Interweaving Multimodal Interaction with Flexible Unit Visualizations for Data Exploration

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Slides:

bit.ly/**databreeze**

Georgia Tech

Microsoft

"Put-That-There":
Voice and Gesture at the Graphics Interface

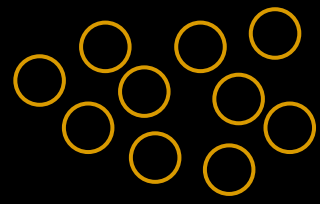
R.A. Bolt, 1980

How can we leverage multimodal interaction to its fullest potential to support a more fluid and free-form data exploration experience?

Multimodal Interaction

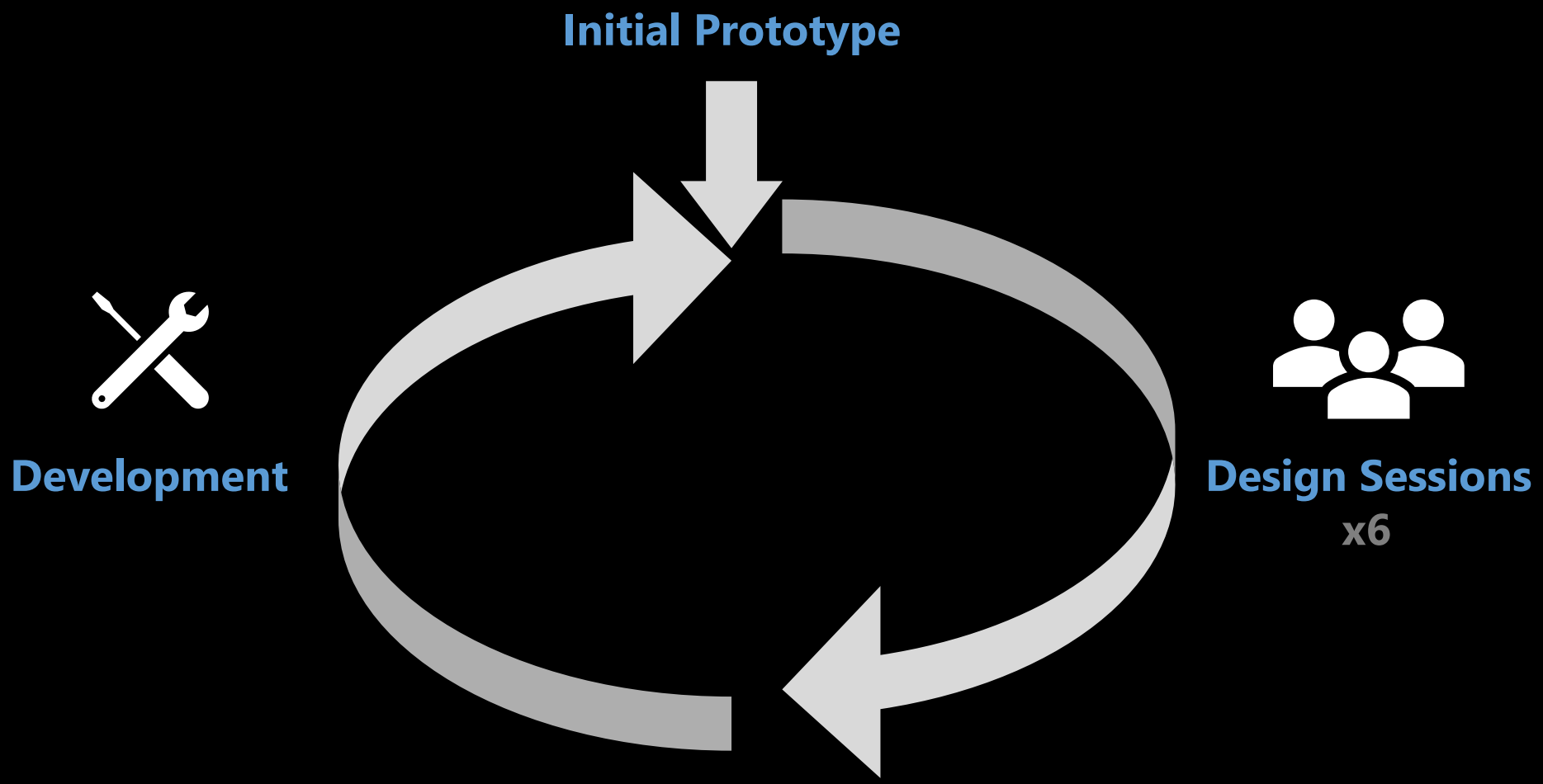
+

Flexible Unit Visualizations



Name	Control	Region	Expenditure	Median Debt	SAT Average	…
Harvard University	Private	New England	47083	7500	1501	…
Stanford University	Private	Far West	88200	11500	1466	…
University of California-Berkeley	Public	Far West	18072	14480	1350	…
Princeton University	Private	Mid Atlantic	48021	7500	1495	…
University of California-Los Angeles	Public	Far West	38489	15200	1289	…
Massachusetts Institute of Technology	Private	New England	58223	13000	1503	…
Georgia Institute of Technology	Public	Southeast	13939	20750	1352	…
…	…	…	…	…	…	…

Design Process



Design Goals for Supporting Free-form Data Exploration with DataBreeze

Details in the paper

DG1. Support both systematic binding and manual customization

DG2. Support variations in input patterns

DG3. Avoid complex gestures for touch/pen

DG4. Support instruction and feedback for speech

DG5. Support both global and local changes

DG6. Role of pen & touch

DG7. Support implicit and explicit triggering of speech

DG8. Support externalization of custom mappings

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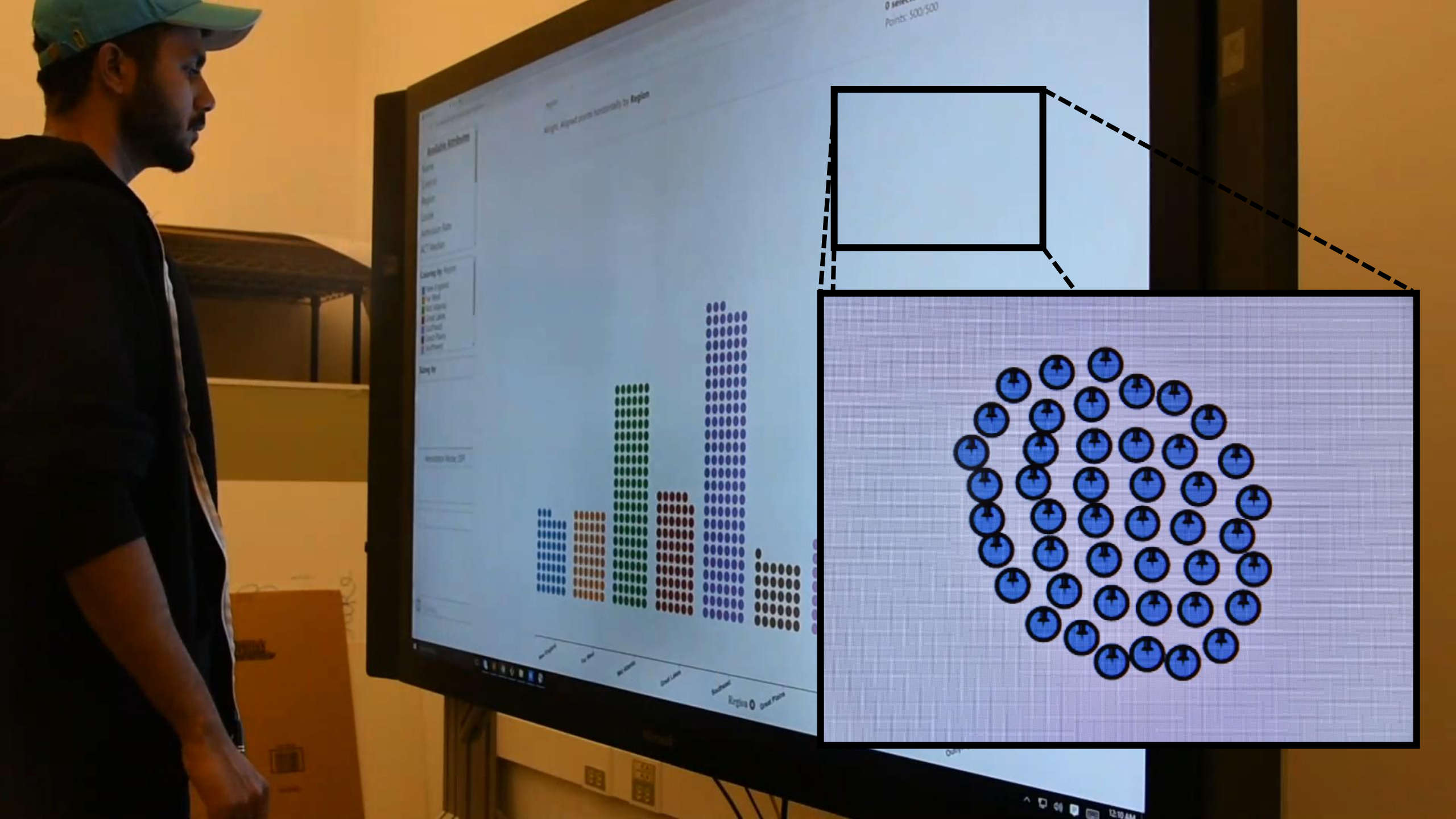
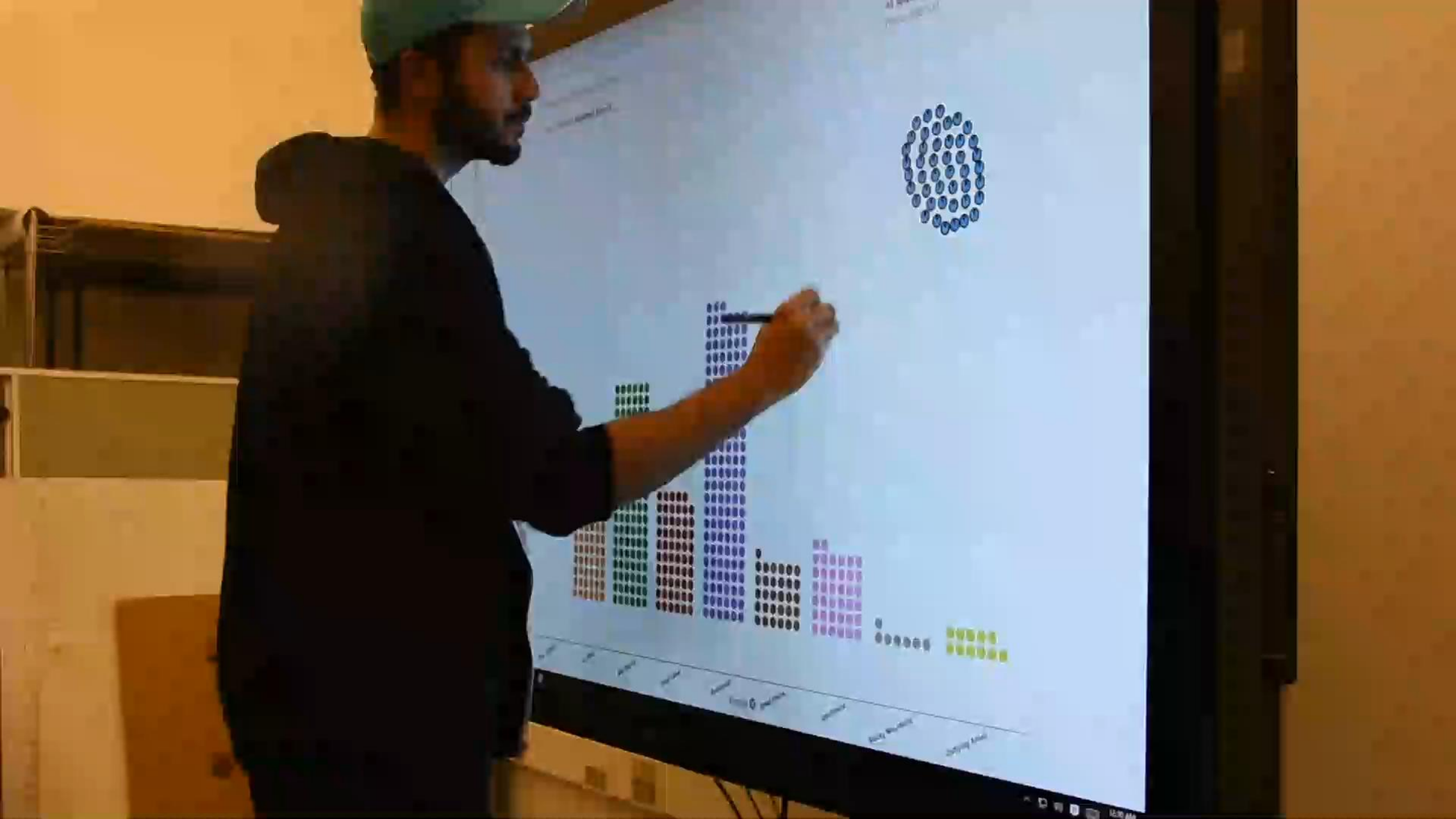
Supporting Global & Local Changes





Triggering Voice Input

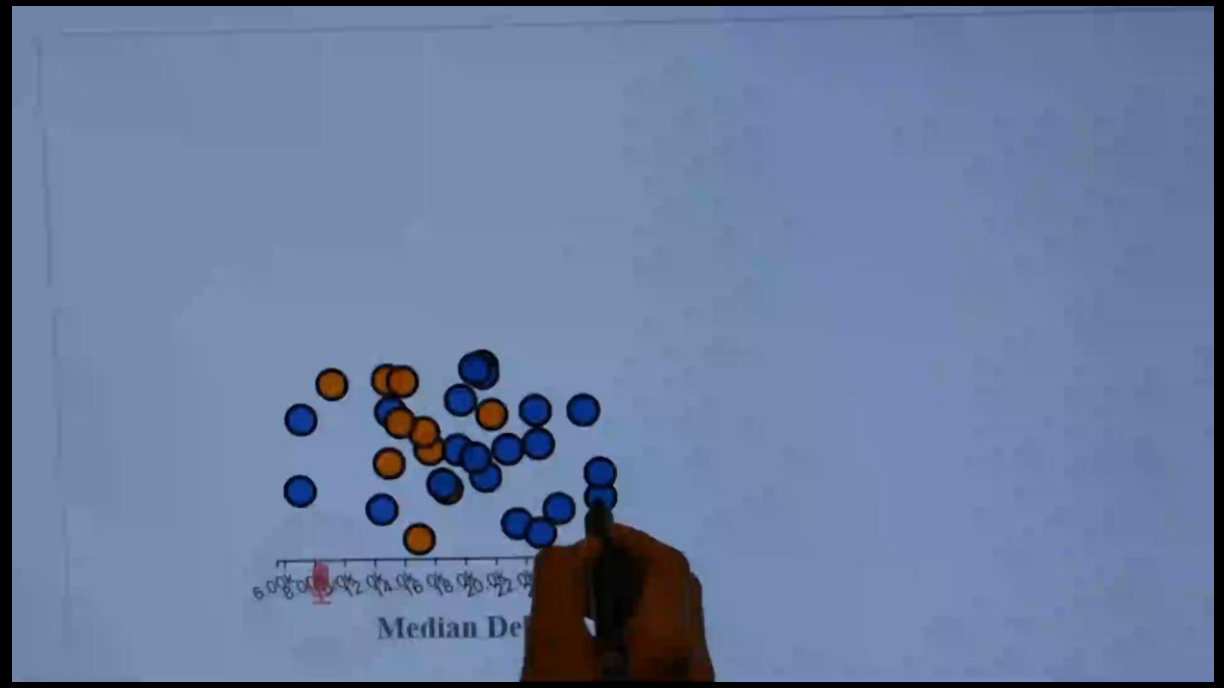
Explicit

Implicit

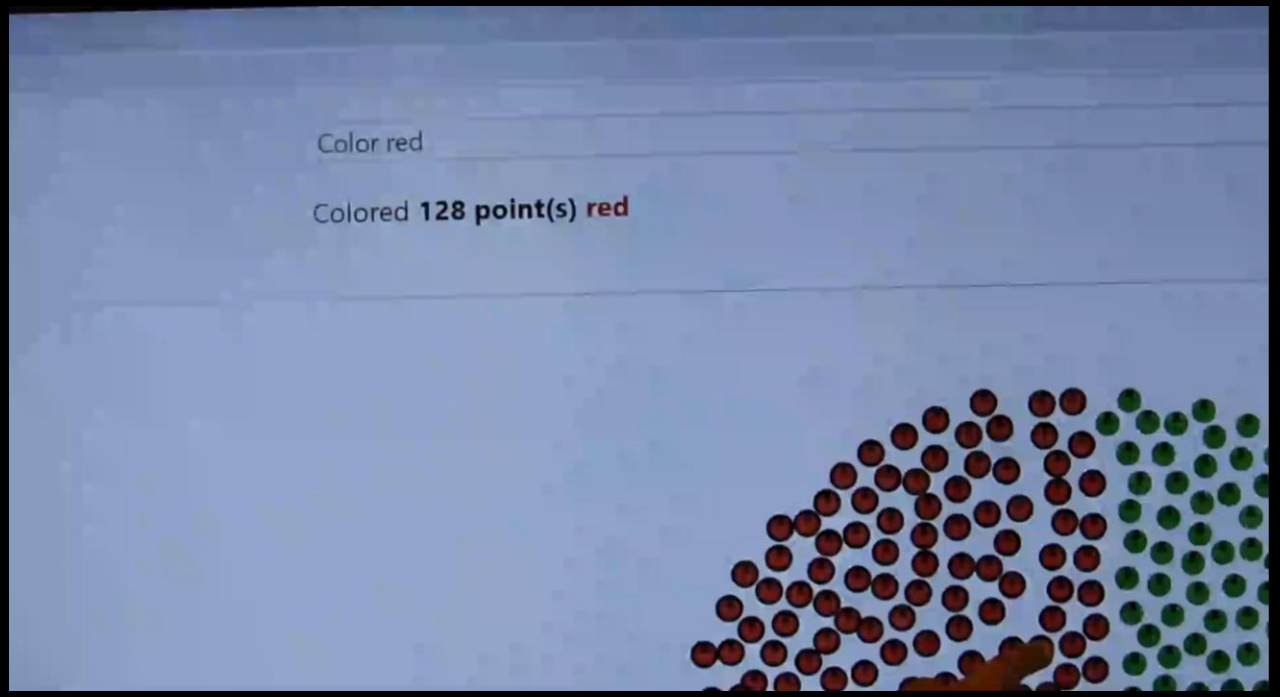
Discoverability

Preemptive
Command Suggestions

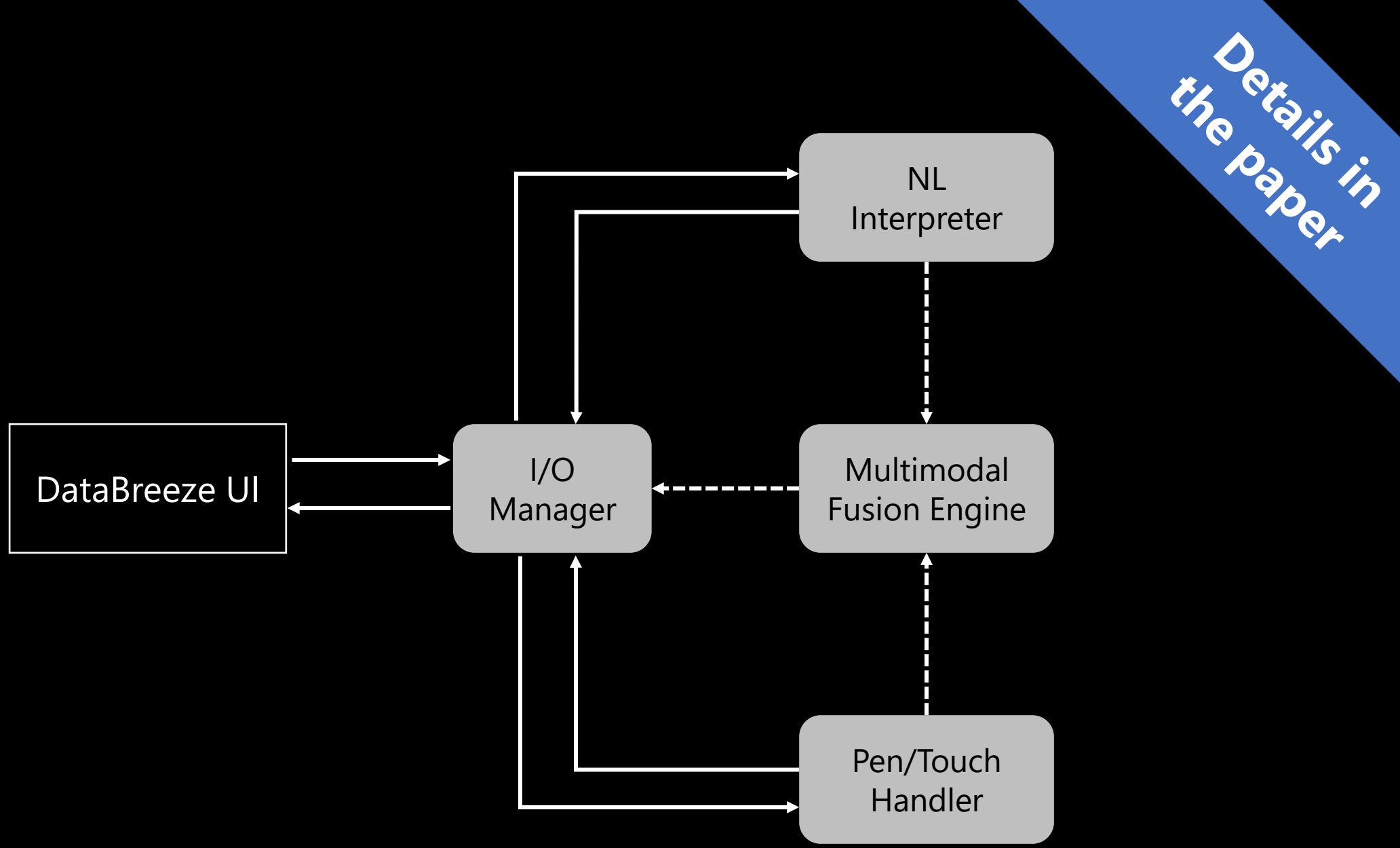
Post-hoc
Command Suggestions



Preemptive
Command Suggestions



Post-hoc
Command Suggestions


Details in the paper
NL Interpreter
DataBreeze UI
I/O Manager
Multimodal Fusion Engine
Pen/Touch Handler

DataBreeze UI

I/O Manager

NL Interpreter

Multimodal Fusion Engine

Pen/Touch Handler

"Bring the New England schools here"

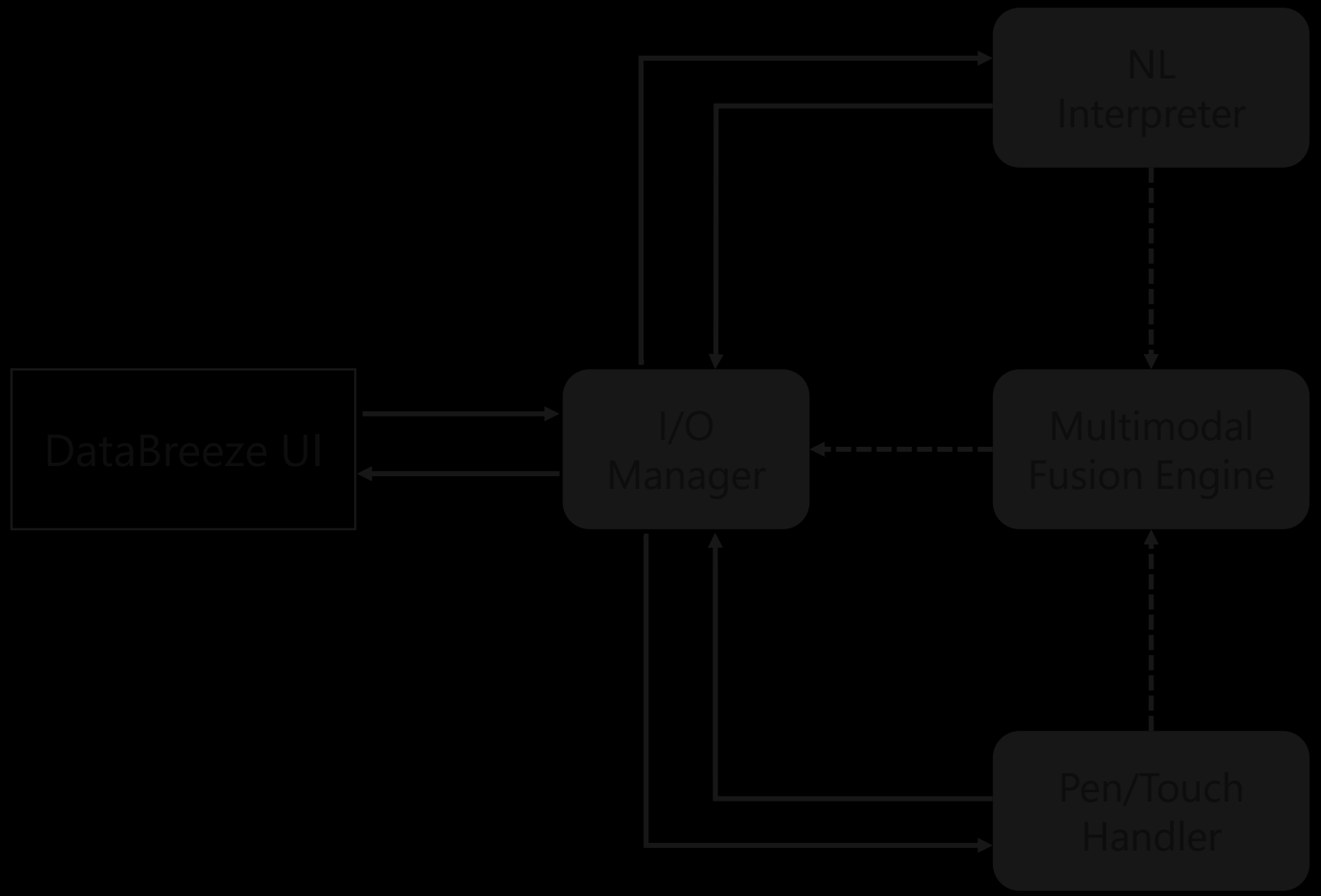
{

Operation: **Move**

Parameter: **(x, y)**

Target: **New England**

}



DataBreeze UI

I/O Manager

NL Interpreter

Multimodal Fusion Engine

Pen/Touch Handler

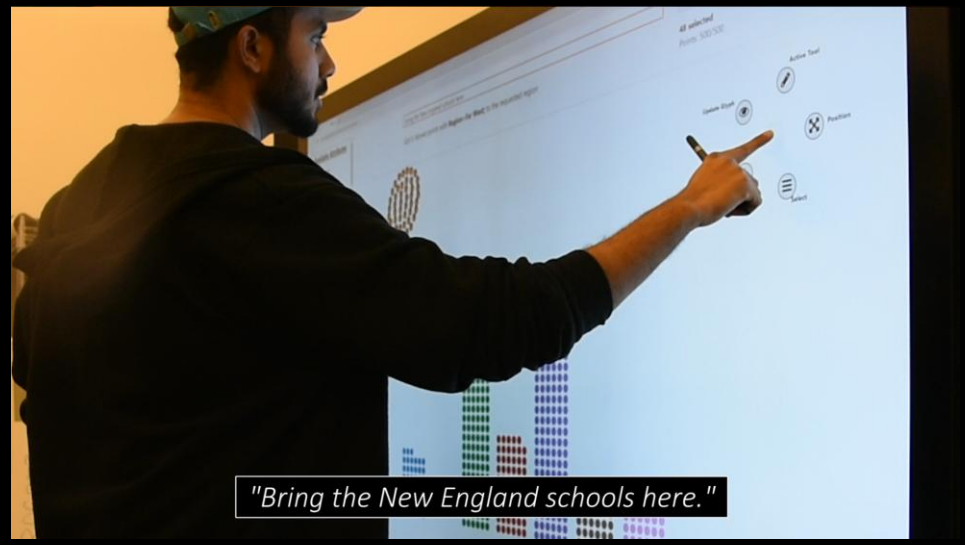
{

Operation: -

Parameter: -

Target: -

}



"Bring the New England schools here"

DataBreeze UI

I/O Manager

NL Interpreter

Multimodal Fusion Engine

Pen/Touch Handler

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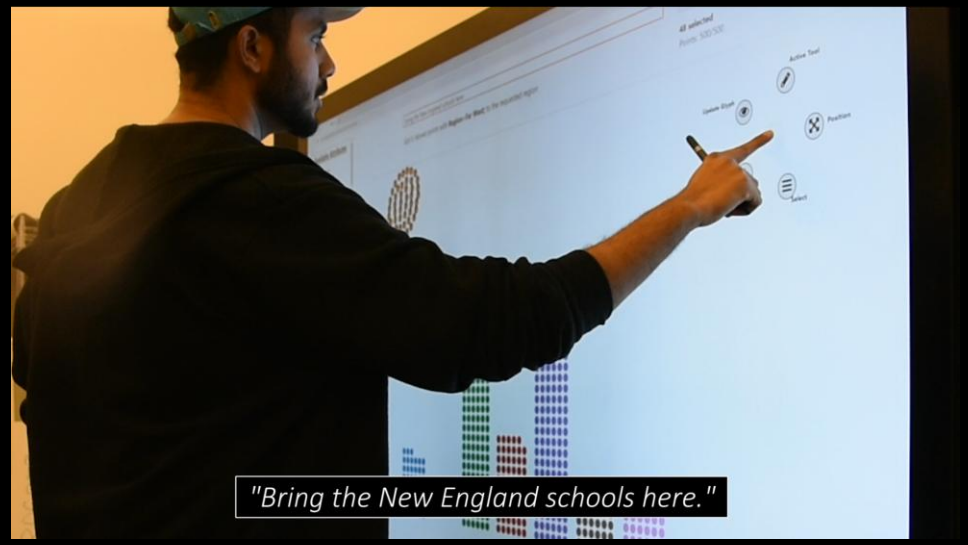

"Bring the New England schools here"

NL Interpreter

Region: ***New England***

Keyword: *here*

DataBreeze UI

I/O Manager

Multimodal Fusion Engine

Gesture: Point

Pen/Touch Handler

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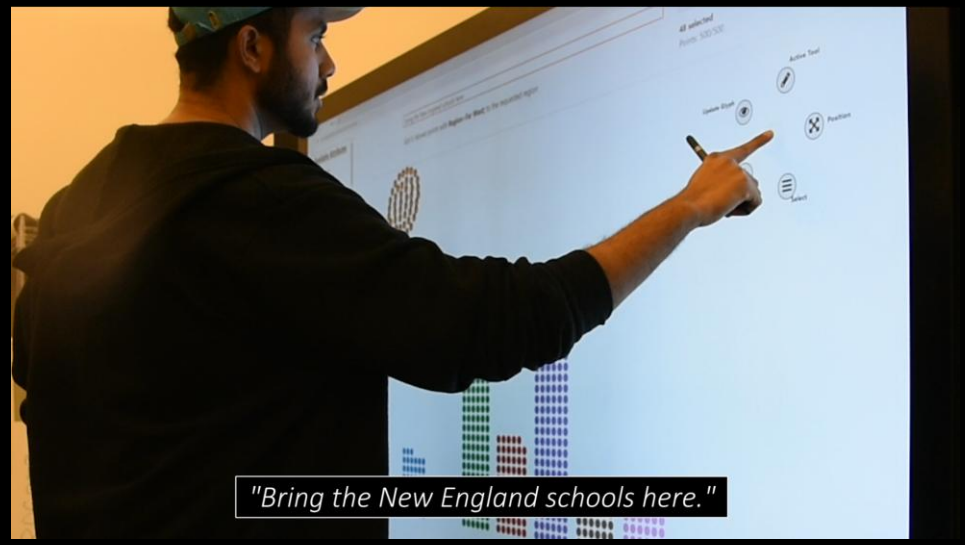

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DataBreeze UI

I/O Manager

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Gesture: Point

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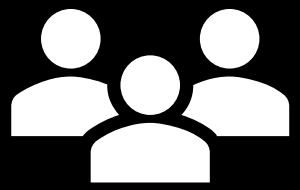
Preliminary User Study

Goal:

To observe if and how DataBreeze supports free-form data exploration & the role of multimodal input in facilitating this experience.

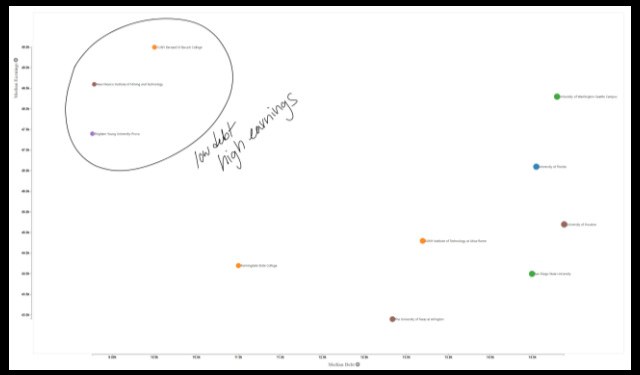


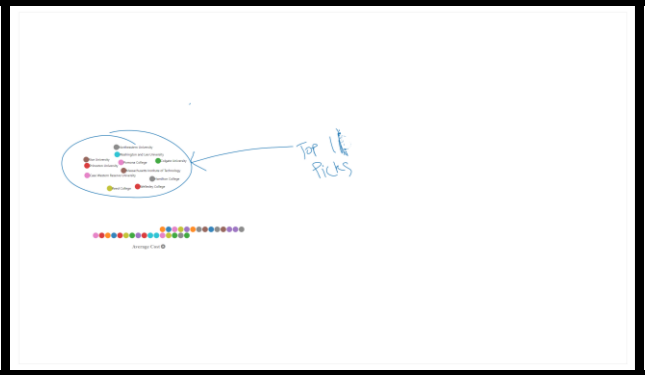
x6

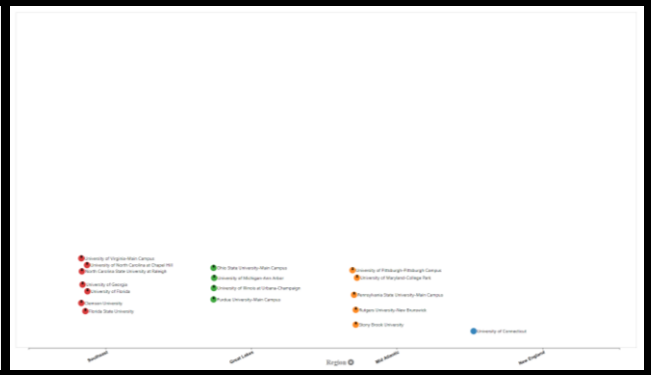
500 U.S. Colleges

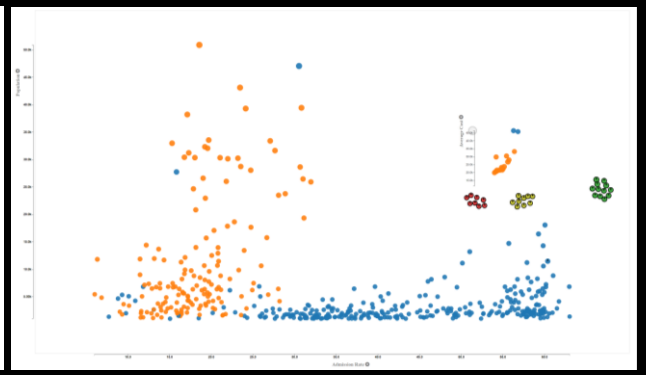
Shortlist 10-15 colleges to apply to

Usage Patterns









Global Views

Hybrid Views
(Global + Local)

P4:

*"The system was great for exploring data and **similar to using an art board**. I could just quickly drag and pull things to **create groups and categories that made sense in my head**."*

P5:

*"I really like that flexibility. Being able to drag and drop points where you want **mimics physical interaction** like you would with documents on your table"*

P6:

*"Gestures typically in my mind aren't combined with voice commands [...] but **once I got used to it, it was great and saves a lot of time**."*

Interaction

Representation

Multimodal Interaction

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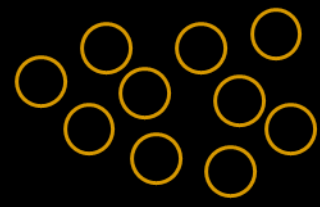
Flexible Unit Visualizations



Multimodal Interaction

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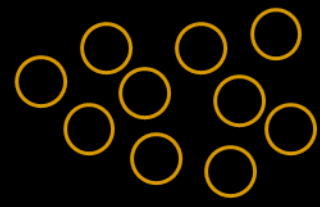
Flexible Unit Visualizations



Thank You

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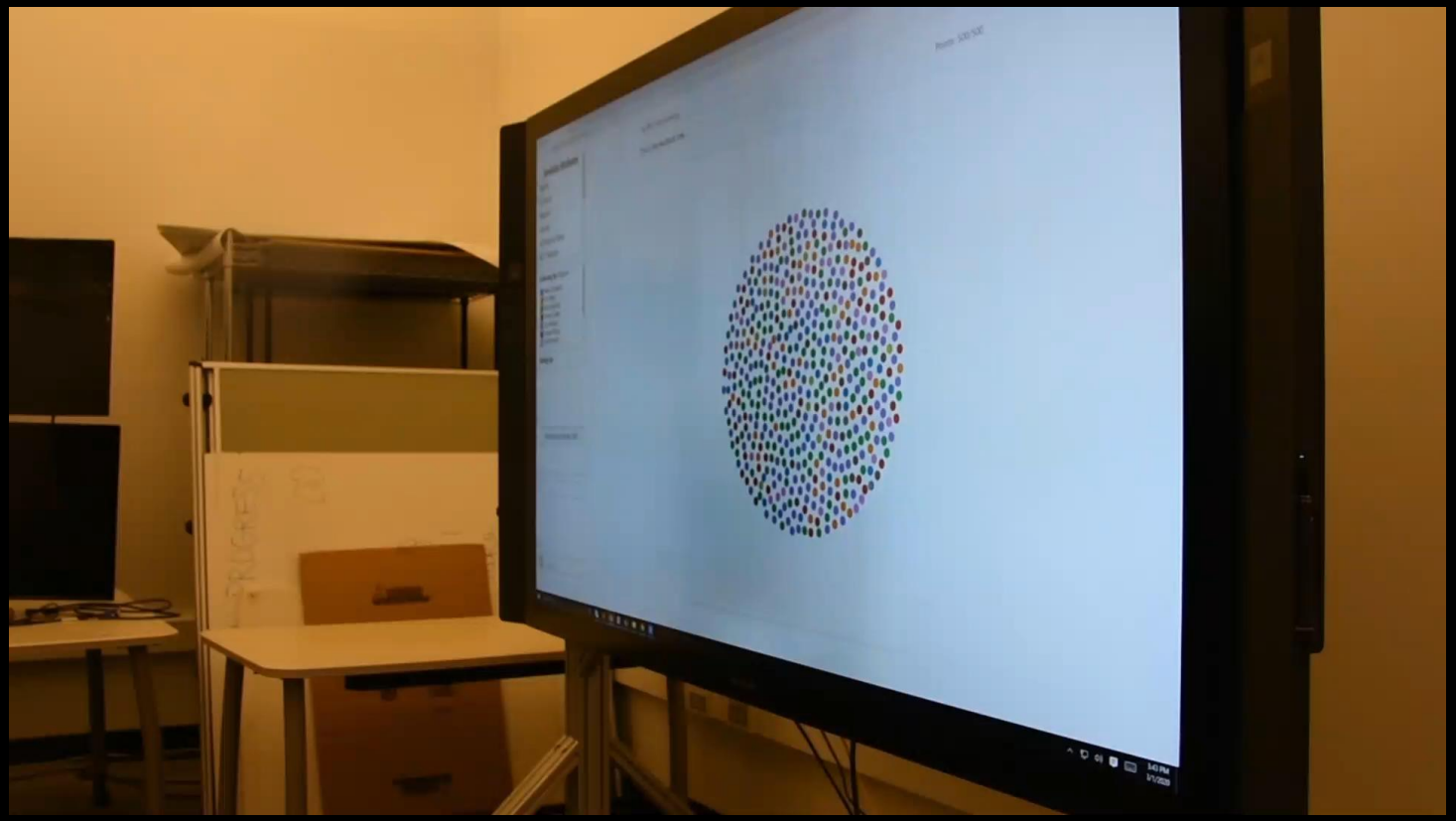
databreeze



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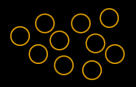
Multimodal Interaction + **Flexible Unit Visualizations**



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