,000 views** of our YouTube tutorial.

Over **150 stars** of Github repository.

* As of January 2019

Timeline Storyteller: Conclusions & Opportunities

No prior interactive tools for presenting **expressive timeline narratives**.

The first to incorporate multi-scene stories with **multiple visual representation choices**.

Incrementally **reveal** + **transform**; selectively **highlight** + **annotate**; applicable to other data types.

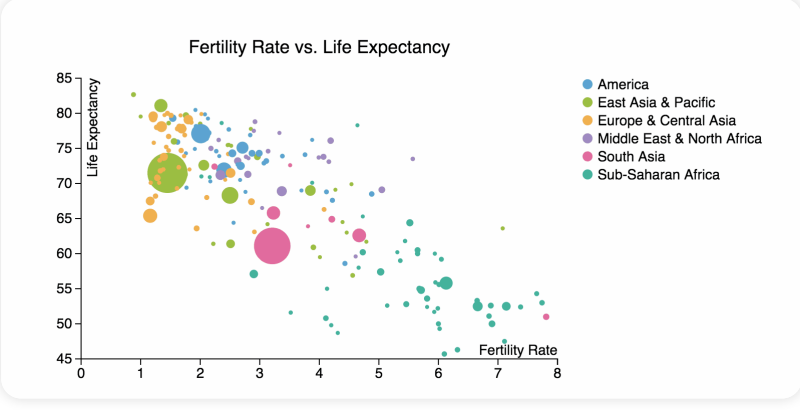
Recommend design choices and **annotations** based on properties of the dataset.

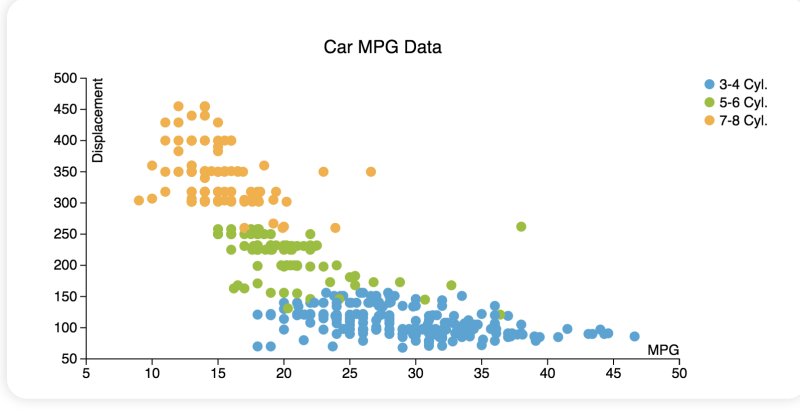
The viewing experience ought to be **more responsive**.

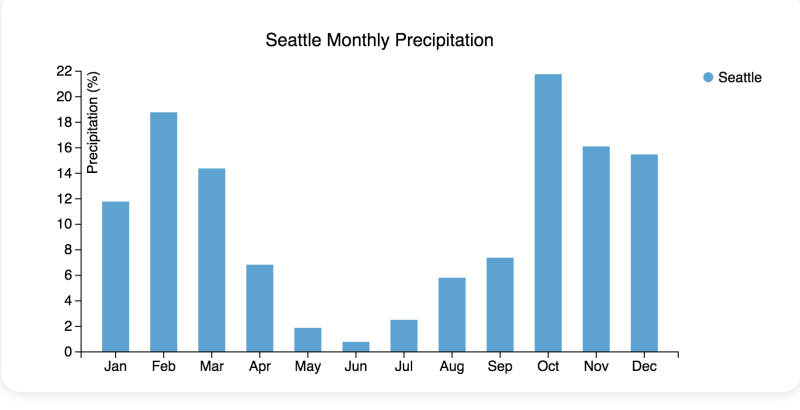
Other Expressive Information Design Tools (1 of 3)

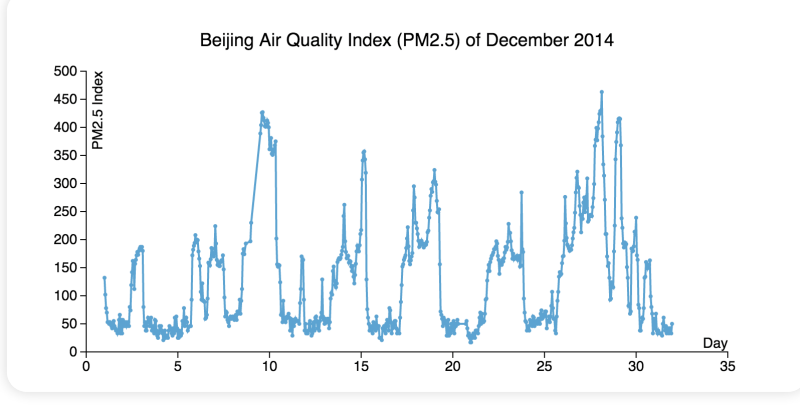
Other Expressive Information Design Tools (1 of 3)

ChartAccent: Annotation for Data-Driven Storytelling.
Ren, **Brehmer**, Lee, Höllerer, and Choe. In Proc. 2017 *IEEE PacificVis* Symp.





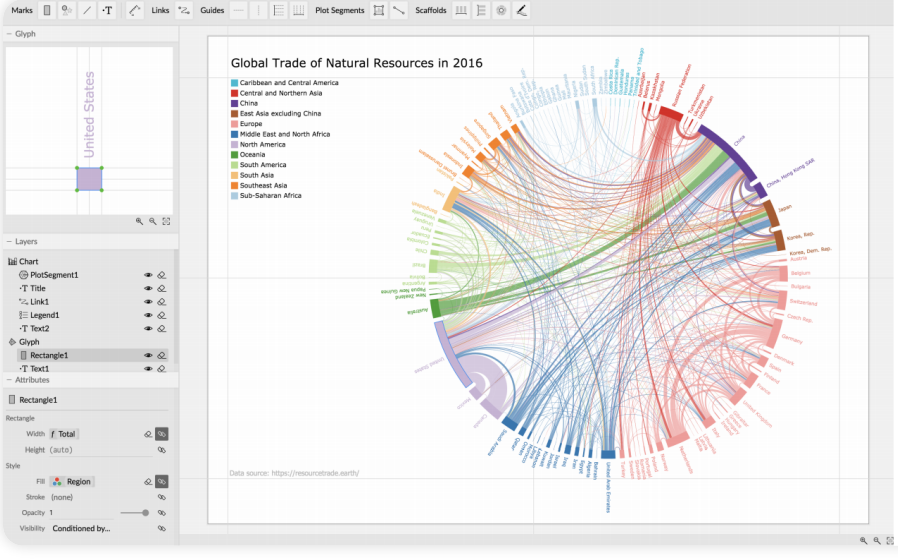


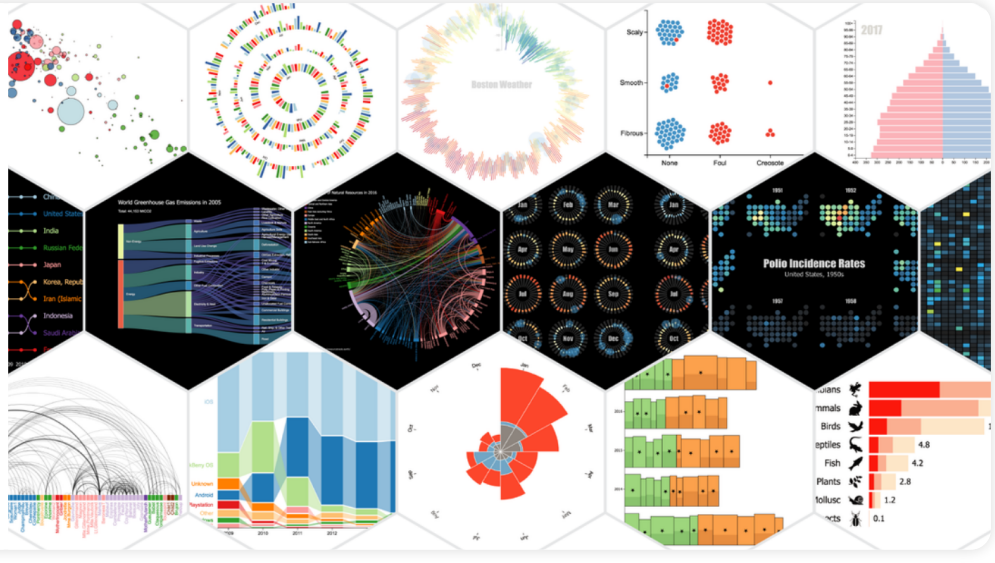


chartaccent.github.io | github.com/chartaccent

Other Expressive Information Design Tools (2 of 3)

Charticulator: Interactive Construction of Bespoke Chart Layouts.
Ren, Lee, and **Brehmer**. In *IEEE TVCG* (InfoVis 2018).





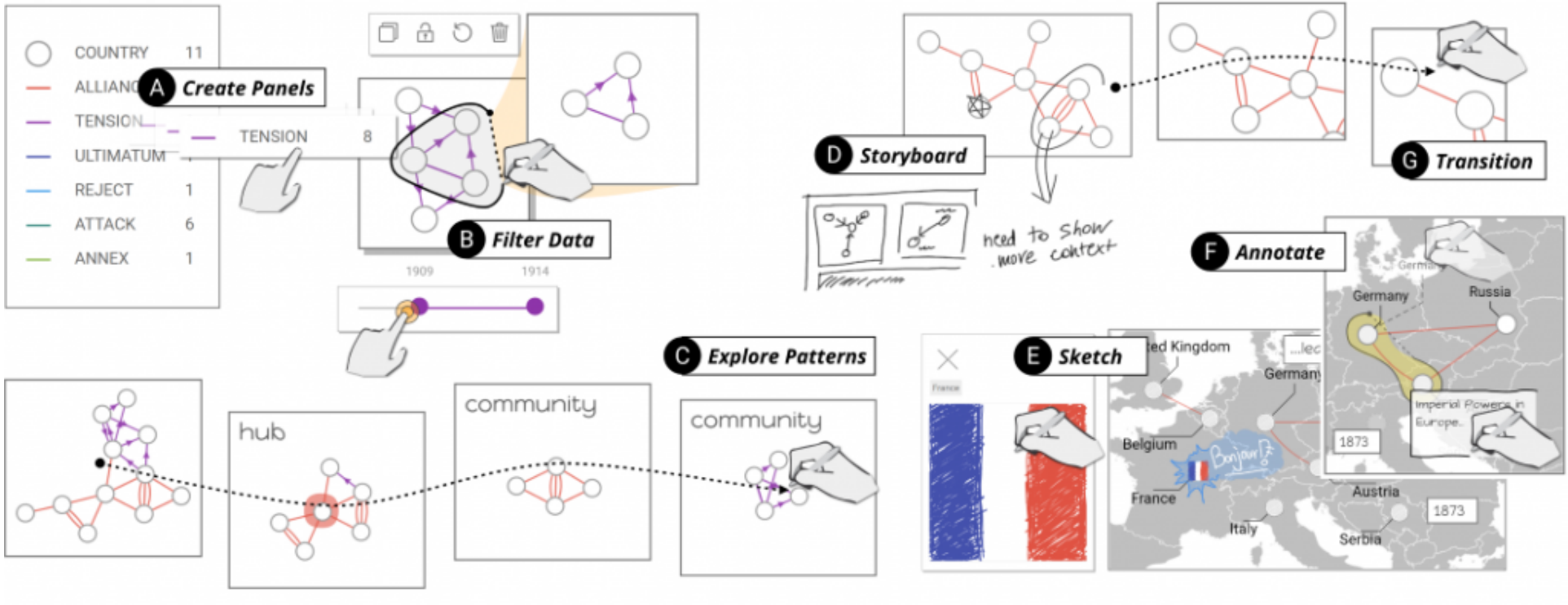
Honorable Mention for Best Paper at IEEE InfoVis 2018.

Shortlisted for the 2018 Kantar Information is Beautiful Awards.

charticulator.com | github.com/Microsoft/Charticulator

Other Expressive Information Design Tools (3 of 3)

DataToon: Drawing Dynamic Network Comics With Pen + Touch Interaction.
Kim, Henry Riche, Bach, Xu, **Brehmer**, Hinckley, Pahud, Xia, McGuffin, and Pfister. In Proc. *CHI* 2019.



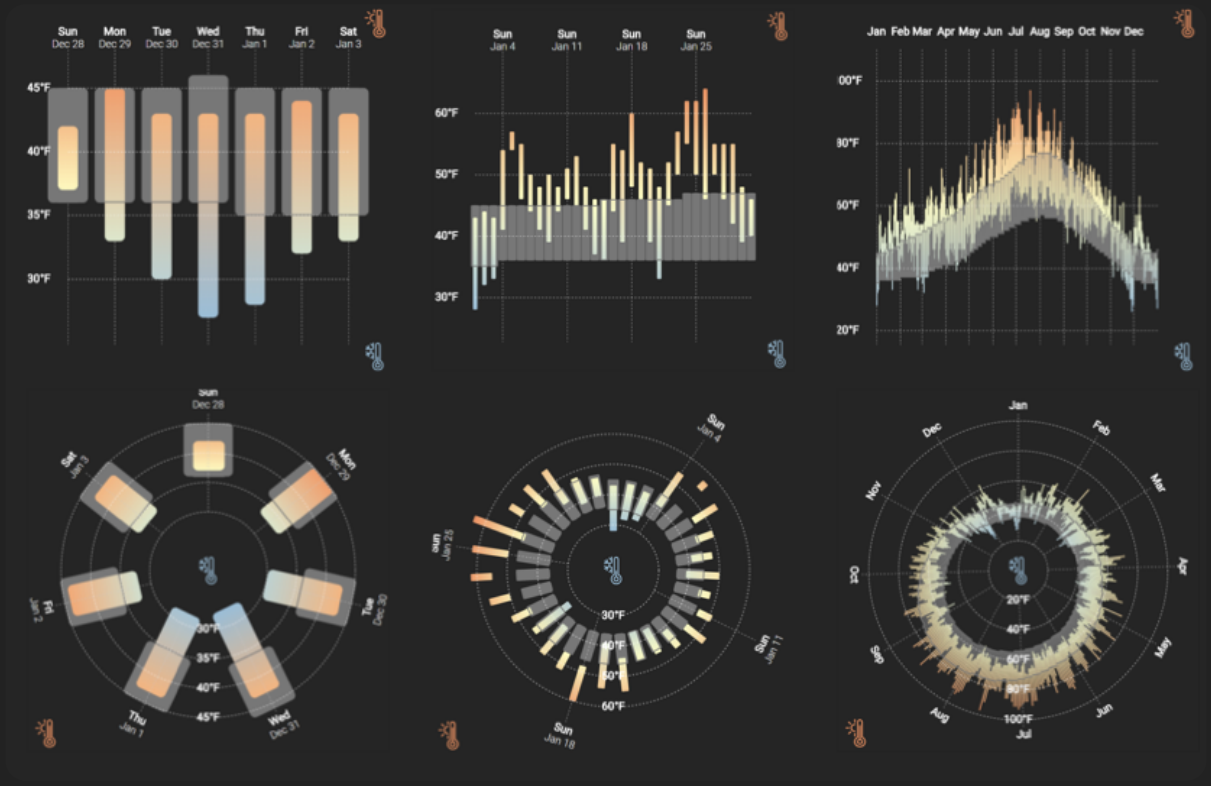
aka.ms/DataToon

Outline

- What is **expressive information design**?
- My **background**, **methods**, and **values**
- **Focus** section 1: *Considerations and tools for expressive information design*
- **Focus** section 2: *Expressive information design for mobile devices*
- **Ongoing** and **future** research
- Why **SIAT**?

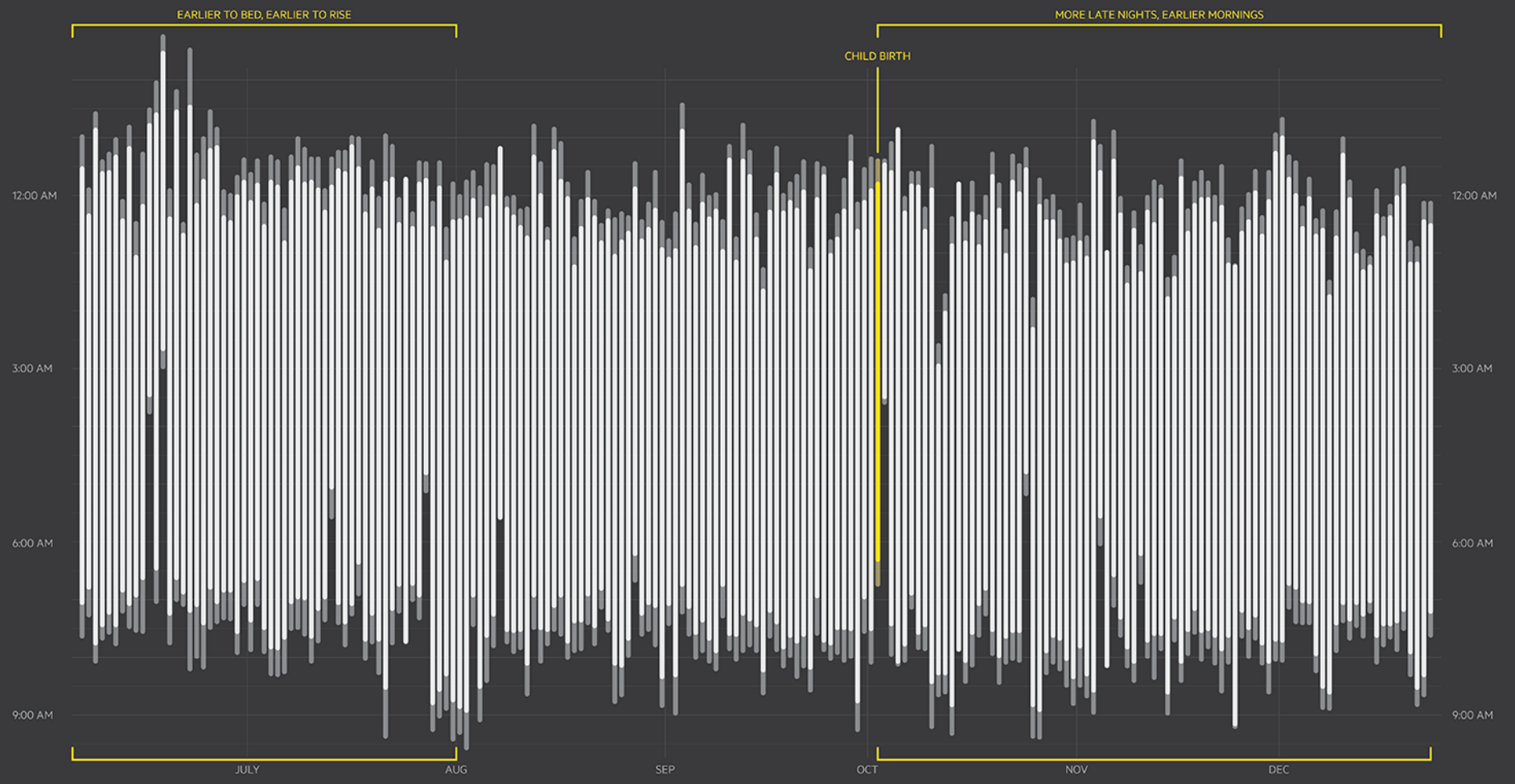
Information Design Choices on Mobile Phones

Visualizing Ranges over Time on Mobile Phones: A Task-Based Crowdsourced Evaluation.
Brehmer, Lee, Isenberg, and Choe. In *IEEE TVCG* (InfoVis 2018).



aka.ms/ranges-tvcg

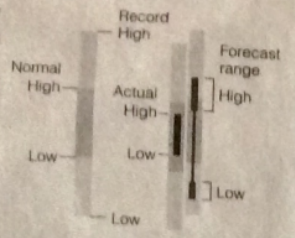
Time In Bed vs. Time Asleep by time of day

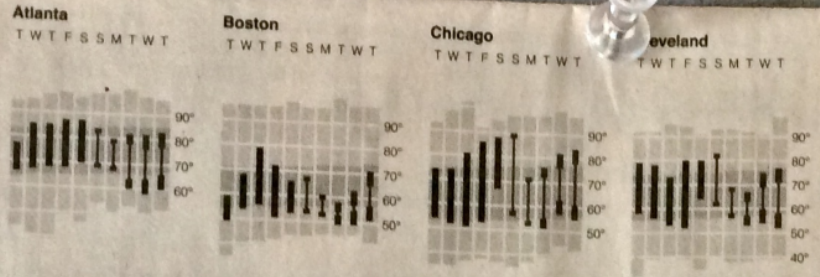


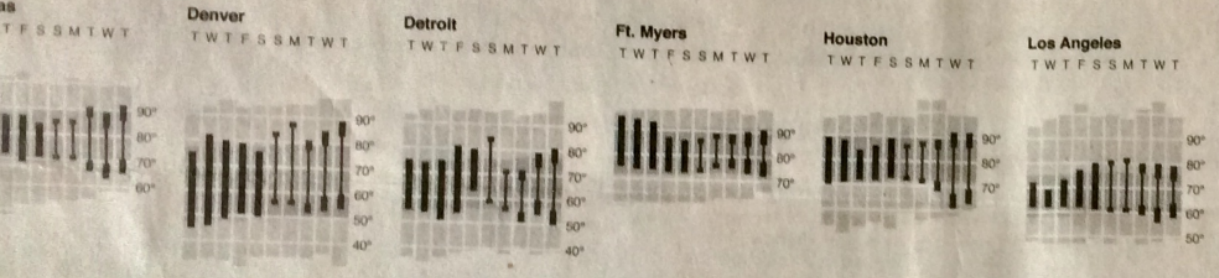
0-Day Temperature Trends

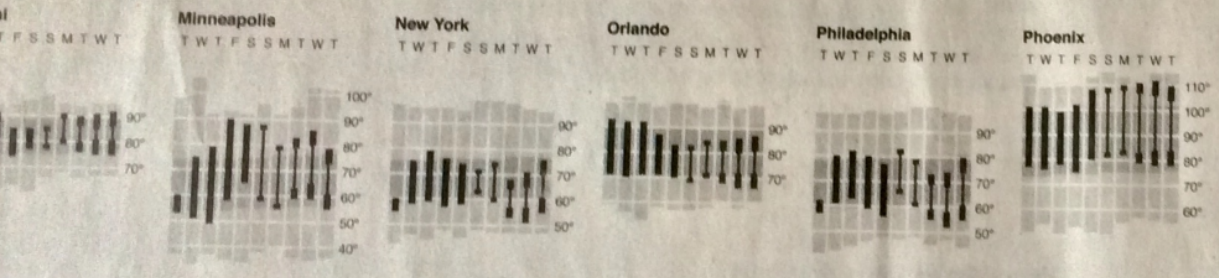
igh and low
mperatures
the past
e days and
ecasts for
next five.

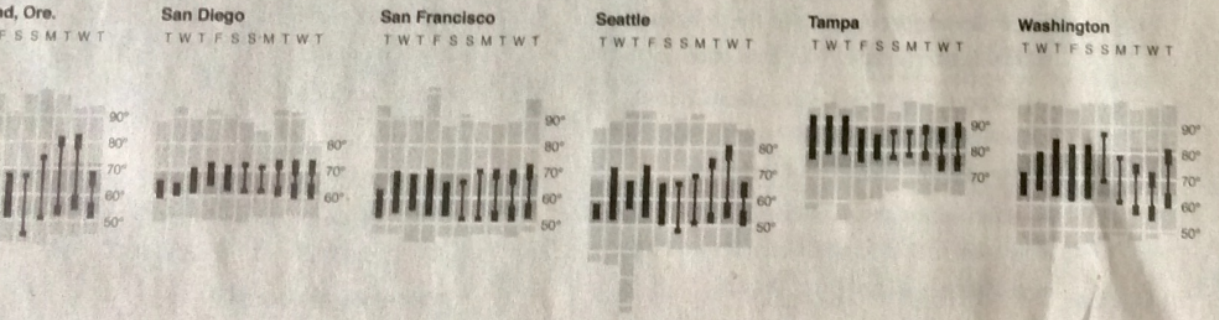
erday's highs
ows are based
eliminary data.











Key West	88/ 80	0.03	87/ 80	Sh	89/ 81	C
Knoxville	87/ 63	0	82/ 66	T	76/ 63	T
Lansing	85/ 64	0	85/ 56	PC	73/ 53	PC
Las Vegas	104/ 80	0	104/ 79	S	104/ 77	PC
Lexington	86/ 62	0	86/ 66	S	80/ 56	R
Little Rock	83/ 69	0.13	83/ 69	T	81/ 67	PC
Los Angeles	80/ 61	0	80/ 61	PC	81/ 61	PC
Louisville	90/ 65	0	87/ 69	PC	86/ 60	R
Lubbock	81/ 60	0.10	84/ 59	PC	88/ 60	PC
Madison	85/ 65	0.60	85/ 56	S	73/ 51	S
Memphis	85/ 72	0.17	82/ 72	T	84/ 68	PC
Miami	85/ 77	0.29	85/ 78	Sh	90/ 80	Sh
Milwaukee	84/ 68	0.45	86/ 57	PC	67/ 54	S
Mpls.-St. Paul	88/ 65	0.60	87/ 59	S	79/ 56	S
Mobile	80/ 70	0.40	83/ 71	T	81/ 70	T
Monterey, Calif.	63/ 52	0	62/ 49	PC	64/ 50	PC
Nashville	90/ 68	0	83/ 69	T	83/ 63	T
New Orleans	82/ 72	0.25	83/ 72	T	82/ 72	T
Norfolk	86/ 65	0	85/ 71	S	82/ 65	T
Oklahoma City	76/ 64	0.45	76/ 65	T	84/ 63	PC
Omaha	92/ 66	0	92/ 63	S	92/ 60	S
Orlando	83/ 70	0.55	82/ 69	T	84/ 71	T
Philadelphia	77/ 56	0.01	82/ 66	PC	78/ 61	T
Phoenix	108/ 80	0	108/ 82	S	109/ 83	S
Pittsburgh	79/ 59	0	84/ 62	T	73/ 54	Sh
Portland, Me.	63/ 47	0.02	66/ 50	PC	56/ 48	R
Portland, Ore.	68/ 51	0	67/ 45	PC	74/ 51	C
Providence	69/ 52	0.13	70/ 56	R	66/ 54	R
Raleigh	88/ 63	0	89/ 69	T	81/ 66	T
Reno	86/ 57	0	82/ 50	PC	85/ 54	S
Richmond	86/ 59	0	89/ 69	S	78/ 62	T
Rochester	71/ 51	0	74/ 59	R	68/ 53	Sh
Sacramento	85/ 53	0	86/ 53	S	90/ 55	S
Salt Lake City	92/ 68	0	96/ 66	S	86/ 64	S
San Antonio	88/ 70	0.11	86/ 70	T	87/ 70	T
San Diego	72/ 62	0	72/ 62	PC	71/ 62	PC
San Francisco	66/ 53	0	66/ 52	PC	70/ 52	PC
San Jose	75/ 54	0	75/ 52	PC	79/ 55	PC
San Juan	90/ 77	0.02	89/ 78	PC	89/ 79	PC
Savannah	88/ 70	0.04	87/ 72	T	87/ 72	T
Seattle	66/ 50	0	66/ 48	PC	69/ 51	C
Shreveport	86/ 70	0.10	83/ 69	T	81/ 68	T

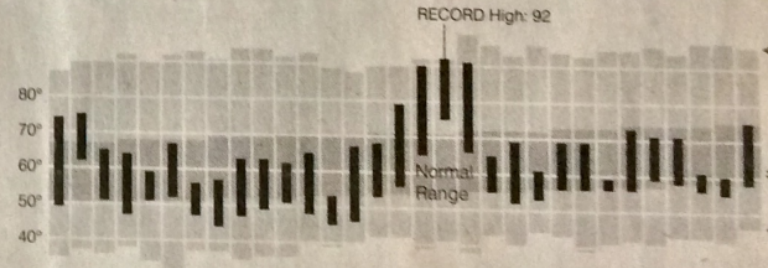
London	68/ 49	0	65/ 52	PC
Madrid	87/ 61	0.16	79/ 50	T
Moscow	50/ 38	0.08	56/ 43	C
Nice	76/ 67	0.10	78/ 68	T
Oslo	59/ 48	0.08	60/ 50	R
Paris	71/ 48	0.06	70/ 53	PC
Prague	82/ 60	0	68/ 50	T
Rome	77/ 60	0	80/ 63	PC
St. Petersburg	48/ 39	0.02	55/ 39	S
Stockholm	60/ 46	0.02	60/ 48	R
Vienna	83/ 62	0	80/ 58	T
Warsaw	71/ 51	0	82/ 54	R

North America	Yesterday		Today	
Acapulco	87/ 77	0.04	88/ 77	PC
Bermuda	77/ 72	0.08	78/ 70	S
Calgary	78/ 55	0	70/ 50	T
Edmonton	78/ 49	0	72/ 50	C
Guadalajara	93/ 58	0	93/ 59	PC
Havana	86/ 72	0.13	88/ 72	PC
Kingston	90/ 79	0.01	90/ 80	PC
Martinique	87/ 78	0.23	86/ 79	Sh
Mexico City	81/ 53	0.04	82/ 60	PC
Monterrey	92/ 69	0	91/ 72	PC
Montreal	64/ 48	0	67/ 53	C
Nassau	93/ 77	0.02	92/ 77	Sh
Panama City	88/ 77	0.15	87/ 77	T
Quebec City	62/ 47	0	68/ 48	C
Santo Domingo	90/ 75	0.15	89/ 76	PC
Toronto	72/ 53	0	75/ 53	R
Vancouver	64/ 46	0	64/ 45	C
Winnipeg	82/ 58	0.04	78/ 55	PC

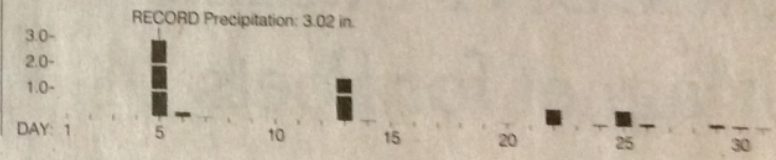
South America	Yesterday		Today	
Bogota	69/ 50	0.02	66/ 50	R
Buenos Aires	62/ 40	0.01	61/ 36	PC
Caracas	90/ 81	0.08	91/ 81	PC
Lima	72/ 63	0	72/ 63	S
Quito	72/ 52	0.10	74/ 51	Sh
Recife	86/ 76	0.08	85/ 75	Sh
Rio de Janeiro	78/ 67	0.02	82/ 70	S
Santiago	58/ 34	0	58/ 34	S
Sao Paulo	70/ 58	0	80/ 66	S

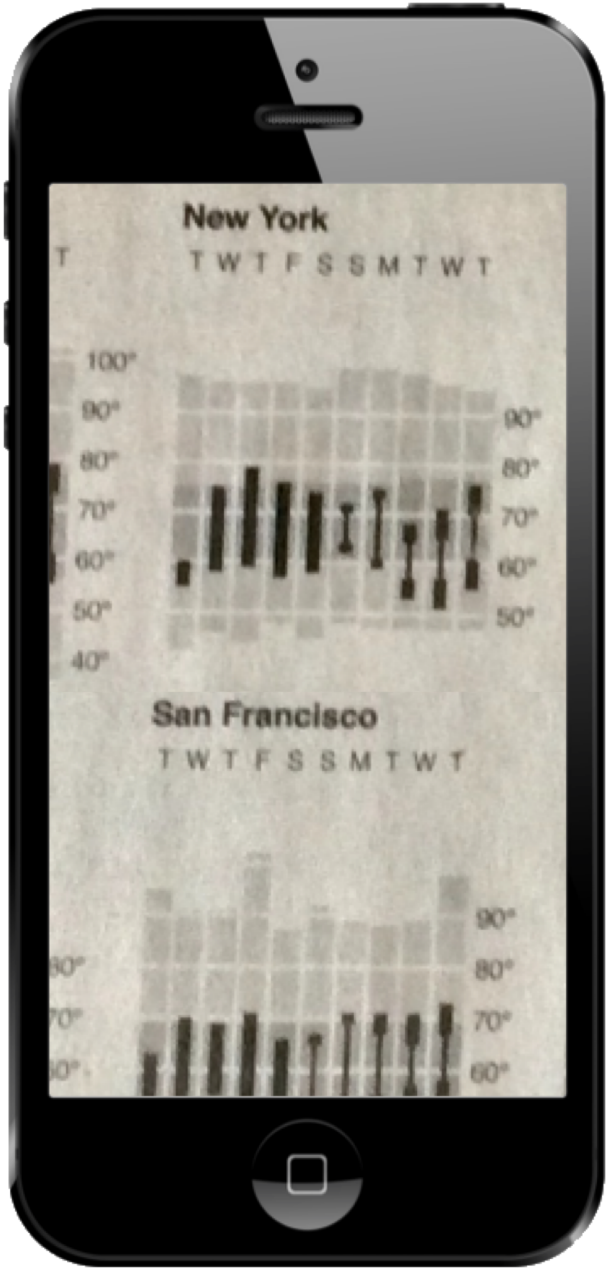
Highlight: New York's Weather in May

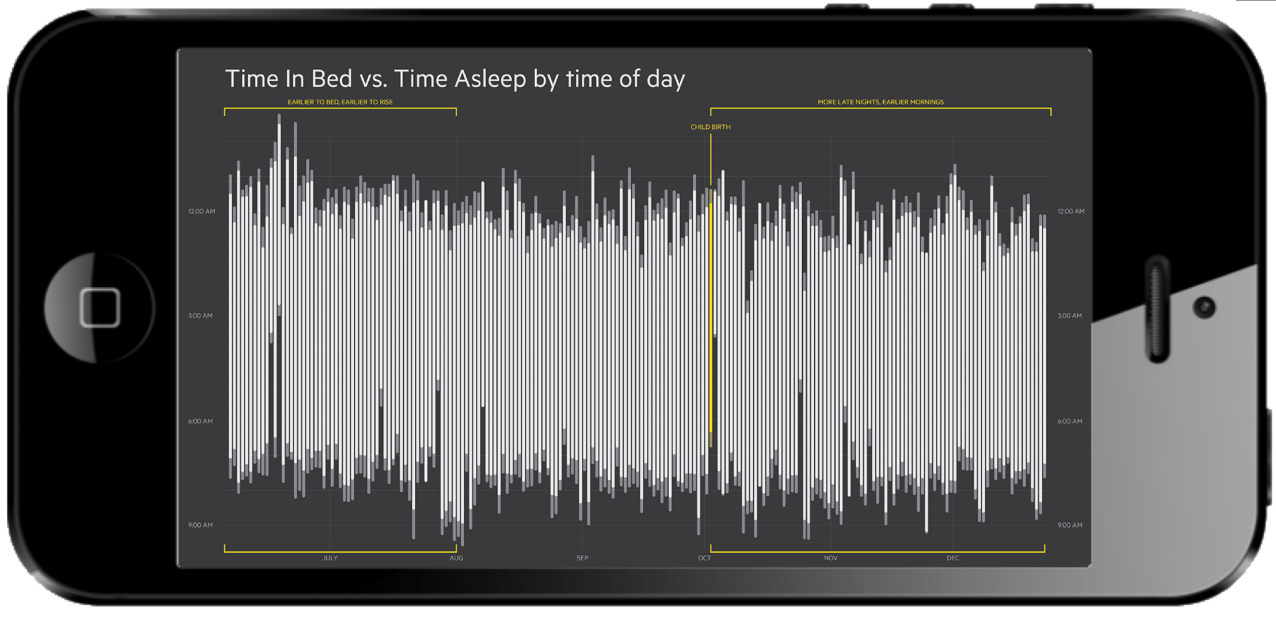
Temperature Central Park

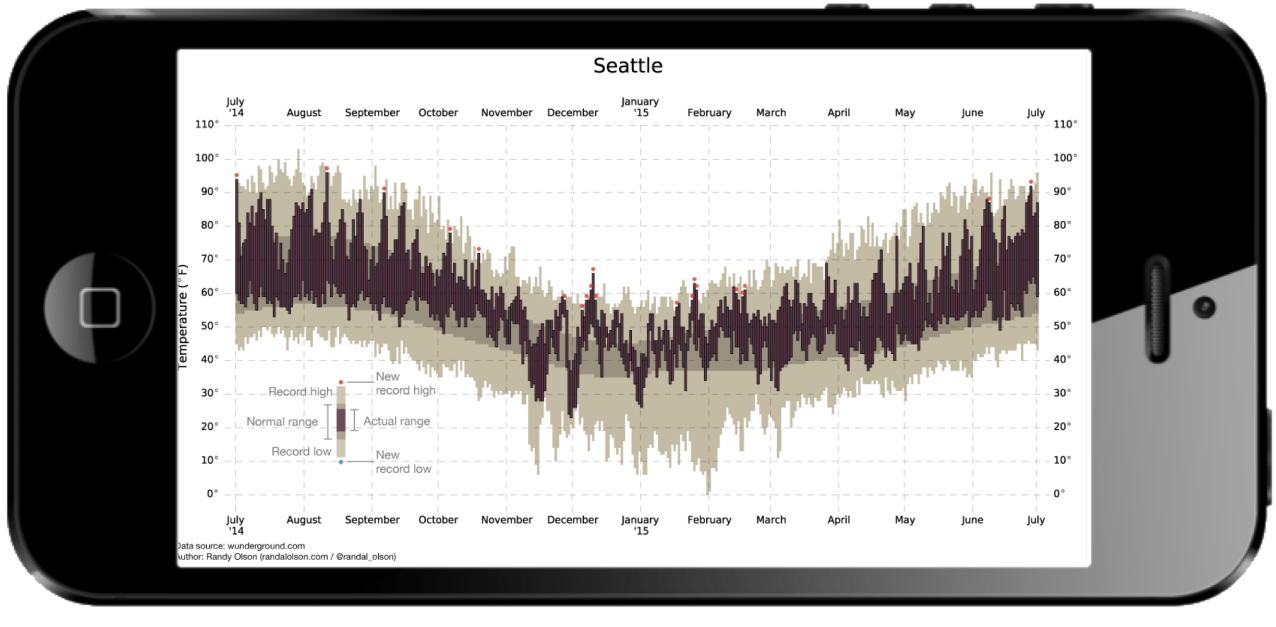


Precipitation (in inches)




New York
T W T F S S M T W T
100°
90°
80°
70°
60°
50°
40°
San Francisco
T W T F S S M T W T

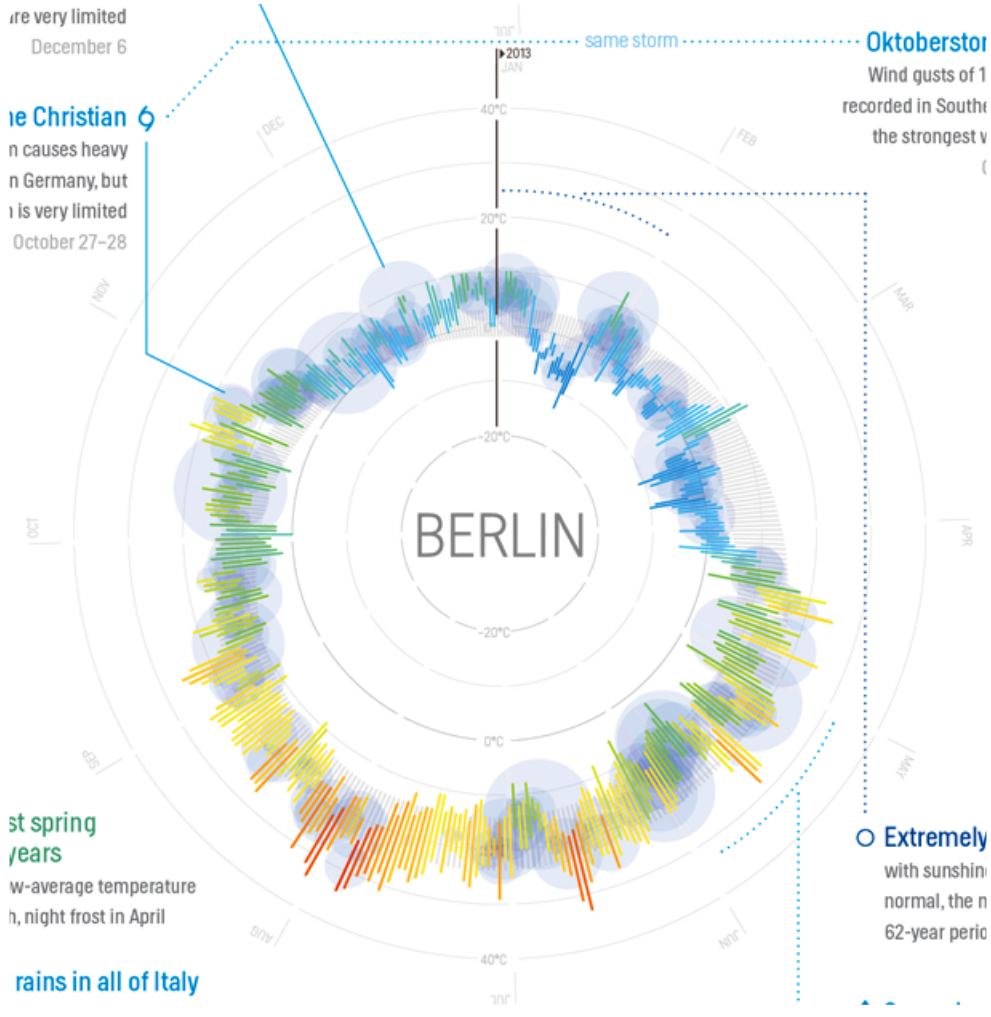

Time In Bed vs. Time Asleep by time of day
EARLIER TO BED, EARLIER TO RISE
MORE LATE NIGHTS, EARLIER MORNINGS
CHILD BIRTH
12:00 AM
3:00 AM
6:00 AM
9:00 AM
JULY
AUG
SEP
OCT
NOV
DEC


Seattle
July '14
August
September
October
November
December
January '15
February
March
April
May
June
July
Temperature (°F)
Record high
New record high
Normal range
Actual range
Record low
New record low
Data source: wunderground.com
Author: Randy Olson (randalolson.com / @randal_olson)

Ranges in Weather Apps

Ranges in Sleep Tracking Apps

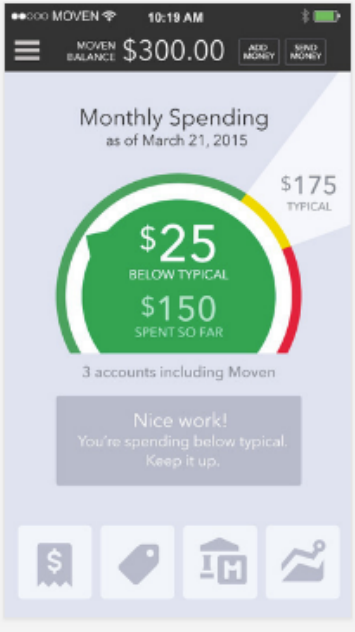
Ranges and Radial Representations



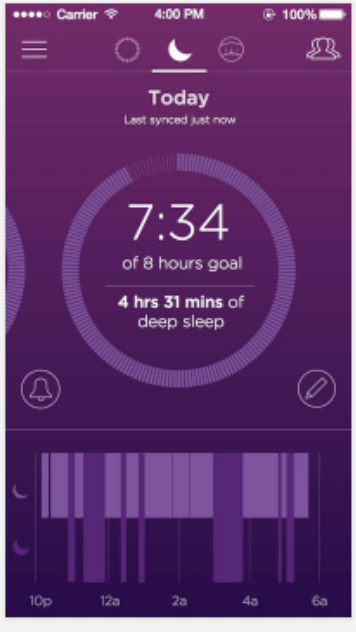
MOBILE INFOVIS

SMARTPHONE TABLET

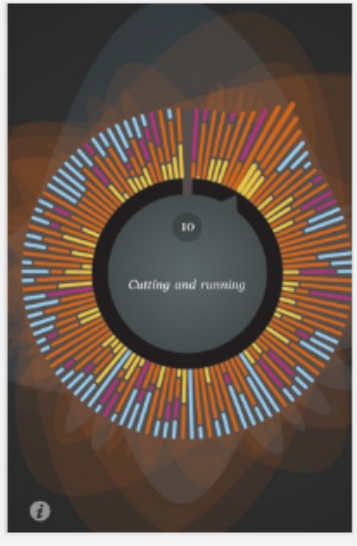
ALL CIRCLE 28 BAR 20 LINE 14 MAP 11 AREA 9 POINT 6 TEXT 4 TABLE 1 NETWORK 1



Moven
Movencorp, Inc.

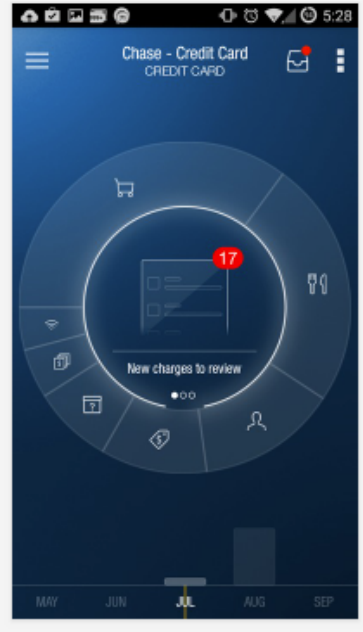


Misfit Shine
MISFIT WEARABLES CORPORAT...

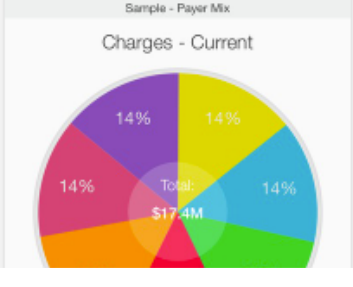


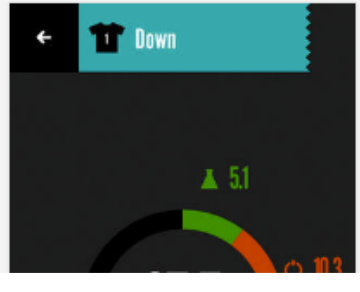
myFry
Stefanie Posavec

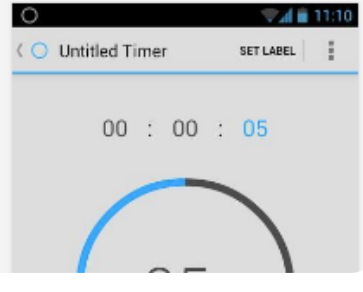
BUDGT
S. Flückiger



BillGuard - Track & Protect
BillGuard, Inc.







A Crowdsourced Experiment on Mobile Phones

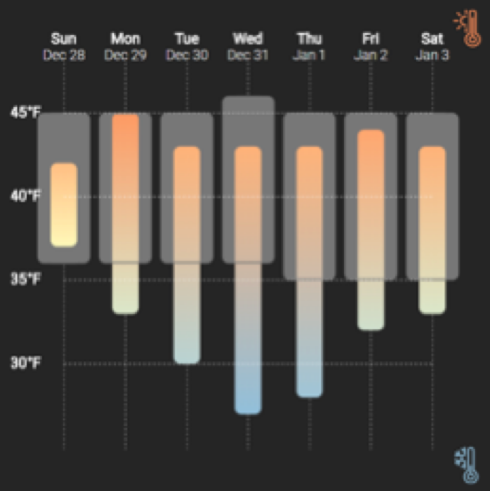
The **first** crowdsourced **visualization evaluation** study performed **exclusively on phones**.

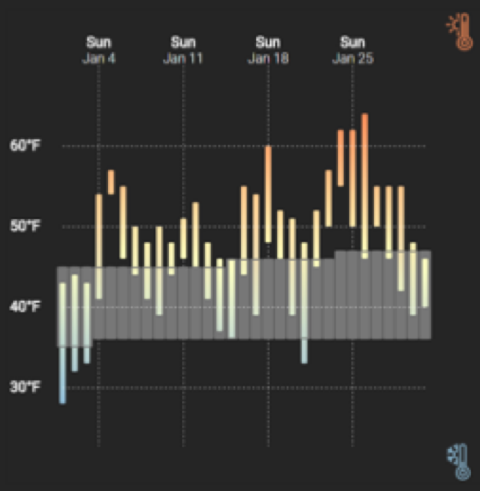
Week

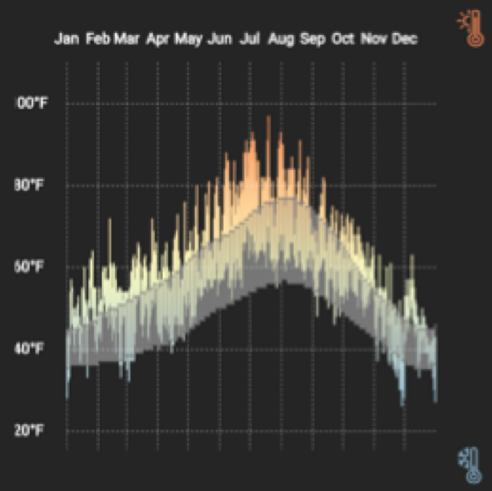
Month

Year

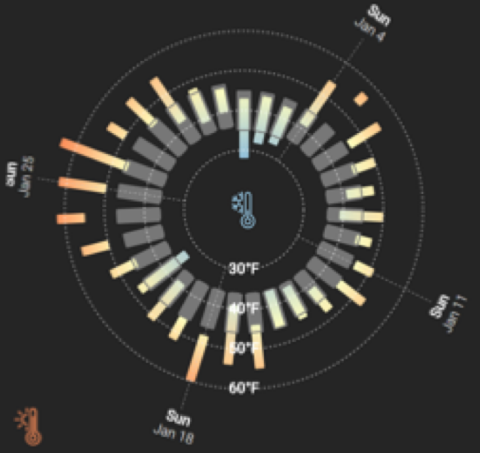
Linear

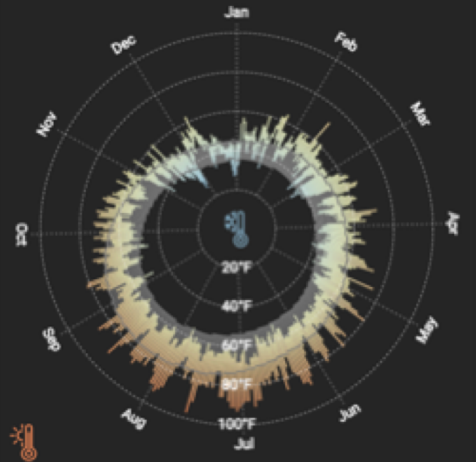






Radial





Thinking Systematically About Tasks

Tasks derived from *A Multi-Level Typology of Abstract Visualization Tasks*. **Brehmer** and Munzner. In *IEEE TVCG* (InfoVis 2013):

- **Locate** Dates
- **Identify** Values
- **Locate** Extreme Values
- **Compare** Values
- **Compare** Ranges

Dependent Measures

For each trial:

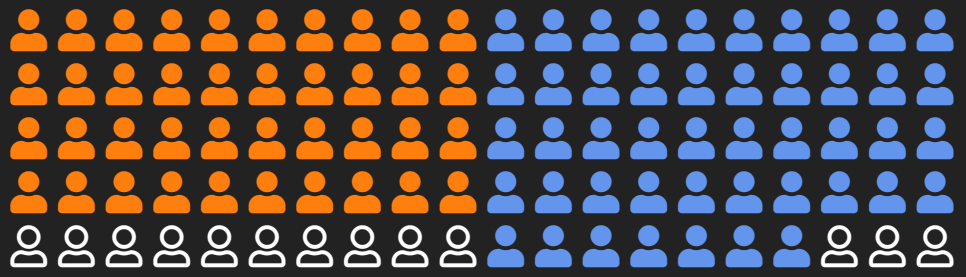
- Trial completion time
- Response accuracy

At each level of granularity:

- Preference: Linear or Radial
- Confidence: Low to High

Participants

Temperature (N = 40), Sleep (N = 47)



84 trials per participant, using their own phone.

Radial or Linear?

Detailed statistics are provided in:
Visualizing Ranges over Time on Mobile Phones: A Task-Based Crowdsourced Evaluation.
Brehmer, Lee, Isenberg, and Choe. In *IEEE TVCG* (InfoVis 2018). aka.ms/ranges-tvcg.

⏱ People are, in general, **slower with radial** representations.

✔ Accuracy appears to be **data-** and **task-dependent**:

e.g., **less accurate with radial** when **identifying** and **locating** values in absence of seasonal variation.

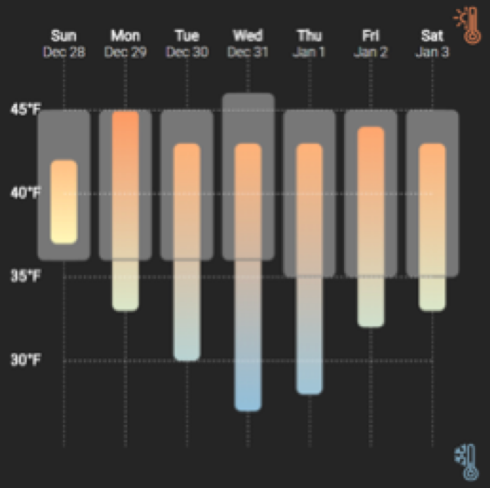
👍 People **prefer** and are **more confident** with **linear** representations.

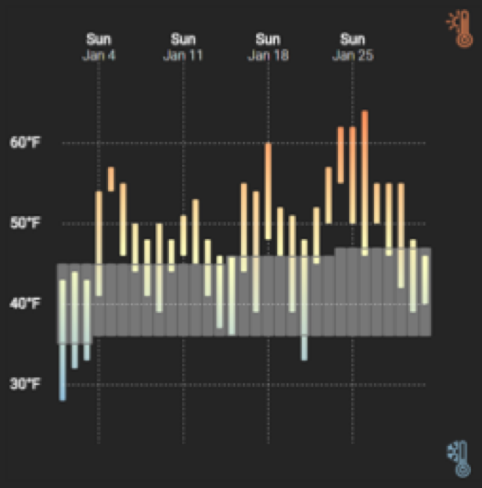
Week

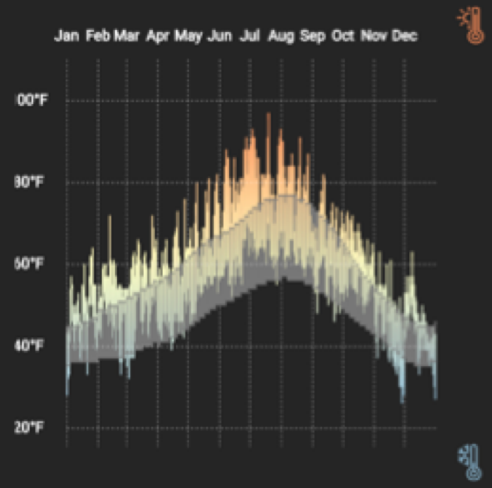
Month

Year

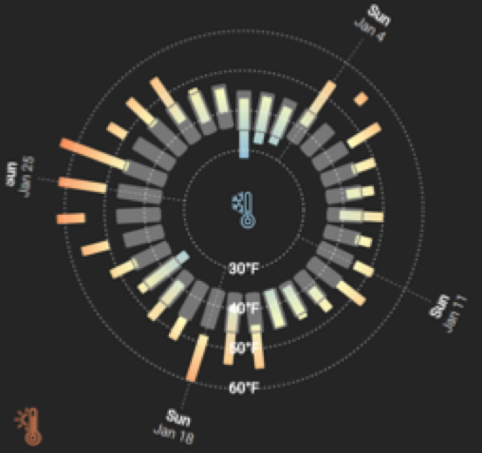
Linear

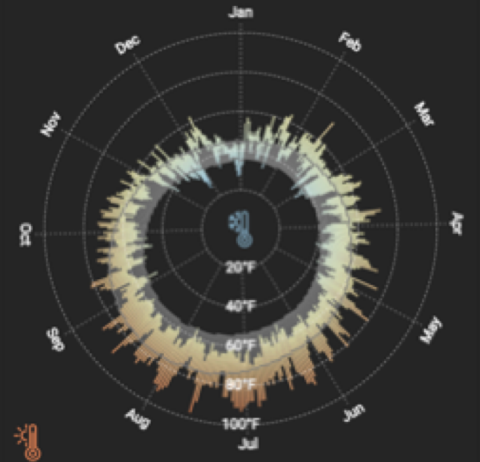






Radial





Week vs. Month vs. Year

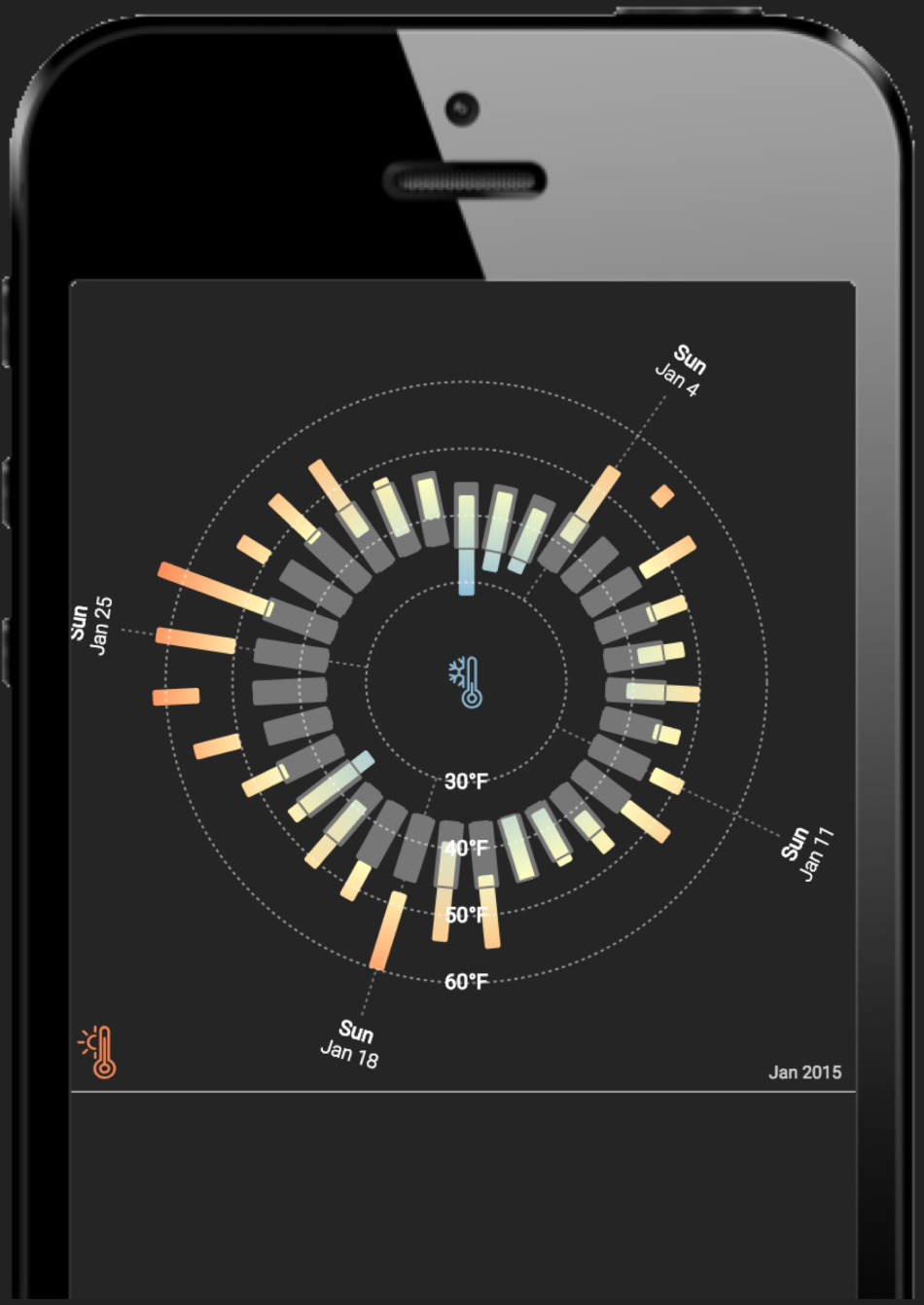
Detailed statistics are provided in:
Visualizing Ranges over Time on Mobile Phones: A Task-Based Crowdsourced Evaluation.
Brehmer, Lee, Isenberg, and Choe. In *IEEE TVCG* (InfoVis 2018). aka.ms/ranges-tvcg.

People are typically **slower with a month than with a week** of ranges.

For **some tasks**, people were **less accurate with a month than with a year**.

e.g., **seasonal variation** in annual temperature appears to be **beneficial** for locating extreme values.

Temperature (L) and Sleep (R) don't follow monthly cycles.


Sun
Jan 4
Sun
Jan 11
Sun
Jan 18
Sun
Jan 25
30°F
40°F
50°F
60°F
Jan 2015


Sun
Jan 1
Sun
Jan 8
Sun
Jan 15
Sun
Jan 22
Sun
Jan 29
8 PM
6 AM
10 AM
Jan 2012

Ranges Over Time on Mobile Phones: Conclusions

Is a **cycle meaningful** in the context of the data?

Does the task involve **locating** values? Or **comparing** them?

Is **efficiency** important?

Locating values quickly? → Choose **Linear**.

Comparing values (and unconcerned with speed)? → Choose **Radial** or **Linear**.

Ranges Over Time on Mobile Phones: Opportunities

More research is needed to **assess visualization design choices** on mobile phones.

- aka.ms/ranges | (mobile only) experimental app.
- github.com/Microsoft/RangesOnMobile | open source app and analysis.
- medium.com/multiple-views-visualization-research-explained | blog post for practitioners.

Outline

· What is **expressive information design**?

· My **background**, **methods**, and **values**

· **Focus** section 1: *Considerations and tools for expressive information design*

· **Focus** section 2: *Expressive information design for mobile devices*

· **Ongoing** and **future** research

· Why **SIAT**?

Expressive Info. Design for Mobile Devices: Recent

A Comparative Evaluation of Animation and Small Multiples For Trend Visualization on Mobile Phones.
Brehmer, Lee, Isenberg, and Choe. Working paper, Jan. 2019.

aka.ms/multiples | (mobile only) experimental app.

Expressive Info. Design for Mobile Devices: Ongoing

Discoverable Interactions for Navigating & Selecting Time-Varying Data on Mobile Phones.
Brehmer, Lee, Collins, and Hinckley.

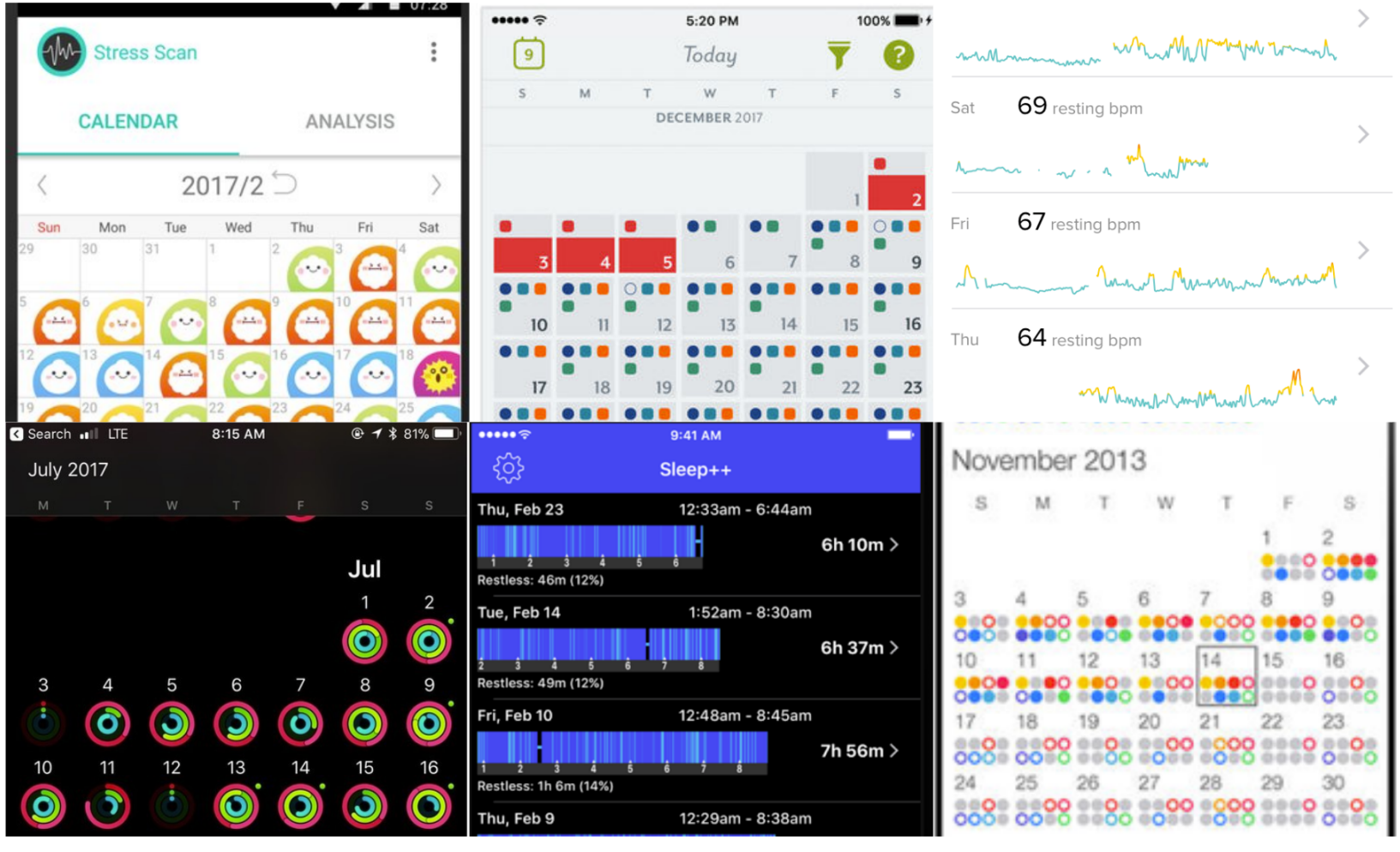
Motivation: few people interact with interactive news graphics beyond scrolling.

Many interactions anticipate a desktop context, but most of the audience is **using a mobile device**.

UI elements for navigating multidimensional time-varying data occupy **too much screen real estate**.

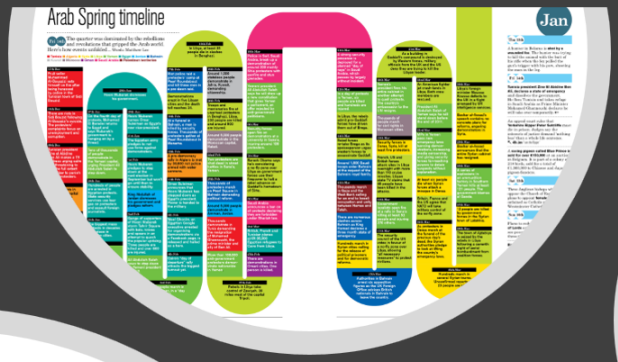
Expressive Info. Design for Mobile Devices: Planned

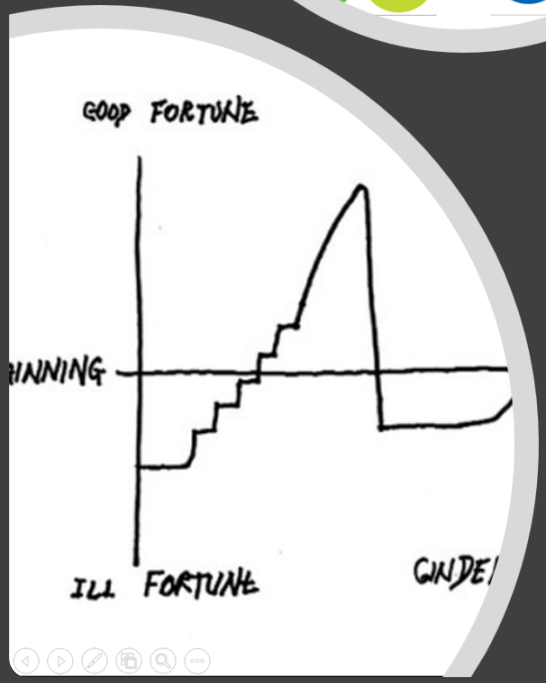
Smaller Multiples: Assessing Multidimensional Glyph Design on Mobile Phones.
Brehmer, Lee, Isenberg, and Choe.

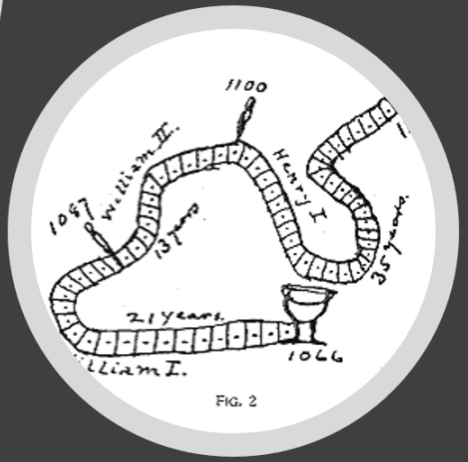


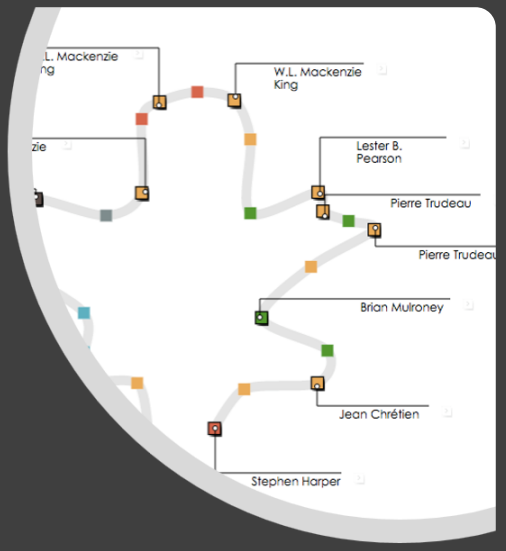
Considerations for Expressive Info. Design: Planned

The Performative and Whimsical Drawing of Timelines with Pen + Touch Interaction.
Planned work.









Opportunities for Expressive Information Design

Future Research Directions

Opportunities for Expressive Information Design (1/2)

Designing and evaluating **inviting** and **memorable** techniques for **presenting information**.

Widening the scope of data types: e.g., **spatiotemporal** data, **dynamic networks**.

Collecting and **assessing** design choices from the **research** and **practice** communities.

Opportunities for Expressive Information Design (2/2)

Measuring audience **graphicacy*** (visual / data / statistical literacy) and identifying ways to **boost** it.

Information design for an audience with a **limited attention span**.

Mobile-first and **mobile-only** information design (and addressing the **scarcity of research**).

More **laboratory-** and **crowd-based experimental** work to assess alternative design choices.

Democratizing Expressive Information Design

Individuals: Visualization of **personally-relevant** information for making decisions in daily life.

Presenters: Interactive design tools for **those without programming expertise** or ample time;

Recomendations and considerations for **those without design expertise**.

e.g., small or local newsrooms, educators, cultural institutions, curators of digital collections.

Outline

- What is **expressive information design**?
- My **background**, **methods**, and **values**
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- **Focus** section 2: *Expressive information design for mobile devices*
- **Ongoing** and **future** research
- Why **SIAT**?

Why SIAT?

- Students trained in **information design**, **visual communication design**, and **interaction design**.
- Potential to collaborate on projects on **resource conservation**, **health**, and **cultural heritage**.
- Research spanning **interactive computing**, **design**, **people**, & the **science of interaction**.
- **Cascadia** (Vancouver, Victoria, Seattle) is the world's **best place** to do **visualization research**.

- It is the ideal place to establish an **Expressive Information Design** group.

Constraints and Opportunities for Expressive Information Design

Matthew Brehmer · Microsoft Research · @mattbrehmer

aka.ms/siat1901 | slides


RUCKER


Darren EDGE
MSR UK


Nathan EVANS
MSR


Ken HINCKLEY
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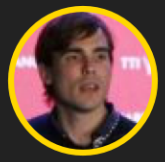
Kate LYVYNETS
MSR


Michel PAHUD
MSR


Nathalie
MSR


SWORTH


Chris WHITE
MSR


Fereshteh AMINI
Microsoft


Benjamin BACH
U. Edinburgh


Eun Kyoung CHOE
U. Maryland


Raimund DACHSELT
TU Dresden


Alyssa GOODMAN
Harvard U.


Bernd HE
RWTH A


ULLMAN
ern U.


Petra ISENBERG
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Ricardo LANGER
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Hanspeter PFISTER
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Christopher COLLINS
UOIT


Christoph
ENA


cGUFFIN


Karthik BADAM
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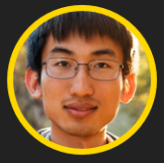
Philipp EICHMANN
Brown U.


Nam Wook KIM
Harvard U.


Yea Seul KIM
U. Washington


Arjun SRINIVASAN
Georgia Tech


Donghao REN
UC Santa Barbara


Haiju
U. Toro

Supplemental

Evaluating Expressive Information Design Tools

Reflecting on the Evaluation of Visualization Authoring Systems.
Ren, Lee, **Brehmer**, and Henry Riche.
In Proc. *BELIV 2018 (Evaluation and Beyond - Methodological Approaches for Visualization)*.

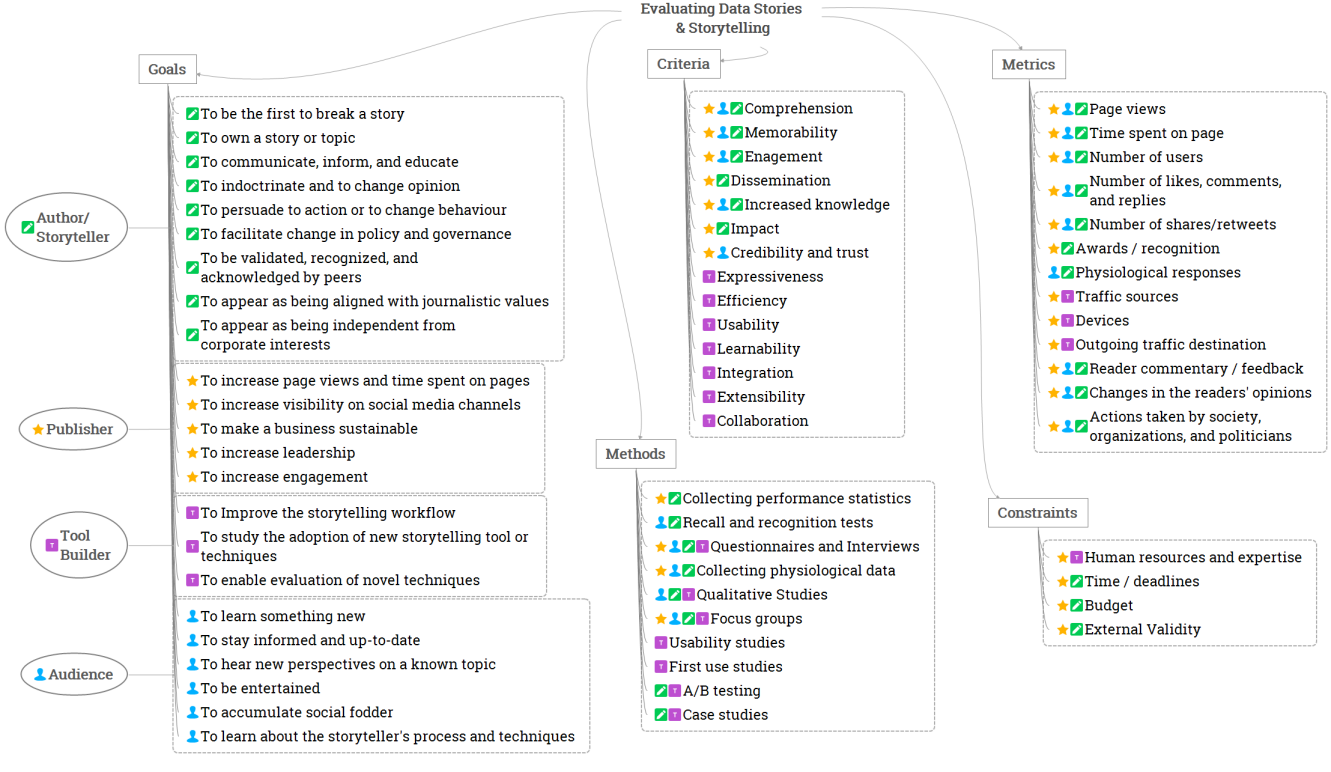
Lessons from evaluating tools incl. **Timeline Storyteller**, **ChartAccent**, & **Charticulator**.

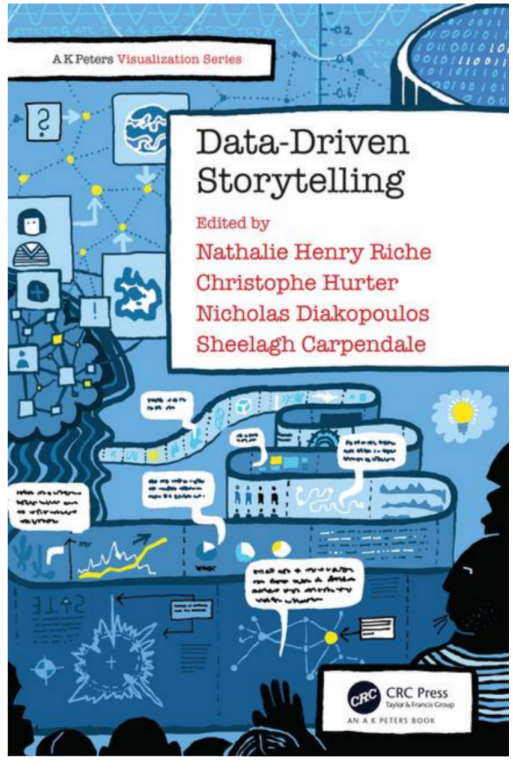
Emphasis on **post-deployment content analysis** and **chart reproduction studies**.

aka.ms/renbeliv18

Beyond Tools: Evaluating Data-Driven Stories

Evaluating Data-Driven Stories & Storytelling Tools.
Amini*, **Brehmer*** (equal contribution), Bolduan, Elmer, and Wiederkehr.
In *Data-Driven Storytelling* (CRC Press 2018).





A summary of **perspectives**, **criteria**, **methods**, **metrics**, and **constraints** w.r.t. **evaluation**.