

# Data Visualization as a Driver for Visual Cognition Research

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Interdisciplinary Research Panel: Discover Pasteur's Quadrant: Four research communities that will inspire your work  
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[www.cs.ubc.ca/~tmm/talks.html#opam17](http://www.cs.ubc.ca/~tmm/talks.html#opam17)

@tamaramunzner

## Interleaved structure

- Things I Currently Say **TICS**
  - that draw on findings from visual cognition about how to visually encode and interact with information
- Things I Wish I Knew **TIWIK**
  - where I'd love to see the visual cognition community do more work!
  - or to hear that the work exists and get pointers to it

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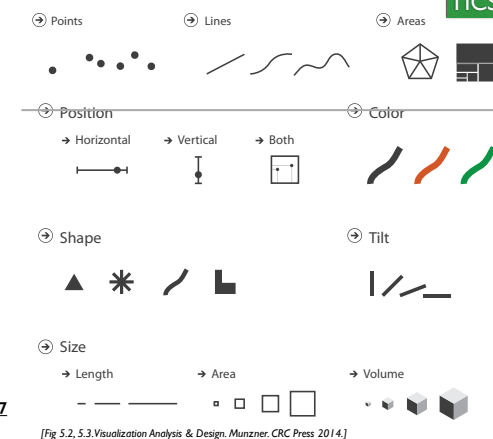
## We have many...

- objects (marks) on the display at once
- visual channels in use at the same time
- views visible side by side
- tasks that users switch between

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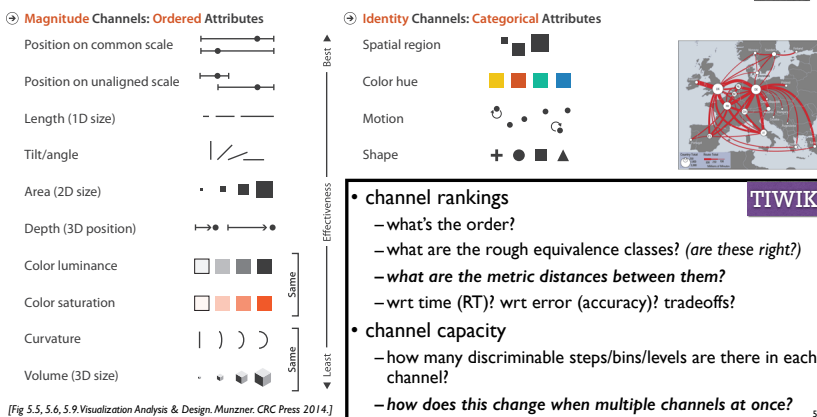
## Objects & channels

- marks (objects)
  - geometric primitives
- channels
  - visual depictions of magnitudes or categories
  - control appearance of marks to convey information



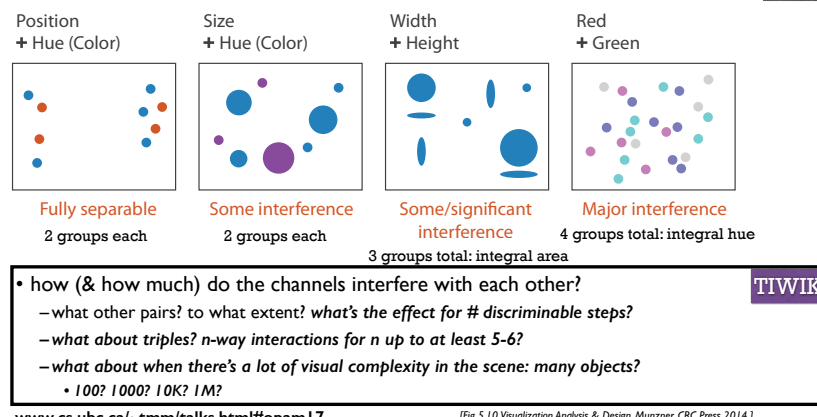
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## Channels: Expressiveness types and effectiveness rankings



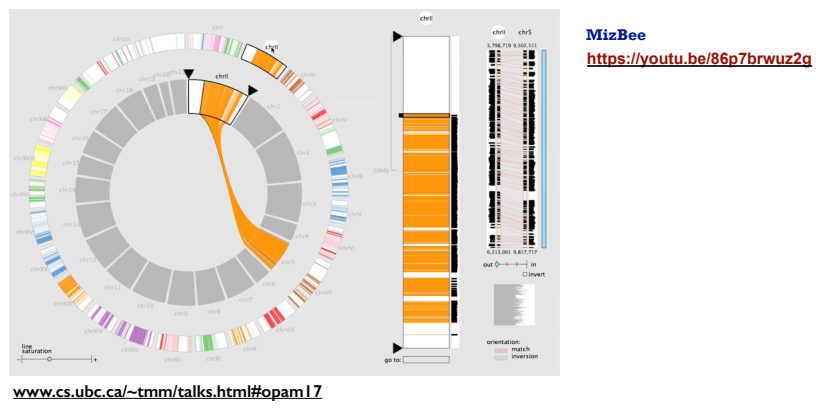
[Fig 5.5, 5.6, 5.9 Visualization Analysis & Design, Munzner, CRC Press 2014.]

## Channels: Separability vs integrality



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## Many marks/objects, many channels, many tasks, many views



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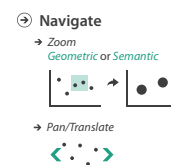
## Channels: Shape

- shape
  - complex combination of lower-level primitives
  - many bins
- how does shape decompose into elements? **TIWIK**
  - I want equivalent of  $L^*a^*b^*$  color space, for "shape space"
    - quantitative metric with equal JNDs along axes
      - eg pointy-ness vs smoothness; open vs closed; ...
    - use for deciding on encoding
    - use for interpolating values

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## Views: memory vs eyes

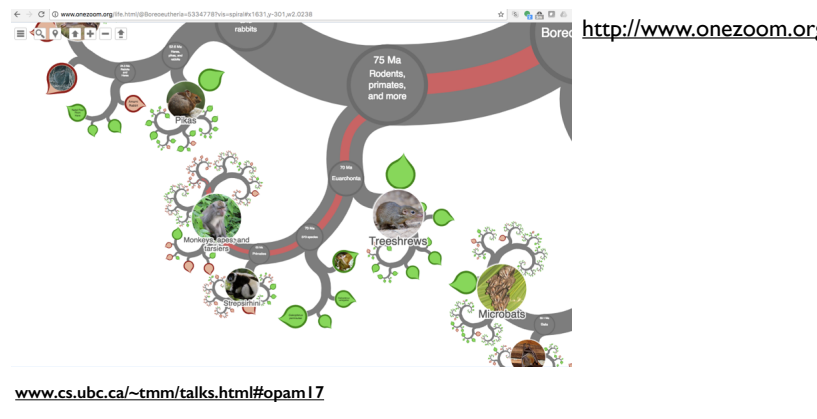
- interactive navigation within view
  - leverage spatial cognition, but rely on memory for previous states



[www.cs.ubc.ca/~tmm/talks.html#opam17](http://www.cs.ubc.ca/~tmm/talks.html#opam17)

[Fig 11.1. Visualization Analysis & Design, Munzner, CRC Press 2014.]

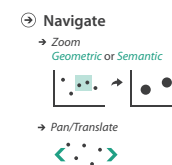
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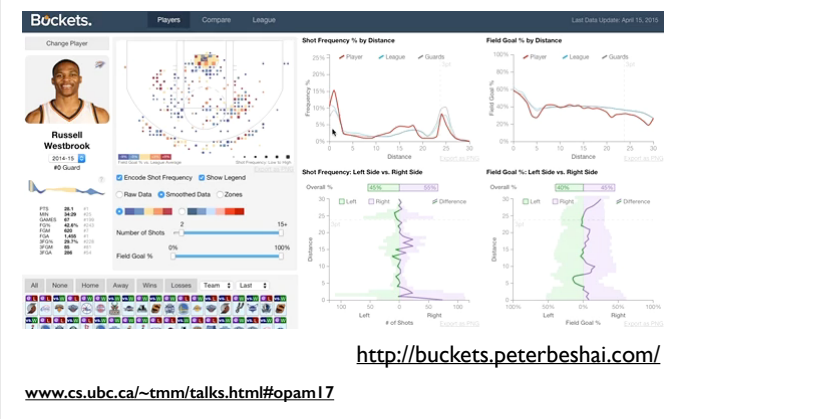
- interactive navigation within view
  - leverage spatial cognition, but rely on memory for previous states
- side by side views
  - low cognitive load to move eyes between juxtaposed views
  - but reduced display area, each view has 1/N pixel budget



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[Fig 11.1. Visualization Analysis & Design, Munzner, CRC Press 2014.]

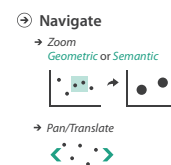
## Views: Multiple linked side by side



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## Views: memory vs eyes

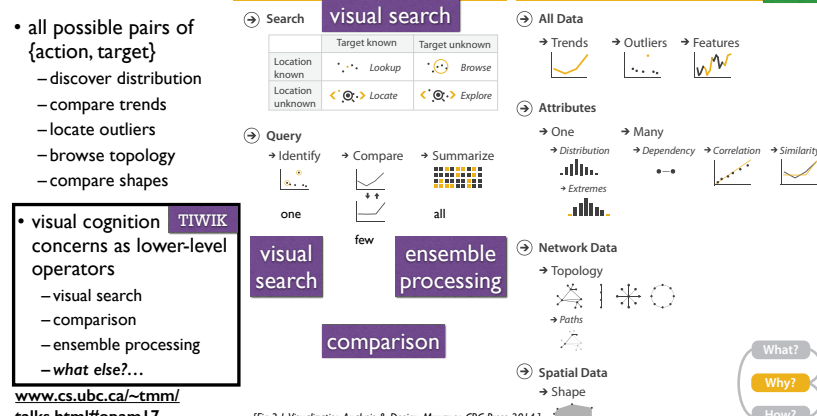
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## Tasks



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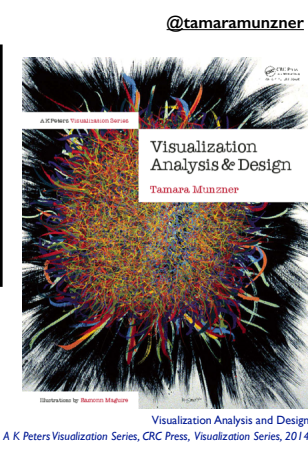
[Fig 3.1. Visualization Analysis & Design, Munzner, CRC Press 2014.]

## Summary

- (many) channels & objects
  - ranking, classes, metric distances, capacity
  - separability / interference
  - shape space
- views
  - tradeoffs of multiple views vs interactive navigation
- tasks
  - from low-level vision operators to high-level vis tasks

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Visualization Analysis and Design, Munzner, A K Peters Visualization Series, CRC Press, Visualization Series, 2014.