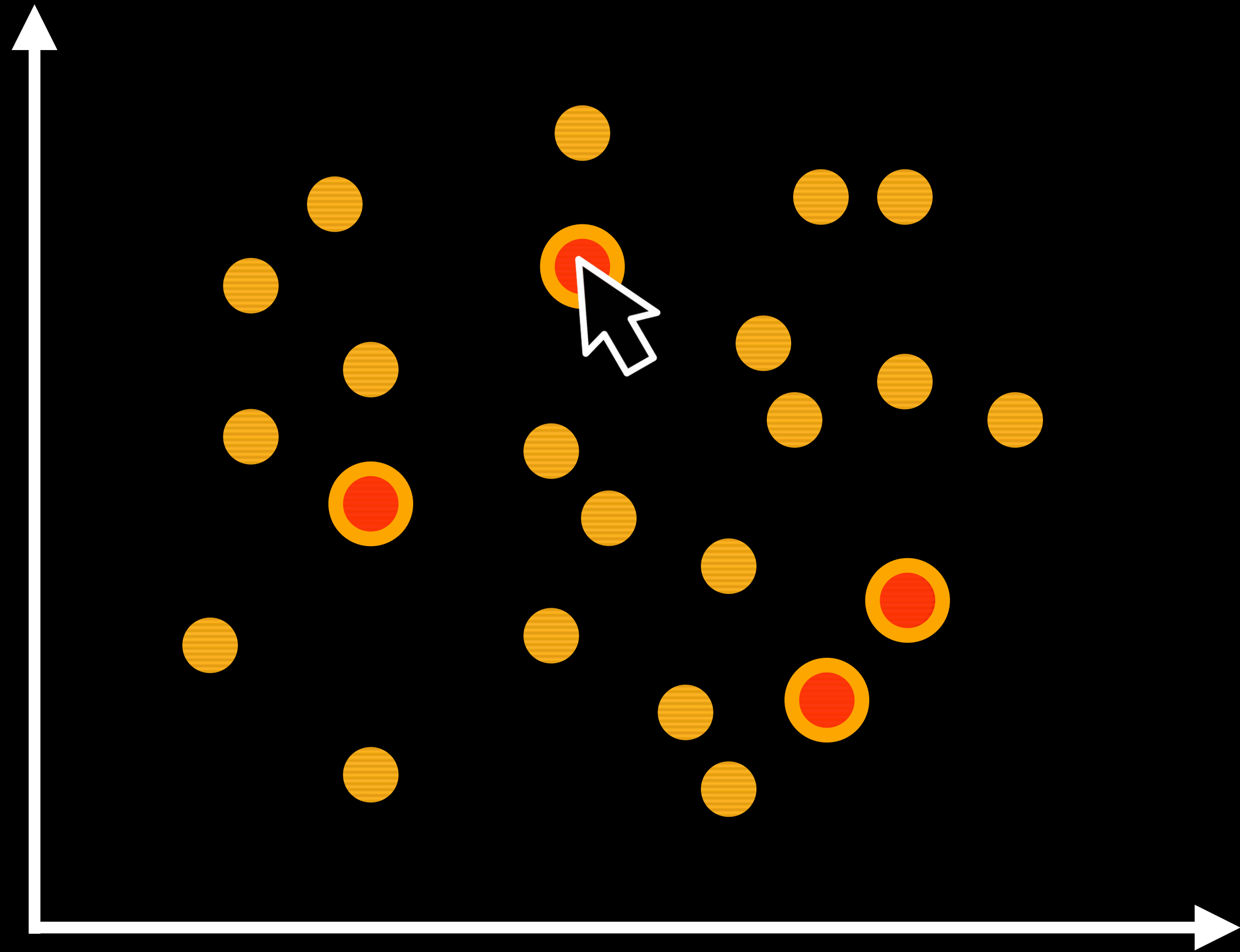


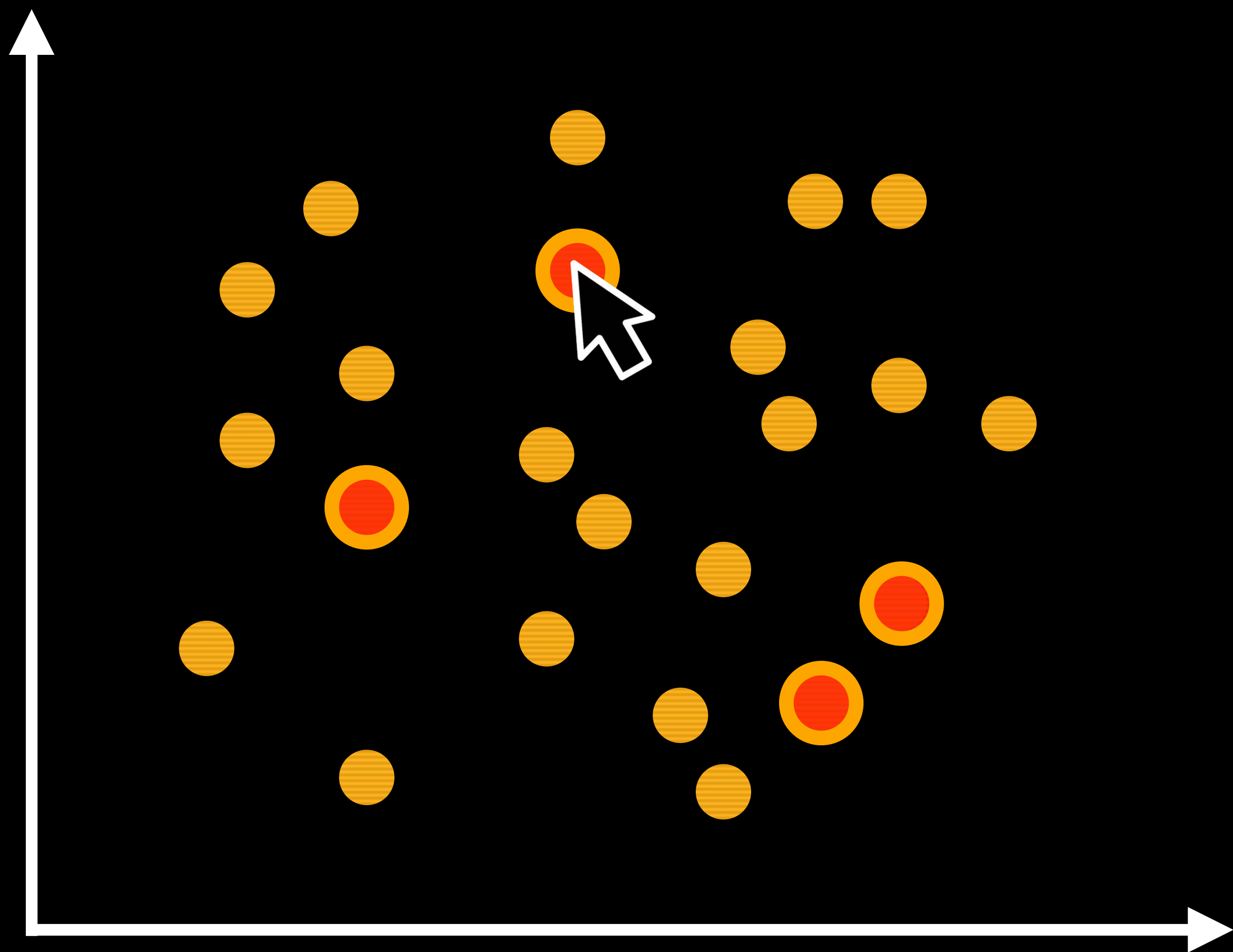
Expanding Selection for Information Visualization Systems on Tablet Devices

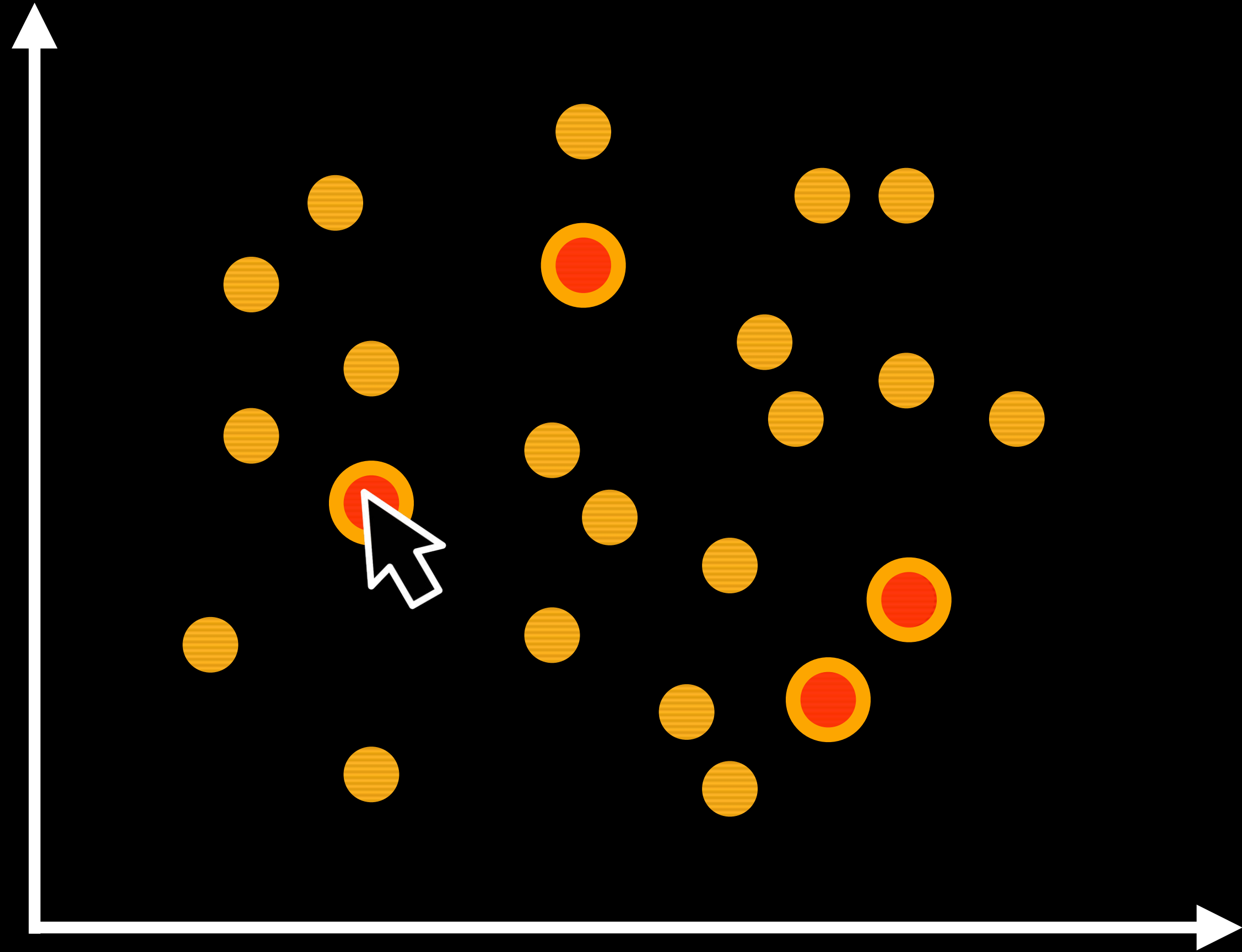
Ramik Sadana, John Stasko

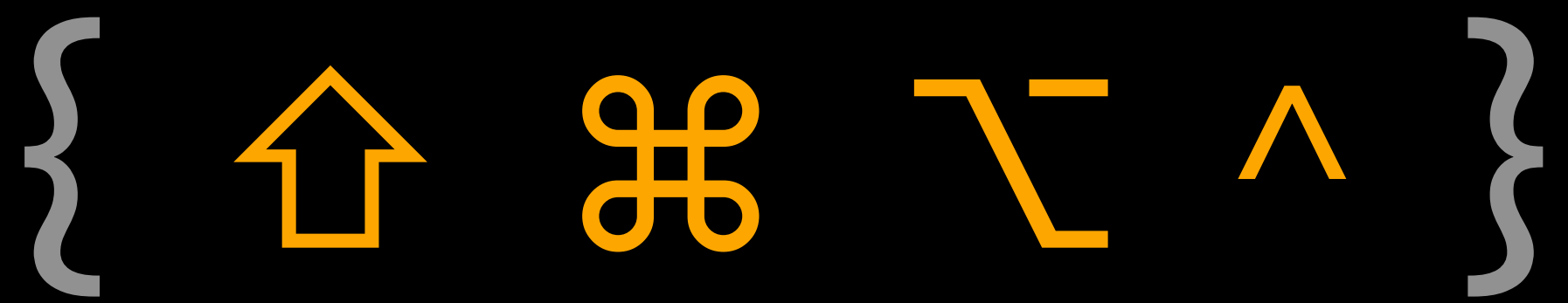
Georgia Visualization
Tech Lab











524,288

Replace Selection

Add to Selection

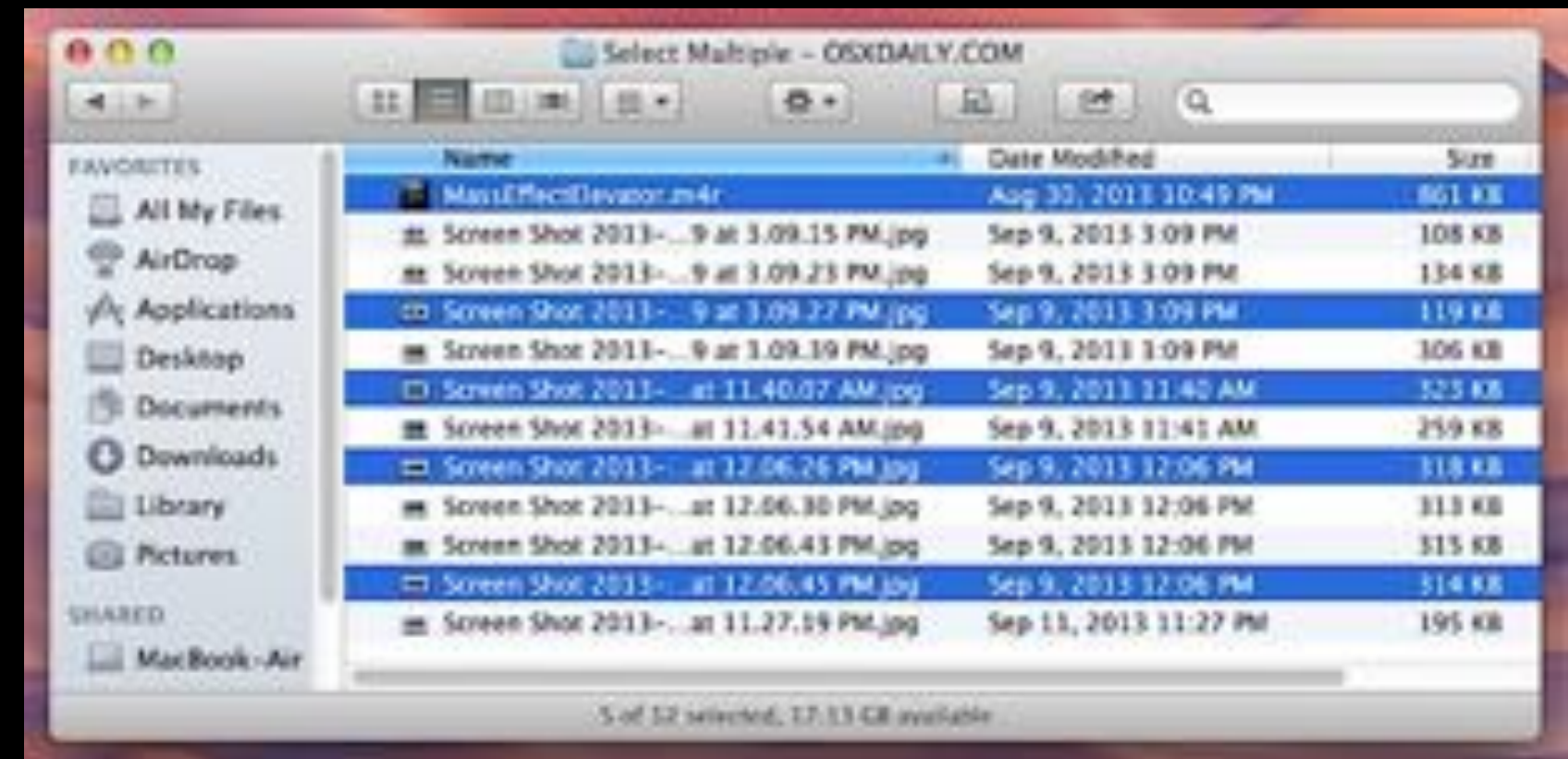
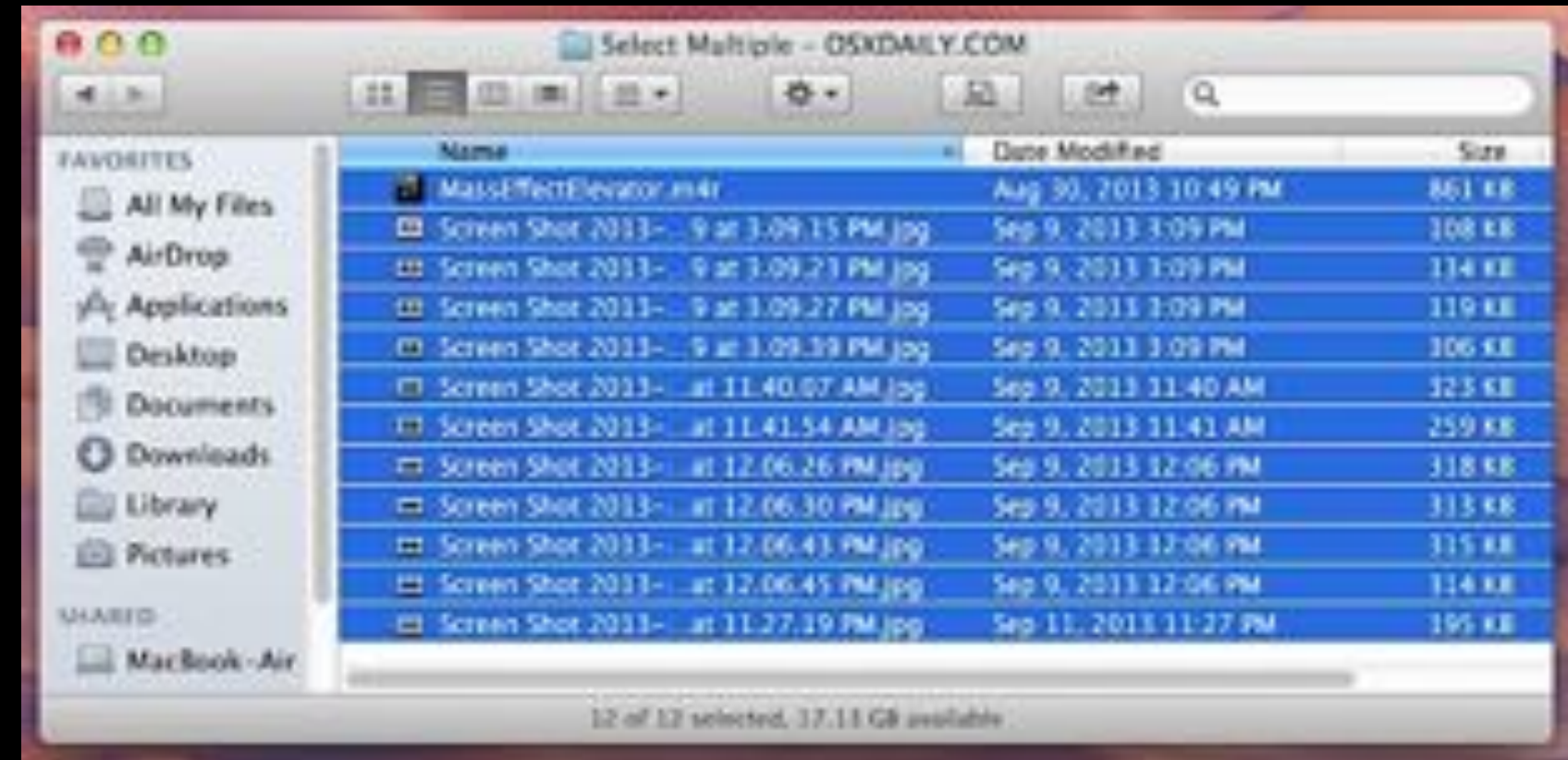
Remove from Selection

Intersect with Selection

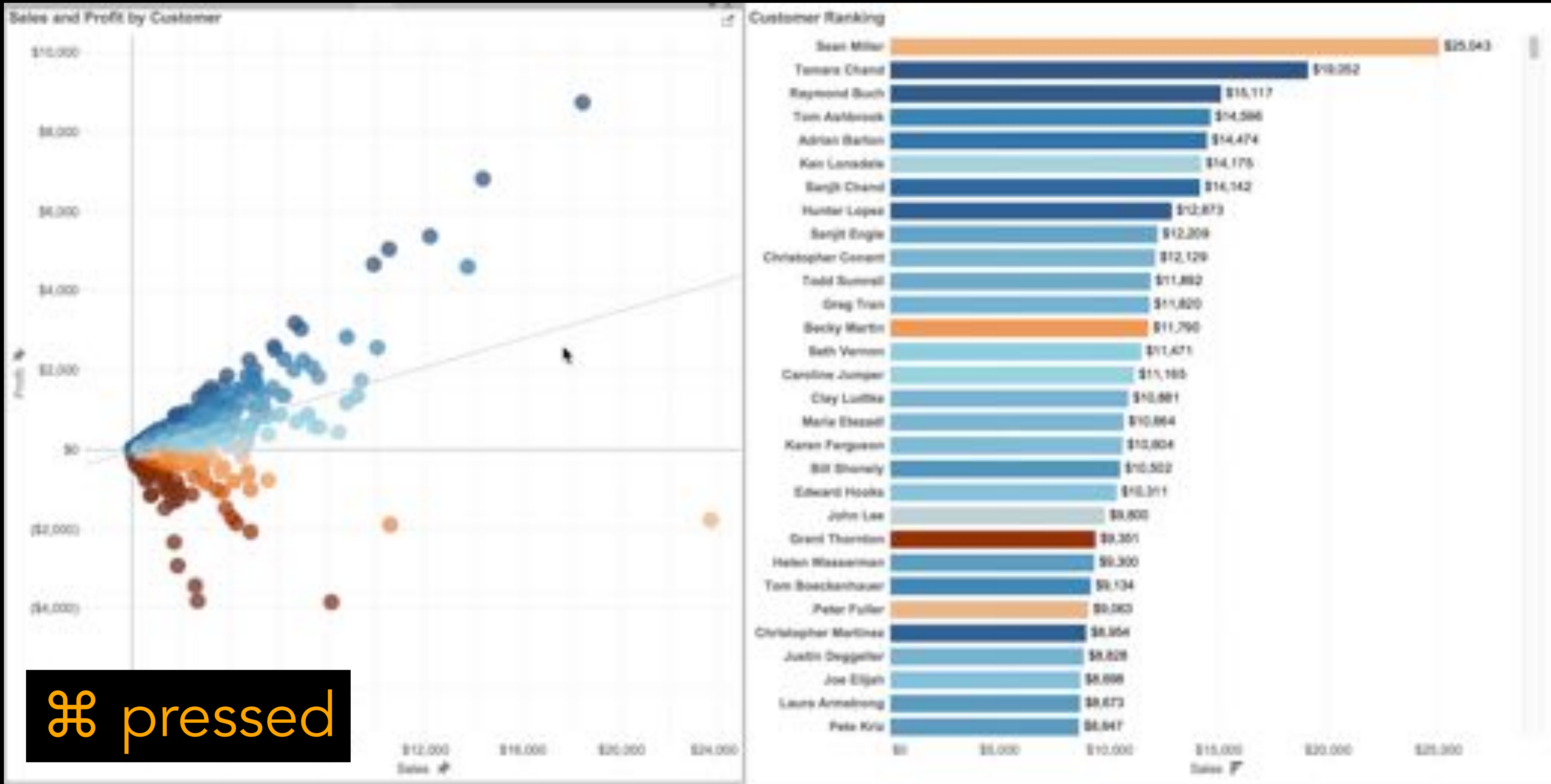
Toggle Selection



Adobe Photoshop

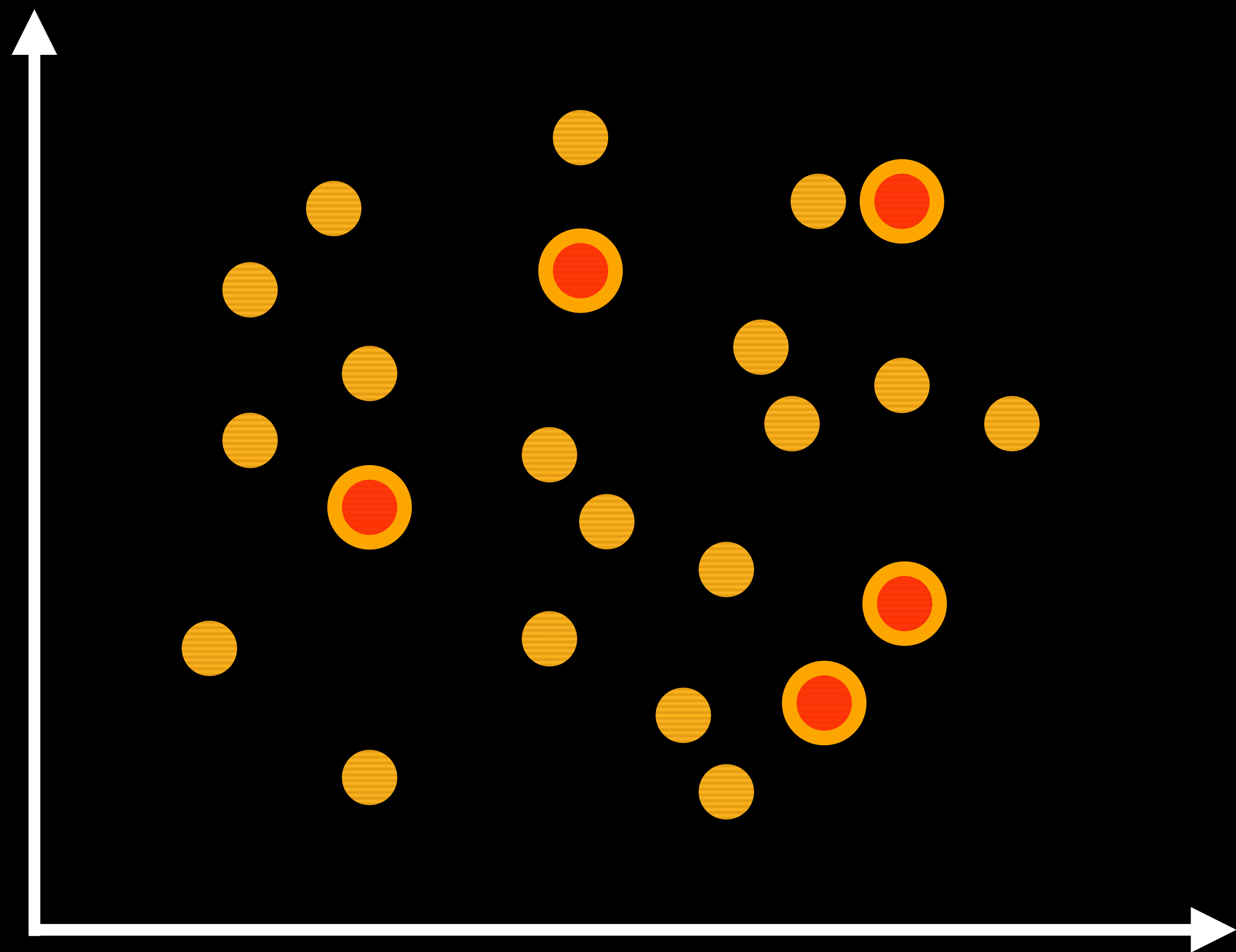


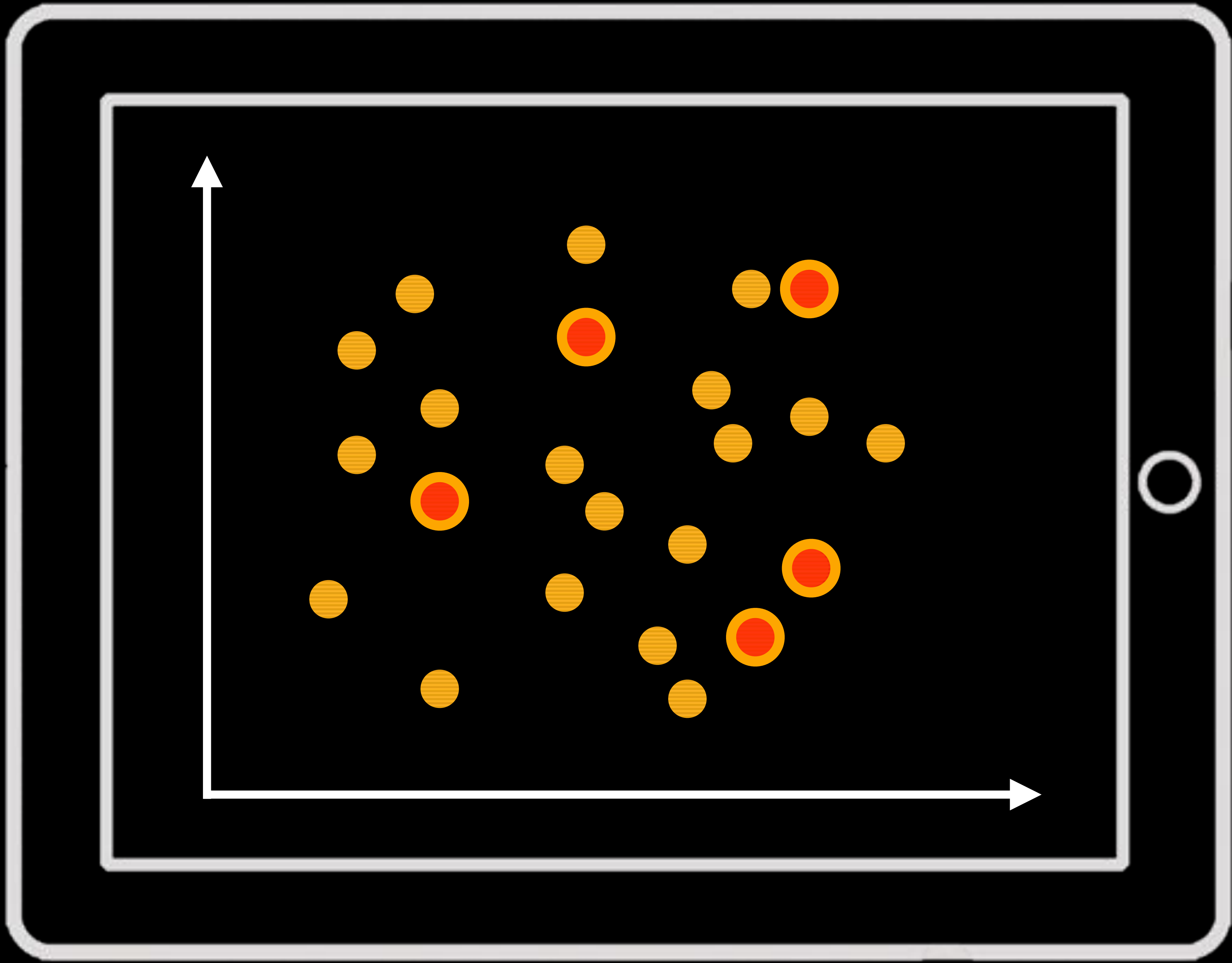
Finder

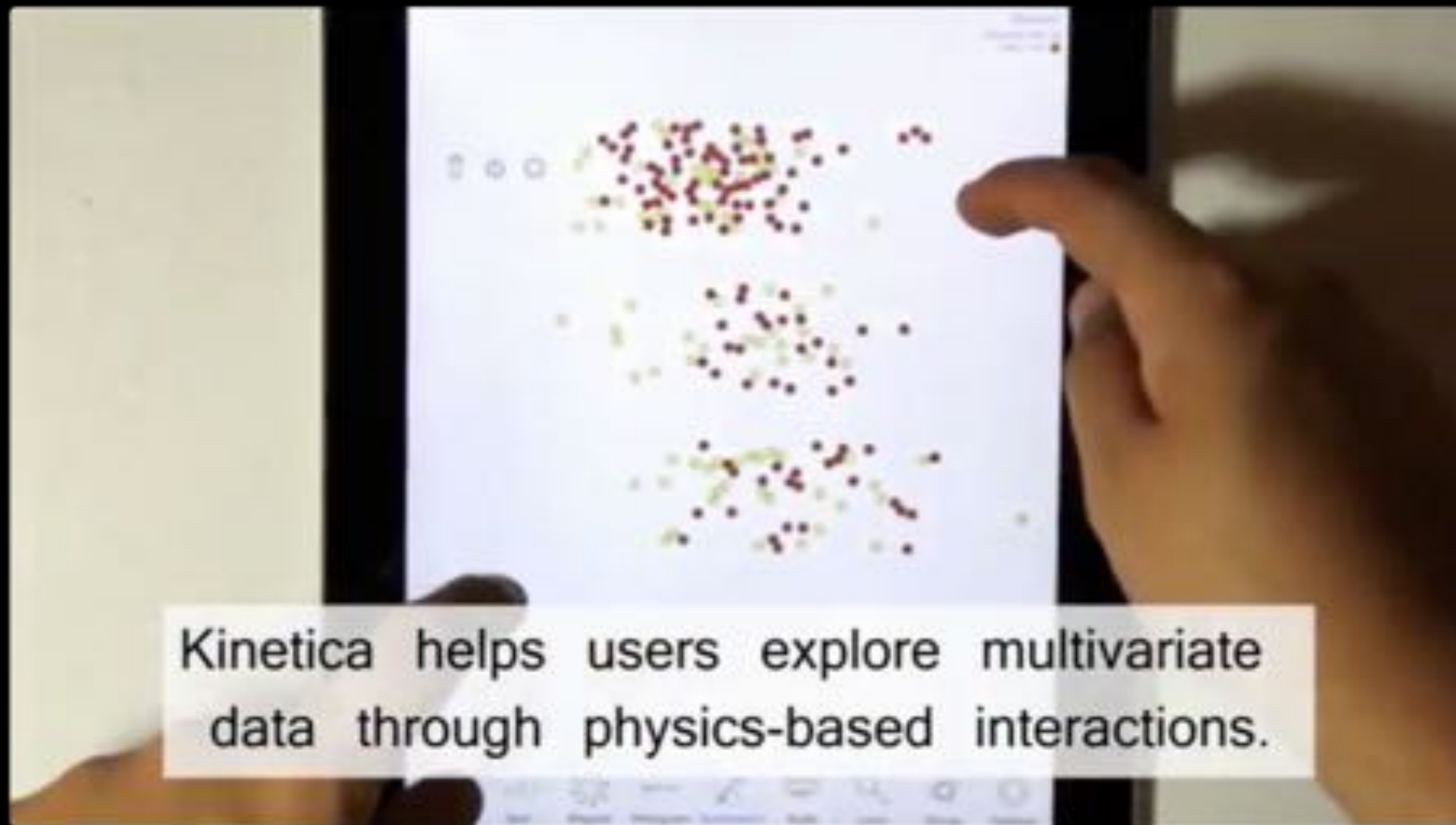


⌘ pressed

Tableau







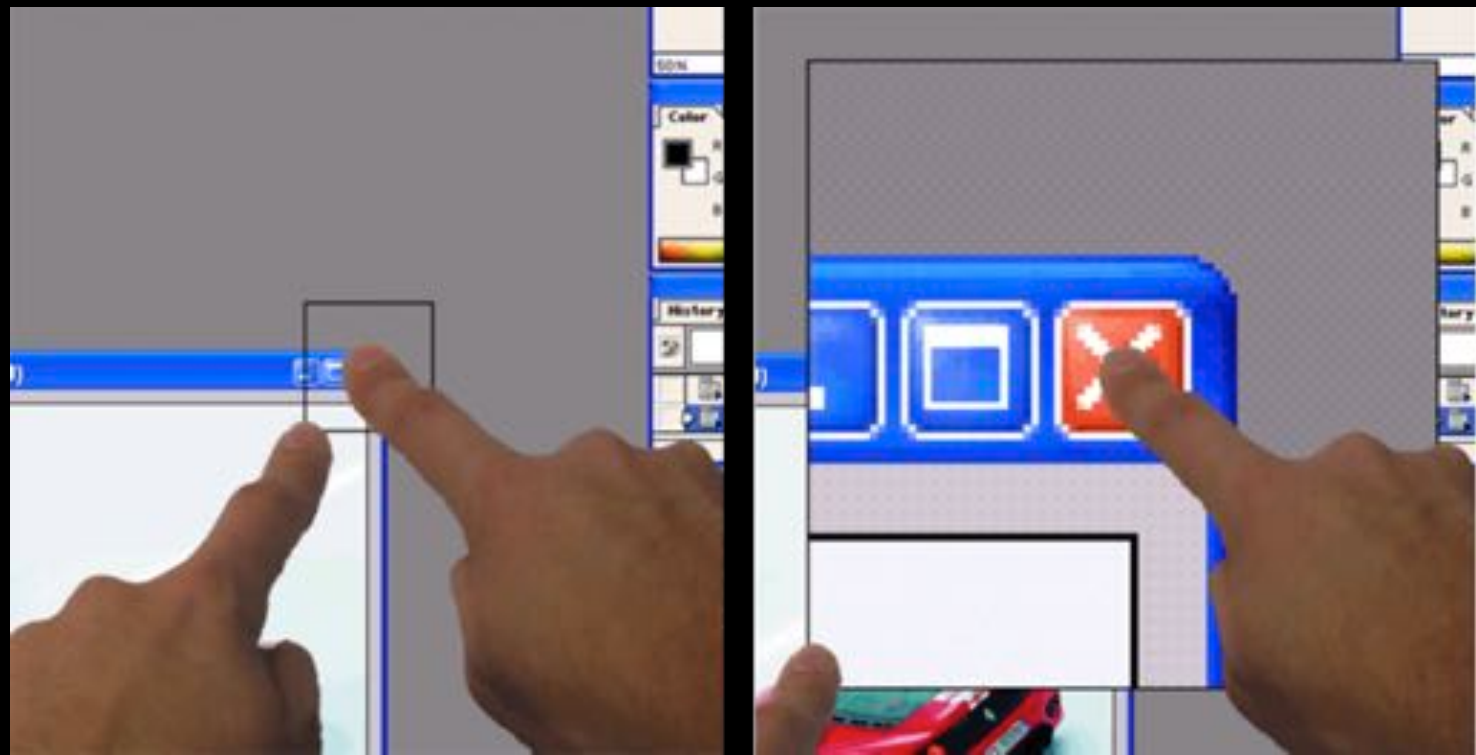
Jeff Rzeszutarski, Aniket Kittur, "**Kinetica**: Naturalistic multi-touch data visualization", CHI 2014

Vizable by Tableau

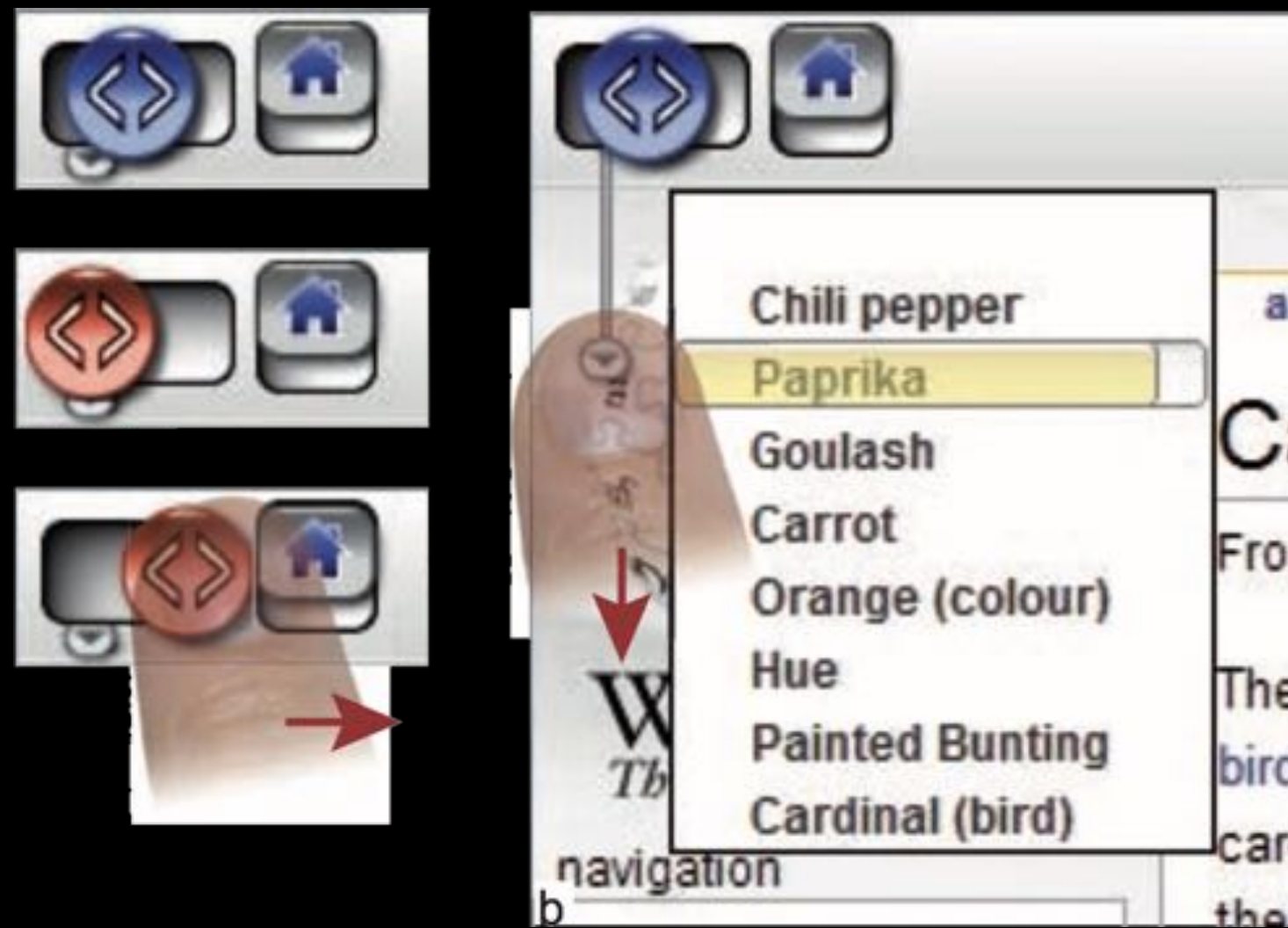


Ramik Sadana, John Stasko "Designing Multiple Coordinated Visualizations for Tablets", EuroVis 2016

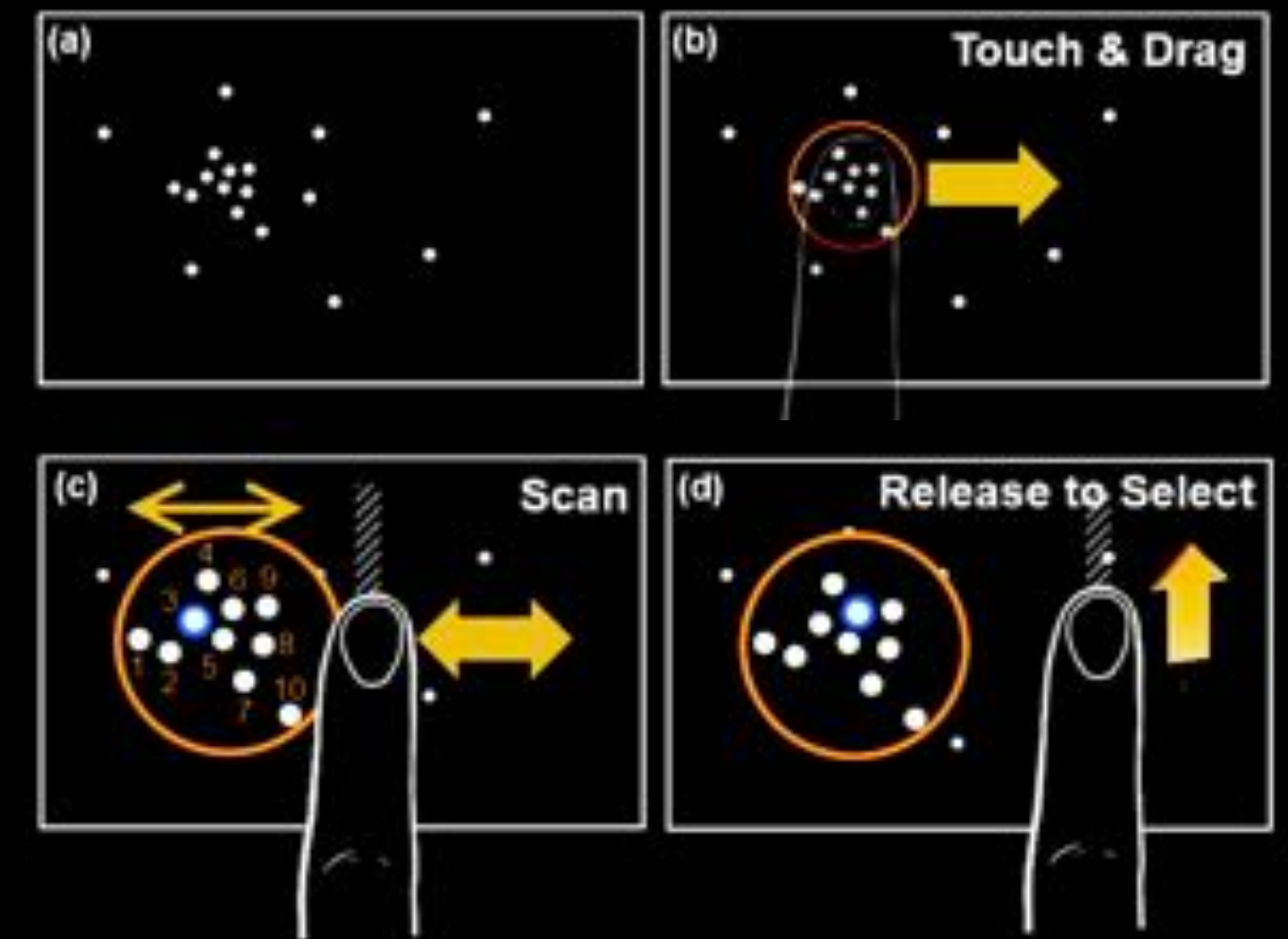
In the past ...



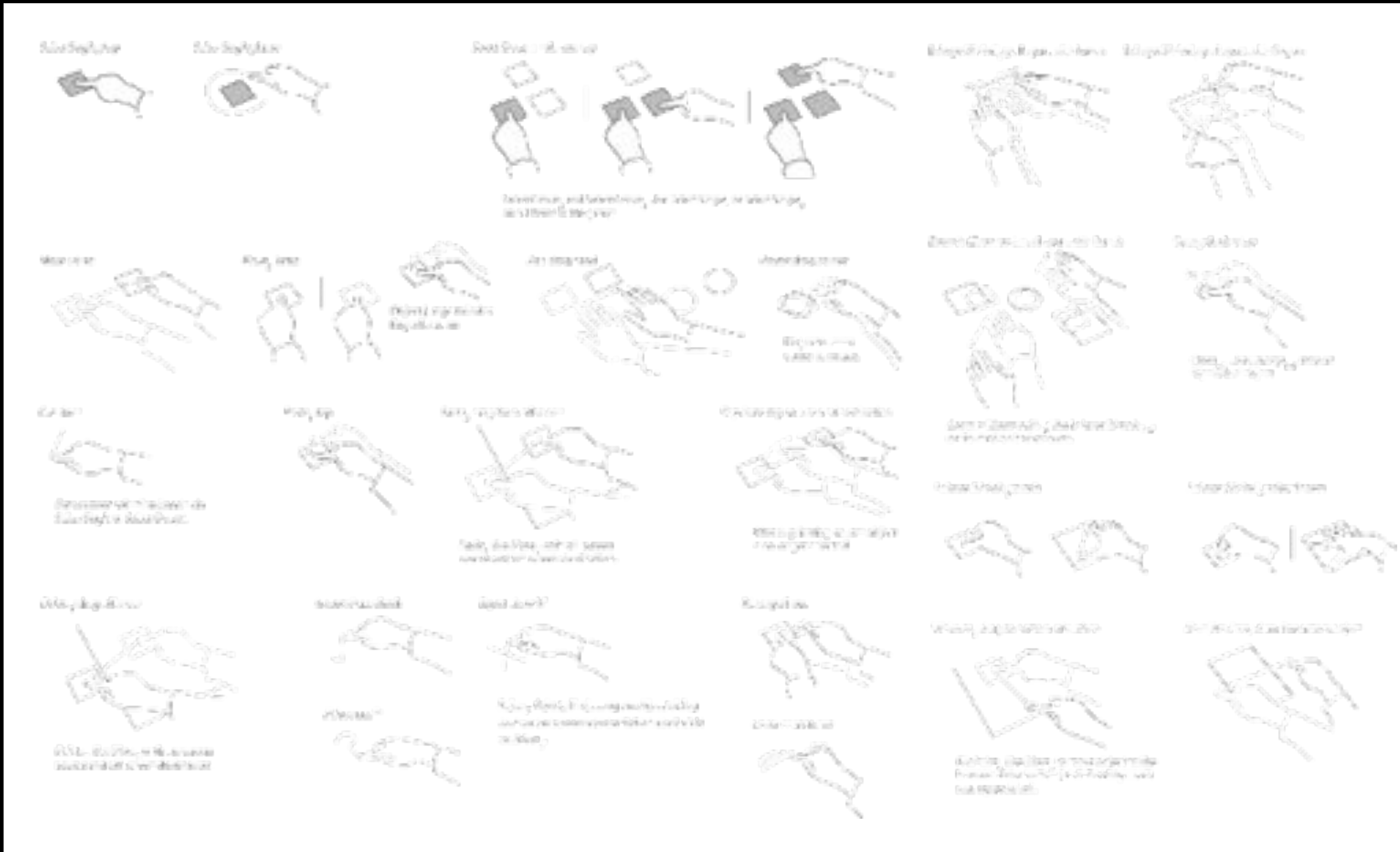
Benko et al., "Precise Selection Techniques for Multi-Touch Screens", CHI '06



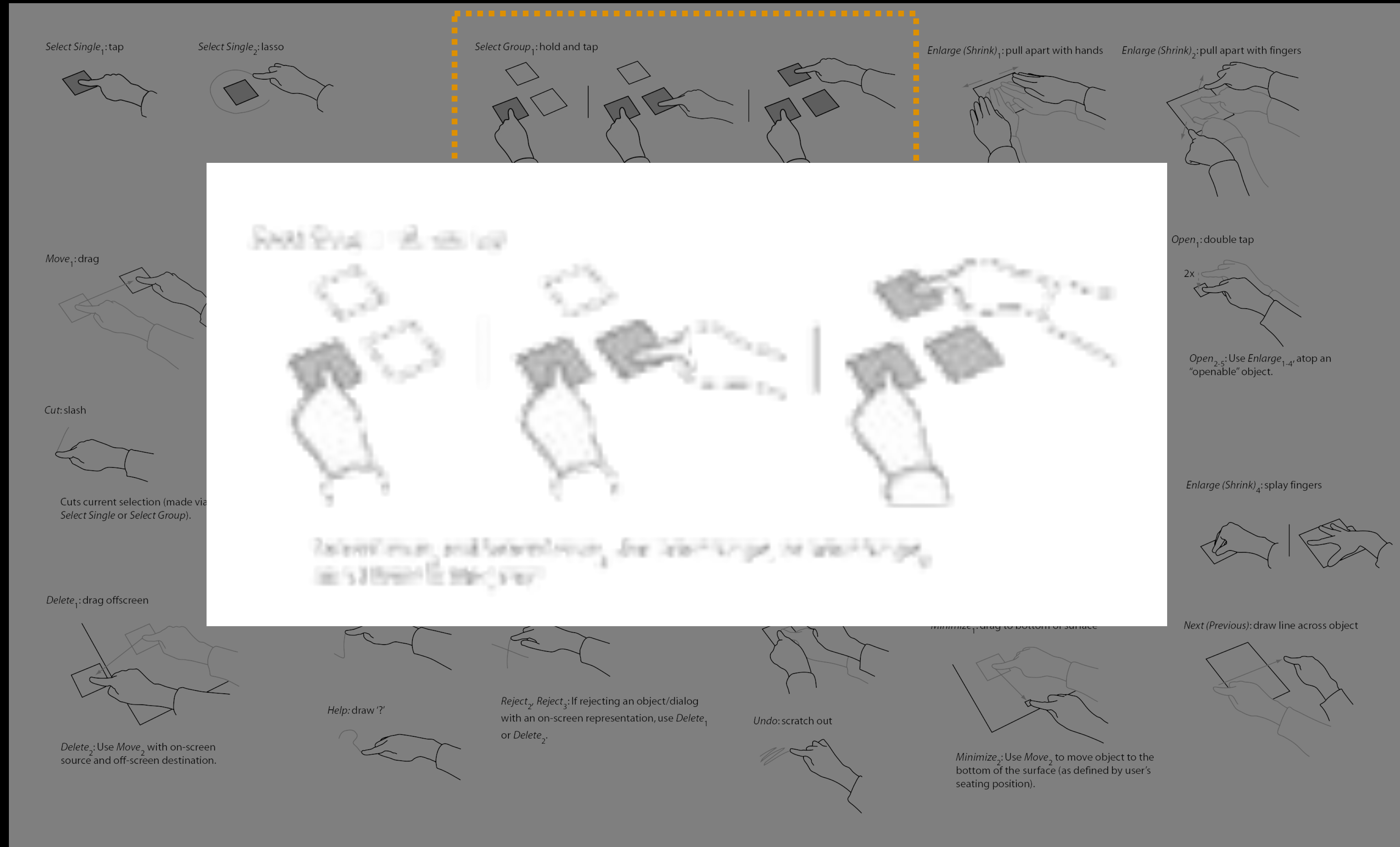
Moscovich, "Contact Area Interaction with Sliding Widgets", UIST '09



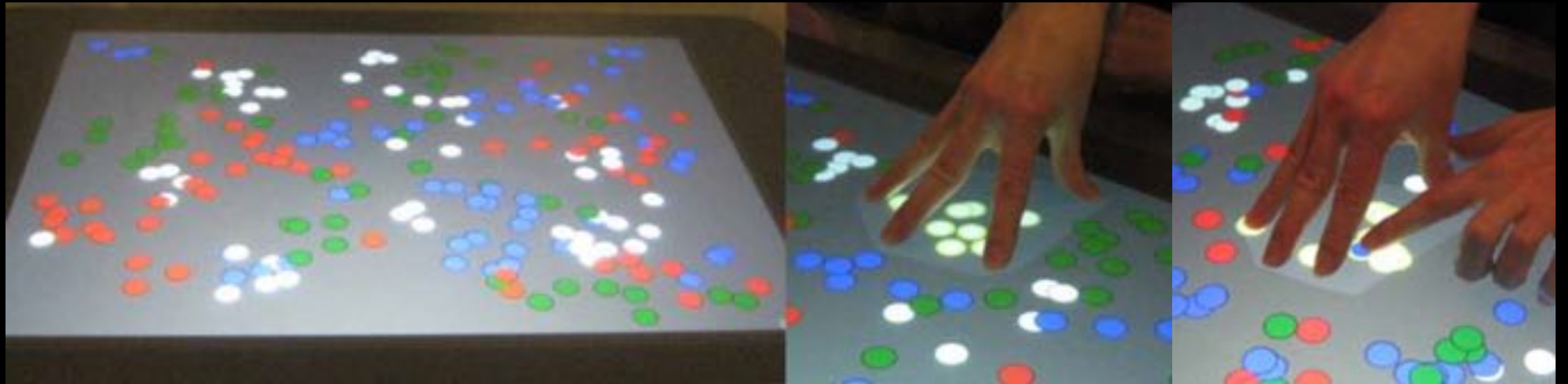
Au et al., "**LinearDragger**: A Linear Selector for One-finger Target Acquisition", CHI'14



Wobbrock et al., "User defined gestures for surface computing", CHI'14



Wobbrock et al., "User defined gestures for surface computing", CHI'14



North et al., *"Understanding multi-touch manipulation for surface computing"*, INTERACT'09

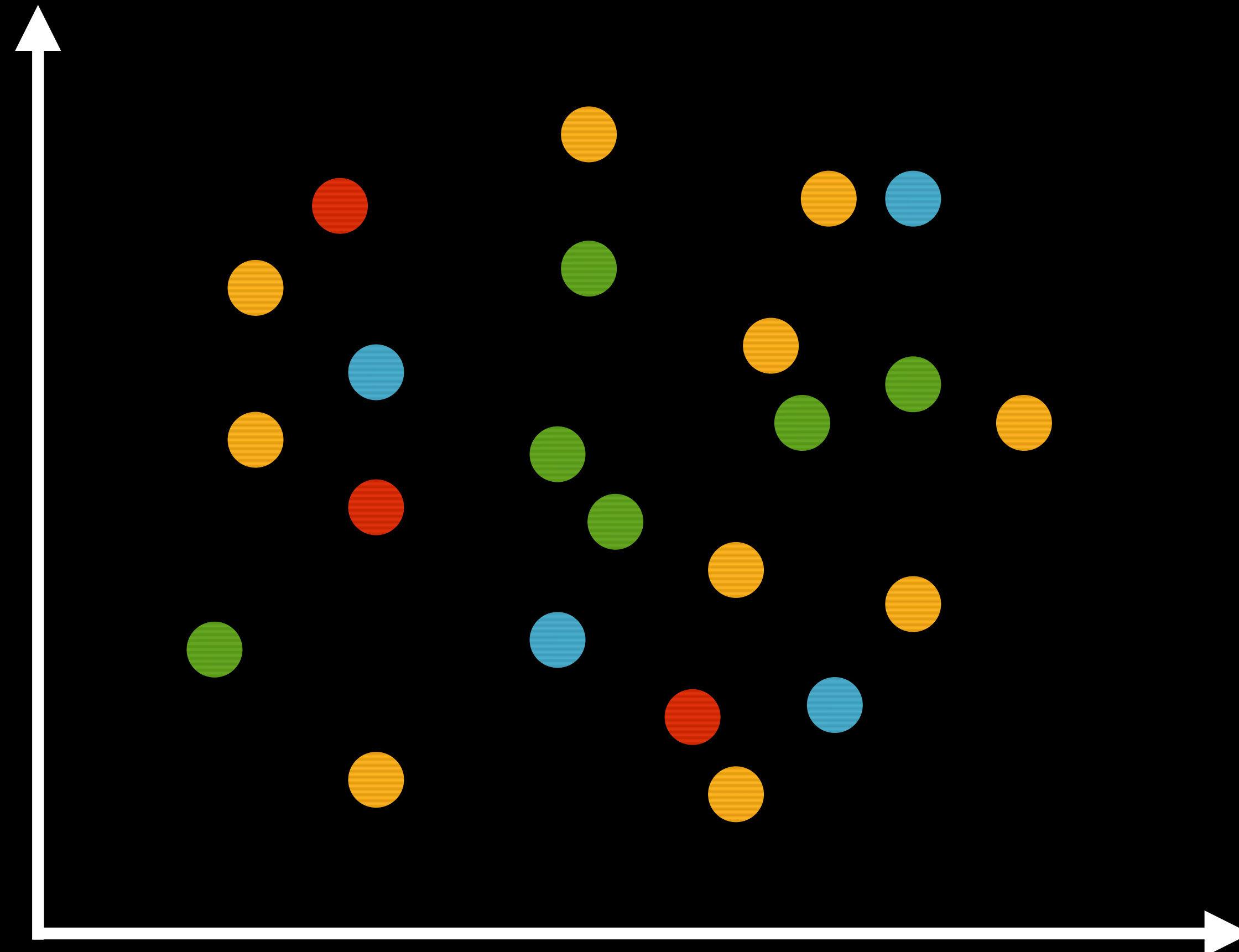
Research Challenge

How can we provide **advanced selection** features within **tablet-based visualization systems**?

Driving Scenarios ...

1. Compound Query

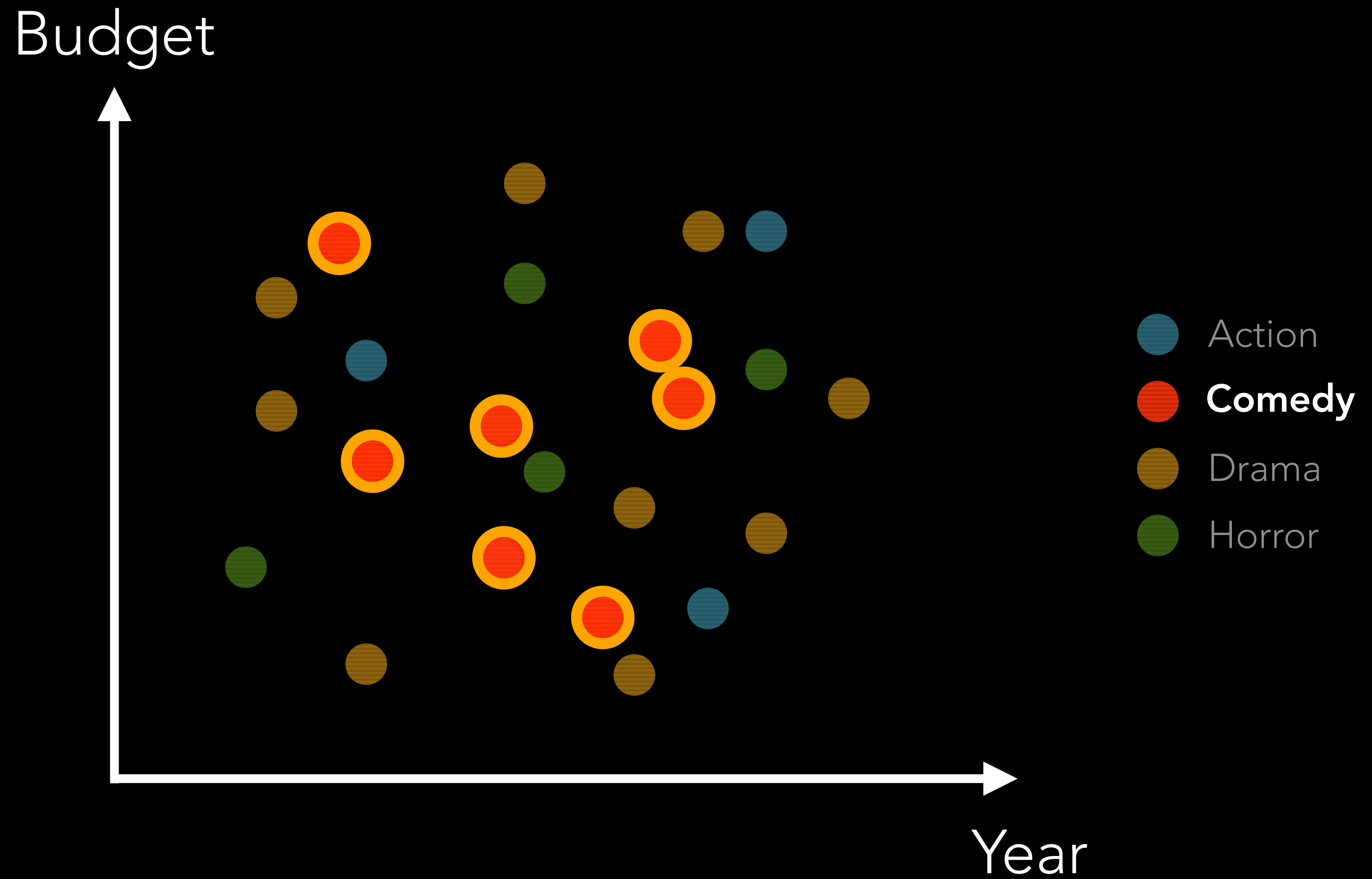
Budget



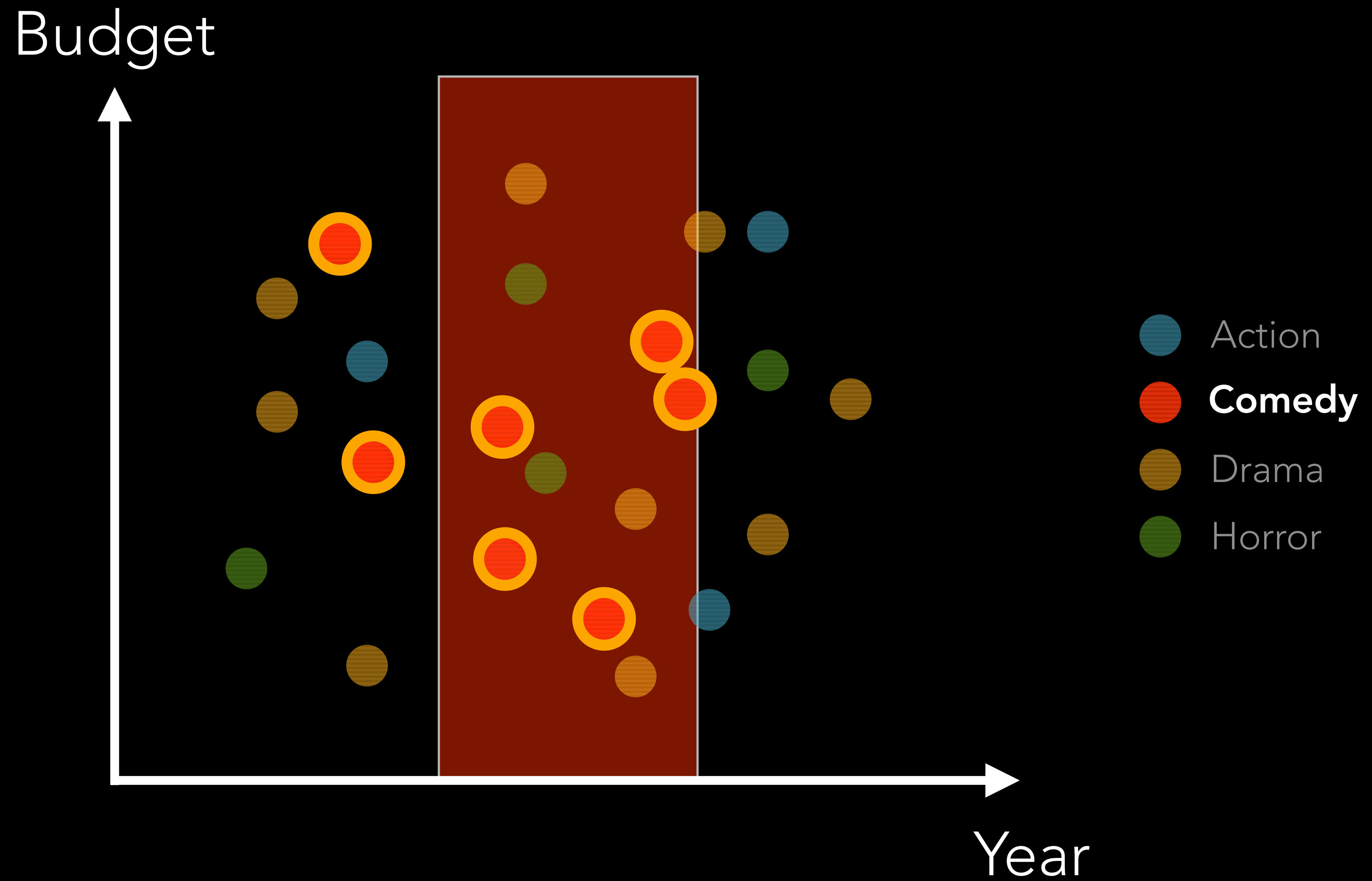
- Action
- Comedy
- Drama
- Horror

Year

1. Compound Query

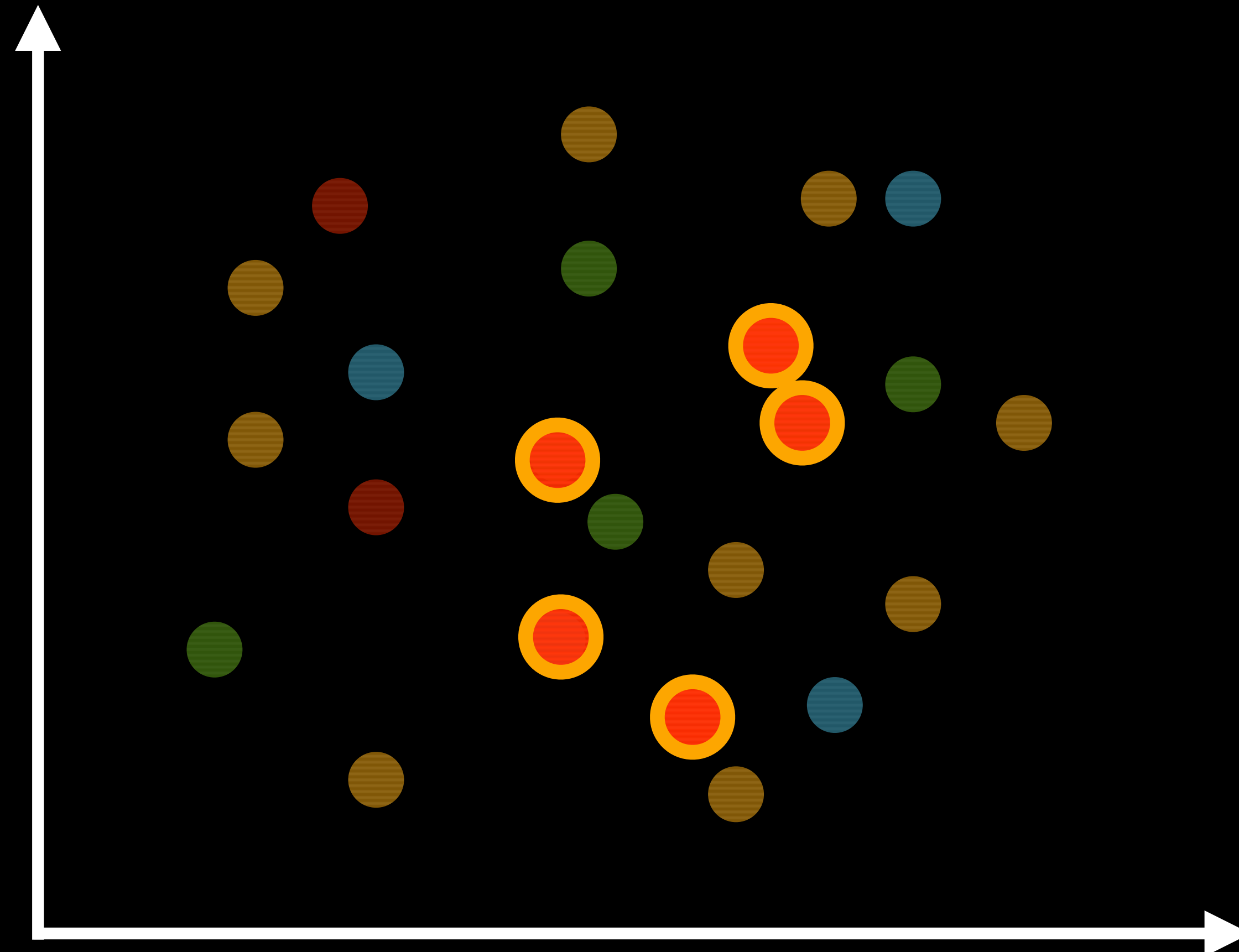


1. Compound Query



1. Compound Query

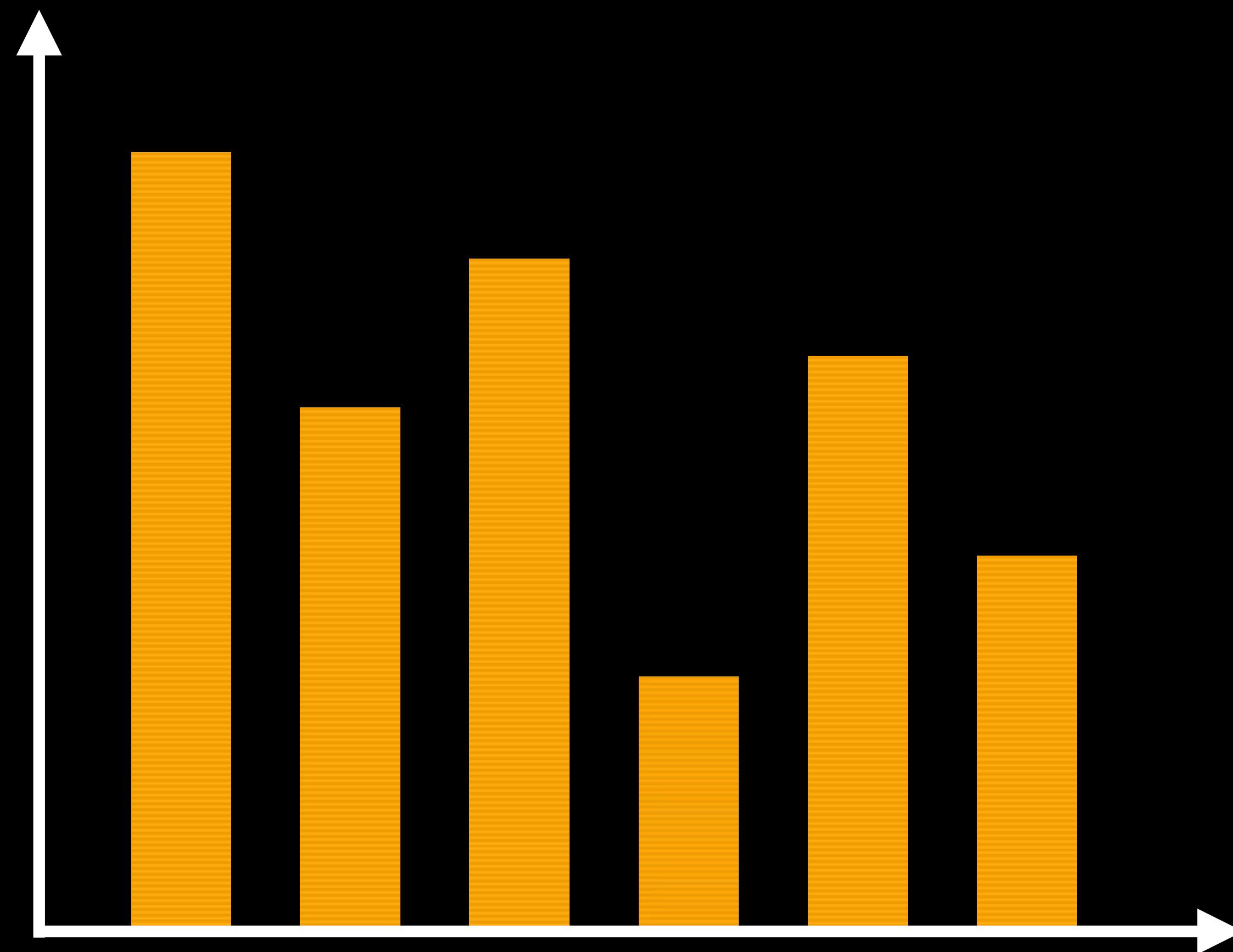
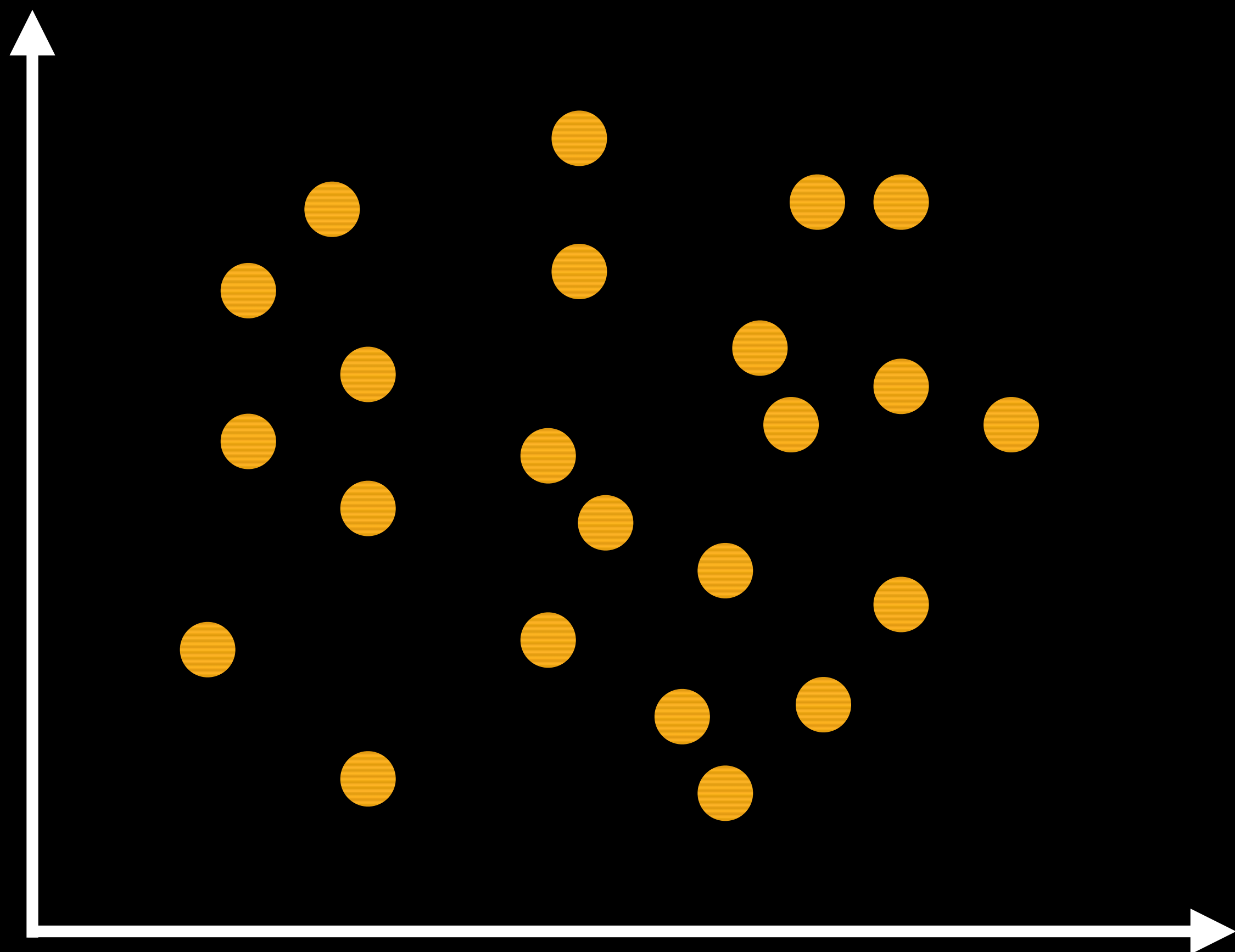
Budget



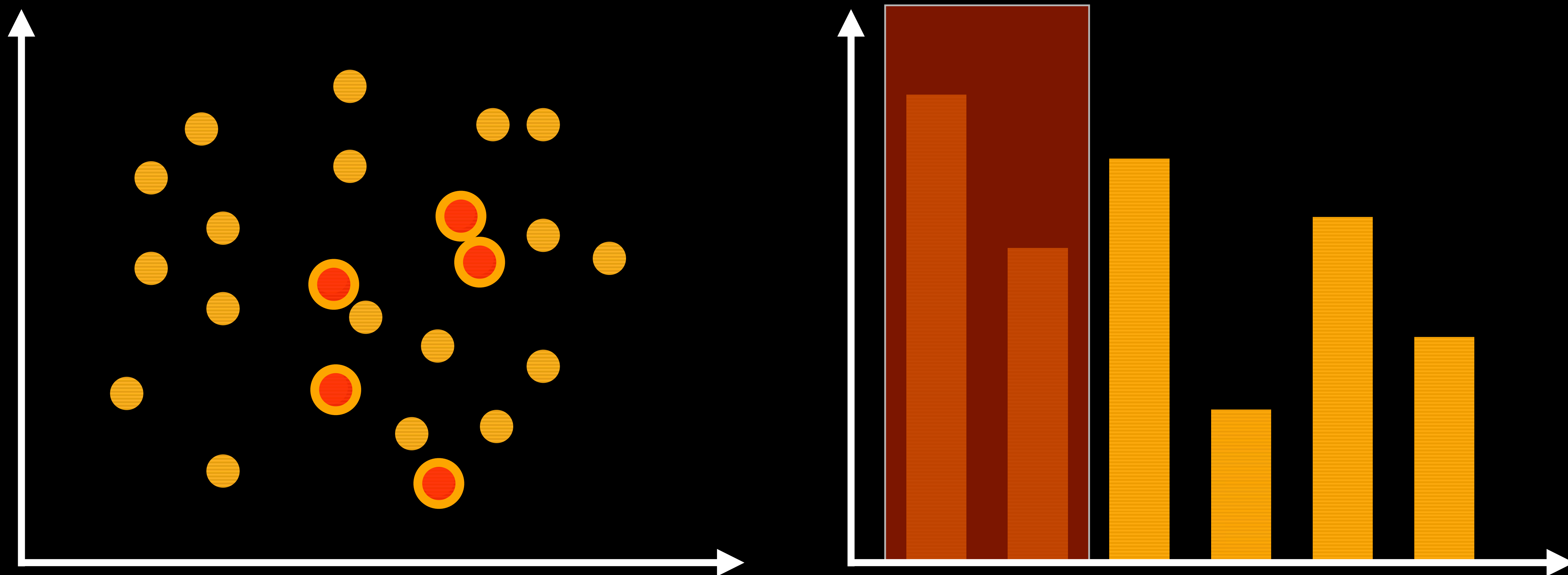
Year

- Action
- Comedy**
- Drama
- Horror

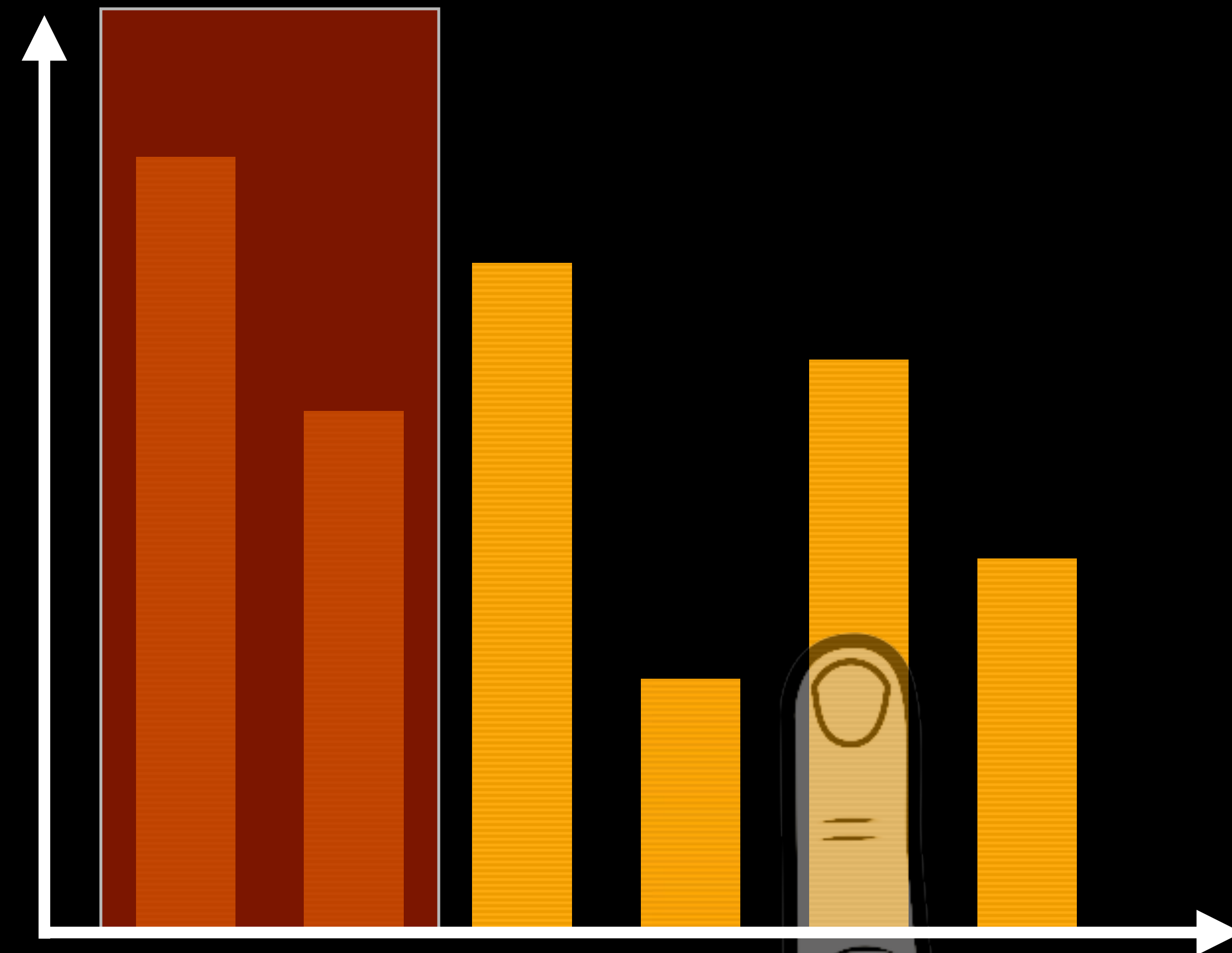
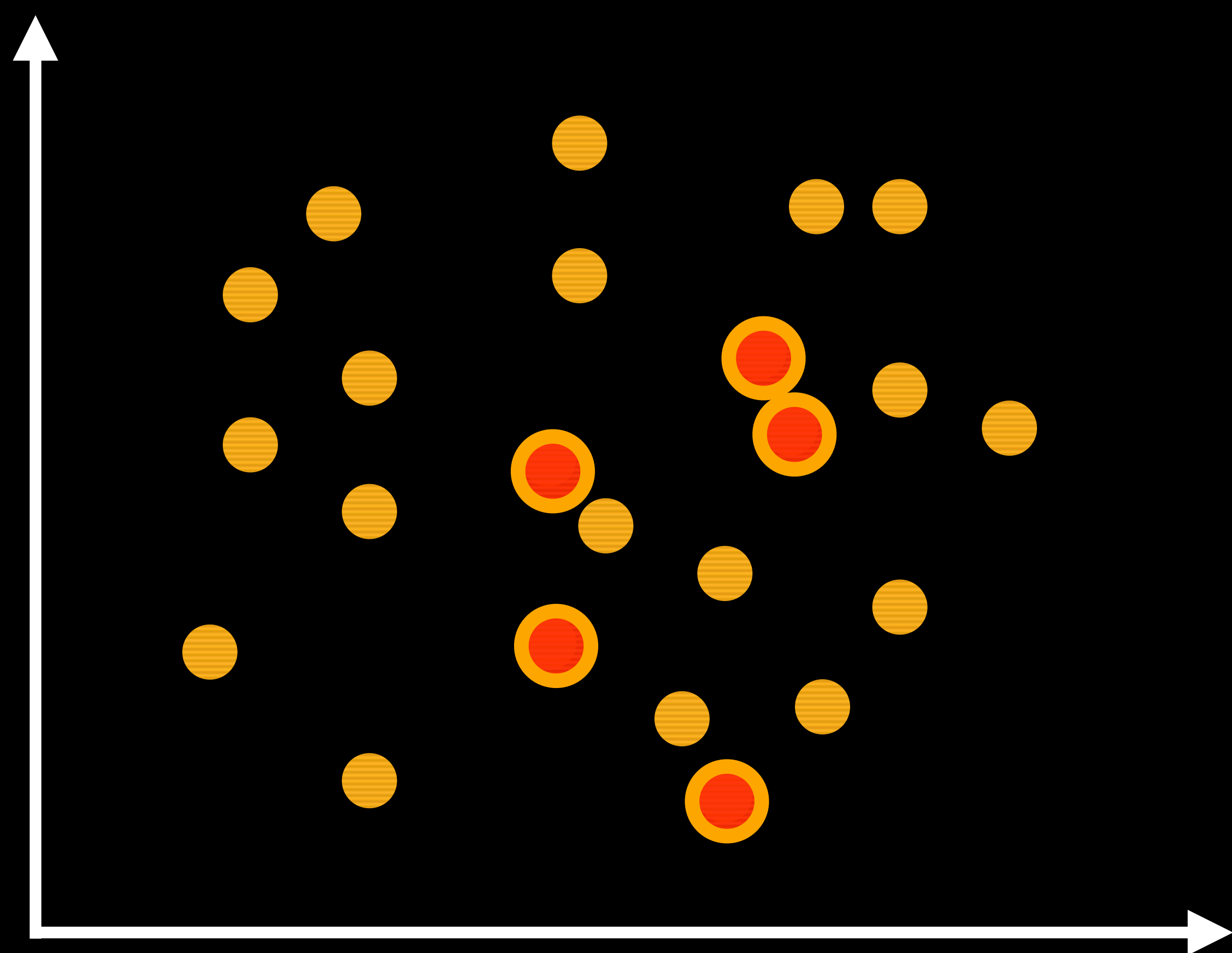
2. Brushing and linking



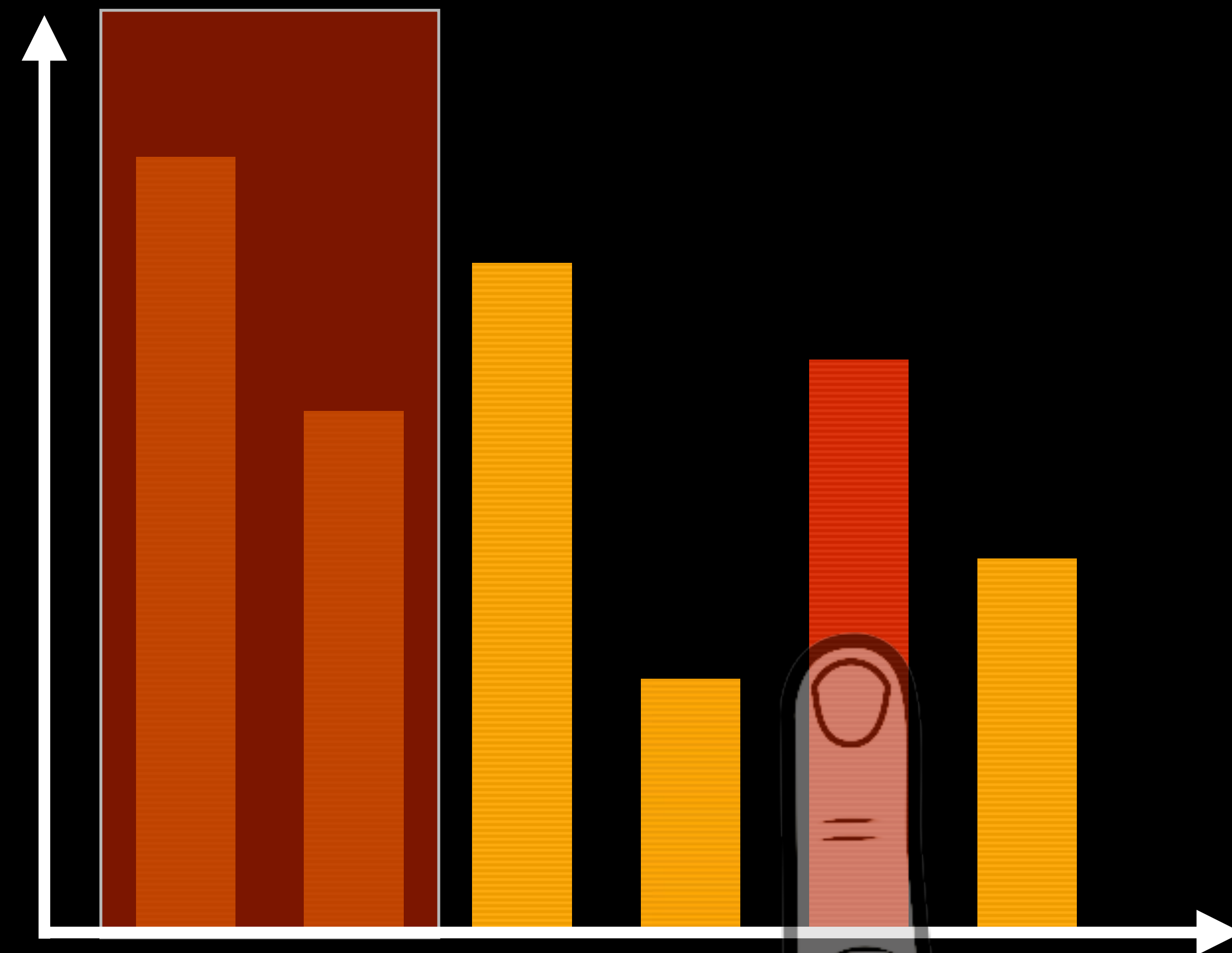
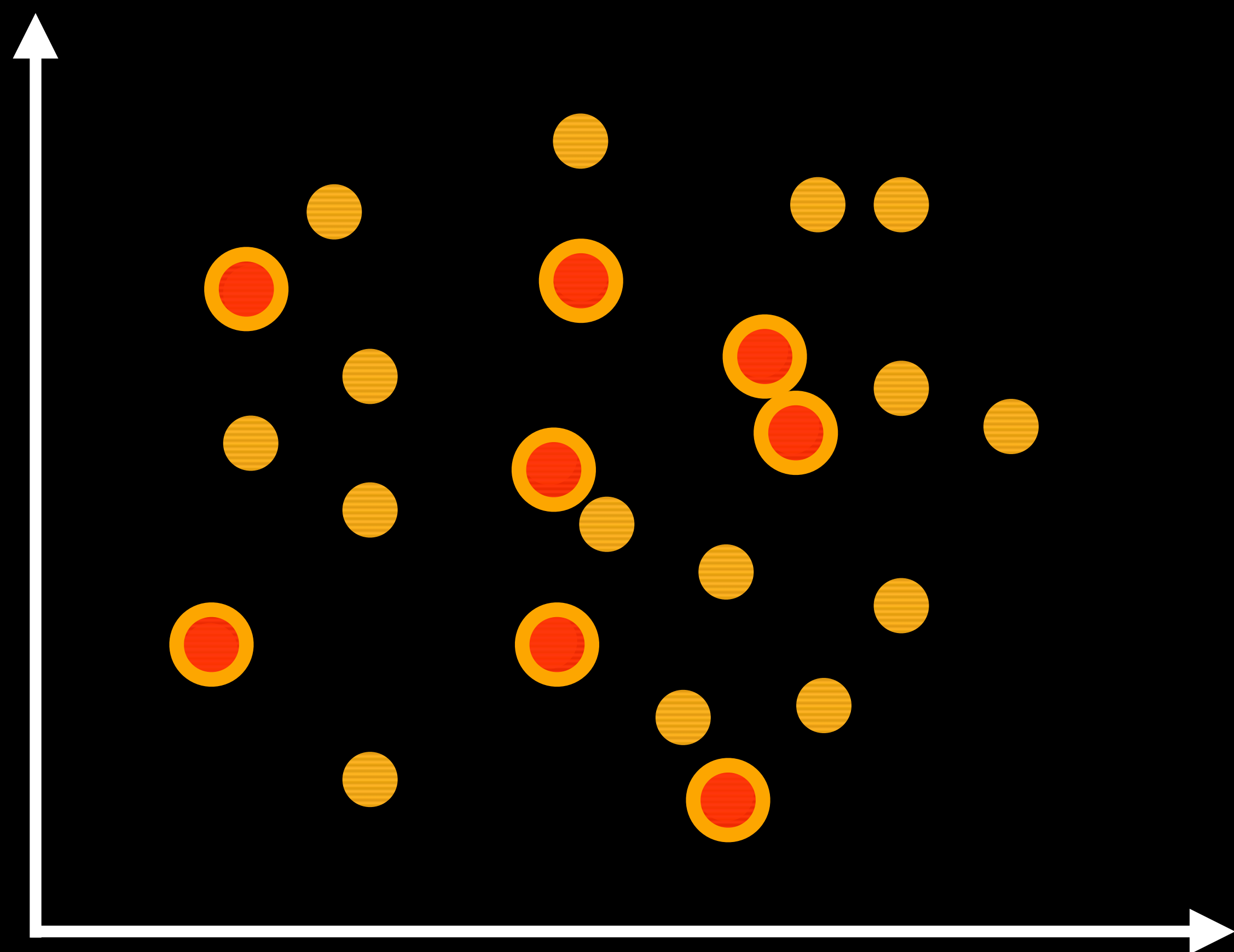
2. Brushing and linking



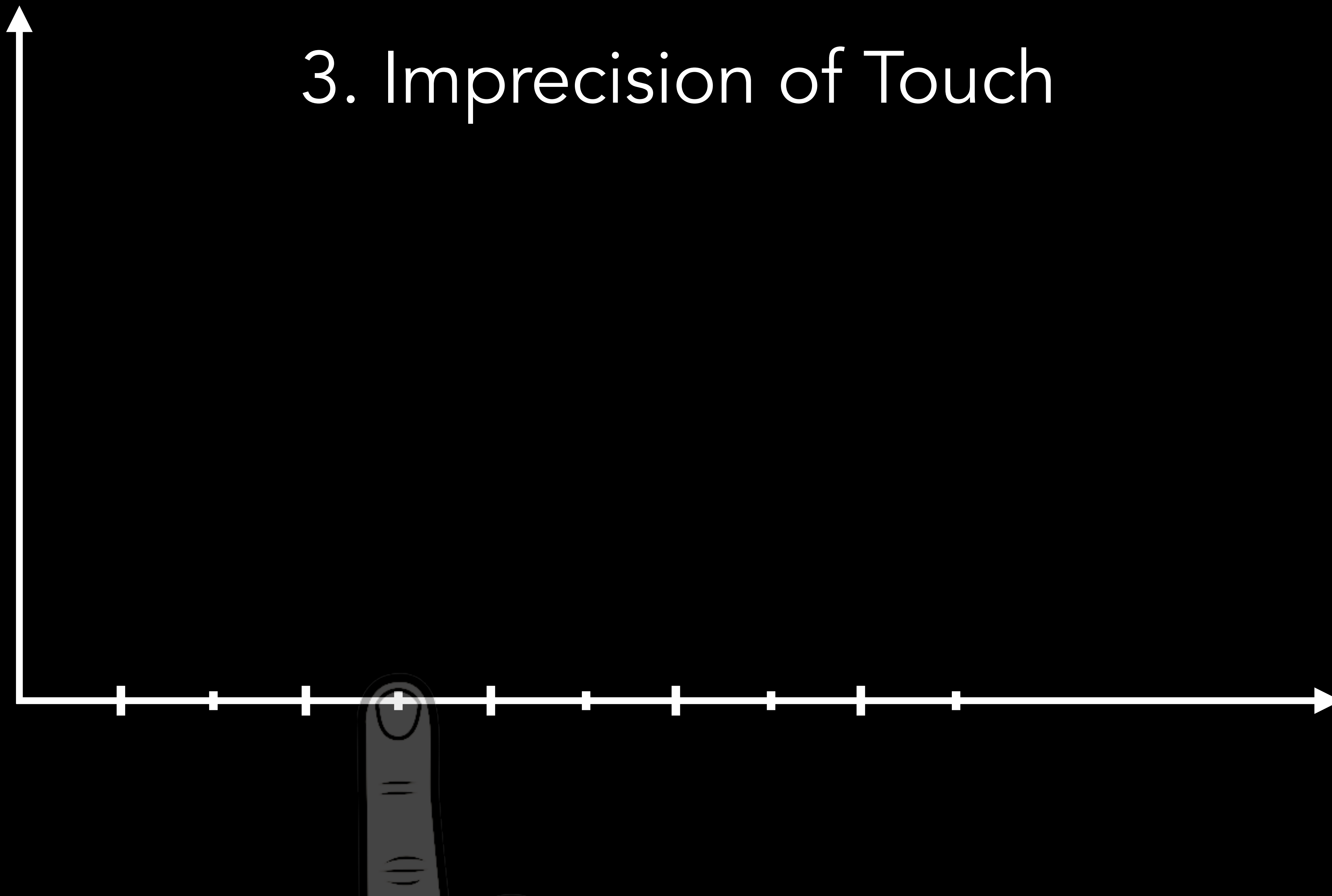
2. Brushing and linking



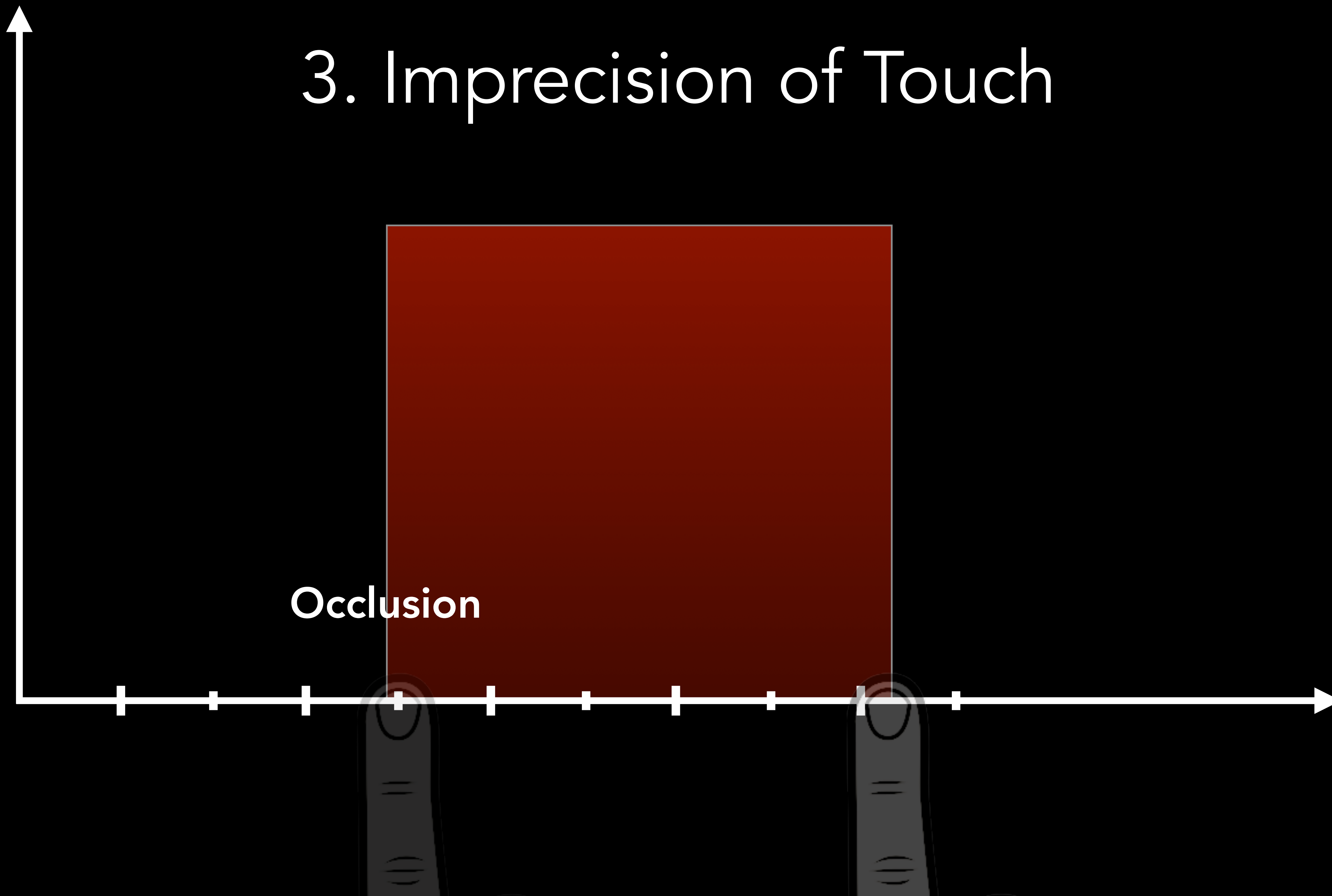
2. Brushing and linking



3. Imprecision of Touch



3. Imprecision of Touch



Designing a Solution ...

MULTITOUCH GESTURES

Tap Gestures



Scale Gestures



Rotate Gestures



Scroll Gestures



Hold Gestures



Swipe Gestures



Drag Gestures



Split Gestures



Flick Gestures



3D Gestures



Anchor Gestures



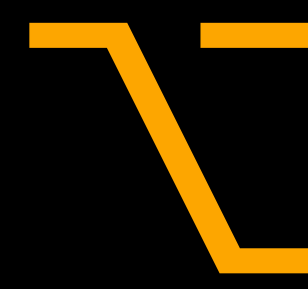
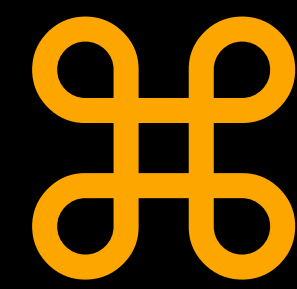
Marking Menus



Touch Overloading



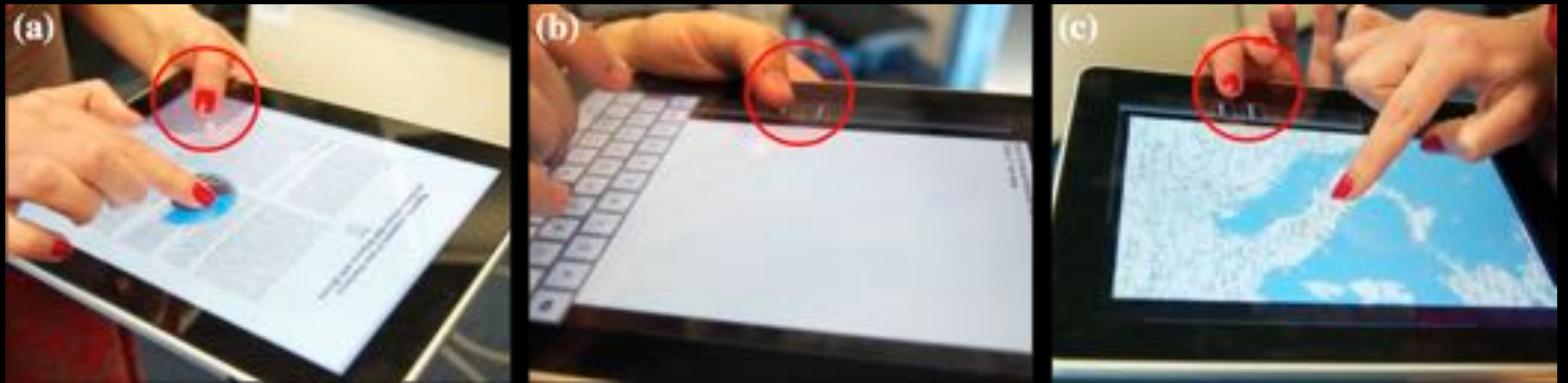




Modifier + Existing Interaction

Non-dominant Hand





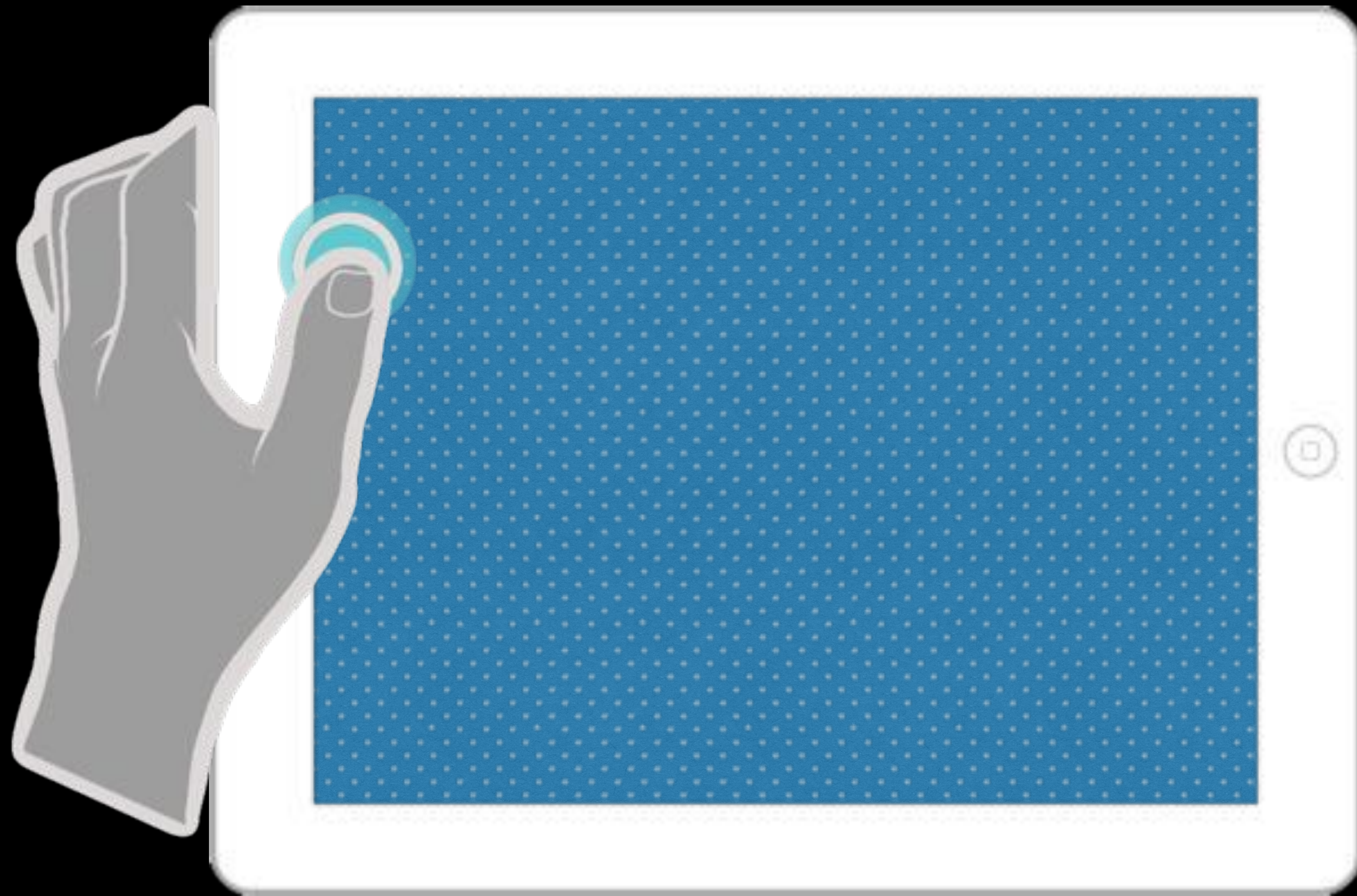
Wagner et al., "**BiTouch** and **BiPad**: Designing Bimanual Interaction for Hand-held Tablets", CHI'12
Li et al., "Experimental Analysis of Mode Switching Techniques in Pen-based User Interfaces", CHI'05

Control selector

~~Control selector~~

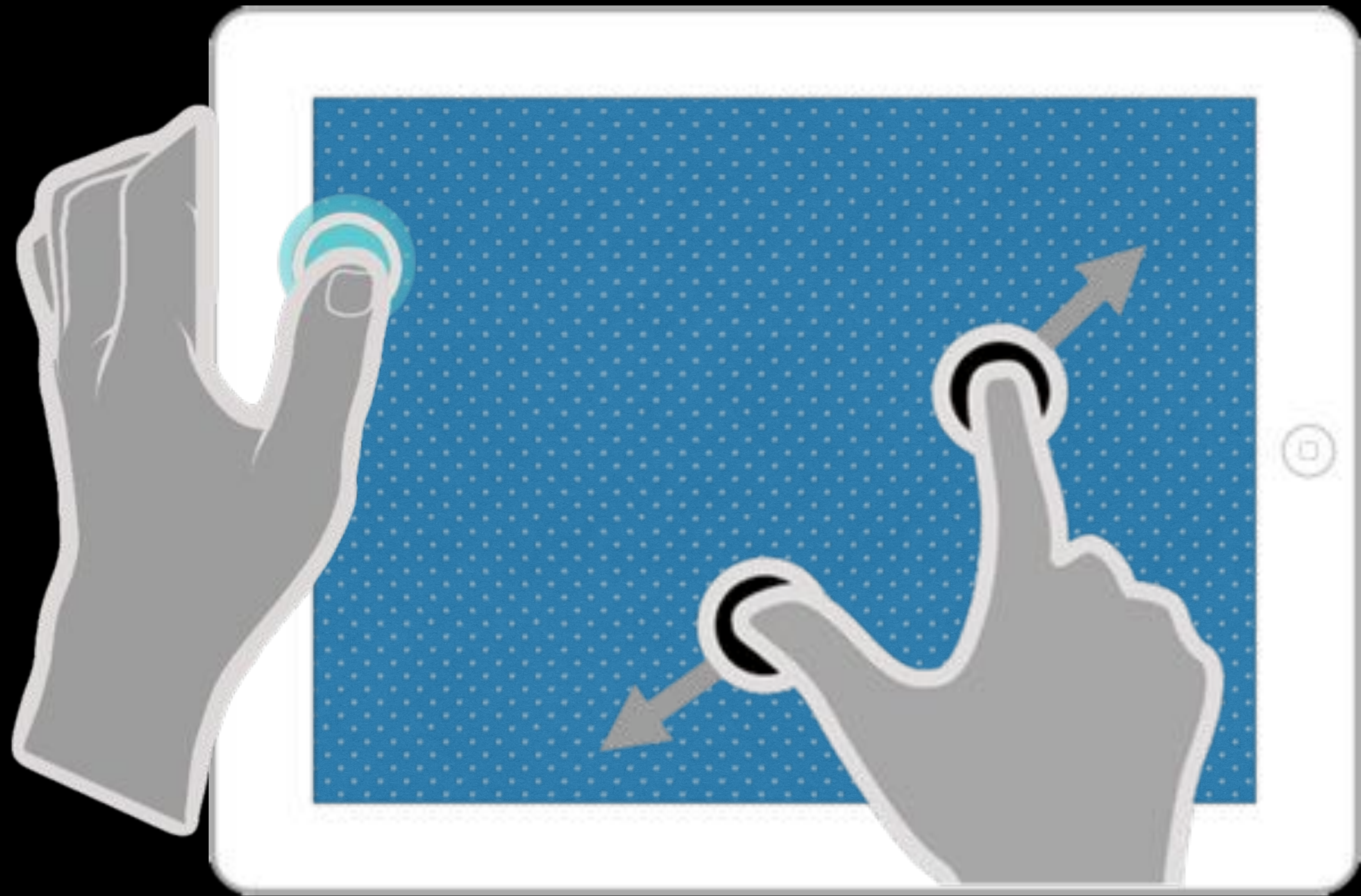
Modifier

1 bit

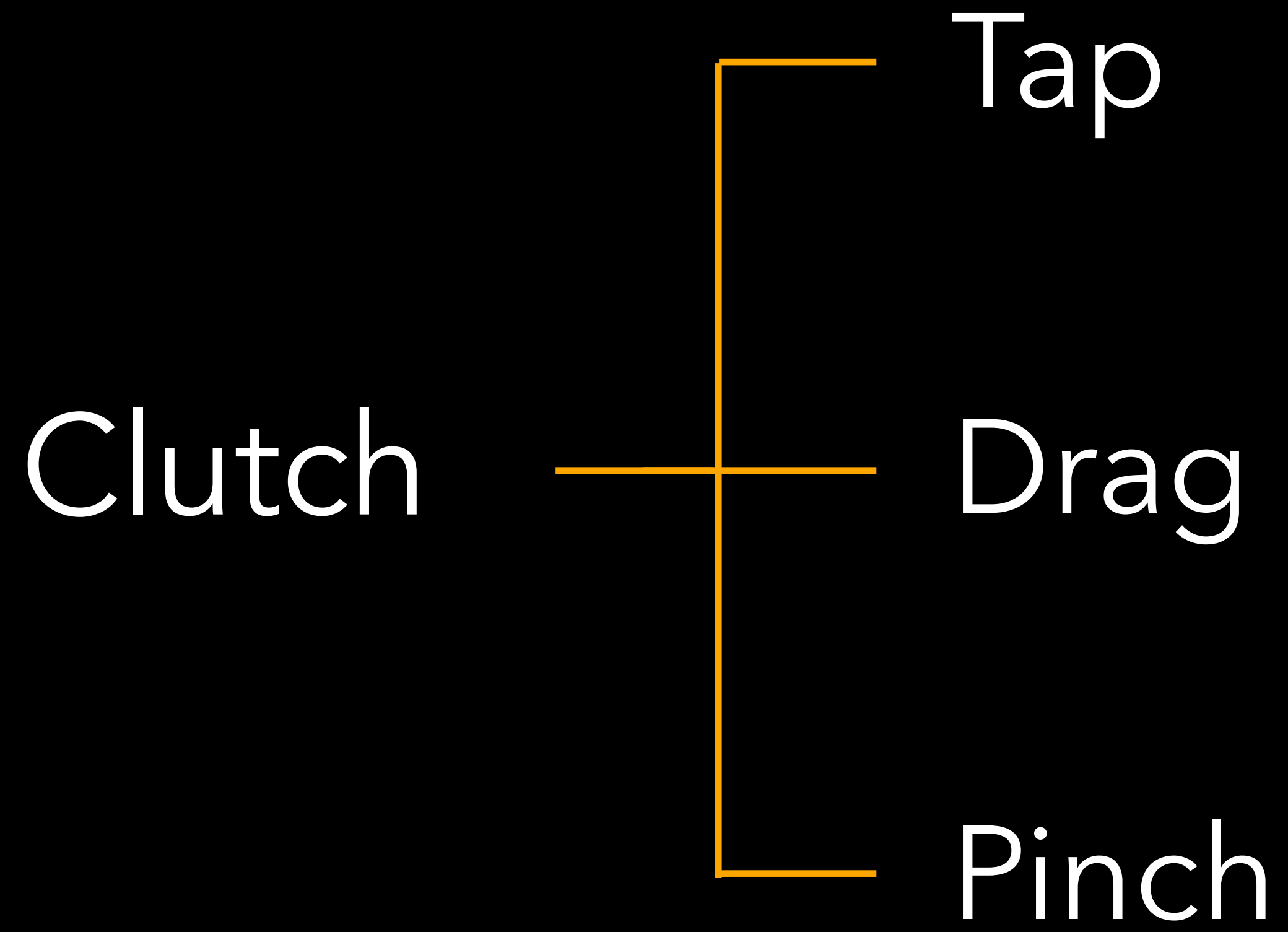




Clutch



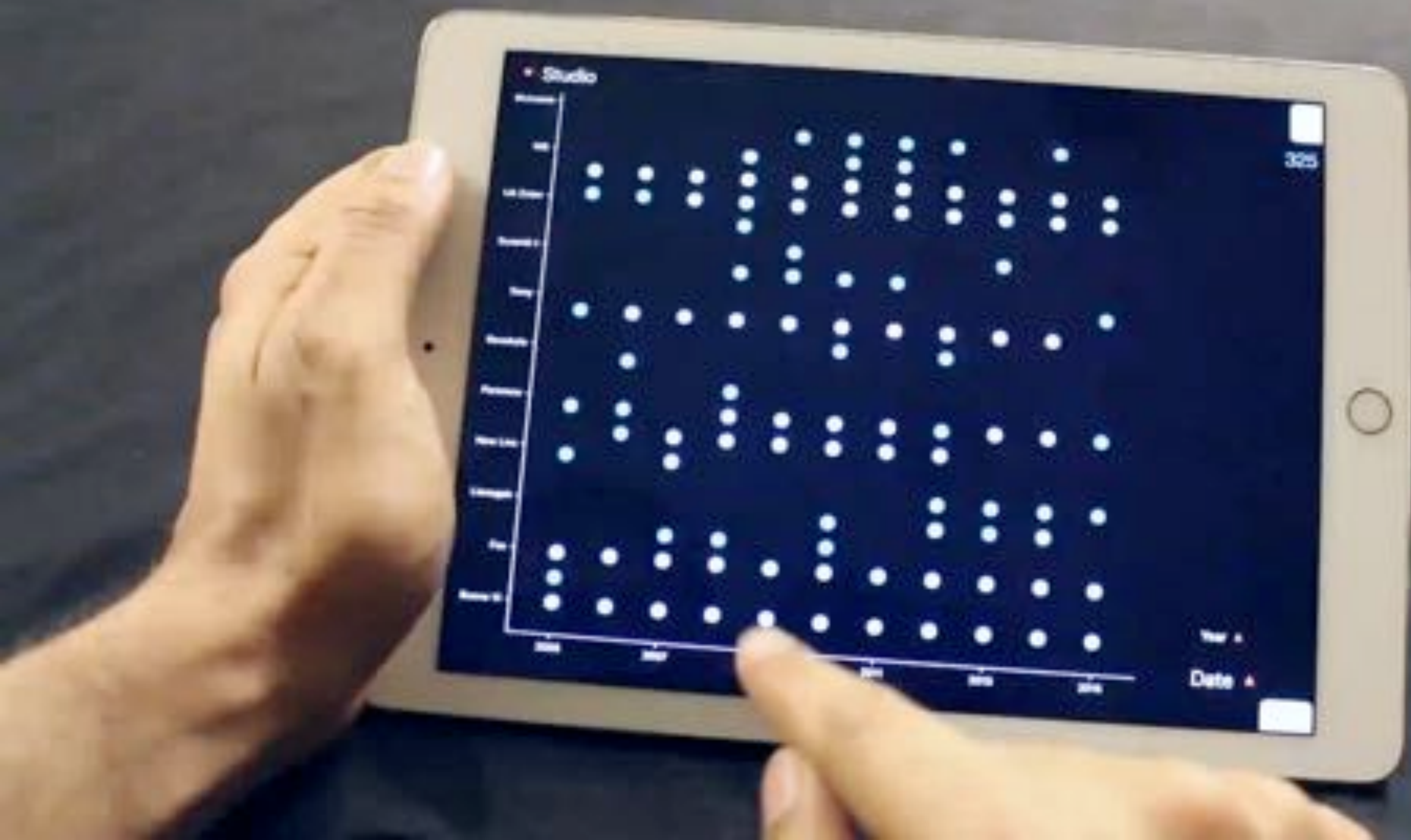
Mapping Clutch ...

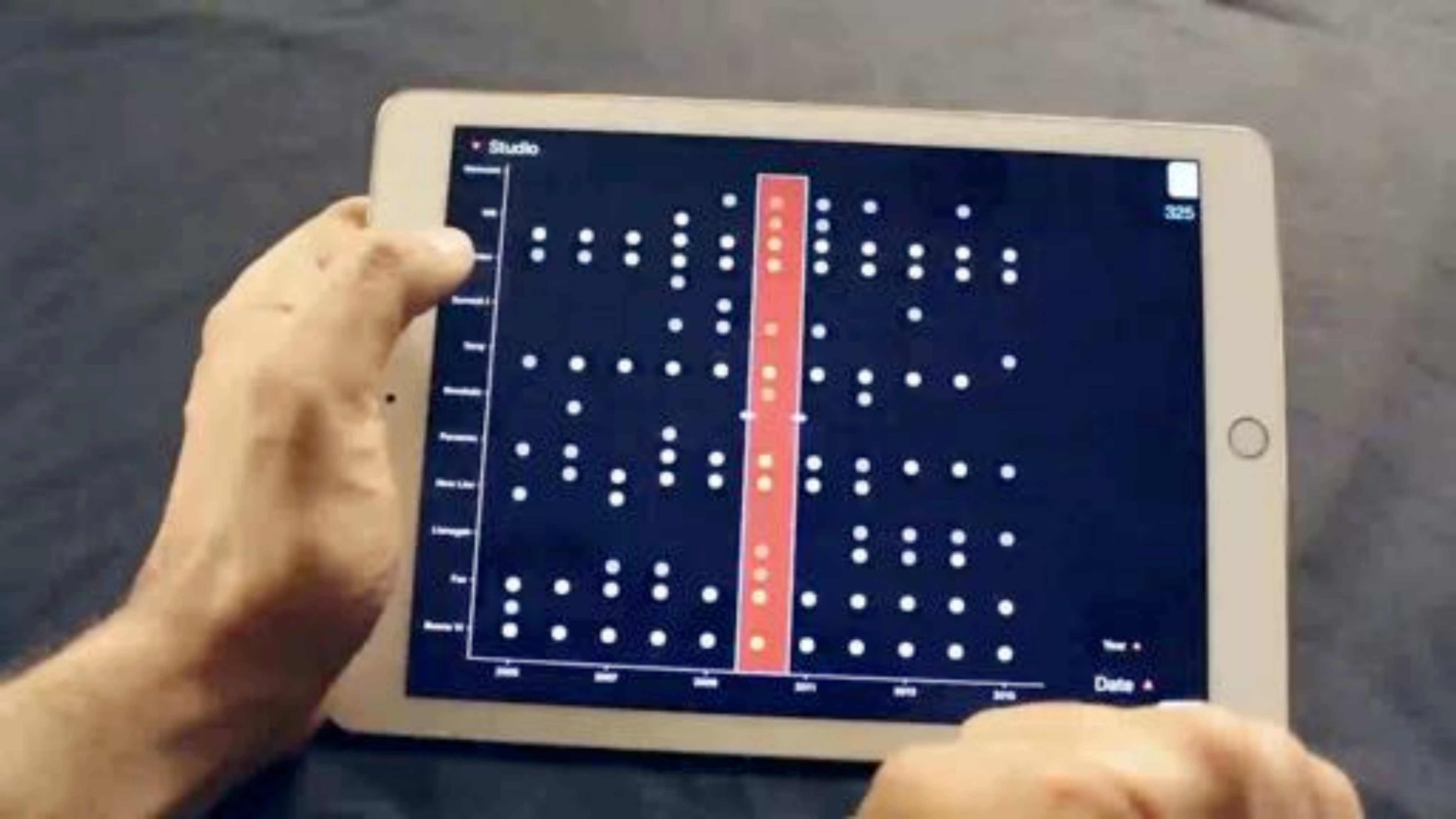


Clutch + Tap



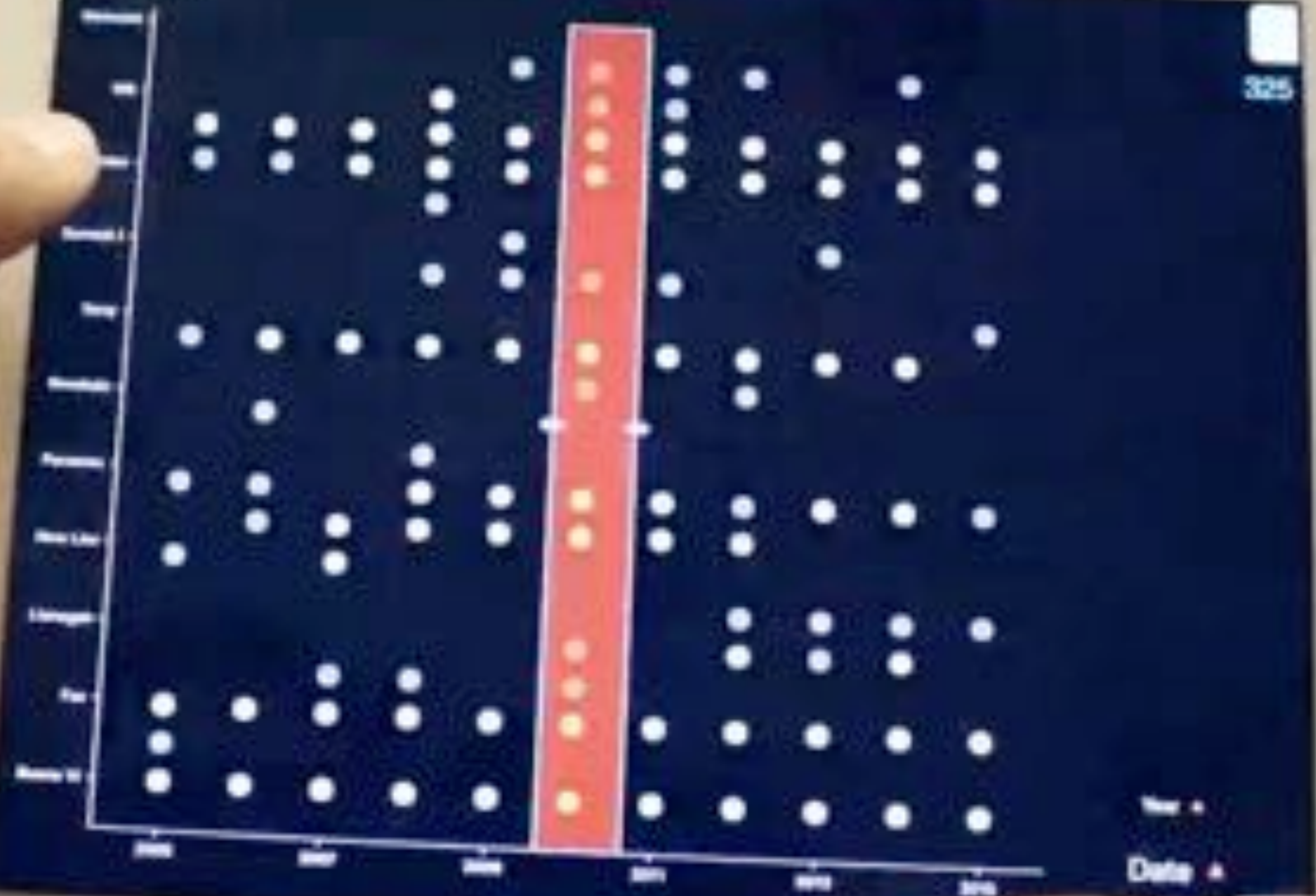
Clutch + Drag





Studio

325



Date A

Clutch + Pinch



Length

330

Budget

Clutch

+

Drag

+

Pinch



Length

300

Budget

Low-tension Clutch



Replace Selection

Add to Selection

Remove from Selection

Intersect with Selection

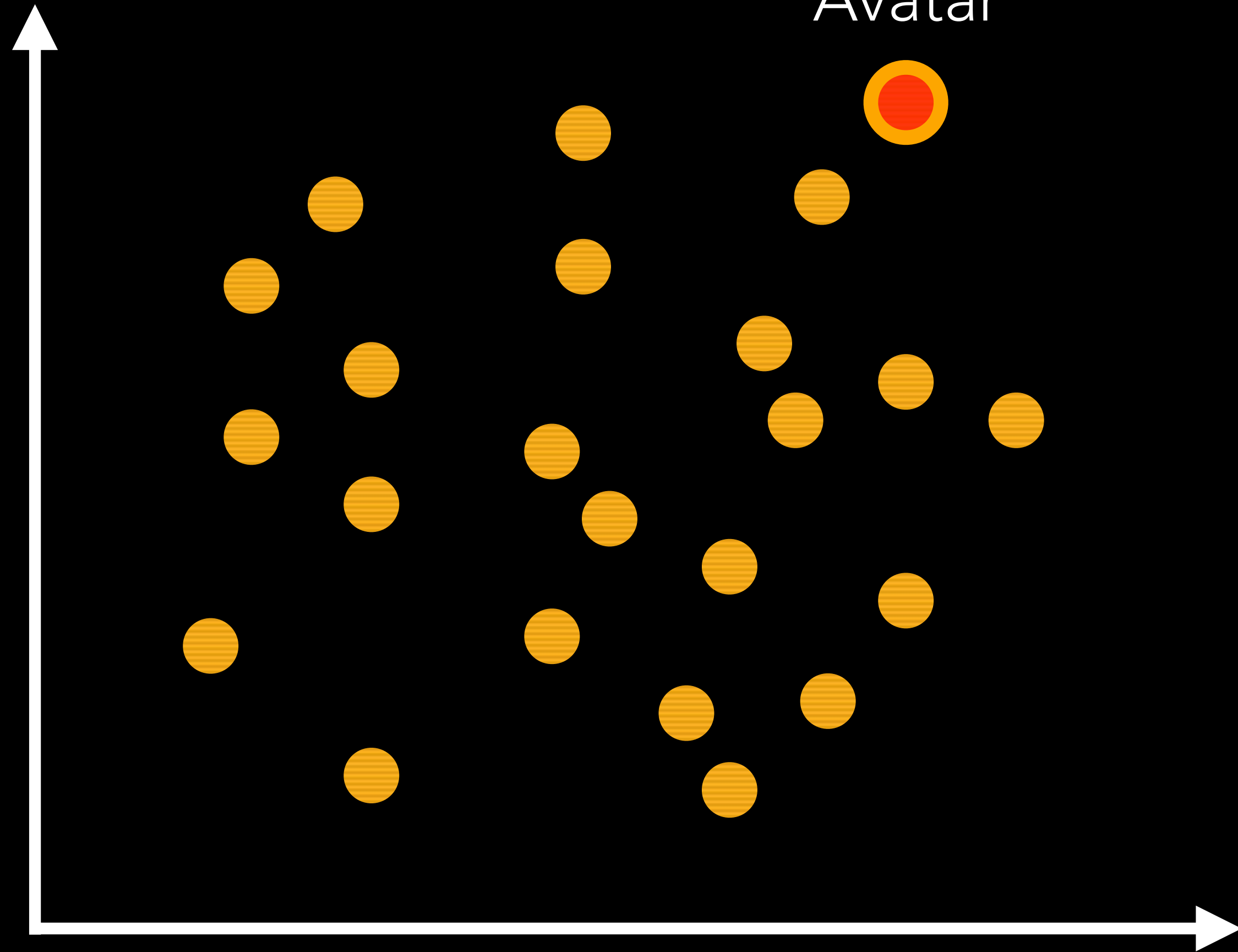
Toggle Selection

Generalized Selection

Generalized Selection

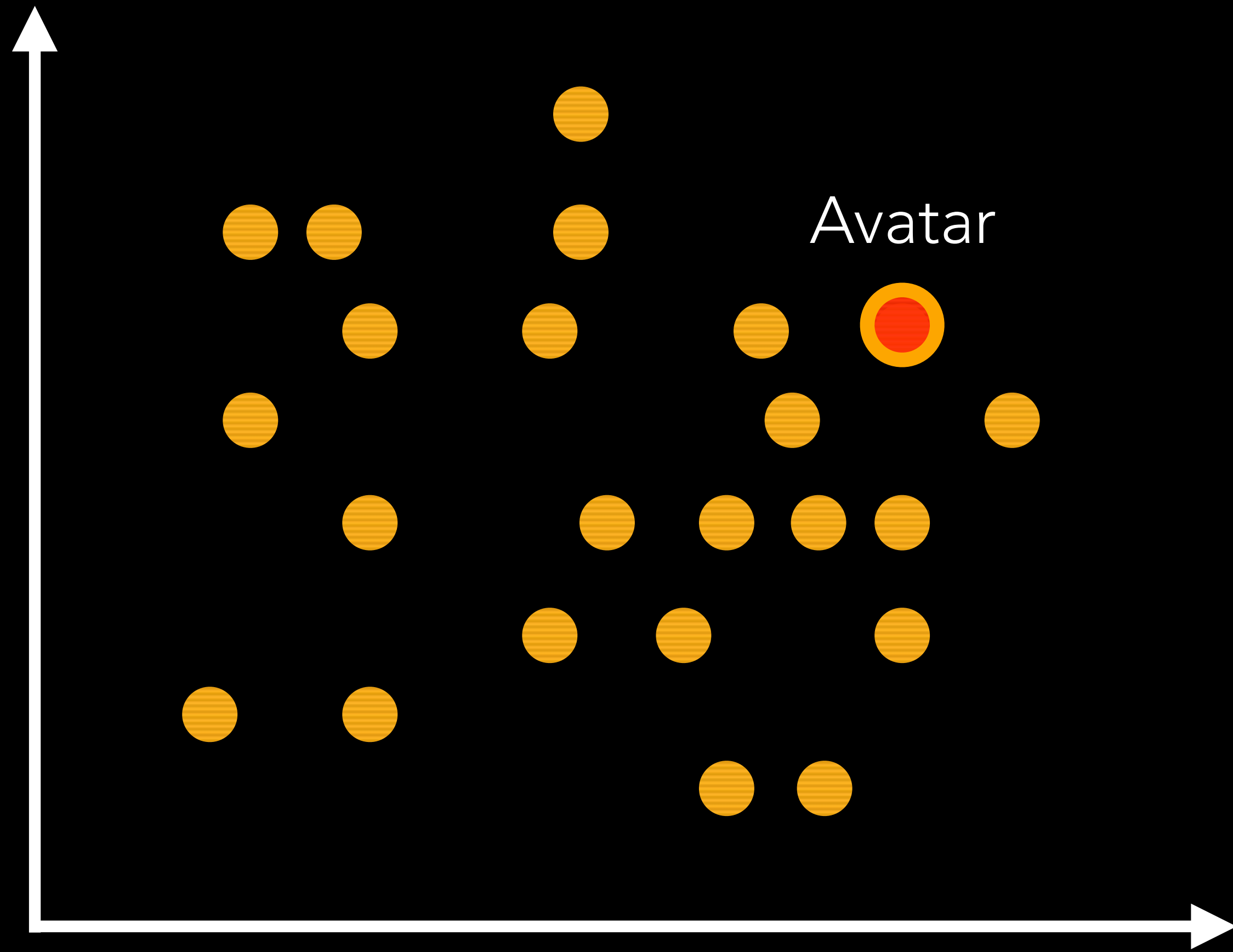
Budget

Avatar



Profit

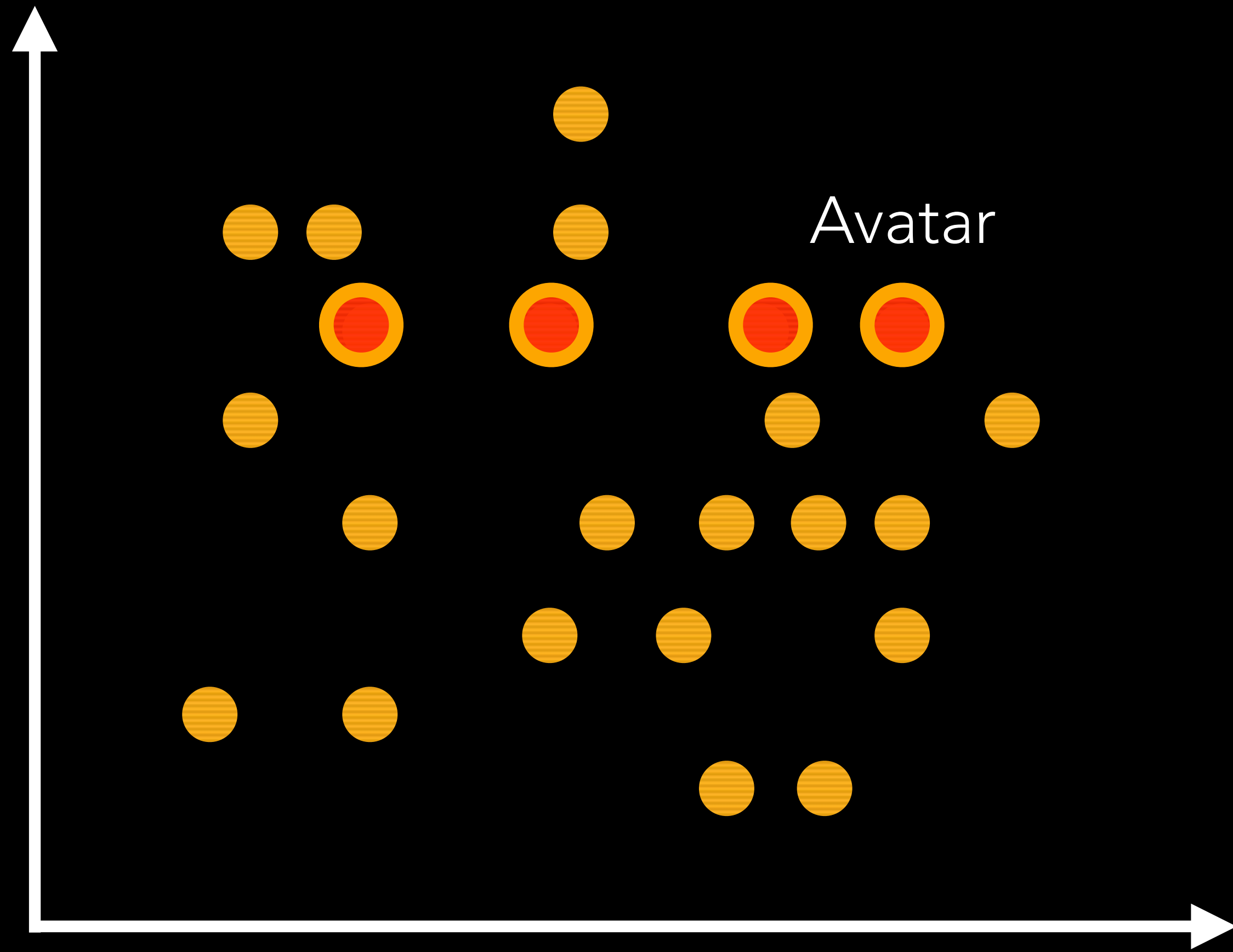
Director



Avatar

Profit

Director

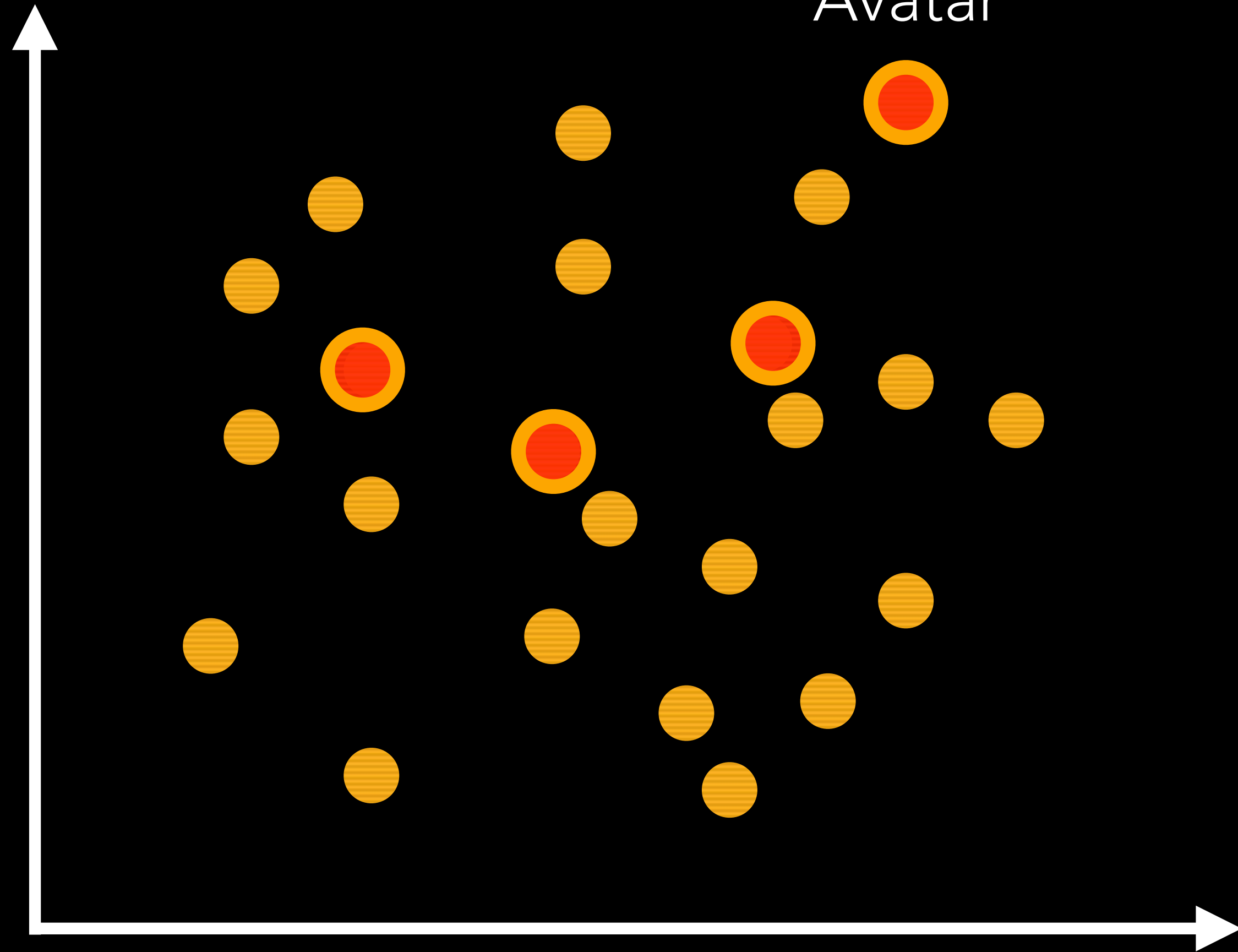


Avatar

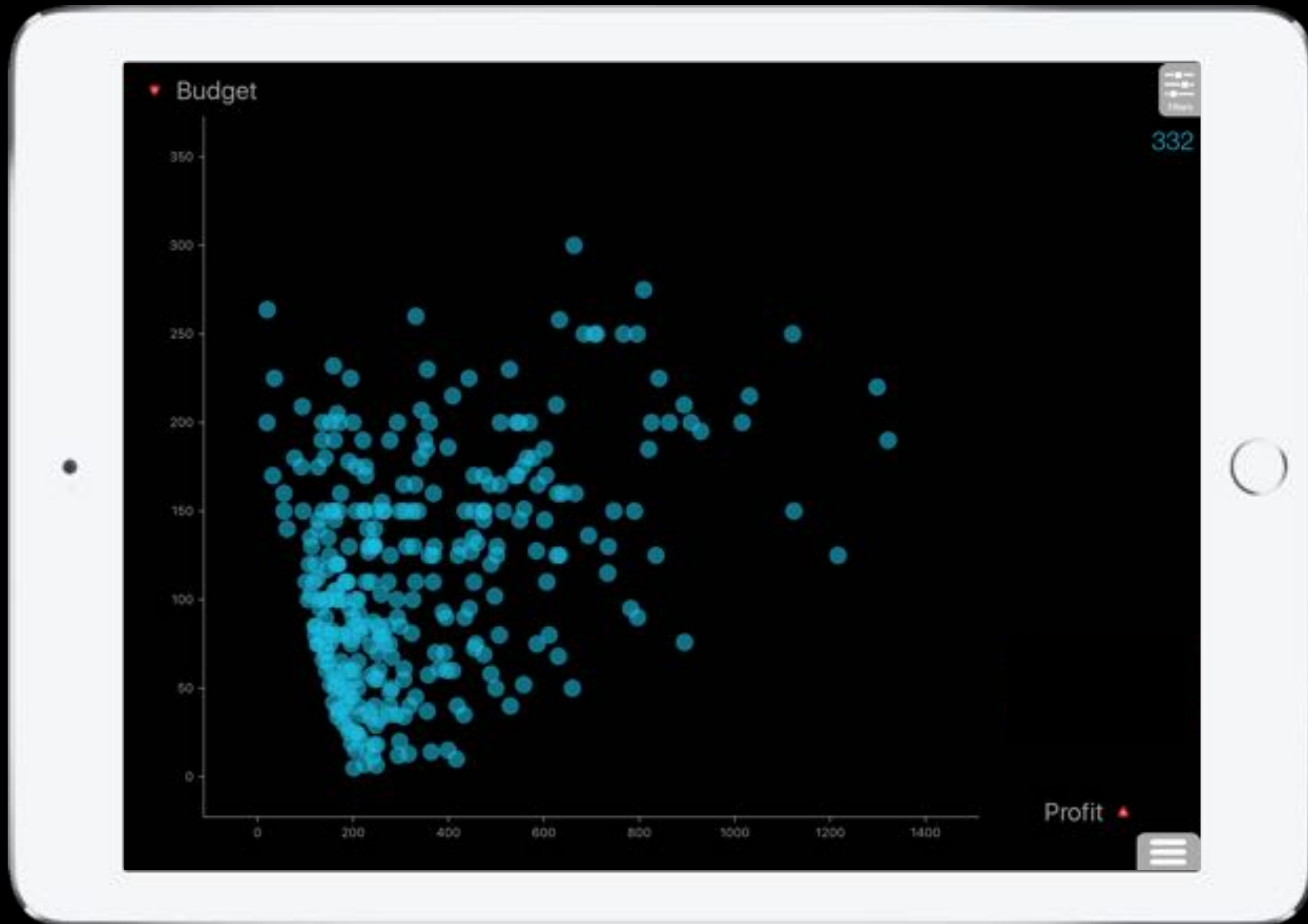
Profit

Budget

Avatar



Profit



Scatterplot

Chart List



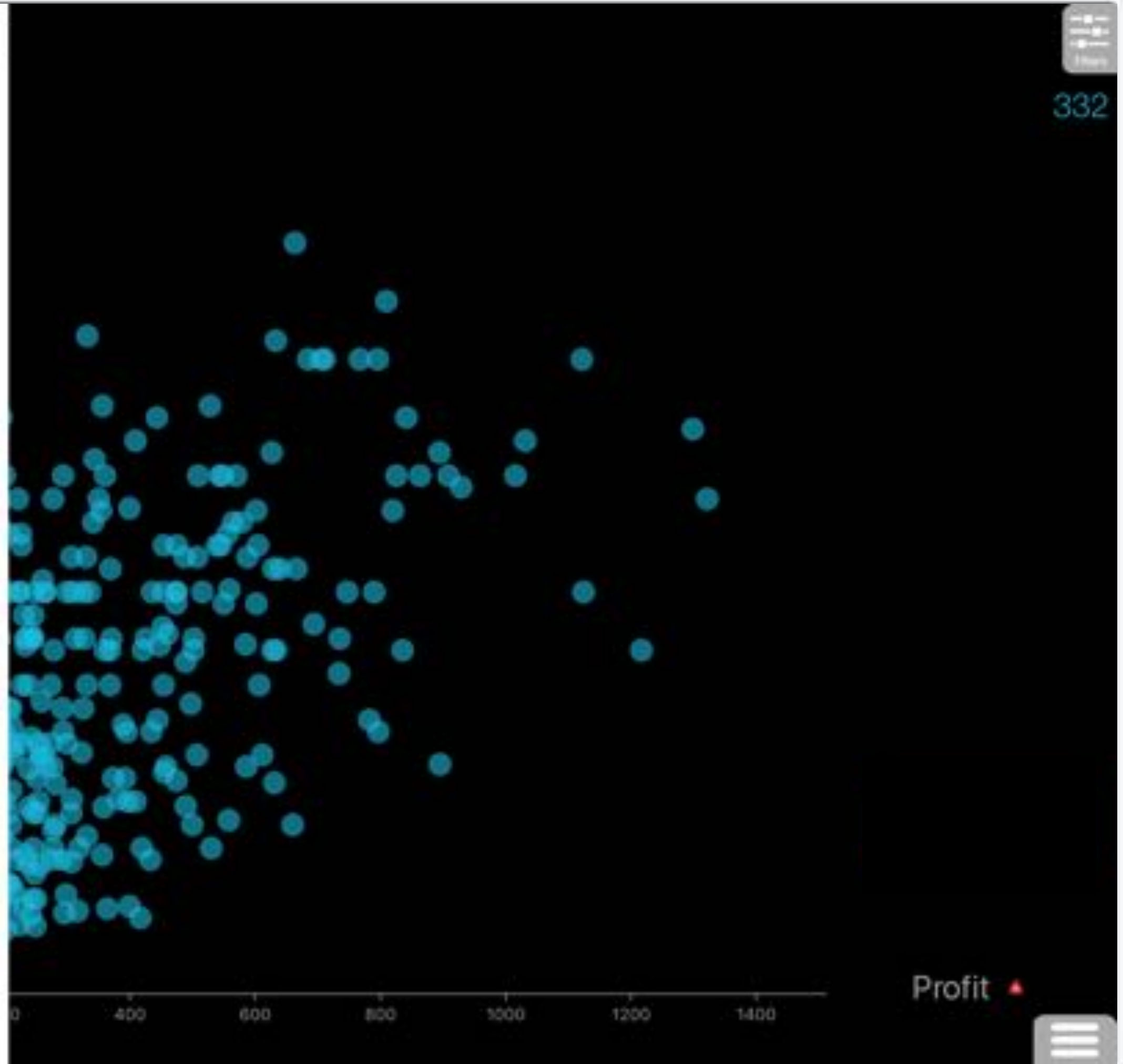
Add Scatterplot

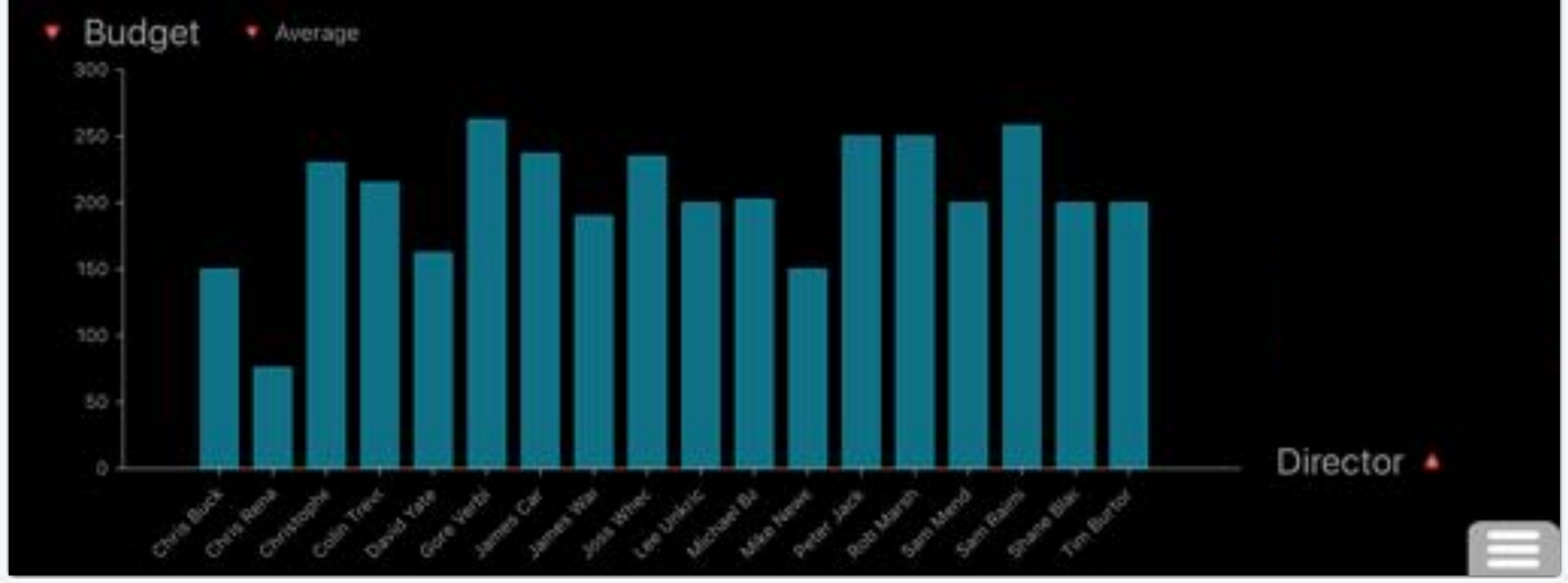
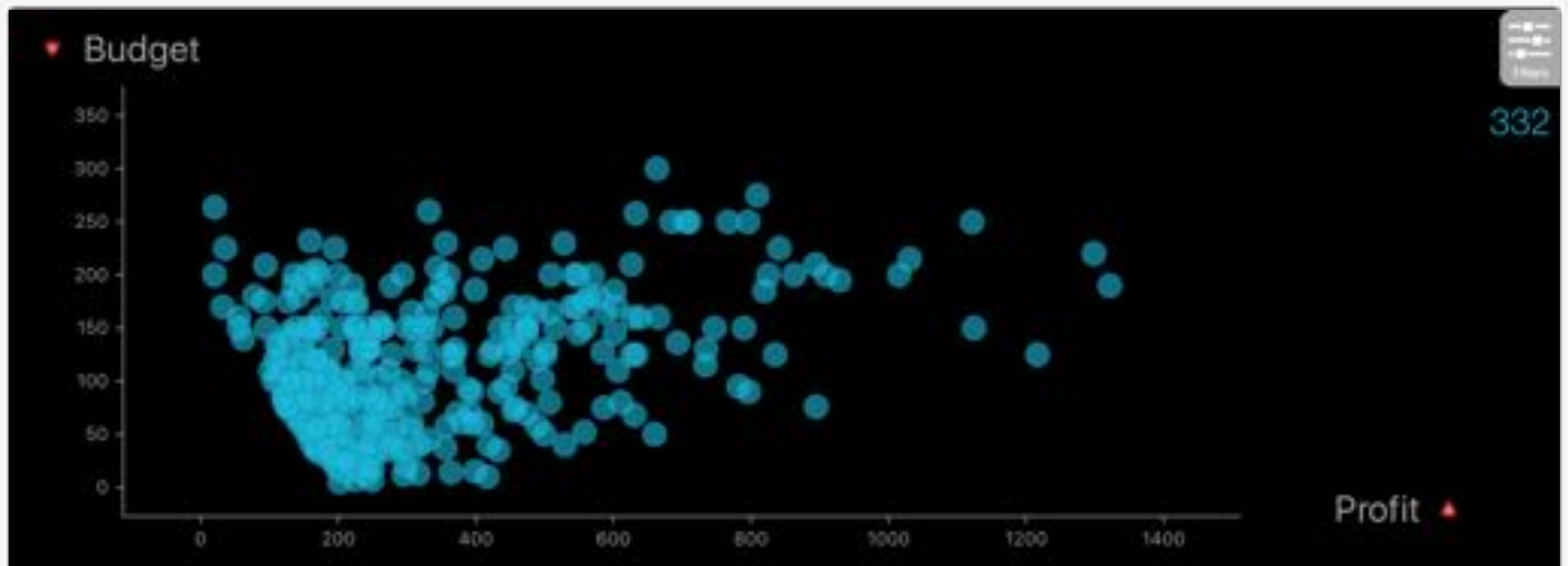


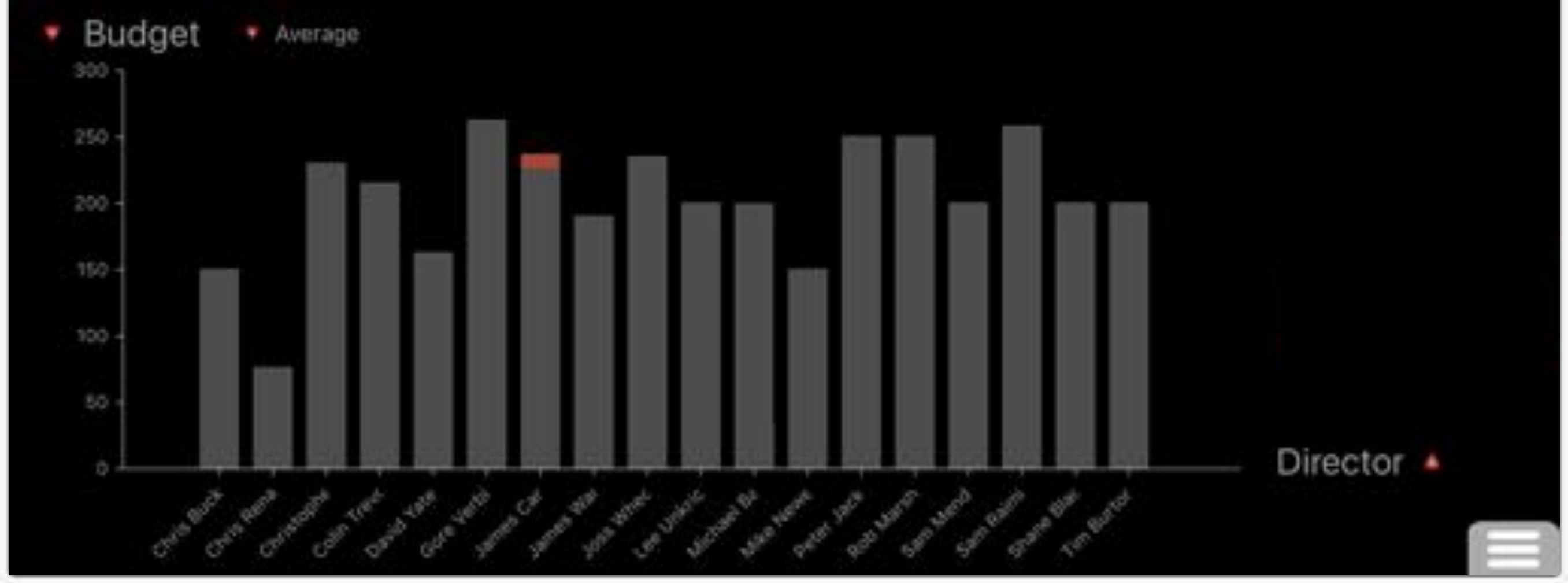
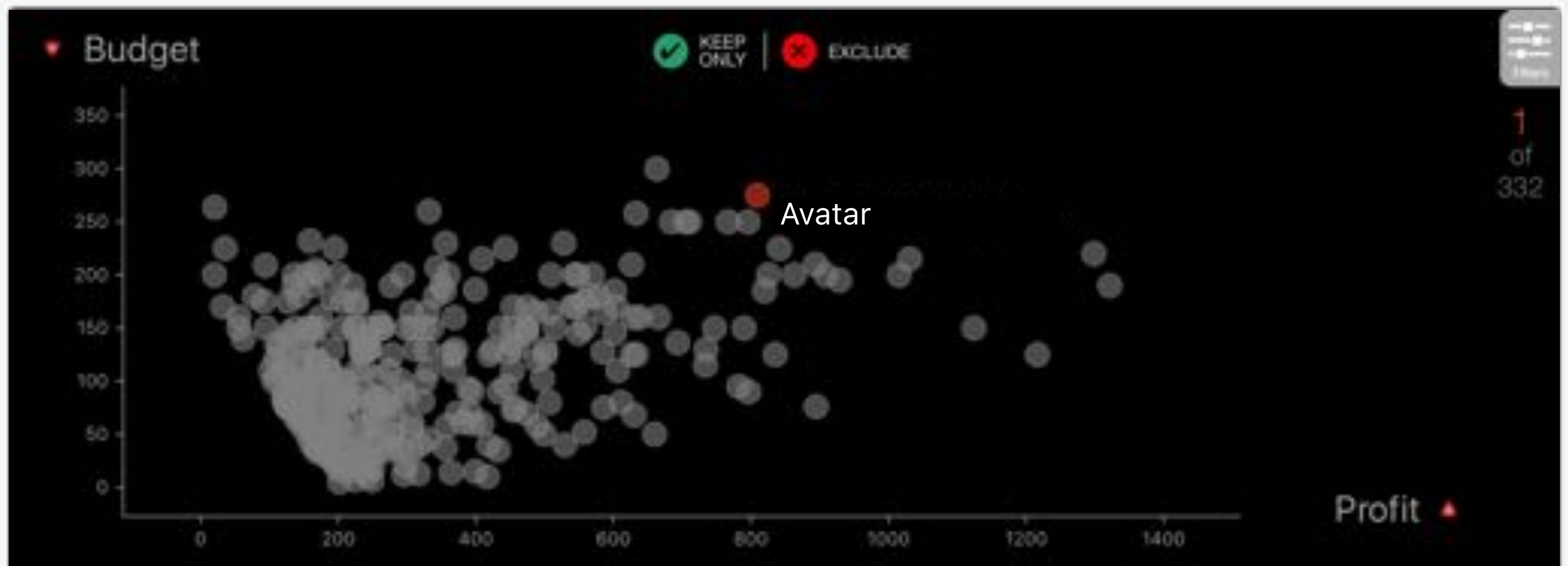
Add Barchart

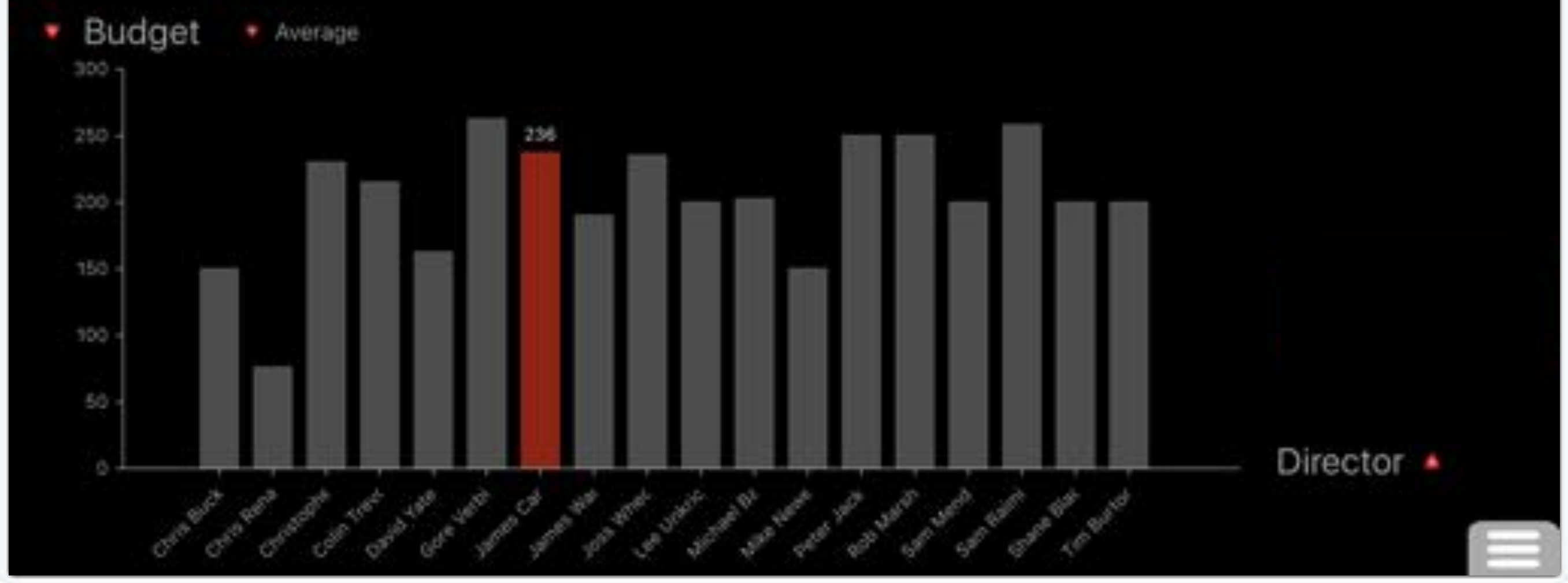
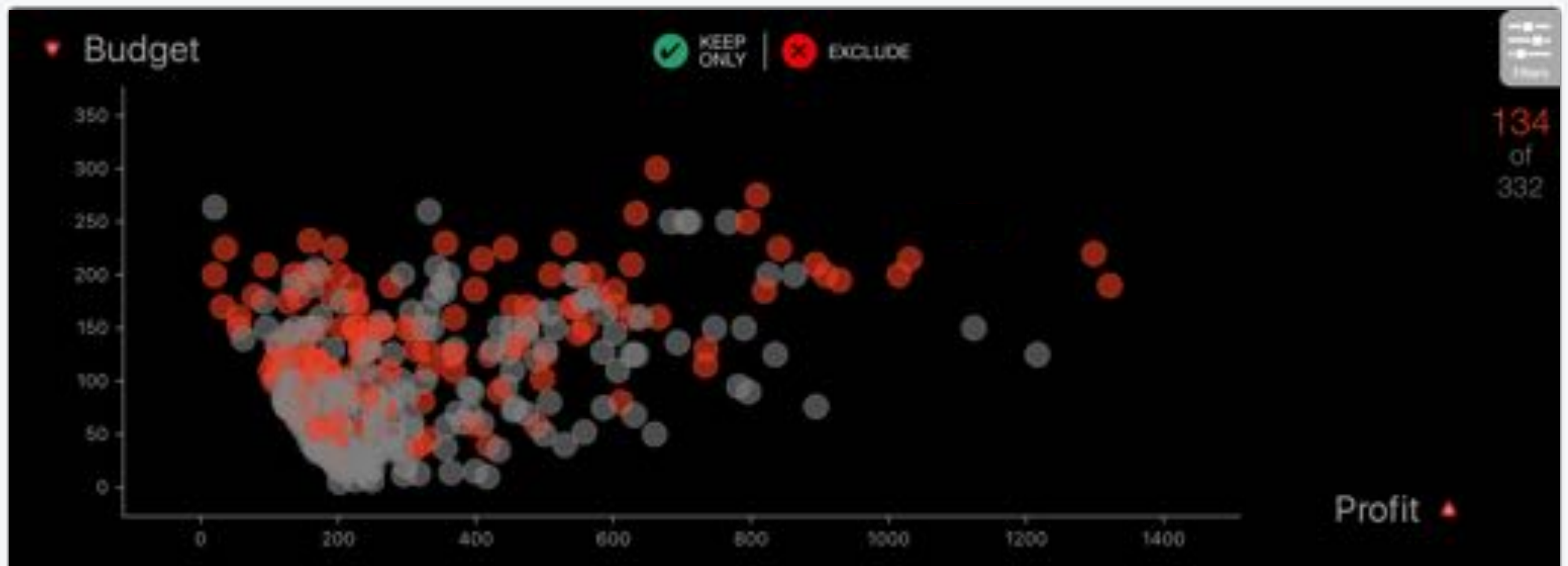


Add Linechart

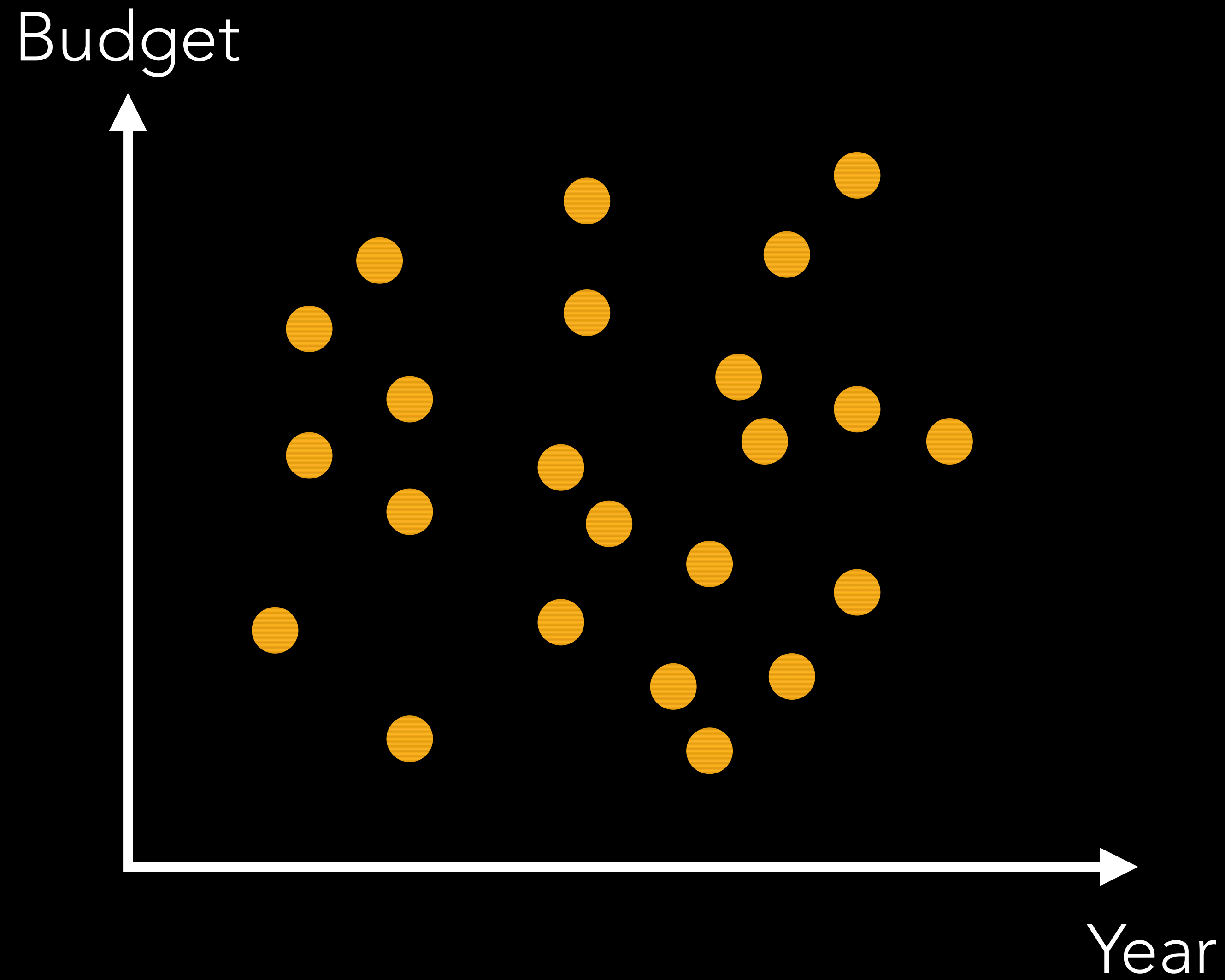




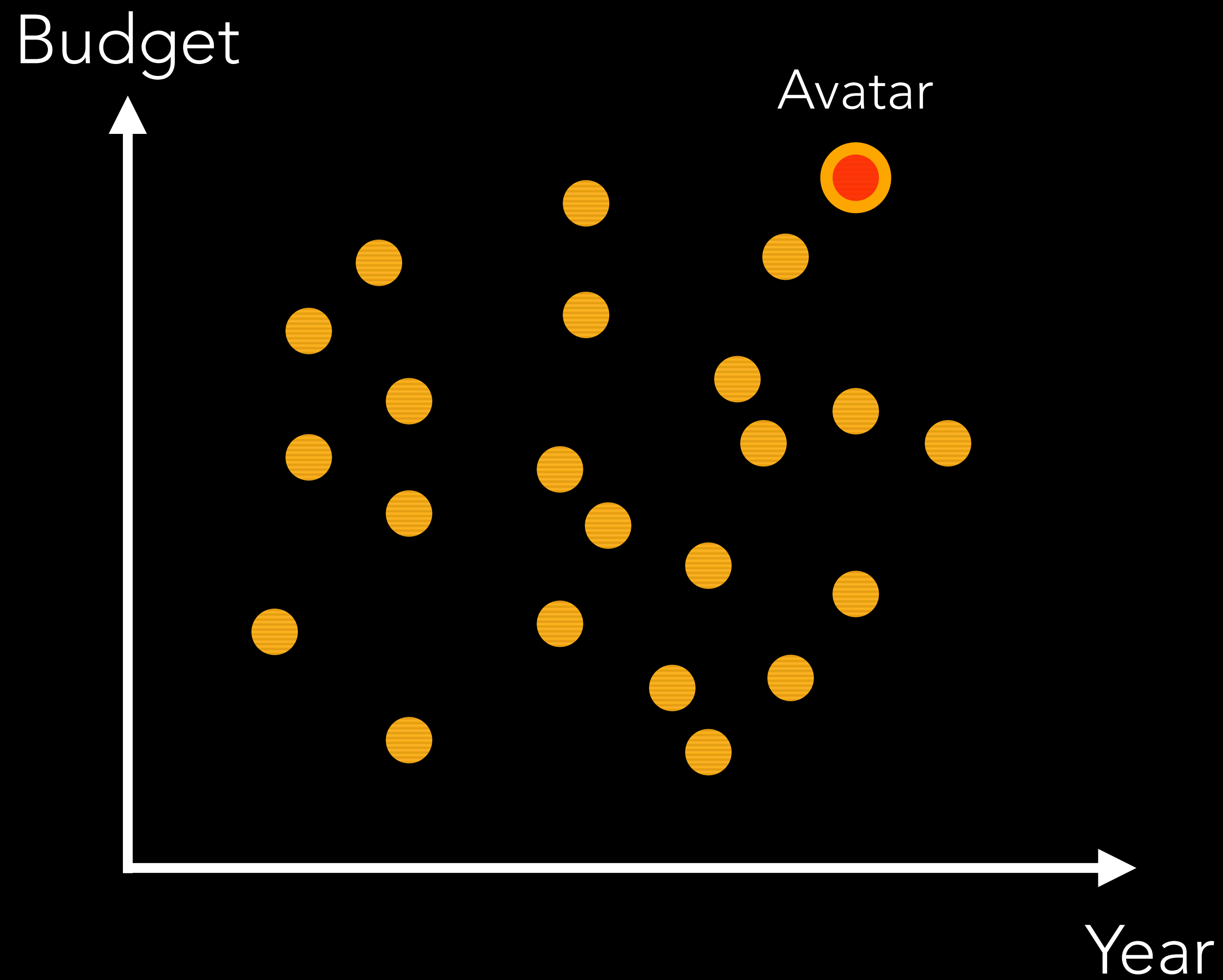




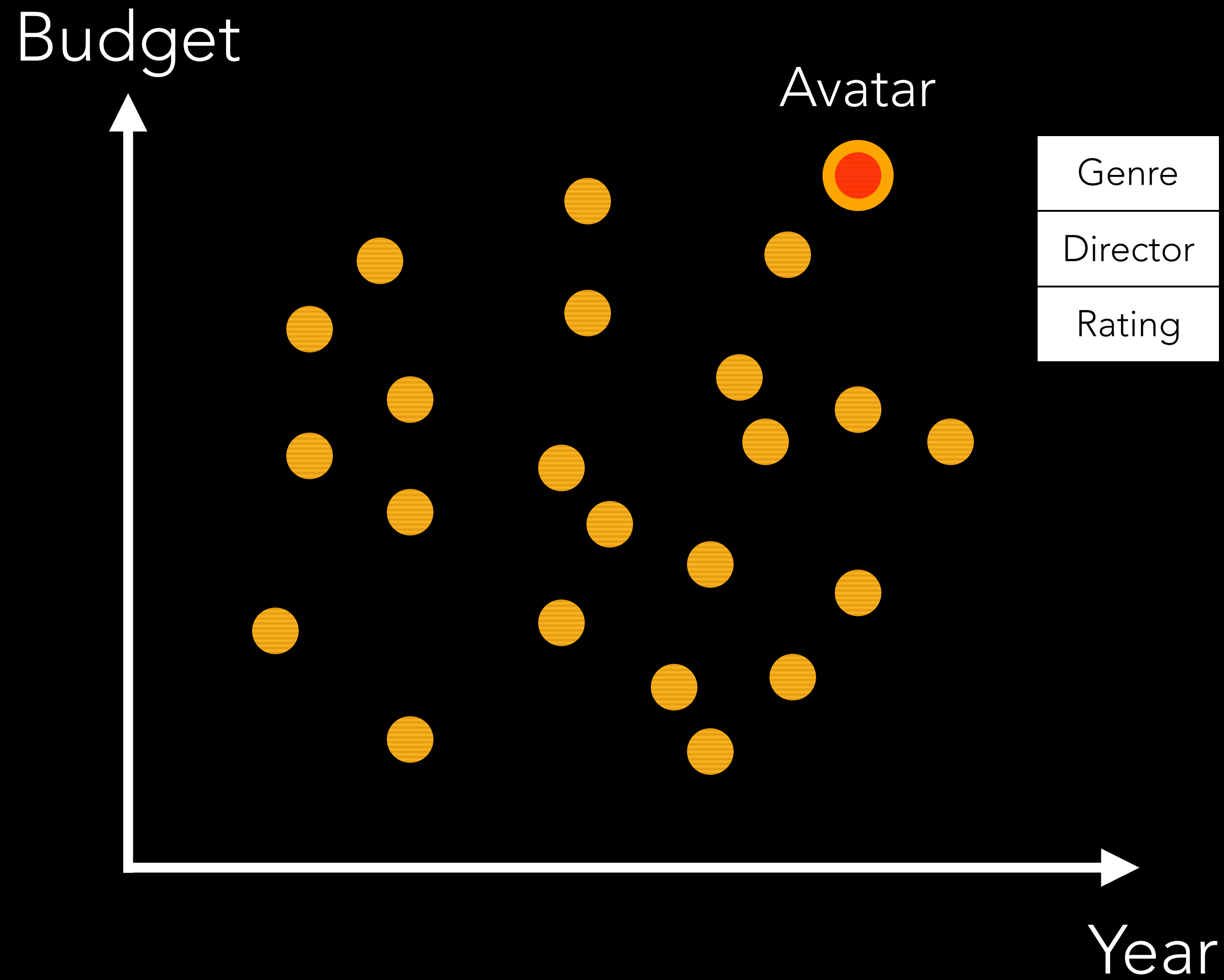
Generalized Selection



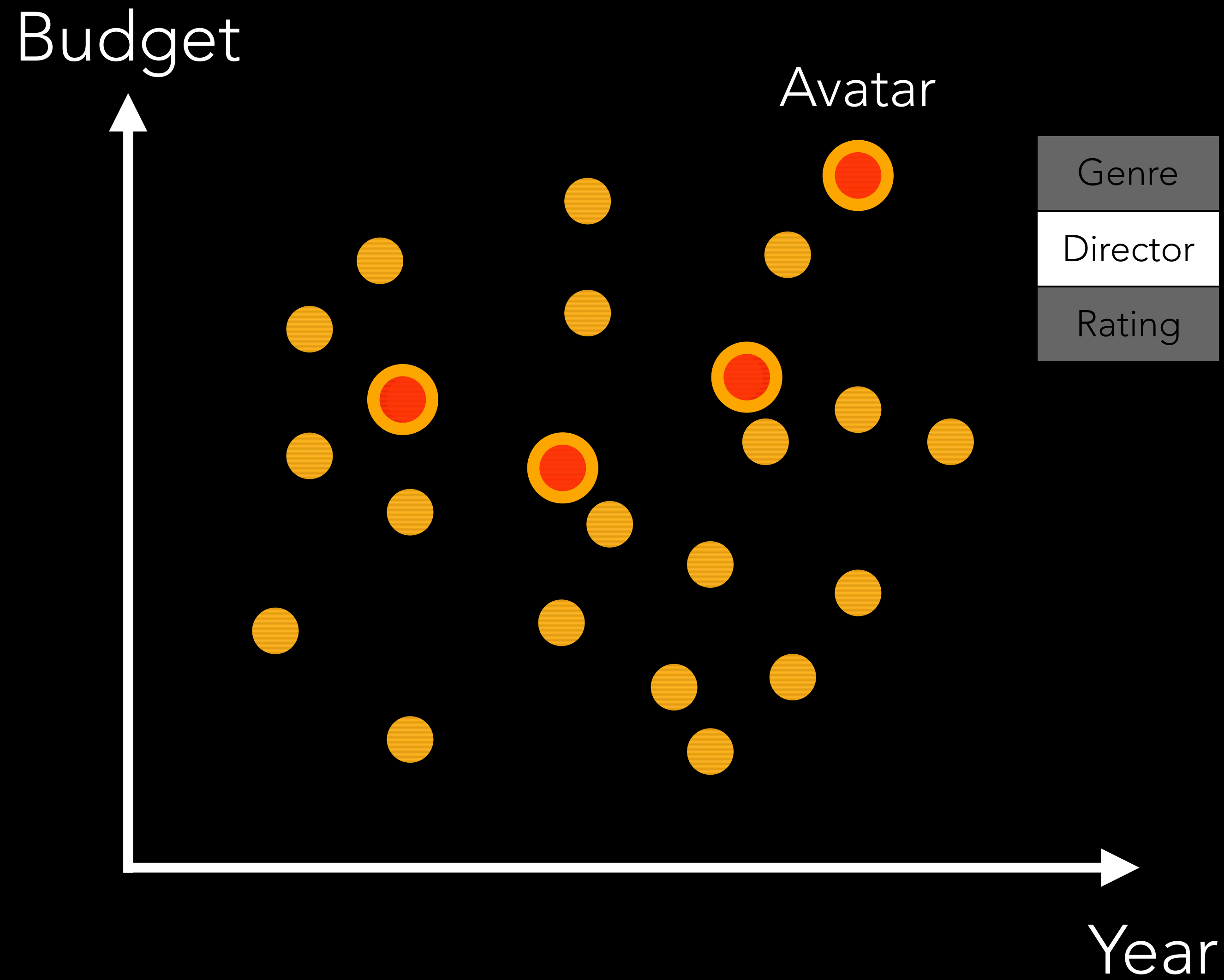
Generalized Selection

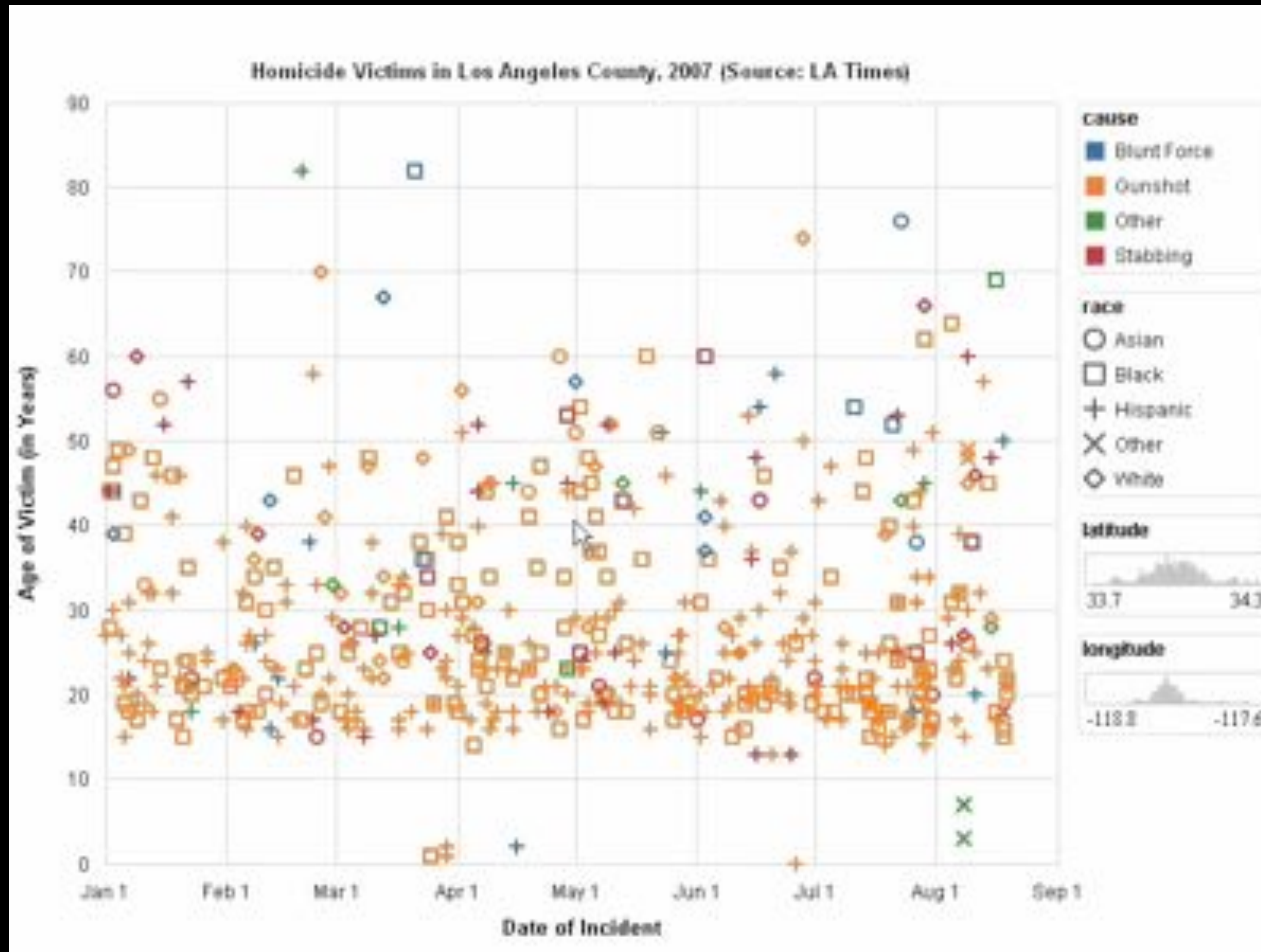


Generalized Selection

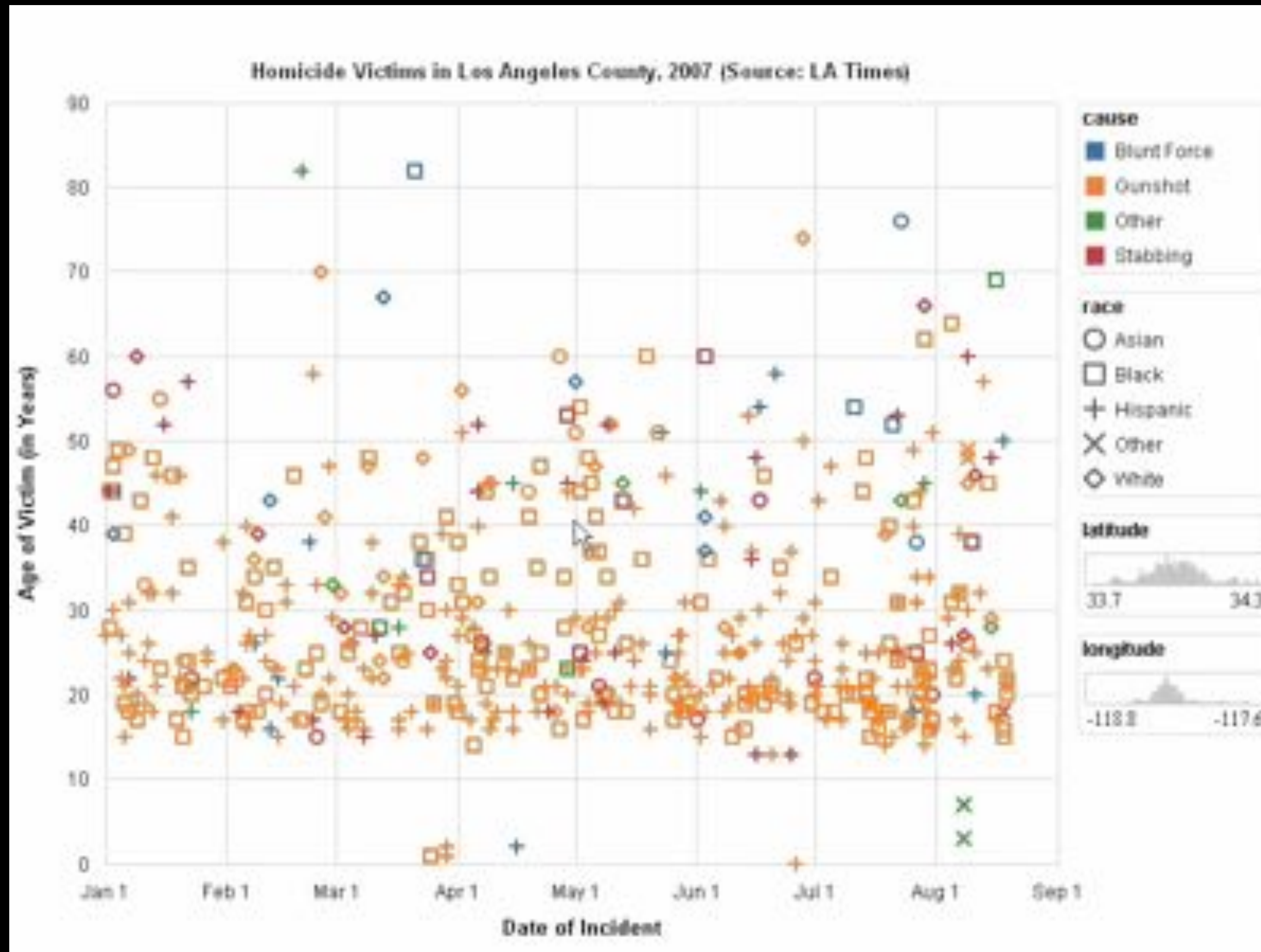


Generalized Selection





Heer et al. "Generalized Selection via Interactive Query Relaxation." CHI '08



Heer et al. "Generalized Selection via Interactive Query Relaxation." CHI '08

Generalized Selection

Genre
Director
Rating

Generalized Selection

Genre
Director
Rating

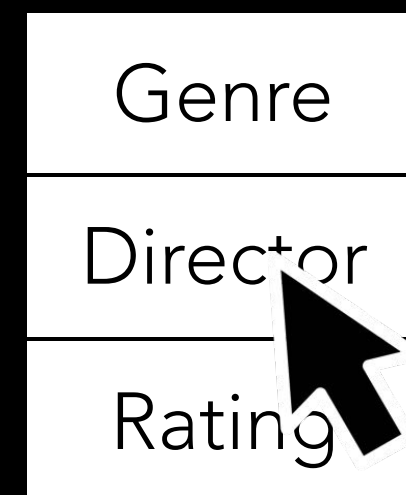
Match by

Genre

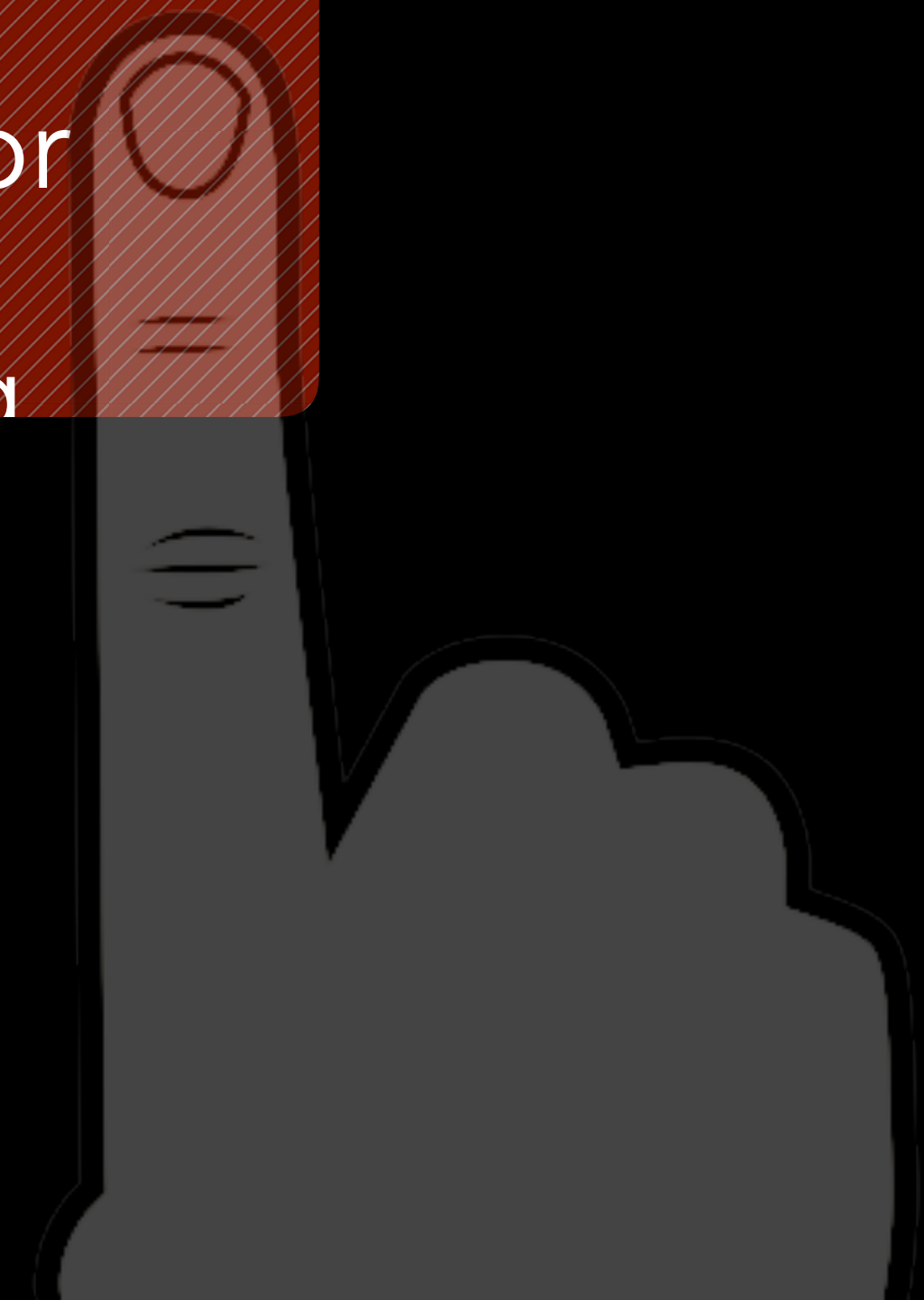
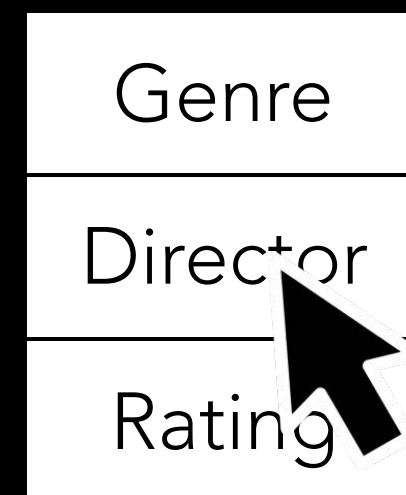
Director

Rating

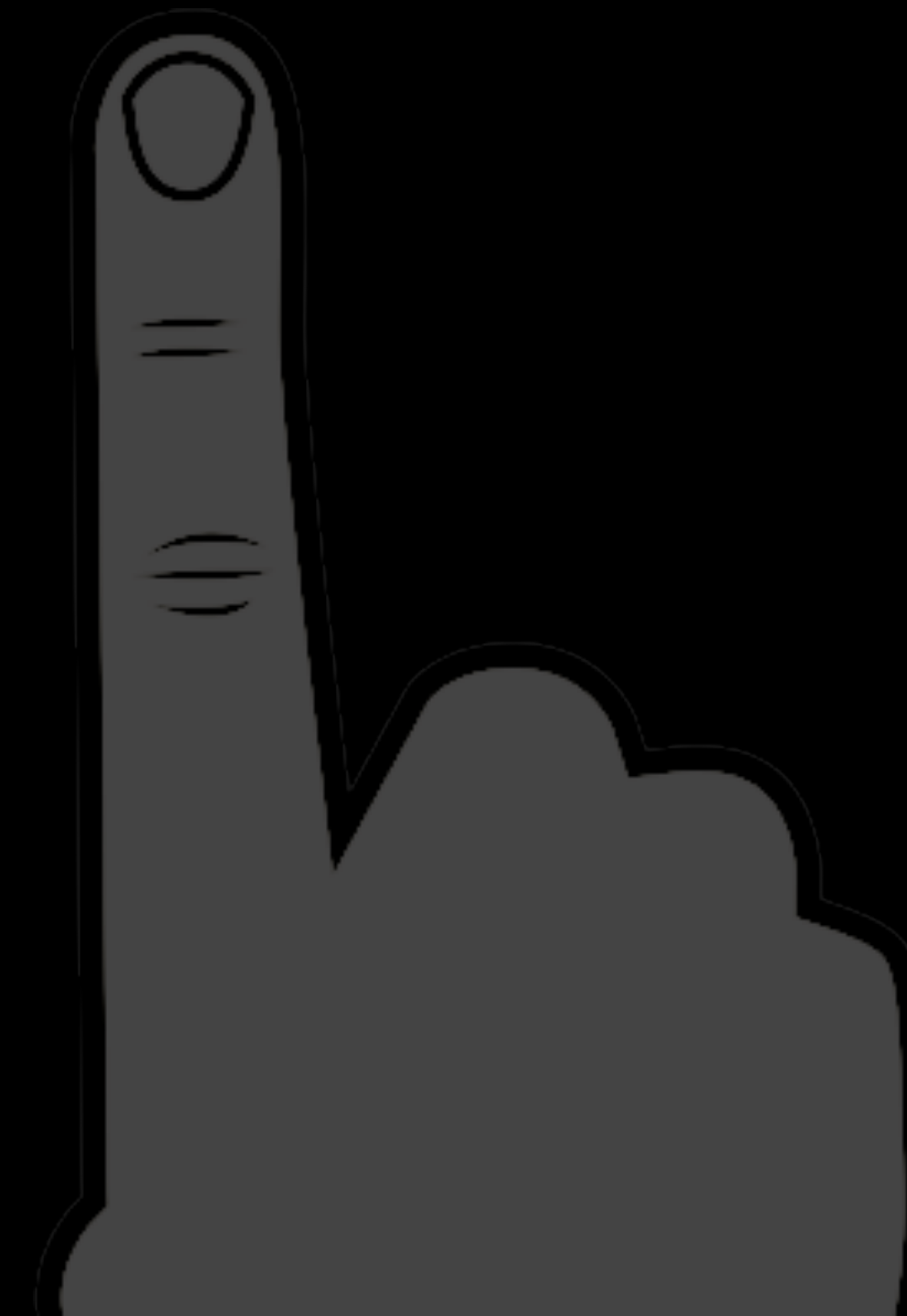
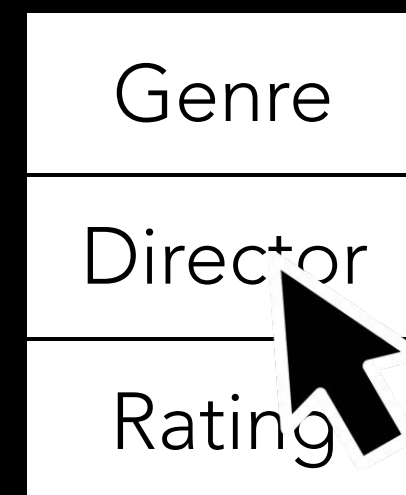
Generalized Selection



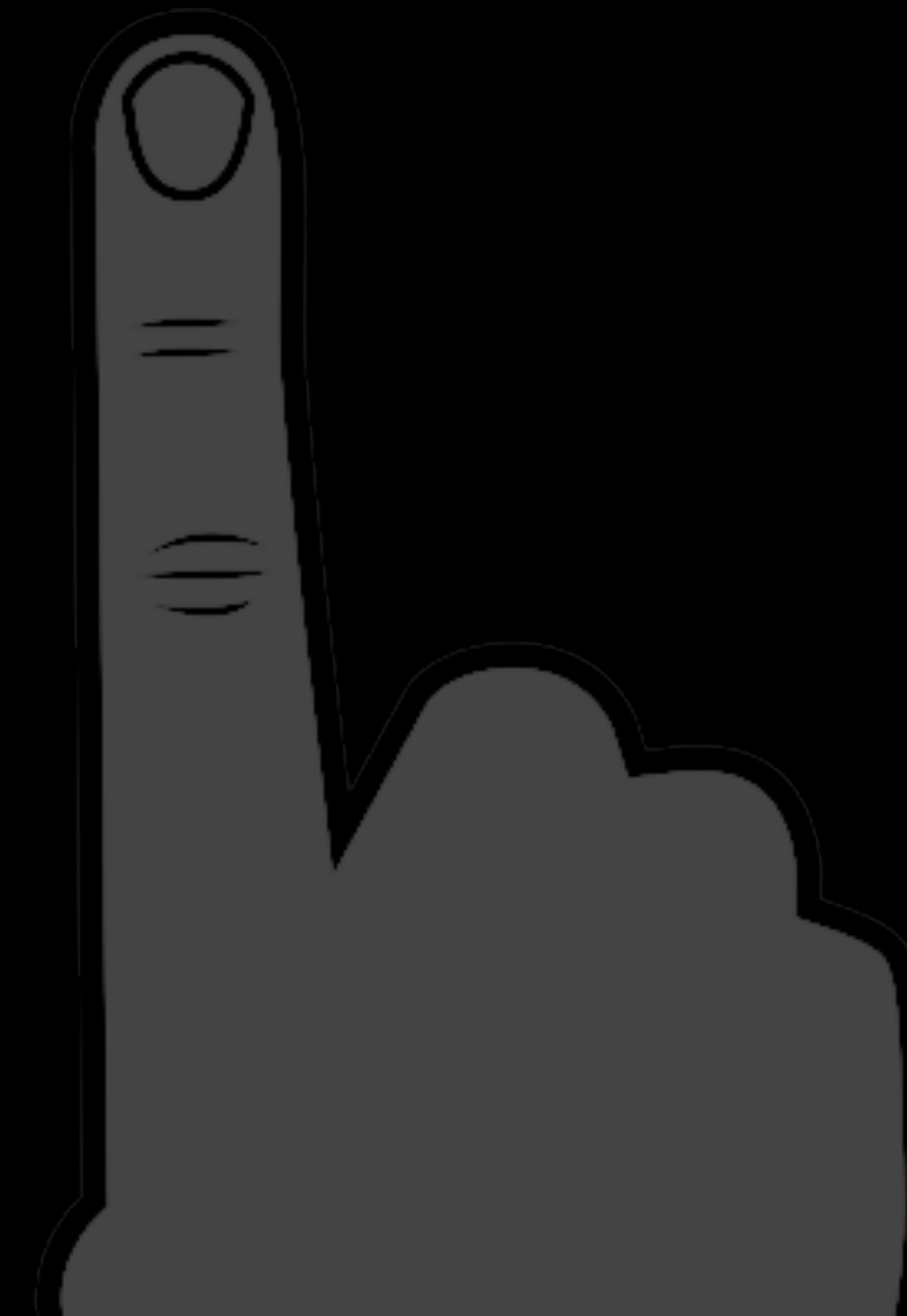
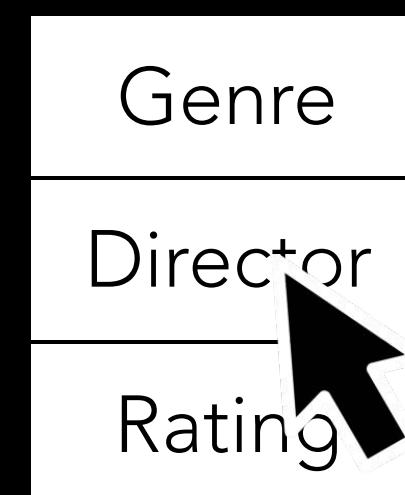
Generalized Selection



Generalized Selection



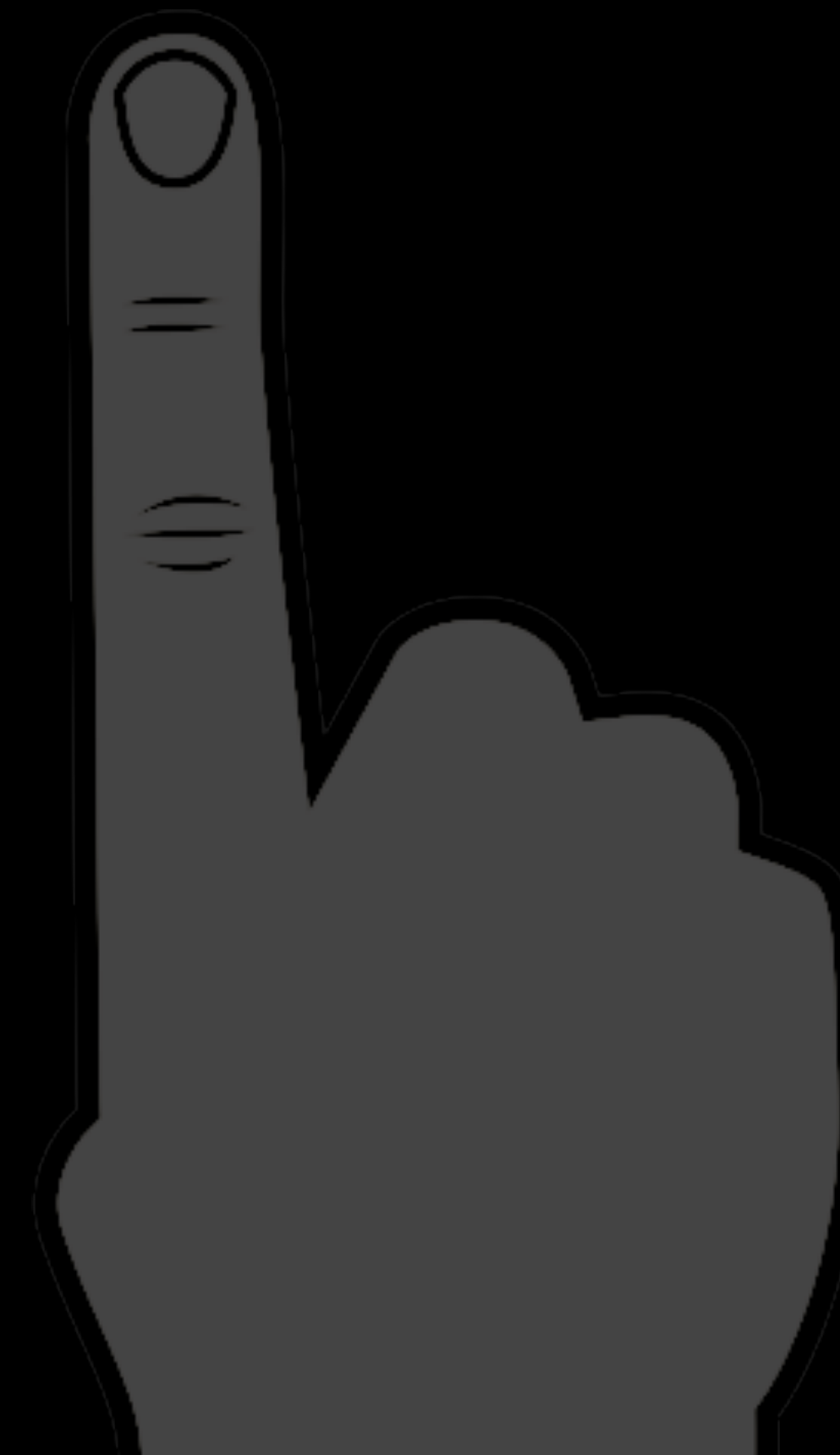
Generalized Selection



Generalized Selection

Genre
Director
Rating

Director





Studio

333

Budget



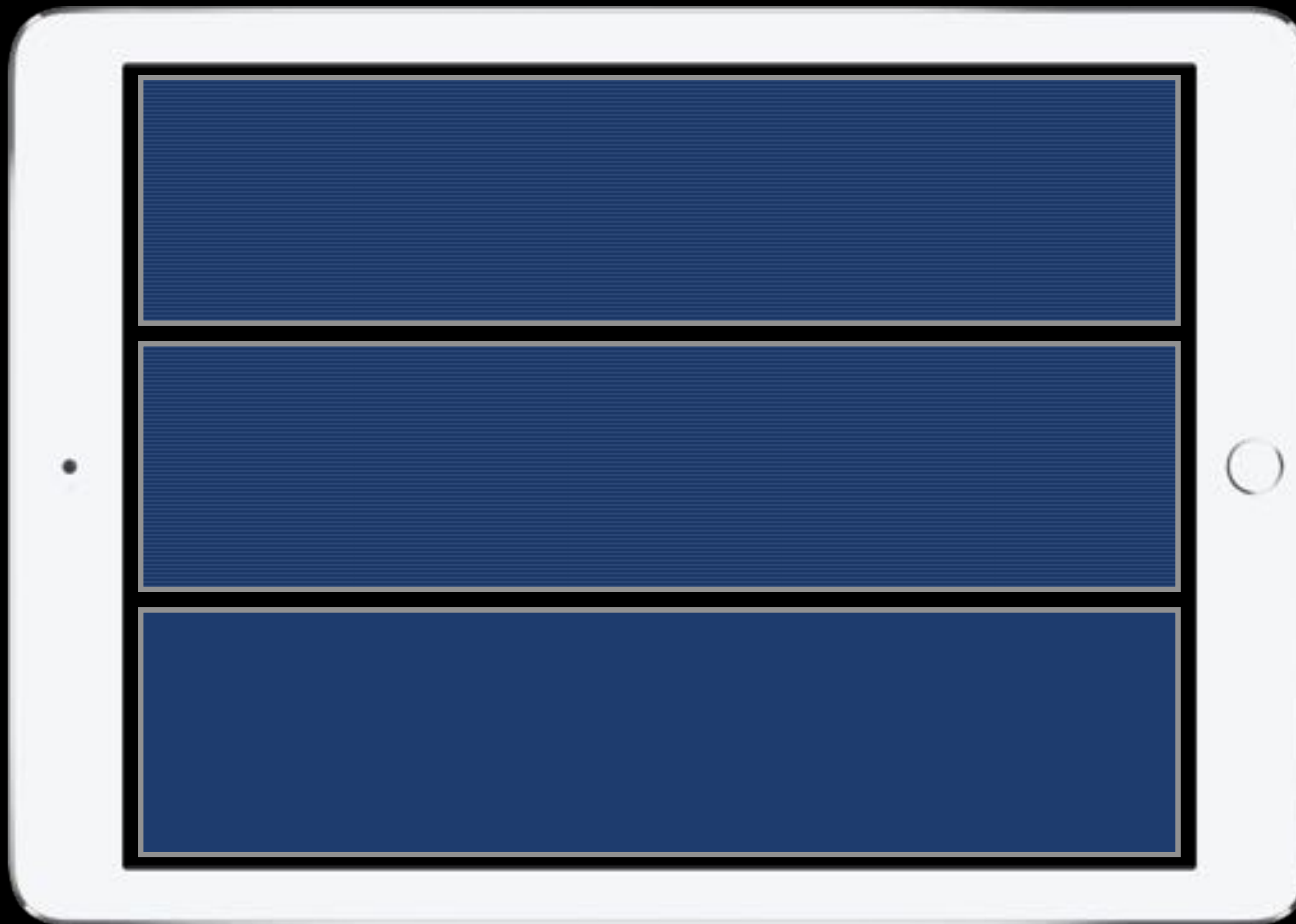


Discussion ...

Extensions



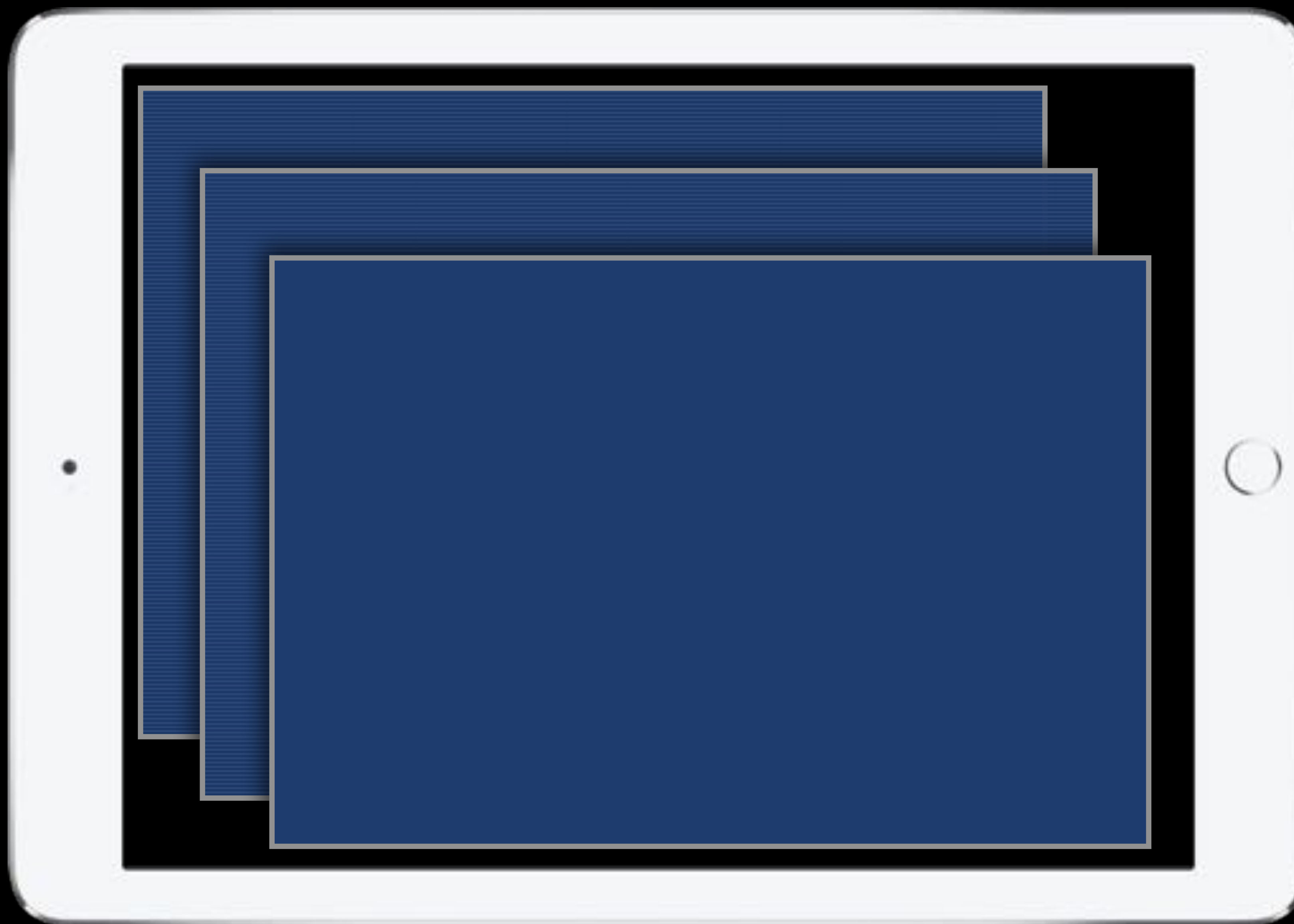
Extensions



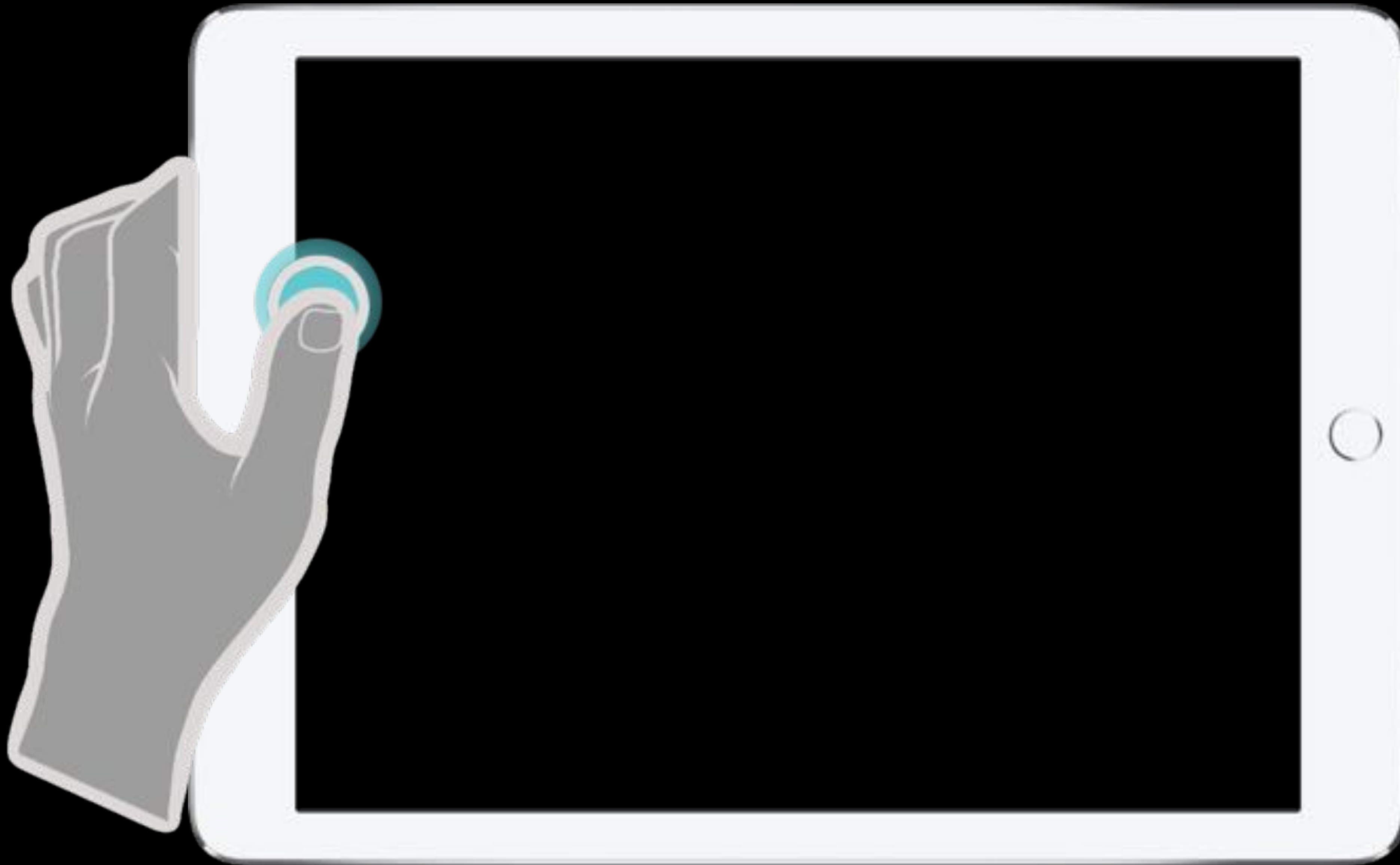
Extensions



Extensions



Limitations



Limitations



Discoverability

Change of Grip

Evaluation

~thanks~

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ramik@gatech.edu

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stasko@cc.gatech.edu

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NSF Award IIS-1320537