Helping people see and understand data
Maureen Stone, Sr. Manager Tableau Research

Roadmap
What does Tableau do?
Key technologies
Designing Tableau
Tableau Research

Tableau helps people see and understand data

Suppose you have data about hurricanes
In the old days...
Write SQL to query your database
Use a graphing package to create a graph
Domain expert needs two other experts, at least!

With Tableau
Connect to your database
See your data schema
Use the Tableau GUI to explore and visualize your data

A few key points
Tableau is designed for enterprise data
  Large, aggregated
  Many different data sources
Tableau's target users are not data analysts
  Domain experts, people with the questions
Tableau design goals are challenging
  Easy to use, but supports deep analysis

Key technologies
Computer
  Graphics
  Human
  Computer
  Interaction

Databases
The Polaris Formalism

“A formal language for describing table-based graphic presentations of multidimensional data that integrates analysis and visualization.”


How this works

Pills on shelves
- Pills define what data
- Shelves describe layout intent

Generates a SQL query
- Generates a visual specification
- Visual spec rendered into a view

Generates a query

```sql
SELECT Candidate, AVG(Amount)
FROM FEC
WHERE Date > '2015-01-01'
AND StillRunning is true
GROUP BY Candidate
```

Generates a visual spec

```sql
DISPLAY [AGG: Avg Amt] ON ROWS,
[Candidate Name] ON COLUMNS
[Candidate Name] ON COLOR
AS BAR
FROM database
```

Allow people to easily and incrementally change the data they are looking at and how they are looking at it

Chris Stolle, Tableau co-founder

In addition...

Data transformations
  Calcs, before and after the query
View transformations
  Layout, formatting
  Compose into multi-view dashboards
  “Switzerland” of data

Designing Tableau

Cycle of analysis

Task analysis: see and understand data

Analytic flow

VizQL

https://www.tableau.com/products/desktop
### Tableau UX design

Incremental, Expressive, Unified, Direct, Effective

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### Important for the flow

Show Me automatic presentation
- Automatic marks
- Rule-based recommendations
- Formal specifications


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### Demo Show Me

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### Help people share their insights

Find data → Query data → Create visual mapping → Create artifacts → Develop insight → View data → Act (share)

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### Key points

Tableau users create **workbooks**
- Views, dashboards, story points
  - Data sources, embedded or separate

For other people
- Authors create and “publish” analytic artifacts
- “Consumers” work from these artifacts
  - Reports, interactive dashboards, analytic applications

Good visual design is very important
Fast, easy, beautiful
Need the right data to get the right answers

Tableau Prep (2018)

Data is rarely a simple table
- Multiple data sources
- Data shaping (joins, unions, pivots)
- Different shapes answer different questions
- Data often needs “cleaning”
  - Errors, wrong types, missing values
- Tableau data is usually not static

Tableau Prep creates data flows

Tableau Research
research.tableau.com
### Tableau Research

**History**
- Started 2012, by Jock Mackinlay
  - Maureen Stone, Anushka Anand, Justin Talbot, Robert Kosara, Vidya Setlur
- 2017—part of RX (~11 people + Maureen as manager)
- 2018—part of OCTO (ditto)

**Why?**
- Tableau innovation based on academic research (Stolte's thesis)
- Continue this by creating an industrial research lab for Tableau

### What do we do?

**We offer to Tableau**
- Academic and prototyping research skills
- Domain-specific expertise, both technical and strategic
- Participation in the academic research community

**That is...**
- Read things, write things, build things
- Consult internally—both solving problems and limiting risk
- Make Tableau visible and influential; build our own skills/careers

### Goal: Make all this easier, more effective

- Find data
- Combine, shape and clean data
- Query data
- Create visual mapping
- View data
- Create artifacts
- Act (share)
- Develop insight

### Color for data

**Maureen Stone**

- Designed, and redesigned all of Tableau's data colors

**Principles**
- Functional yet beautiful
- Palettes and mappings, not color pickers
- Started in 2004, redesigned in 2010

- Drove a research agenda in color for visualization
Storytelling

Robert Kosara

Tableau Story points feature

Tapestry Conference

Blogs, talks, podcasts, research papers


Query pipeline improvements

Justin Talbot

Analytic Query Language (AQL)

A high-level, strongly typed functional programming language that expresses all the computation required to produce the underlying data for rendering analytic views in Tableau.

Query-graph visualizer

See and understand Tableau’s query ecosystem (GitHub)

Rick Cole

ML + Query optimization


Tableau “Ask Data”

Vidya Setlur & Melanie Tory

Started as a research project (Eviza, 2015)

Create a research + dev team

Acquire Cleargraph, build a bigger team

Ask Data feature released 2018

Ongoing NLP/NLI research

Vidya Setlur, Melanie Tory

Marti Hearst (visiting scientist)


Color research

Color names


Color and size


Color affect


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What’s coming next?

Get the right data
- New data for new questions
- Text “wrangling” for semi-structured text
- Data sequences, events, intervals
- Relationship data (aka graphs)
- Performance
  - Query optimization
  - Data sketching
  - UDFs (with the Hyper team)

Enhanced analytic flow
- Analytic “conversations”
  - NLP, NL + Visualization
  - Understanding intent, pragmatics in this context
- More automation
  - Enhanced Show Me
  - Suggestions, recommendations
  - Data semantics

Increase understanding
- Encourage skepticism
  - Black hat visualization
  - Visual summaries
  - “Spell checking” for visualization
- Integrate computational analytics
  - Data science models (stats, ML)
  - Human in the loop, not black box
  - Answer and explain

Improve communication
- Dashboards
  - Who uses them and how?
  - “Second cycle of analysis”
- Presentation
  - More visually expressive
  - Easier to create and style
  - Suitable for Tableau data

Tableau Vancouver
- Tableau development office, downtown Vancouver
- Head: Jesse Calderon
- Org: Augmented Analytics
  - Adding “AI” to Tableau’s products
  - Recommendations, Ask Data, Explain Data
- Tableau Public
  - Two DFP projects already (Tamara)

300-545 Robson St., Vancouver, B.C.

Maureen Stone, Tableau Research
6/19/2019

Designing for People Seminar, UBC
In summary

People need to understand their data
But understanding data is hard
Let’s build tools to help them

We help people see and understand data