### Viz Theory
- block feedback: many people not seeing value of lecture material
- module covers both visualization tooling/code and visualization theory
  - lectures teach theory (assessed with both buzz and reasoning)
  - are you coding the right thing?
  - tutorials teach tooling/code
  - how to code it
- lab 1: 25% mechanics, 49% code, 21% theory, 5% writing
- milestone 1: 5% mechanics, 65% theory, 30% writing
- milestone 2: 15% mechanics, 45% code, 38% theory, 2% writing
- milestone 3: 7% mechanics, 10% code, 75% theory
- today: in-class practice on theory to help you do well on milestone 3
  - bar is set considerably higher for milestone 3 than for milestones 1 & 2
  - now that more theory has been covered in class.

### Normalized vs Absolute

<table>
<thead>
<tr>
<th>Normalized</th>
<th>Absolute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viz theory</td>
<td></td>
</tr>
<tr>
<td>Data</td>
<td></td>
</tr>
<tr>
<td>encoding</td>
<td></td>
</tr>
</tbody>
</table>

### How to handle complexity: 4 families of strategies

<table>
<thead>
<tr>
<th>Manipulate</th>
<th>Change</th>
<th>Facet</th>
<th>Filter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create</td>
<td>Select</td>
<td>Partition</td>
<td>Aggregate</td>
</tr>
<tr>
<td>Change</td>
<td>Navigate</td>
<td>Superimpose</td>
<td>Embed</td>
</tr>
<tr>
<td>Select</td>
<td>Filter</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Scenario
- data: room occupancy rates
  - 1 building: 200 rooms across 4 floors
  - measured every 5 min, duration 1 day
  - facet across multiple views
  - reduce items/attributes within single view
  - is a single static chart good enough?
  - should you derive any useful additional data?

<table>
<thead>
<tr>
<th>Design</th>
<th>Justify Idiom Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>propose idioms (visual encoding, interaction)</td>
<td></td>
</tr>
</tbody>
</table>

### Cardinality
- Marshall: 68 cities * 40 years * 4 crime types = 10,880
- Wine: 130K * 4 = 650,000
  - spatial (hierarchical), quantitative, categorical, free-form text

### Population maps trickiness
- beware!
- absolute/counts vs normalized/relative
- population density per capita
- investigate with Ben Jones Tableau Public demo

<table>
<thead>
<tr>
<th>Beware!</th>
<th>Consider</th>
</tr>
</thead>
<tbody>
<tr>
<td>absolute/counts vs normalized/relative</td>
<td></td>
</tr>
<tr>
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<td></td>
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### Consider
- what’s the cardinality of the data?
- is a single static chart good enough?
- should you derive any useful additional data?
- what are trade-offs between
  - filtering to see one chart at a time
  - showing all side by side with small multiples
  - superimposing all on top of each other

### Change
- facet across multiple views

### Select
- reduce items/attributes within single view

### Filter
- filtering to see one chart at a time

### Embed
- superimposing all on top of each other

### Design Choices (Additional Context)

### Idiom: choropleth map
- use given spatial data
  - when central task is understanding spatial relationships
- data
  - geographic geometry
    - table with 1 quant attribute per region
  - encoding
    - use given geometry for area mark boundaries
    - sequential segmented colormap [more later]
    - (geographic heat map)
Derive

Idioms: Bayesian surprise maps
- use models of expectations to highlight surprising values
- confounds (population) and variance (sparsity)

Idioms: radial bar chart, star plot
- radial bar chart
  - radial axes meet at central ring, line mark
- star plot
  - radial axes meet at central point, line mark
- bar chart
  - rectilinear axes aligned vertically
- accuracy
  - length unaligned with radial
  - less accurate than aligned with rectilinear

Idioms: glyphmaps
- rectilinear good for linear vs nonlinear trends
- radial good for cyclic patterns

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Idioms: Idiom: Thursday
- Idiom: Query
  - identify
  - compare
  - summarize

Radial vs Rectilinear

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Radial vs Rectilinear
### Scenario
- **data**: many metrics across many machines
  - 100 machines, belonging to 20 companies
  - 4 metrics measured every 5 min, duration 1 month
  - CPU, memory, disk I/O, network traffic
  - time series + company name + company sector (finance/tech/entertainment/other)
- **task**: forensic analysis to determine possible causes of crashes

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  - superimposing on top of each other
- multi-scale structure to exploit?
  - aggregate, zoom, slice/dice, filter?
- can you normalize the data? should you - always vs on demand?
- how to handle multi-scale space and multi-scale time?
- is spatial information germane or extraneous?

### Next Steps
- Visual Design Process In Depth: **Dear Data**

- Visual Design Process In Depth: **Data Sketches**

- Redesign En Masse: **Makeover Mondays**
  - [http://www.makeovermonday.co.uk/blog/](http://www.makeovermonday.co.uk/blog/)