

# BaVA: Bayesian Visual Analytics

Scotland Leman, Leanna House – *Statistics*

Chris North – *Computer Science, HCI*

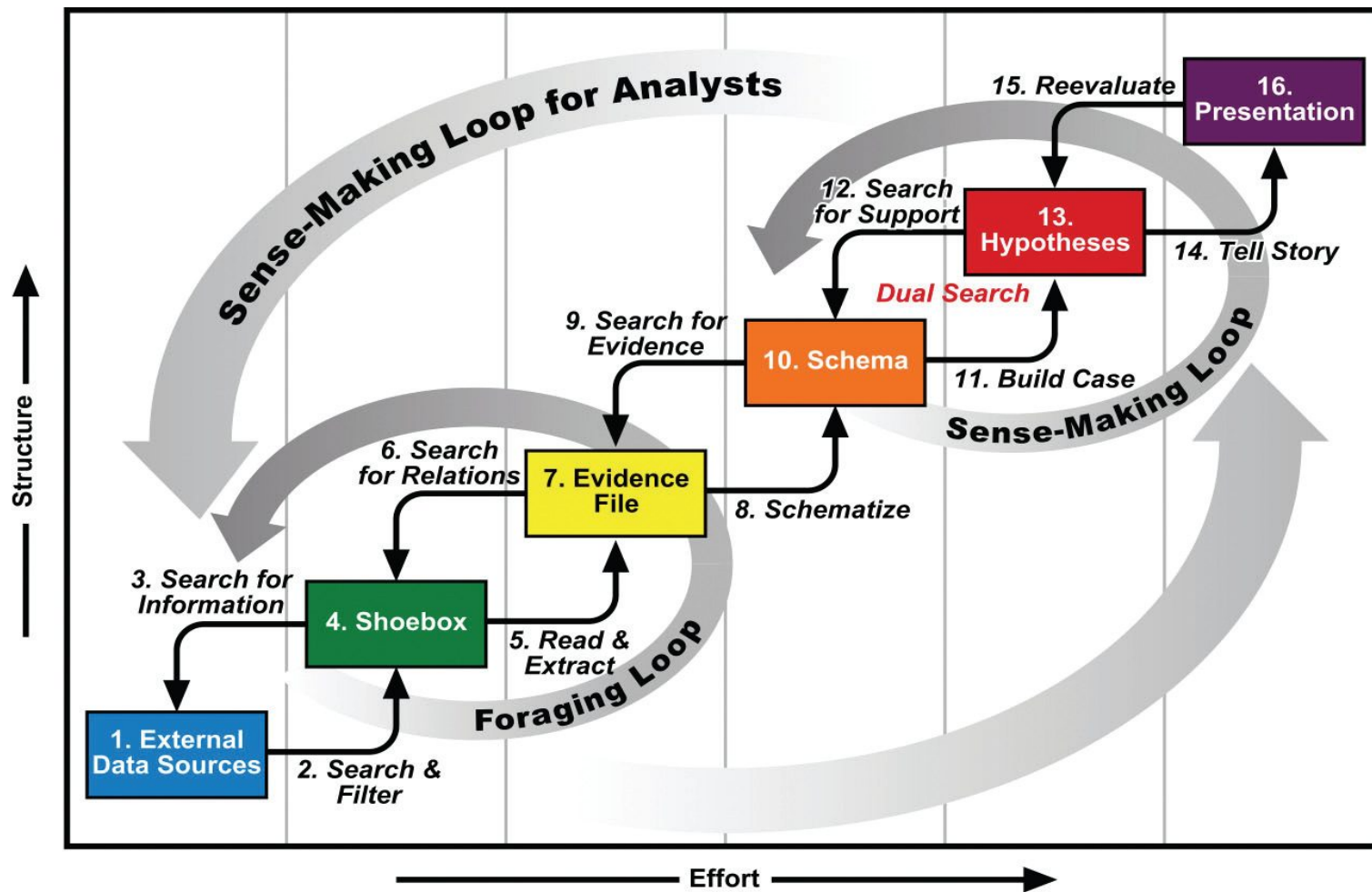
*Virginia Tech*



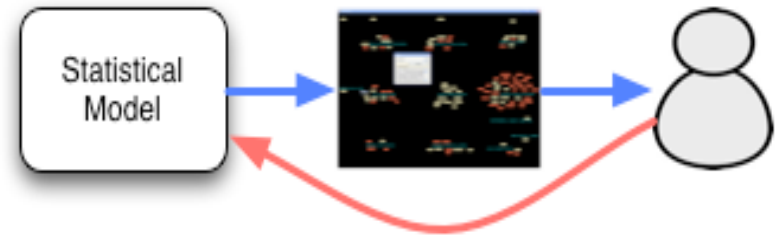
FODAVA



# Sensemaking = Foraging + Synthesis



# Foraging



- Computationally Intensive
- Models filter/extract/mine raw data
- Direct parameter adjustments

Galaxy - Alderwood

File View Tools Capture

16 total selected

Selection History (16/53)

Group	Contribution
Current Selection	<input type="checkbox"/>
1-W- "Alderwood Week ..	<input type="checkbox"/>
3-W- "Alderwood Week ..	<input type="checkbox"/>

% selected within group

Word	Contributi...
washington	<input type="checkbox"/>
valley	<input type="checkbox"/>
program	<input type="checkbox"/>
family	<input type="checkbox"/>
yakima	<input type="checkbox"/>
past	<input type="checkbox"/>
don	<input type="checkbox"/>
held	<input type="checkbox"/>
days	<input type="checkbox"/>

Auto summarize

Summarize

Outliers

Outlier Terms

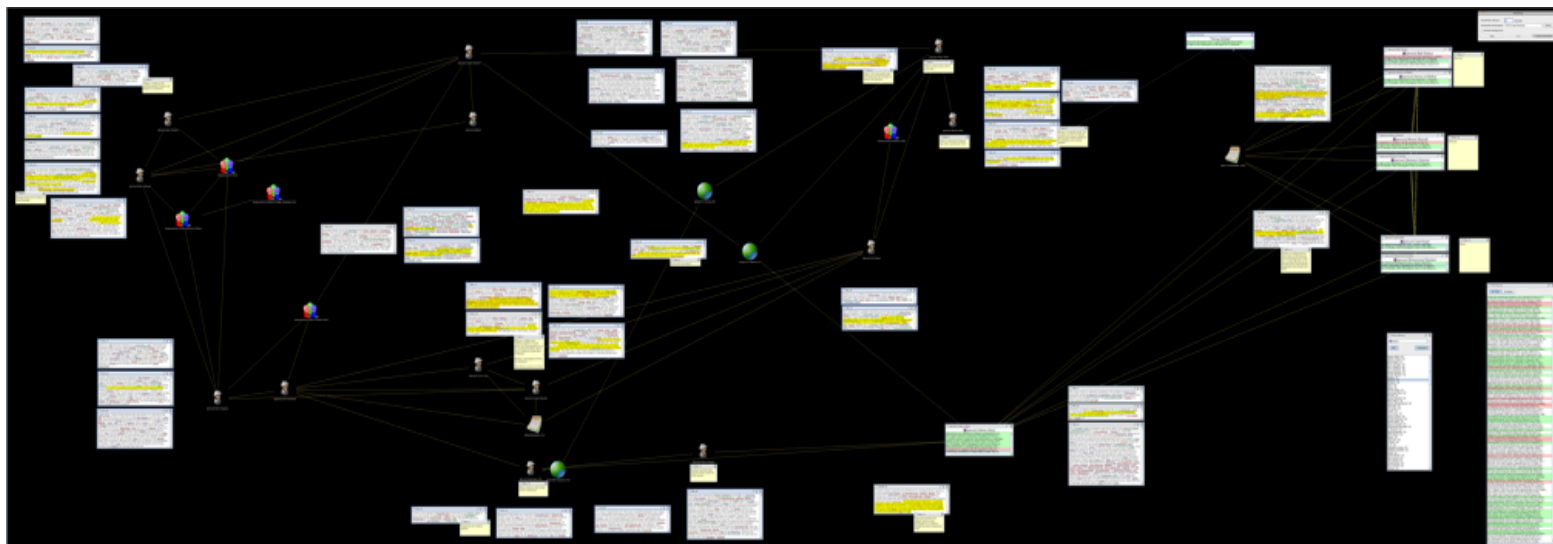
- alderwood
- city
- community
- school

Select: Click or drag to select docs; Shift-click or drag to add to current selection; Alt-click or drag to remove from selection; Shift-Alt-click or drag to select just colored docs.

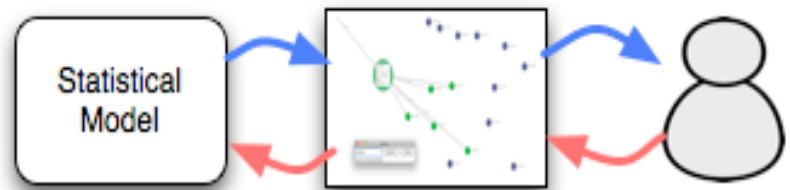
# Synthesis



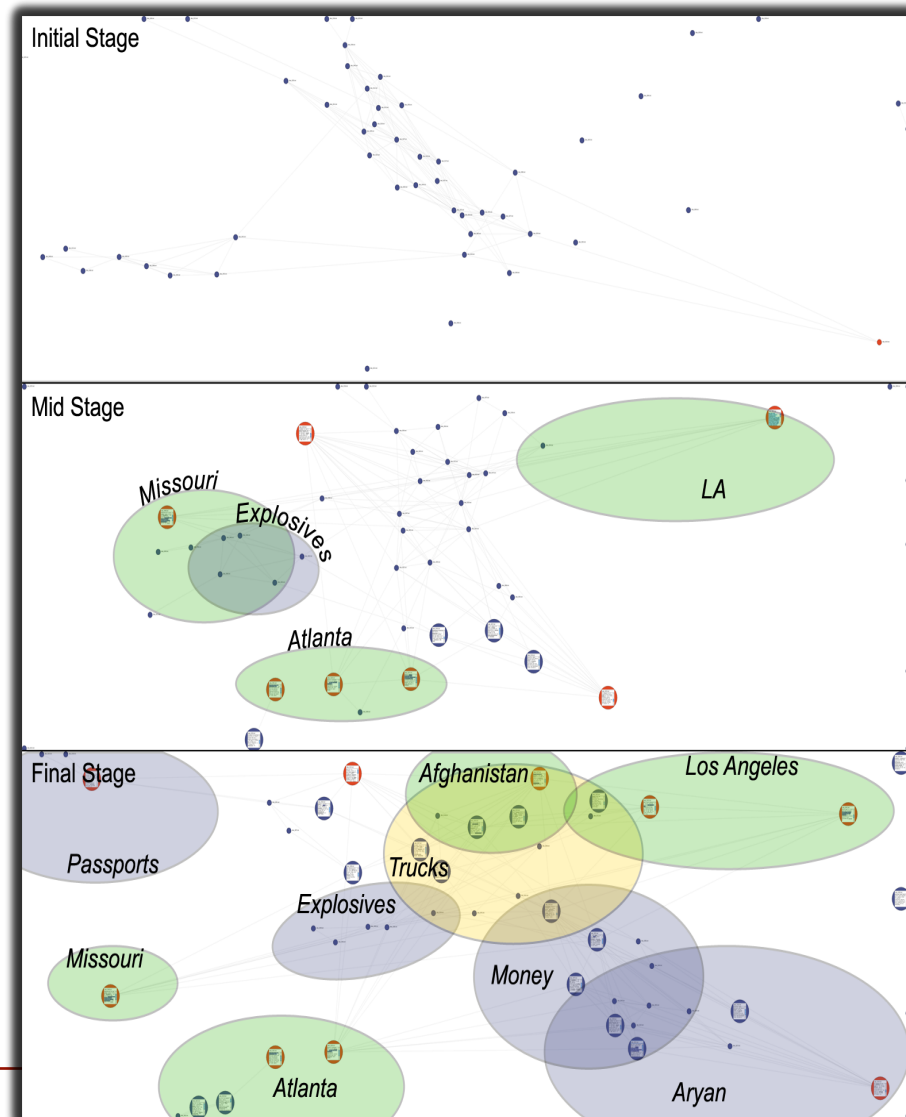
- “Cognitively Intensive”
- Users incrementally organize, combine, link information
- Create spatial structures, clusters, ...
  - Establish *informal* relationships



# Semantic Interaction



- Foraging + Synthesis
- Couple analytic interactions with model updates
  - Document Movement
  - Highlighting
  - Searching
  - Annotation
- Shield analyst from model parameters
- *Incremental formalism*  $\approx$  incremental model learning



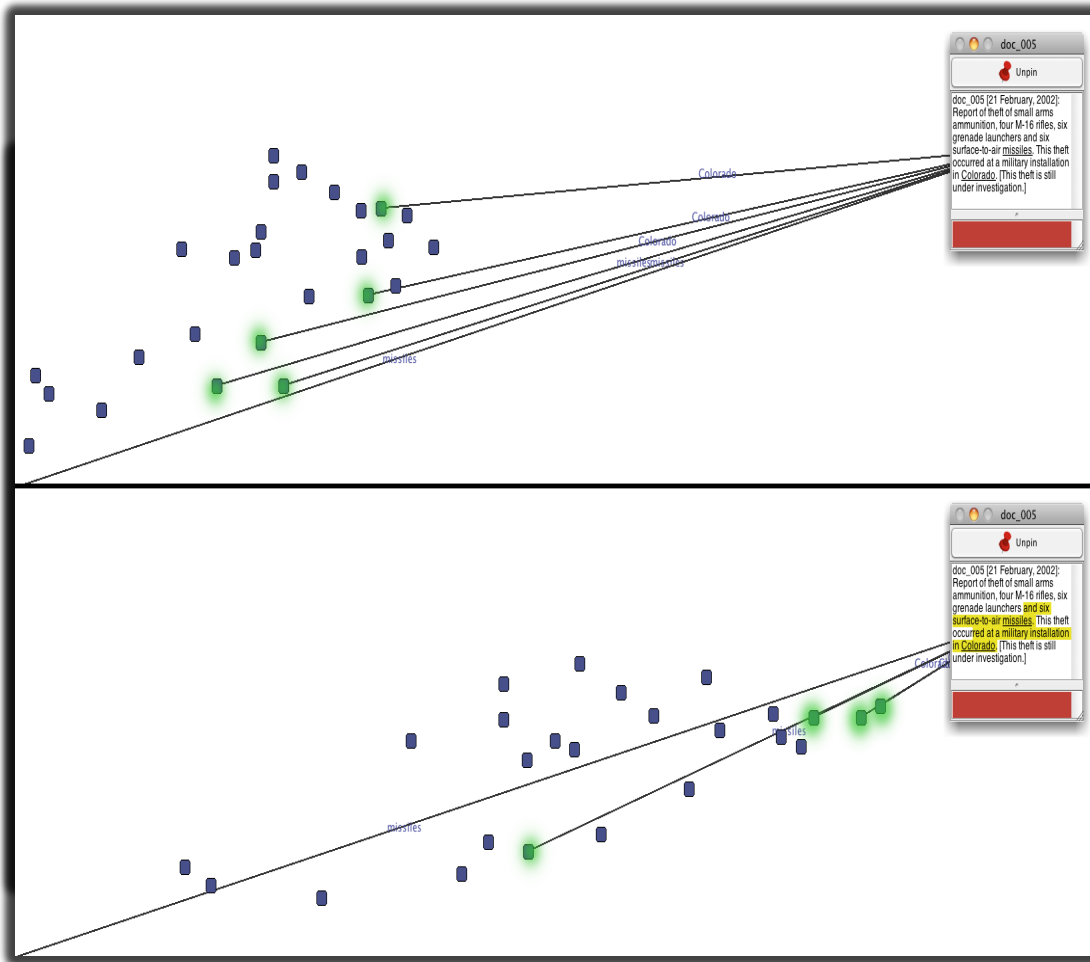
# ForceSpire

- Modified force-directed model
- Semantic interactions add/up-weight terms

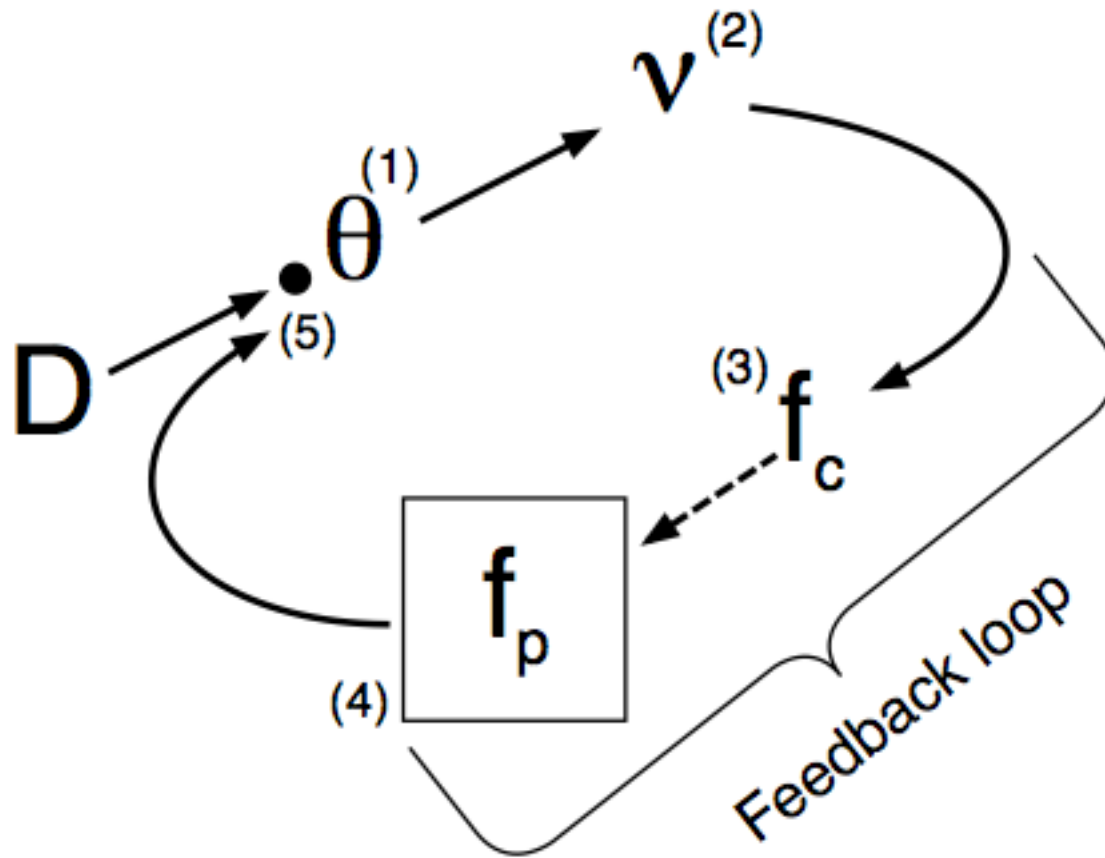
(video)



## Interactive Highlighting:



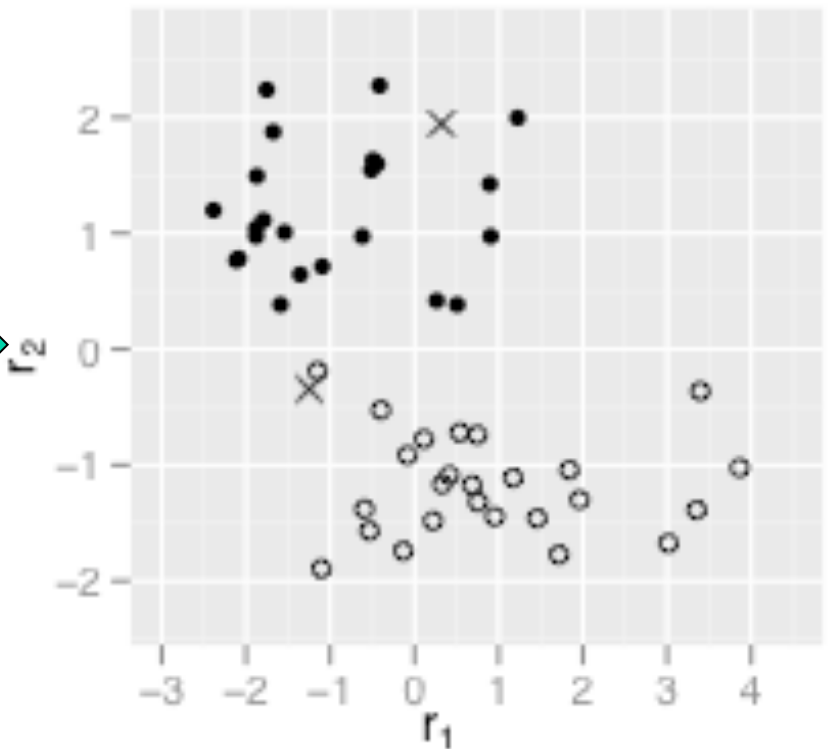
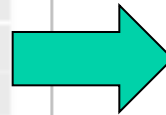
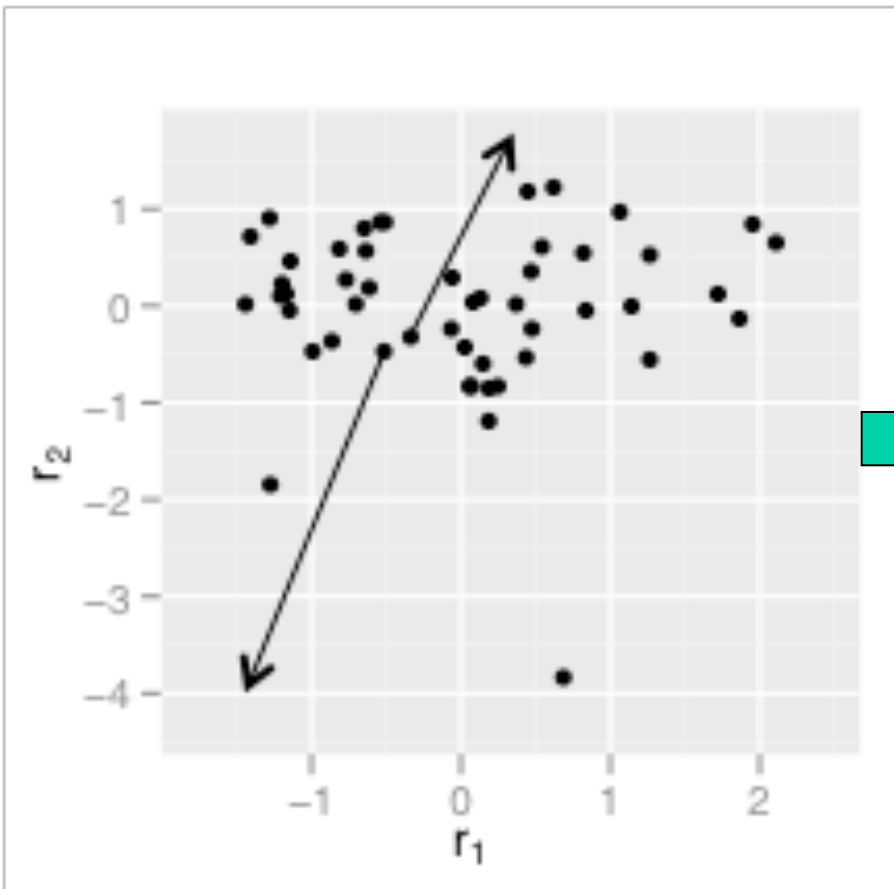
# BaVA Process / V2PI



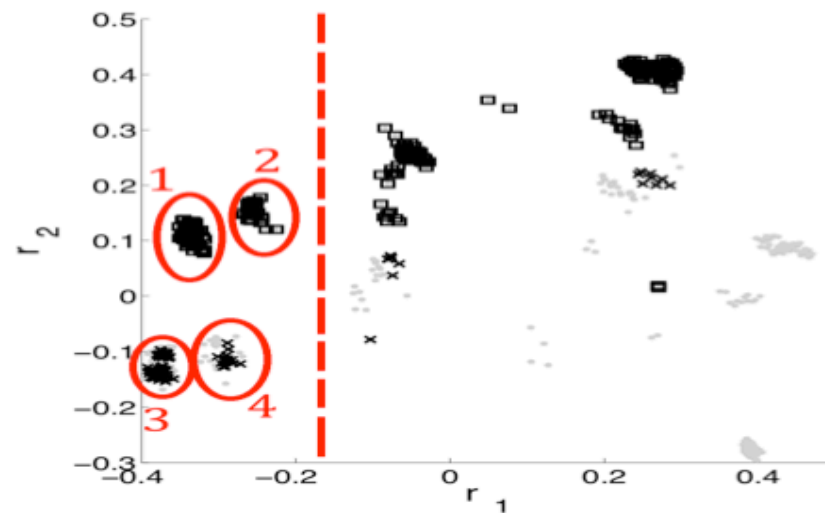
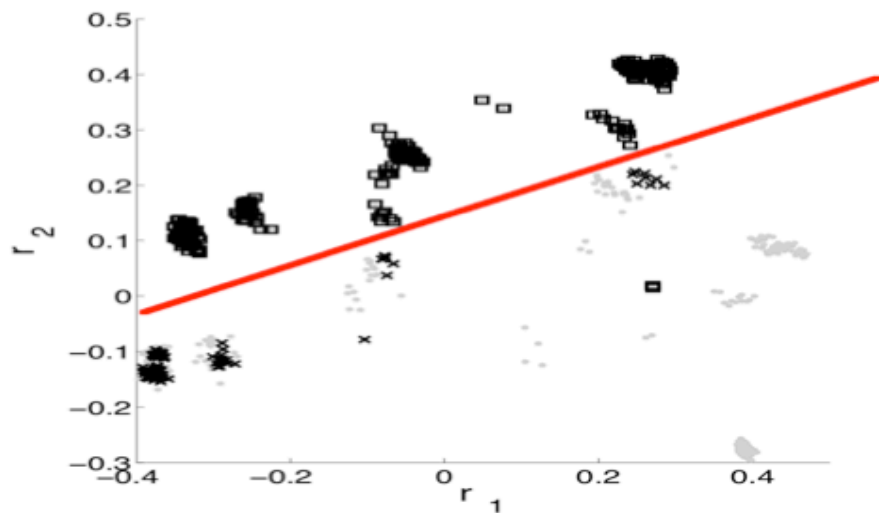
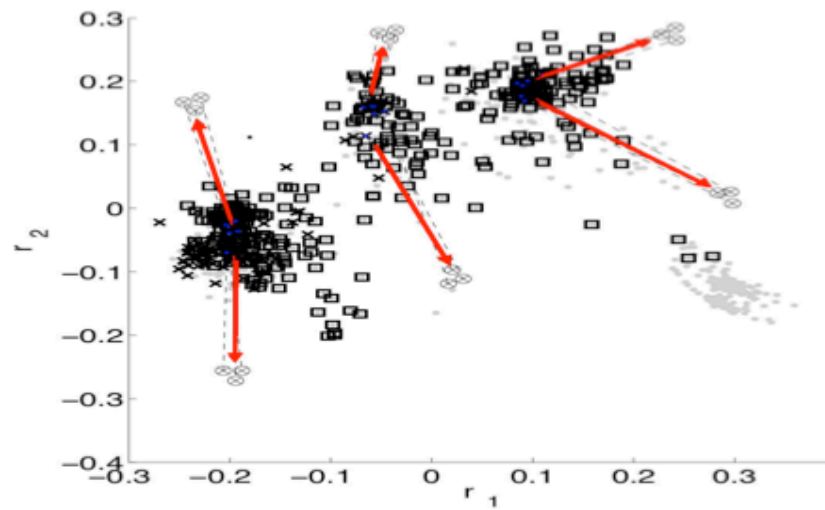
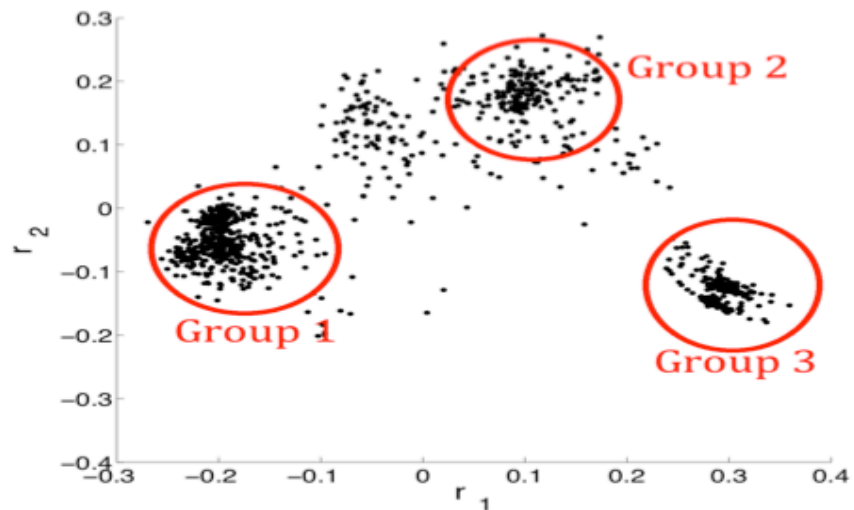


# BaVA - PCA

- 50 observations, 7 features

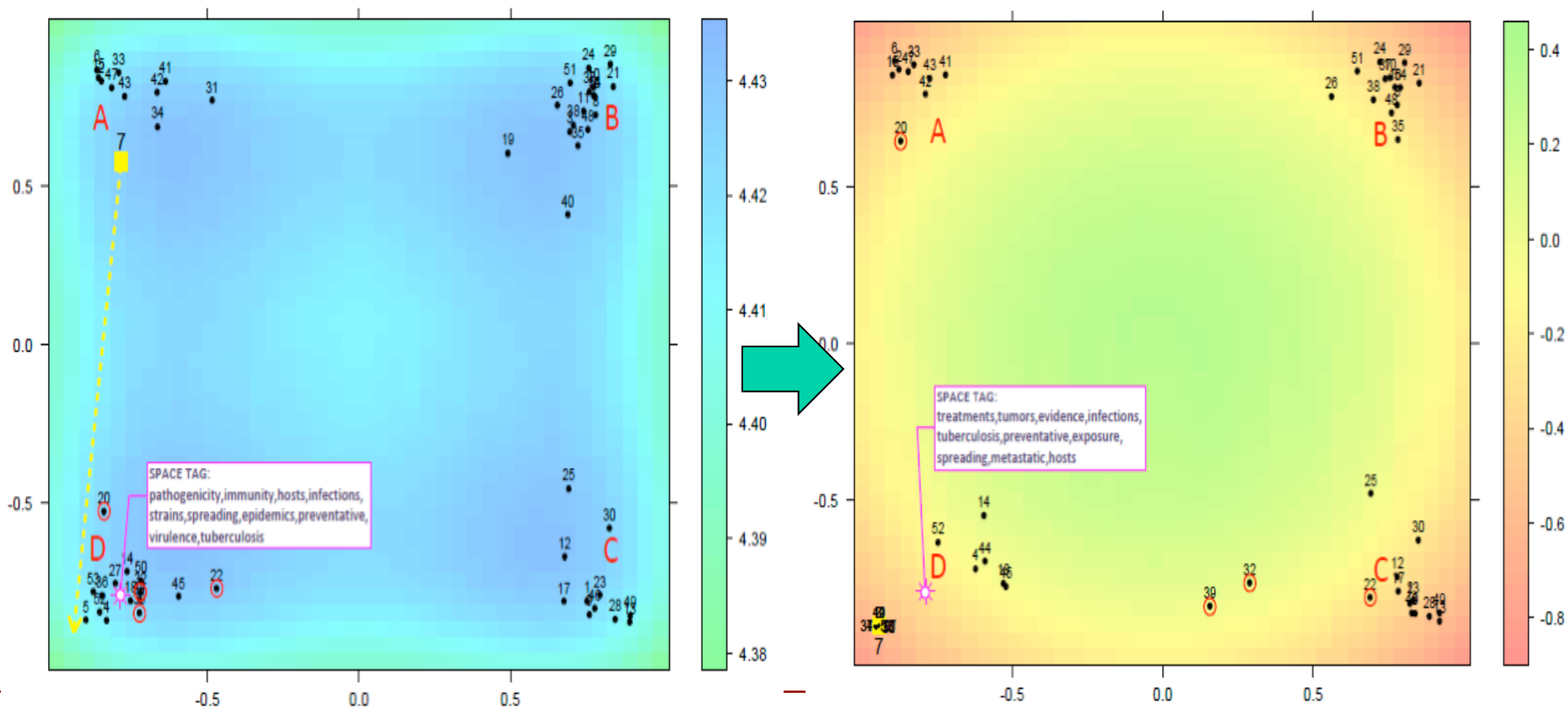


# BaVA - MDS



# BaVA - Generative Topographic Map

- NIH Proposal Abstracts, 54 documents, 1000 dimensions



# Educational Practices

The BaVA methodology transitions easily into the classroom, and promotes Data Analytics (DA) through interactive exploration.

Key benefits include:

- Teaching begins with a qualitative understanding of the data at hand.
- Emphasis is placed on how to explore complex data through an iterative sequence of interactions.
- Quantitative methods are motivated and taught after a richer understanding of the methods utility is conveyed.
- Because DA relies on exploration, data summaries, mathematics and computation, they are synthesized in a single course.
- Students are able to explore their various strengths when performing DA (exploration and summary, mathematics, computation, etc.).