

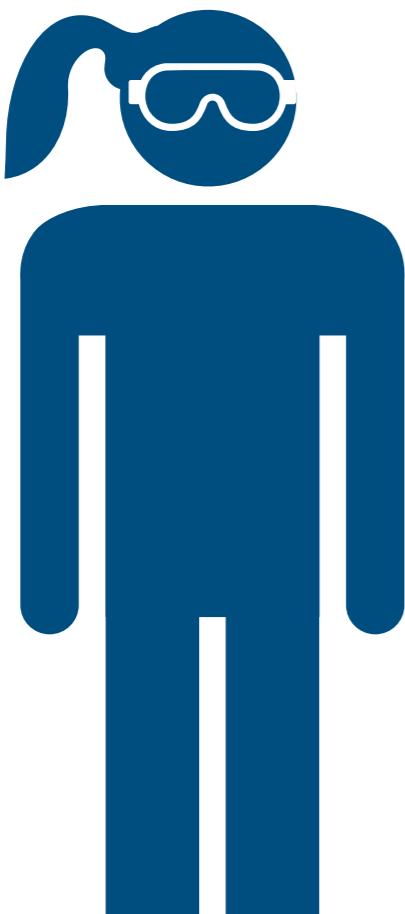
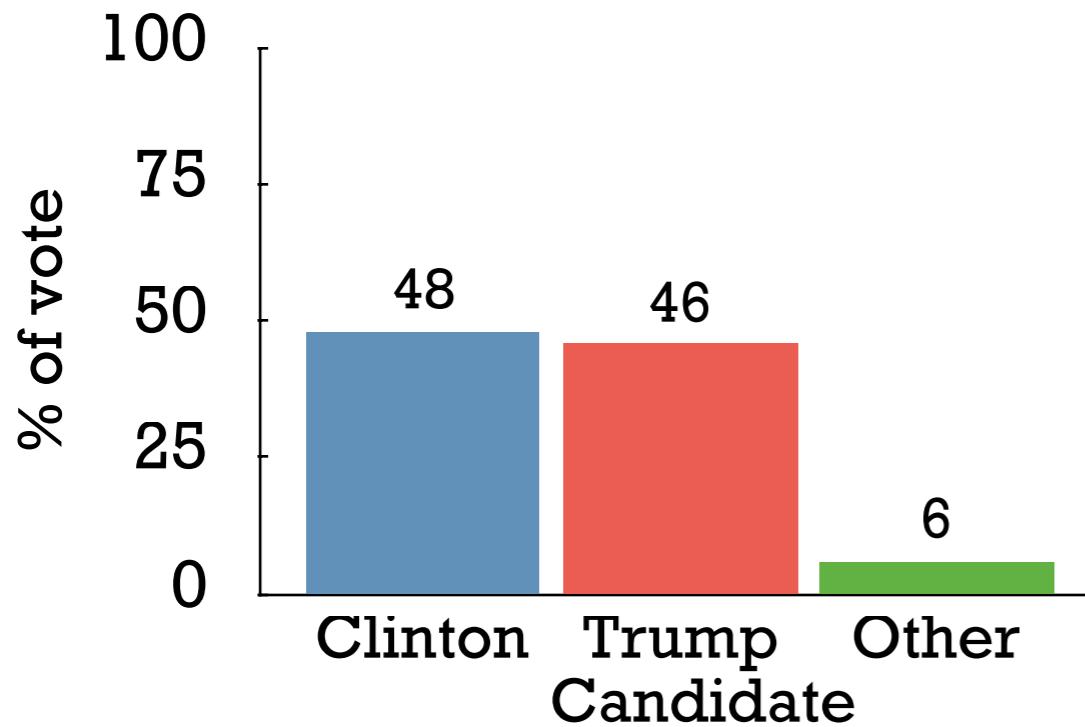
Avoiding Drill-down Fallacies with *VisPilot*: Assisted Exploration of Data Subsets

Doris Jung-Lin Lee, Himmel Dev, Huizi Hu,
Hazem Elmeleegy, Aditya Parameswaran

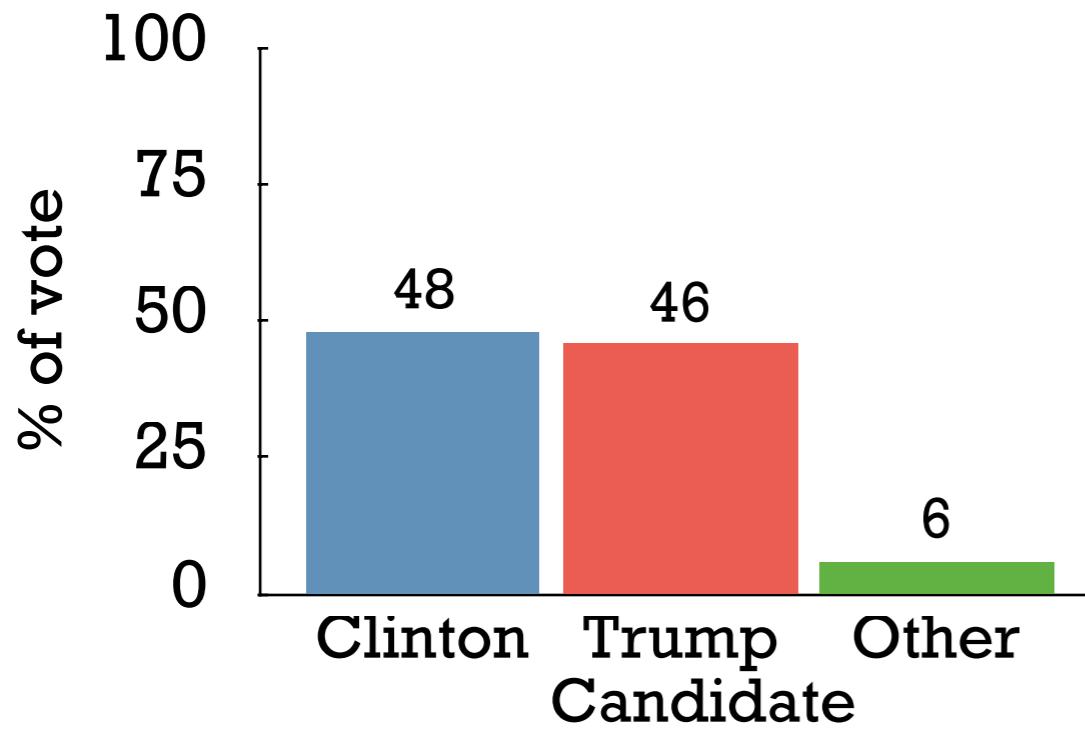


IUI 2019

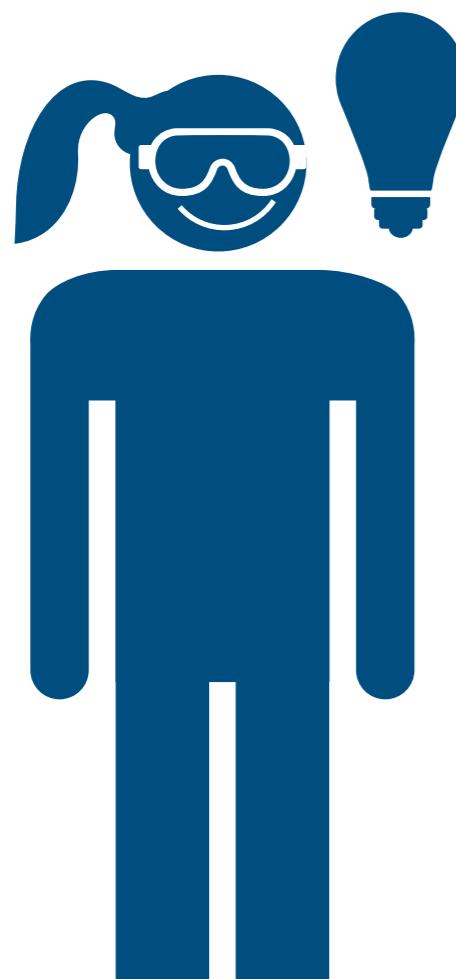
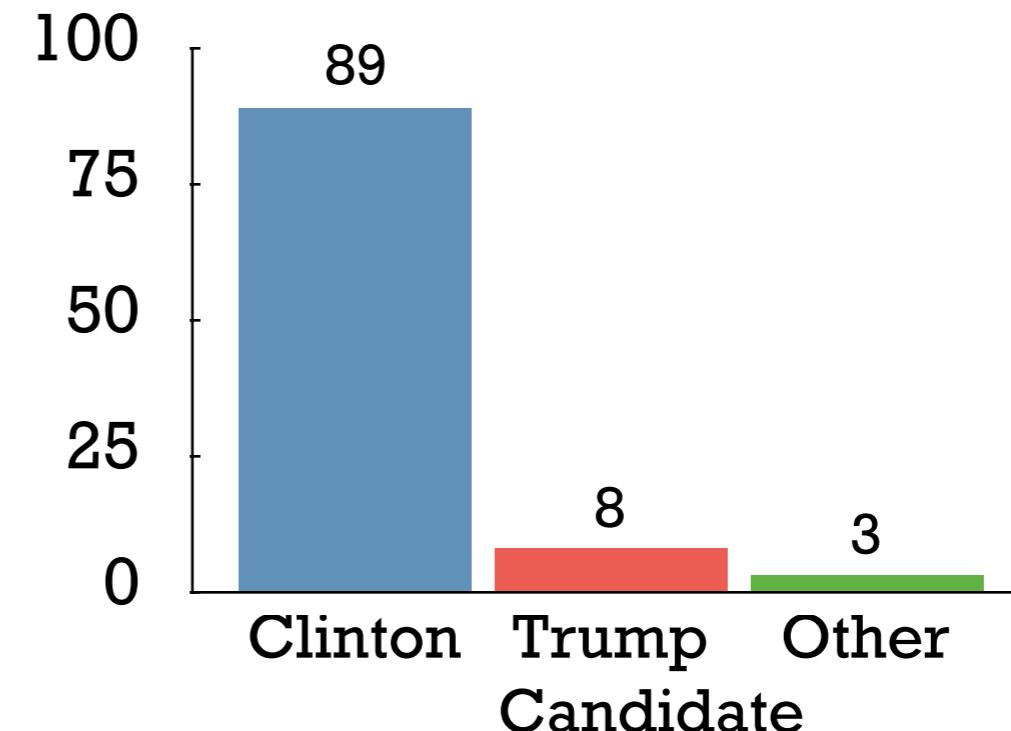
Overall Population



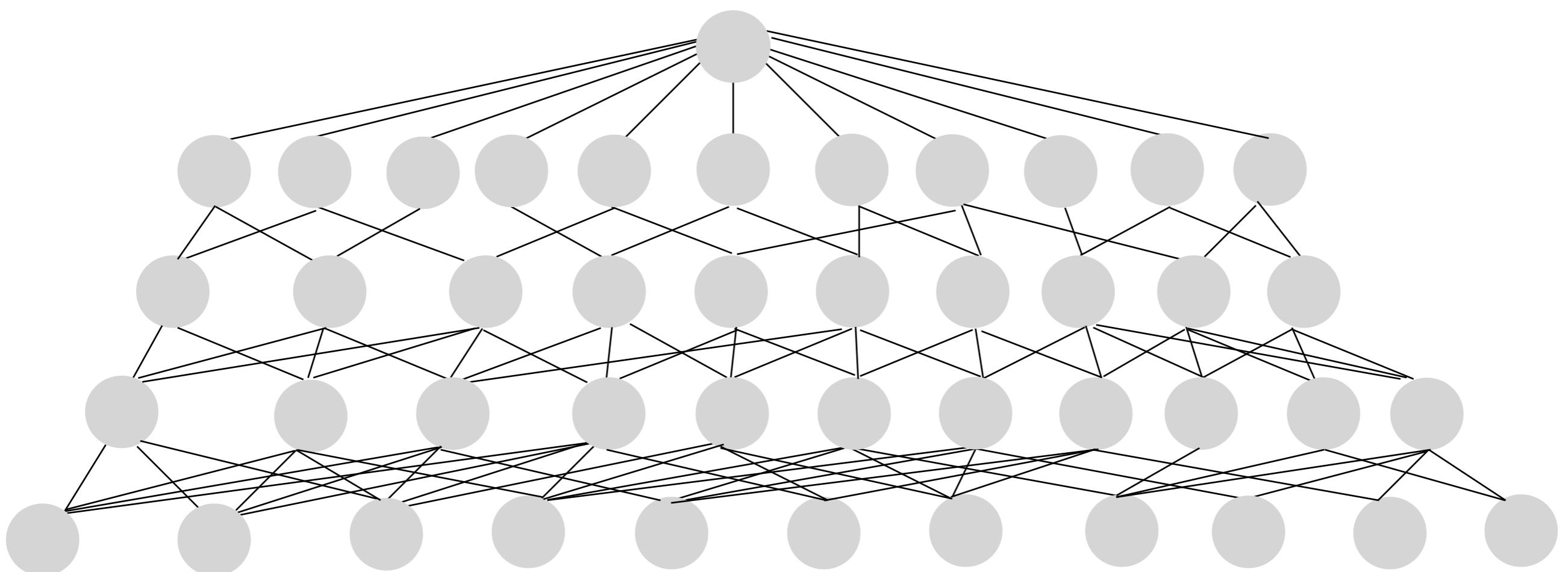
Overall Population



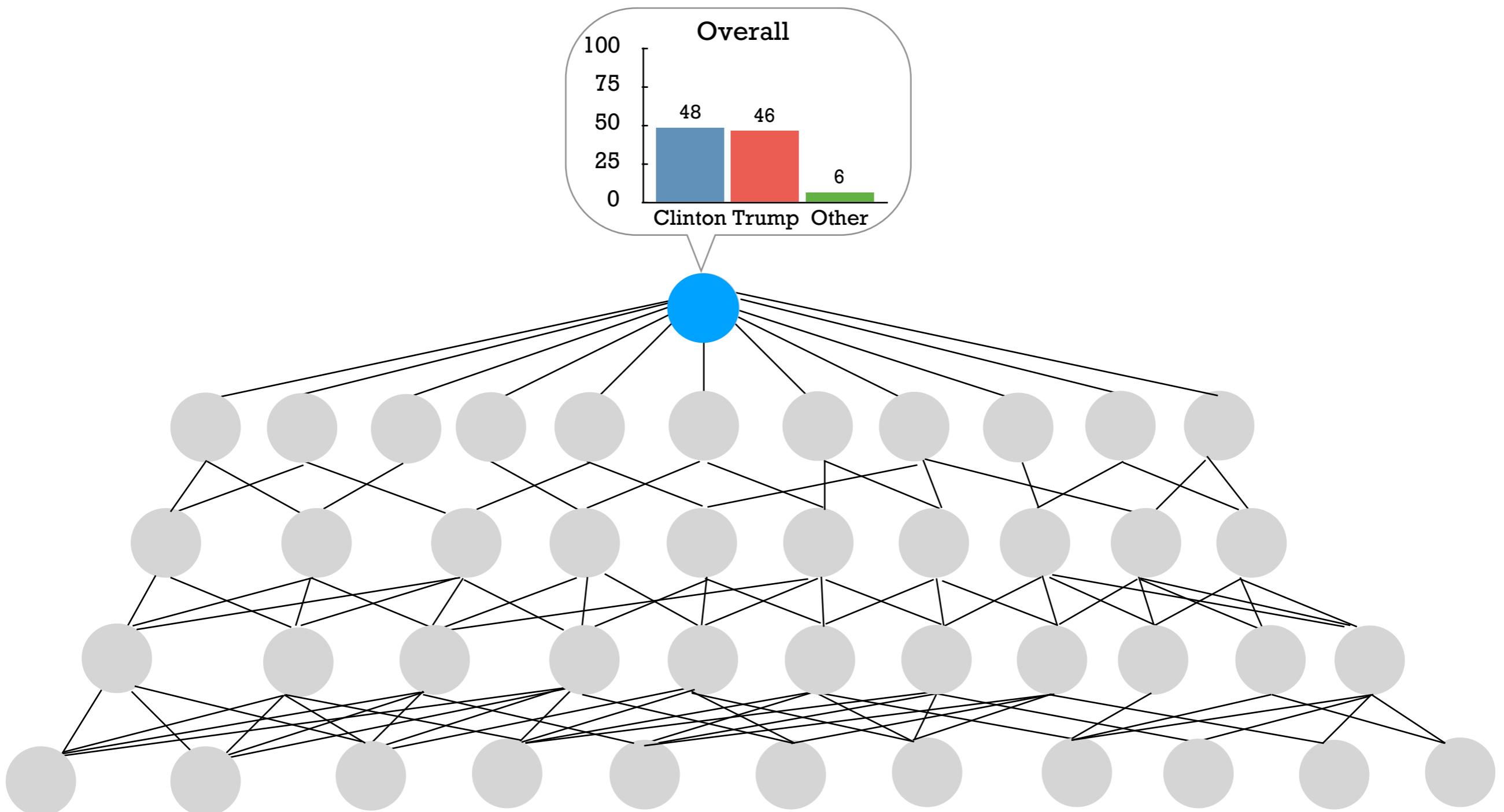
African-American



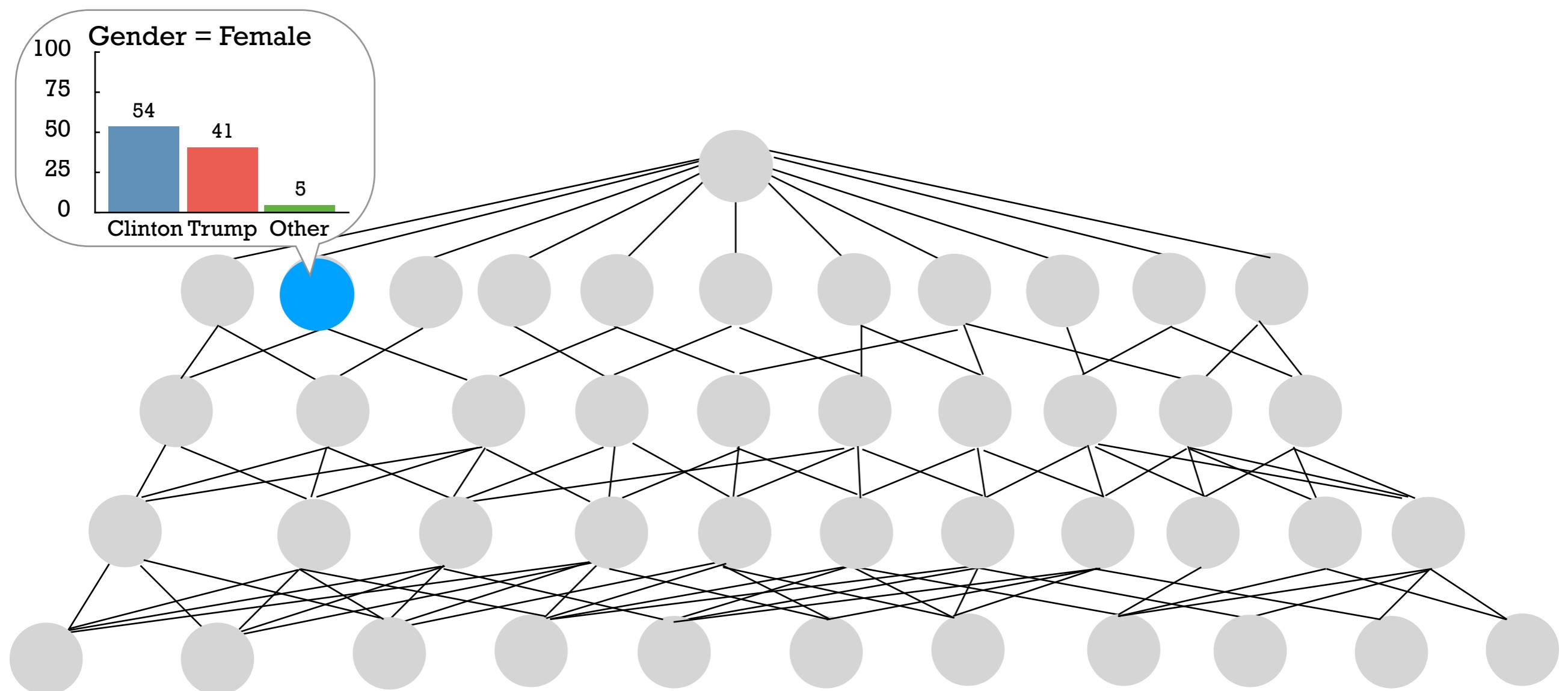
The Drill-Down Lattice



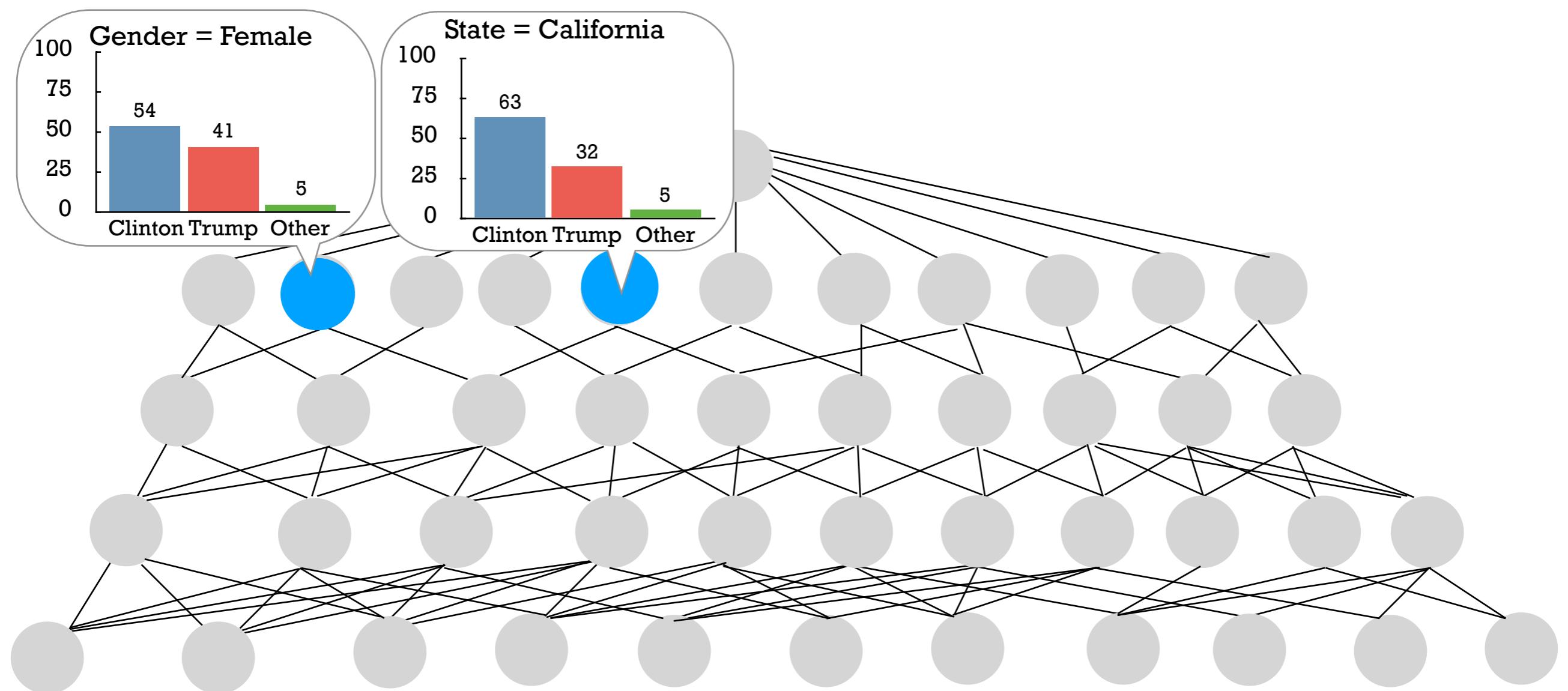
The Drill-Down Lattice



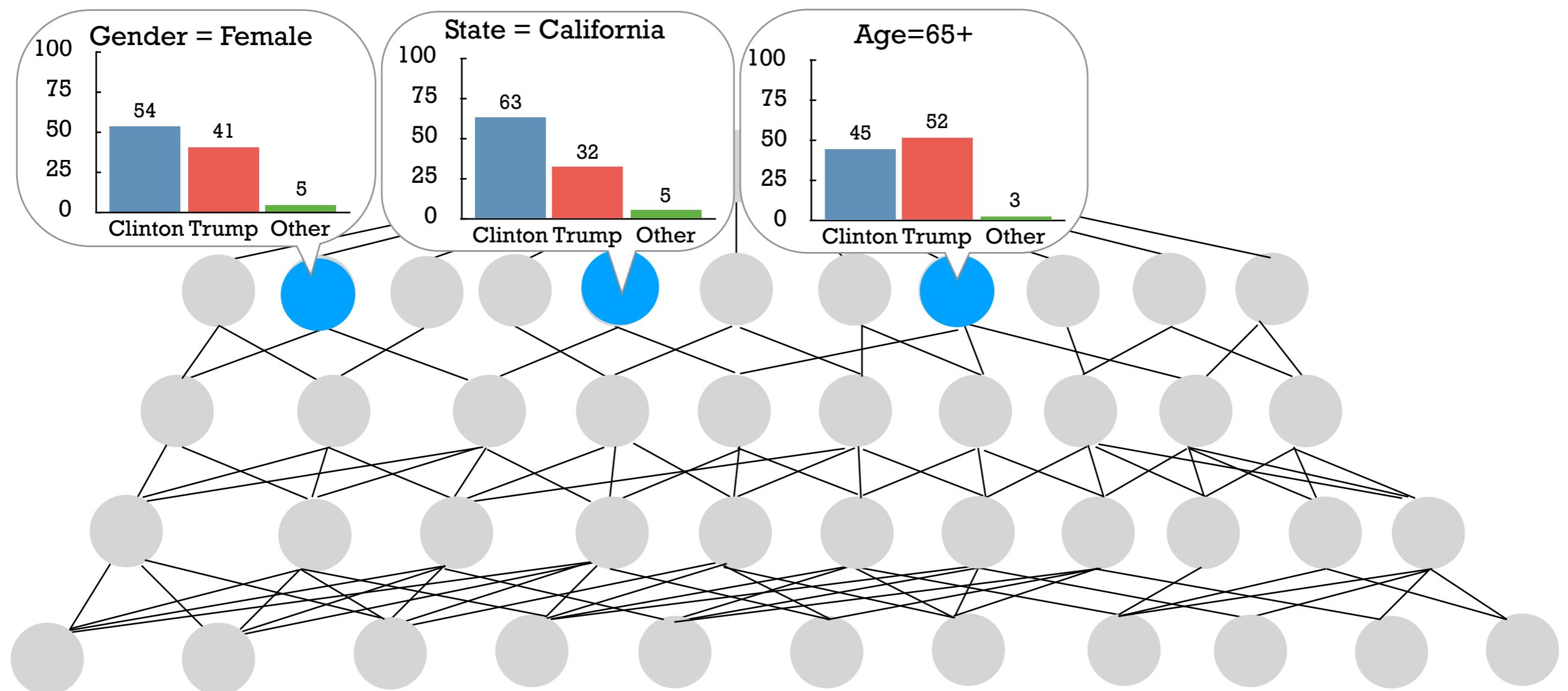
The Drill-Down Lattice



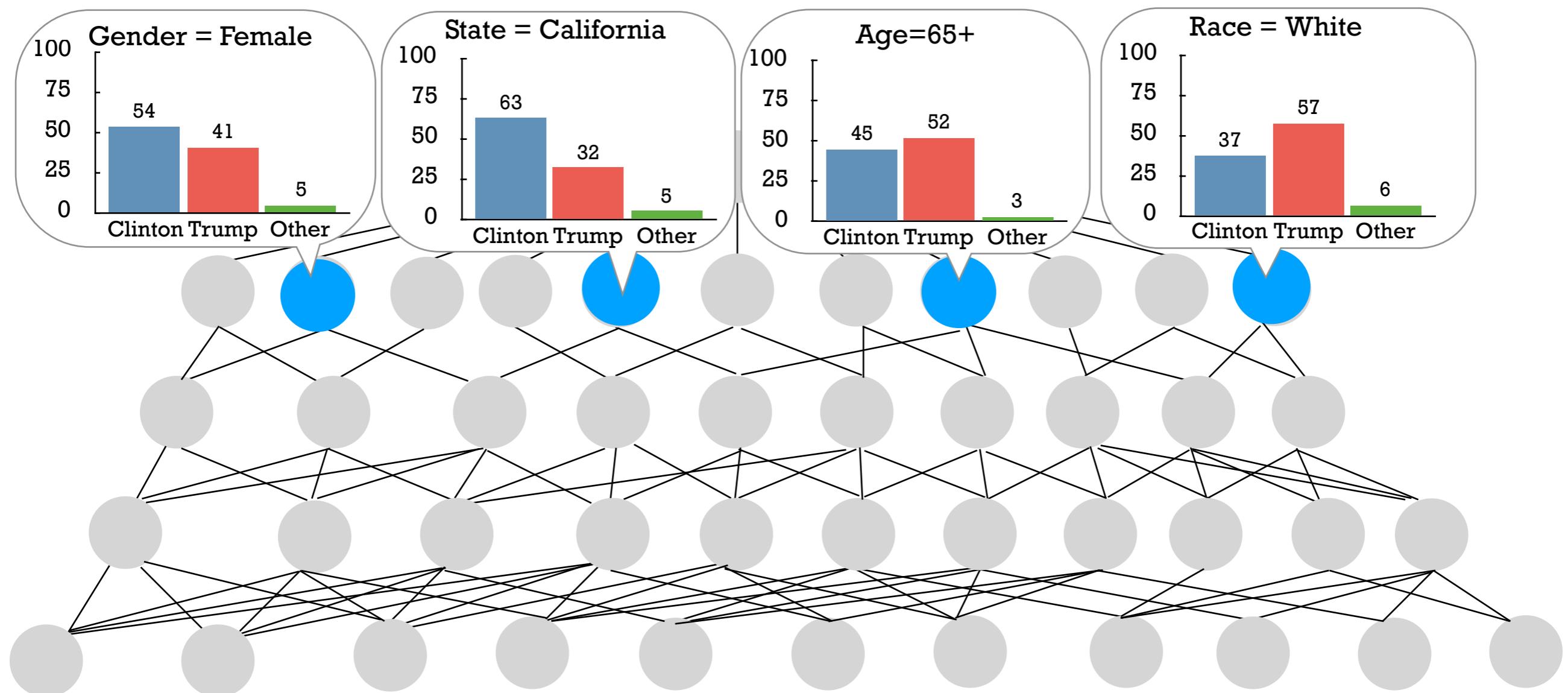
The Drill-Down Lattice



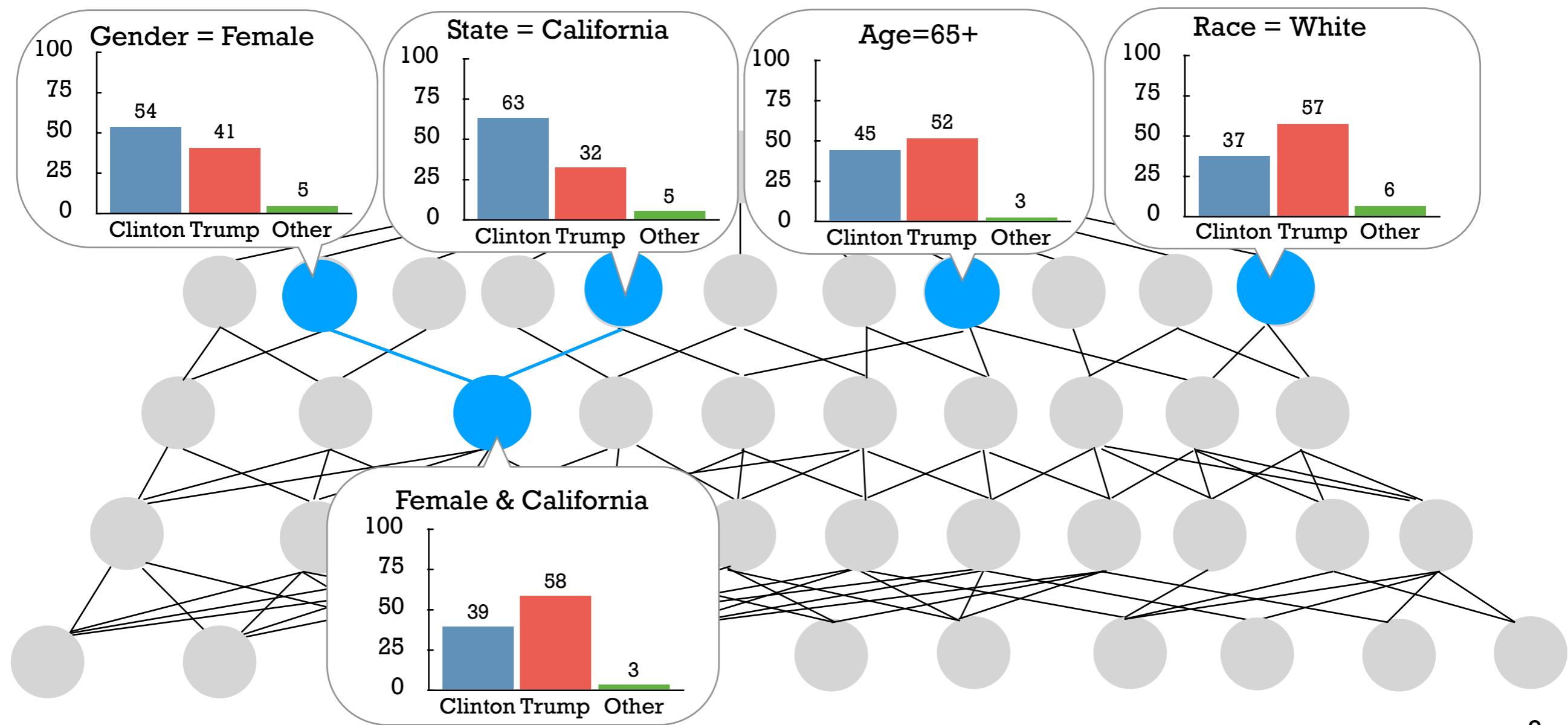
The Drill-Down Lattice



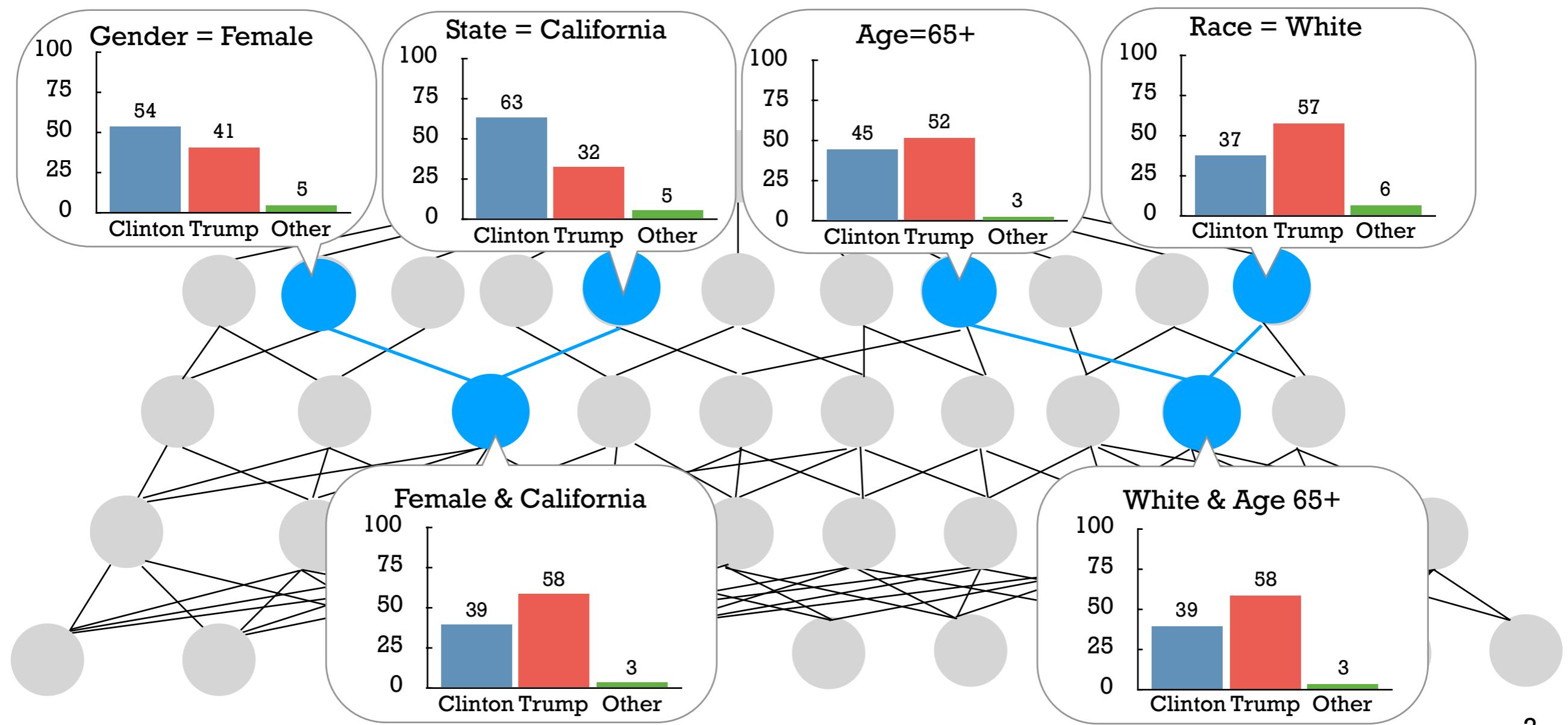
The Drill-Down Lattice



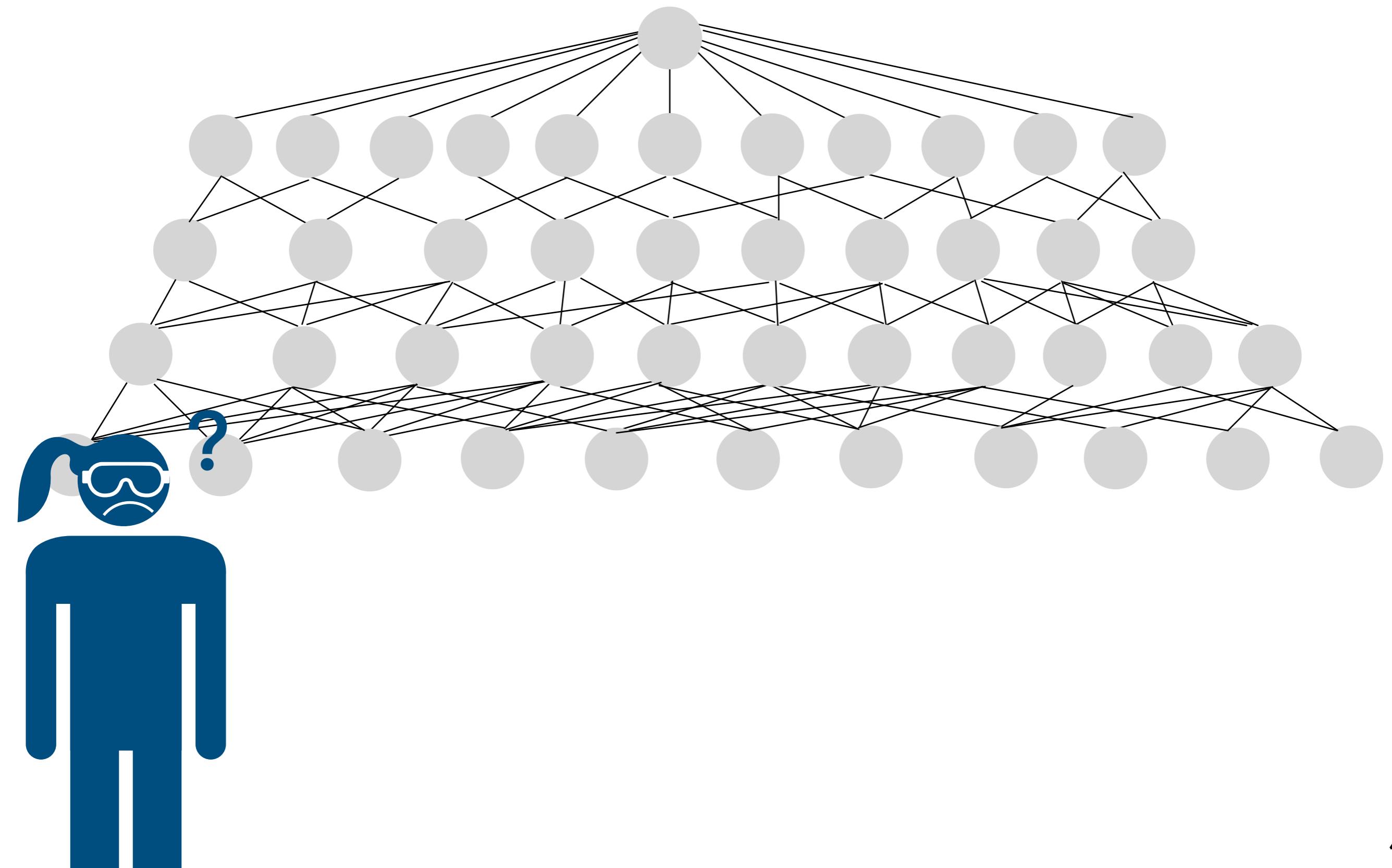
The Drill-Down Lattice



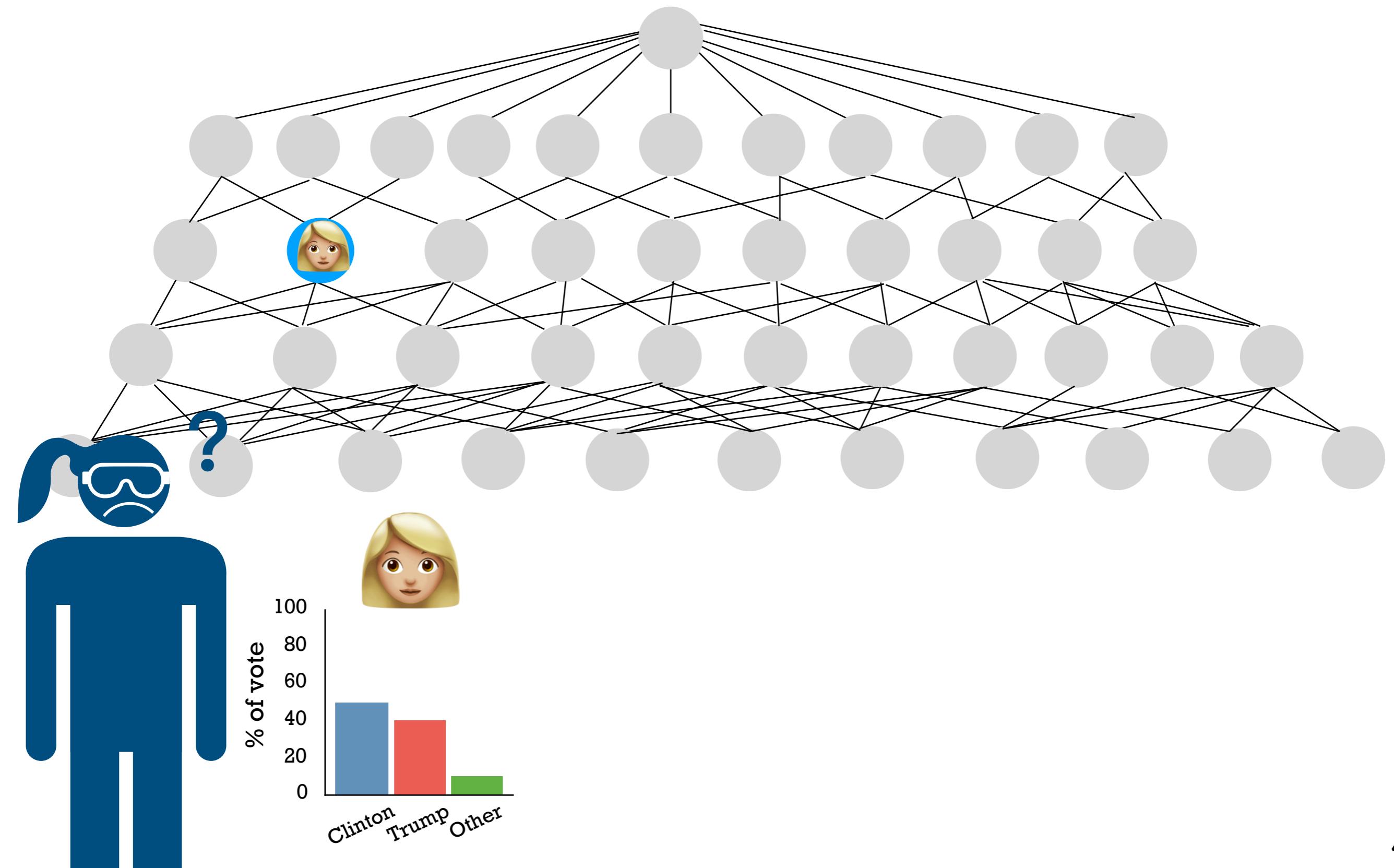
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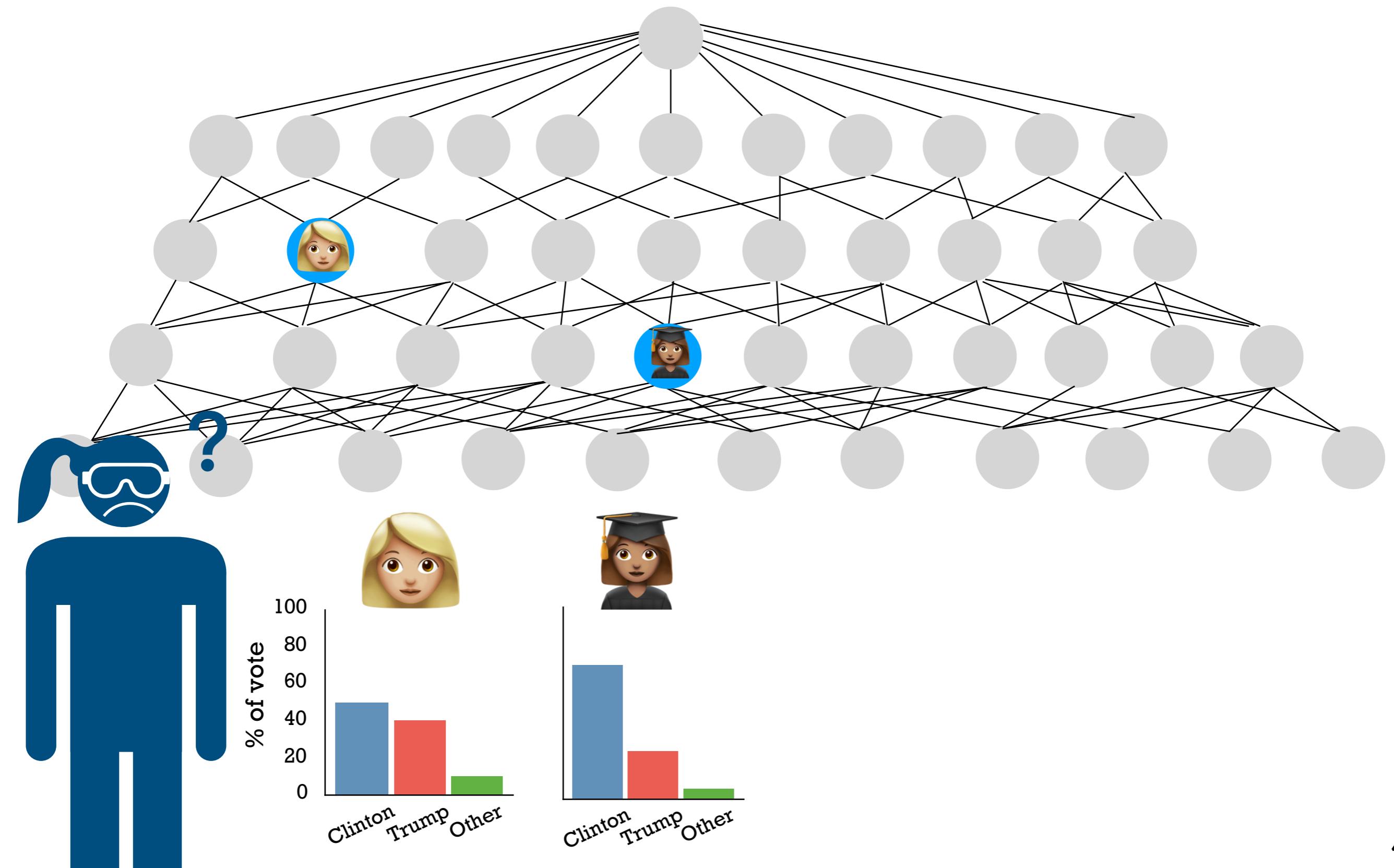
Lattice is **HUGE** !



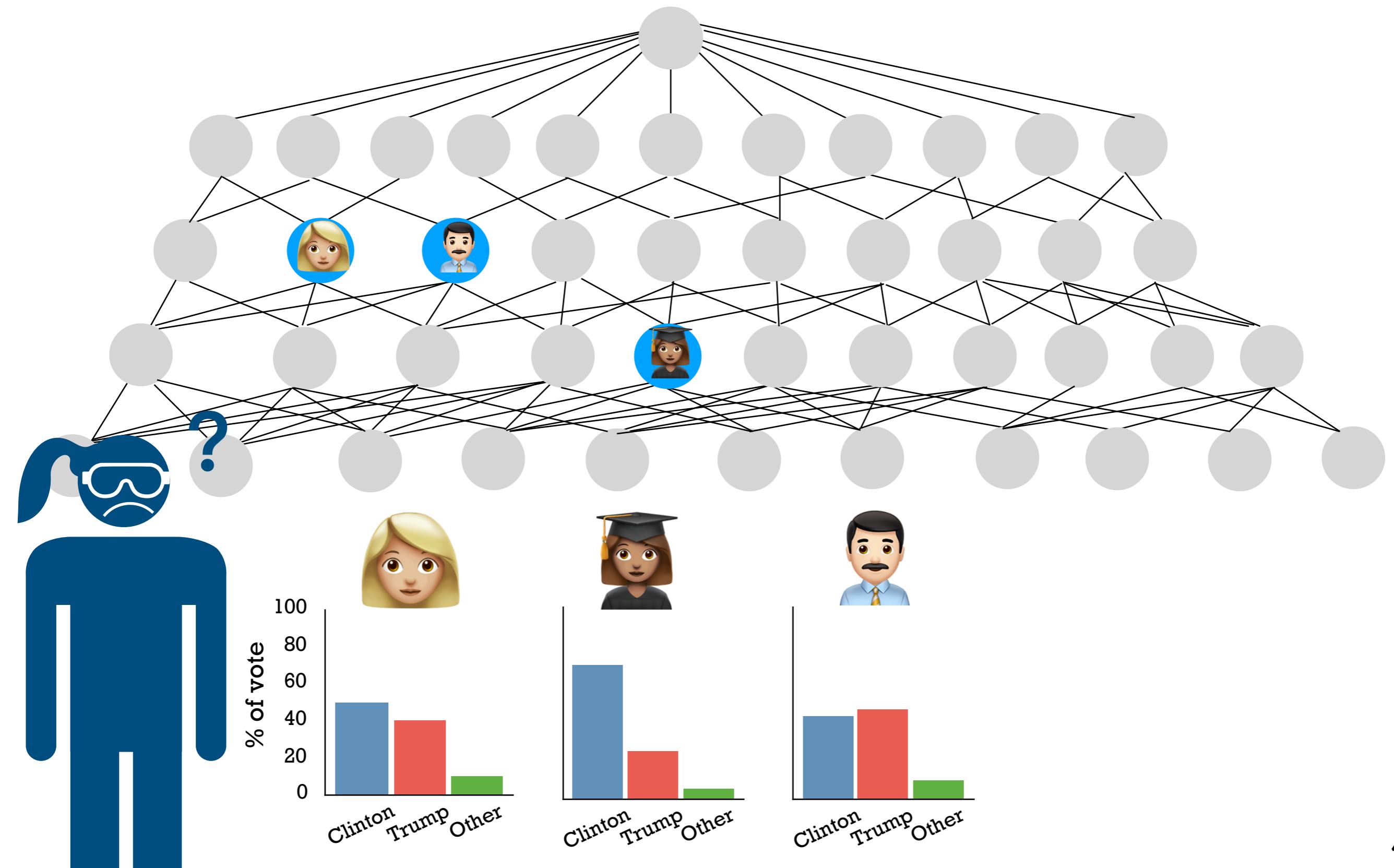
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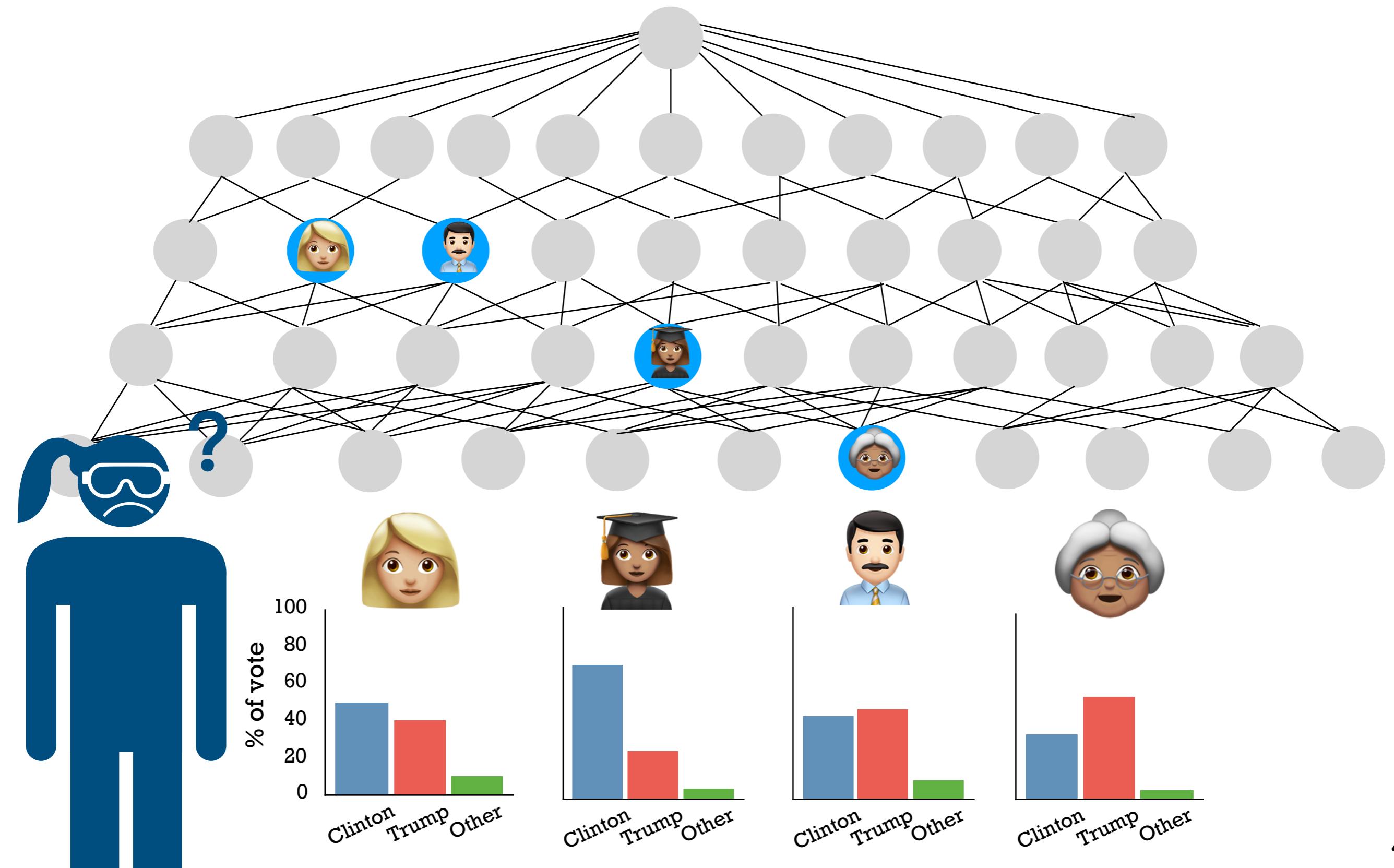
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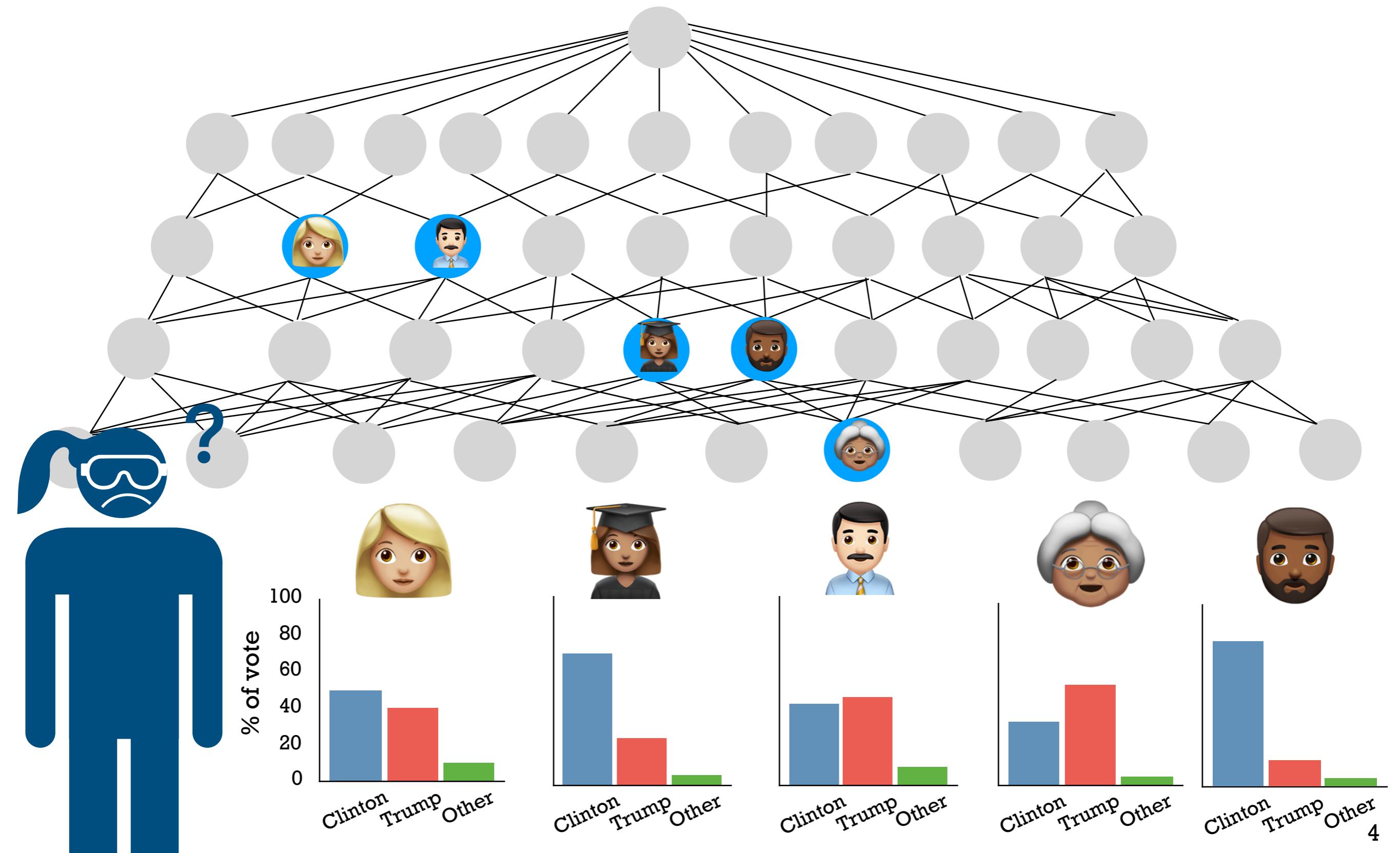
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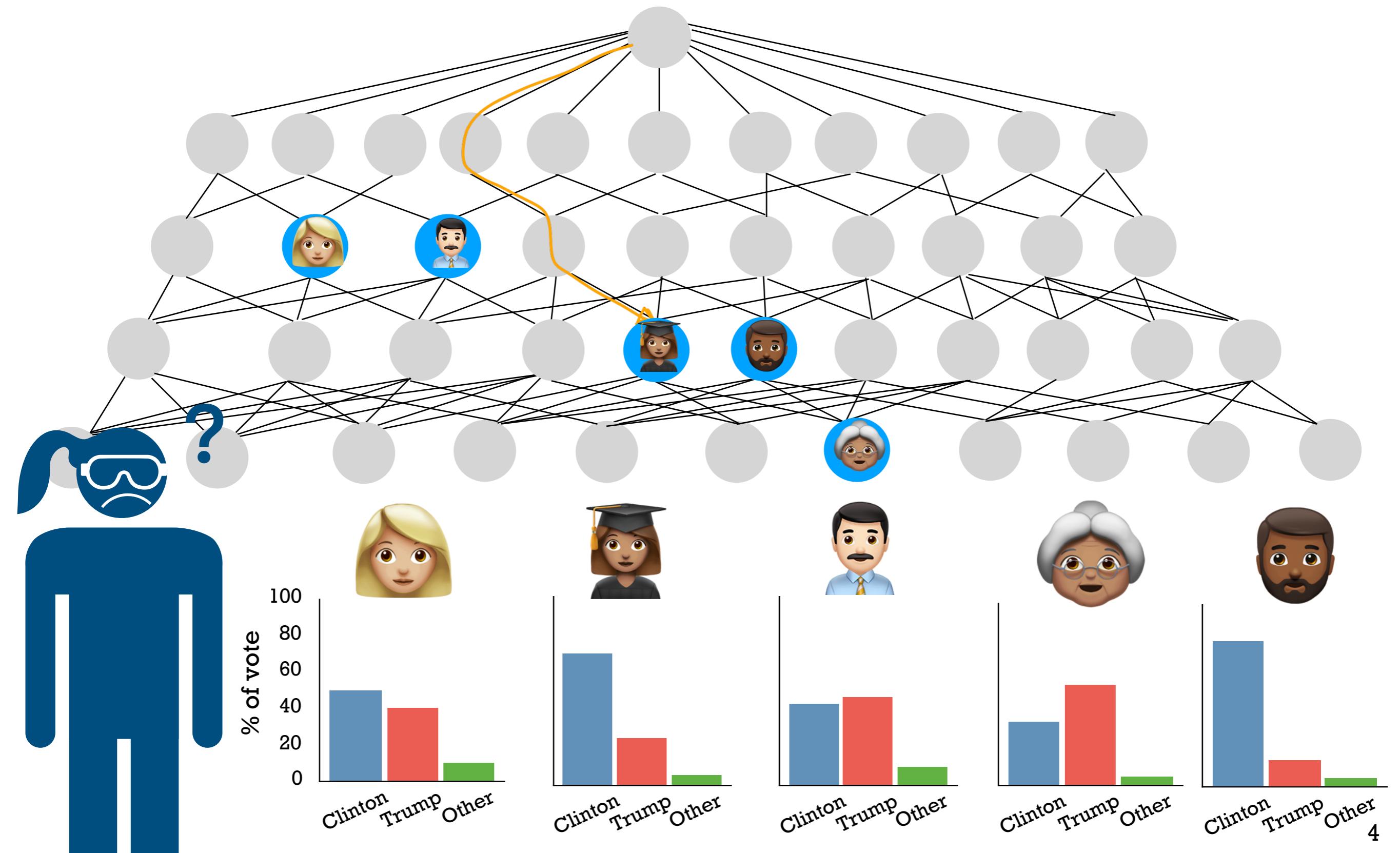
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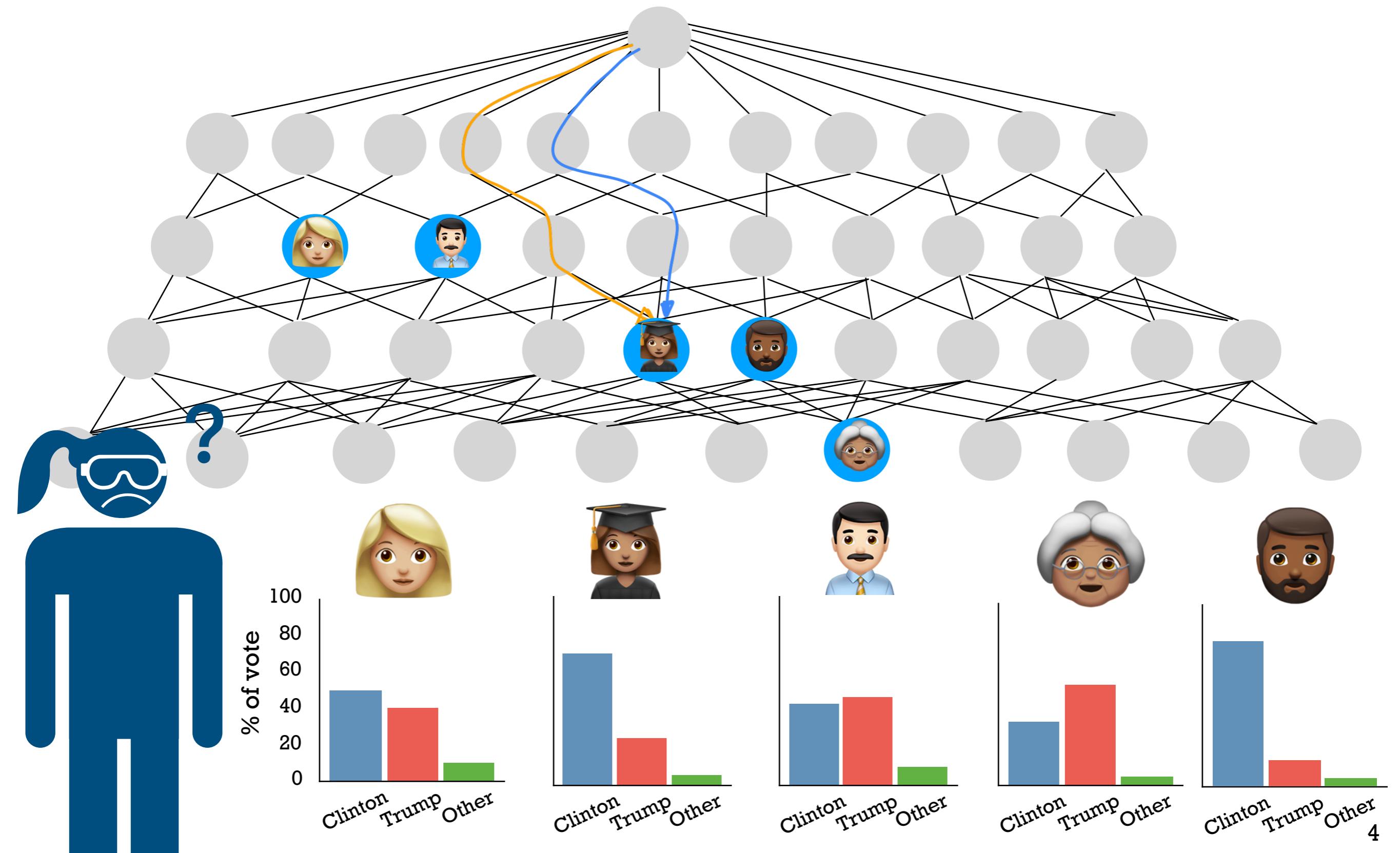
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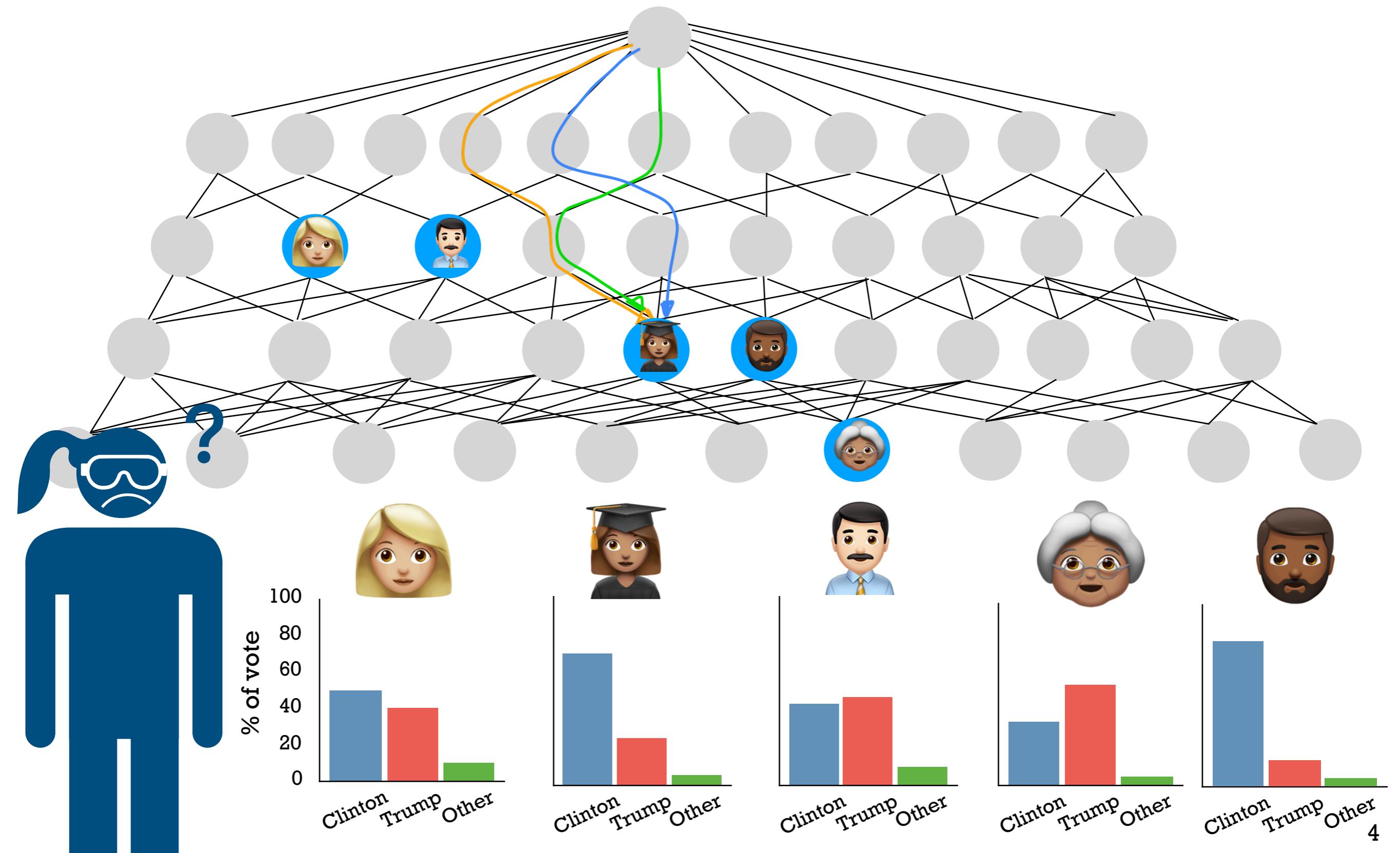
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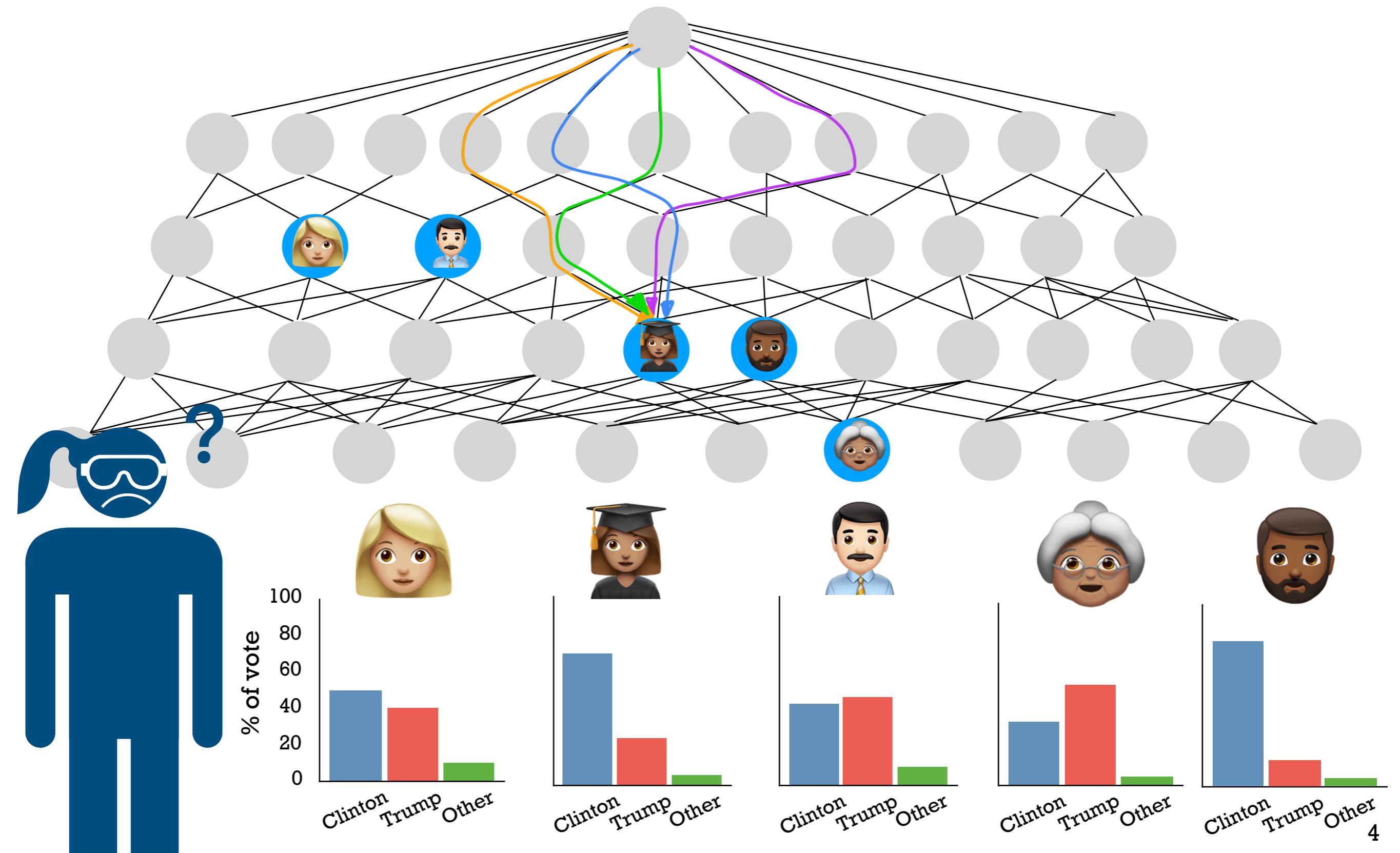
Lattice is HUGE !



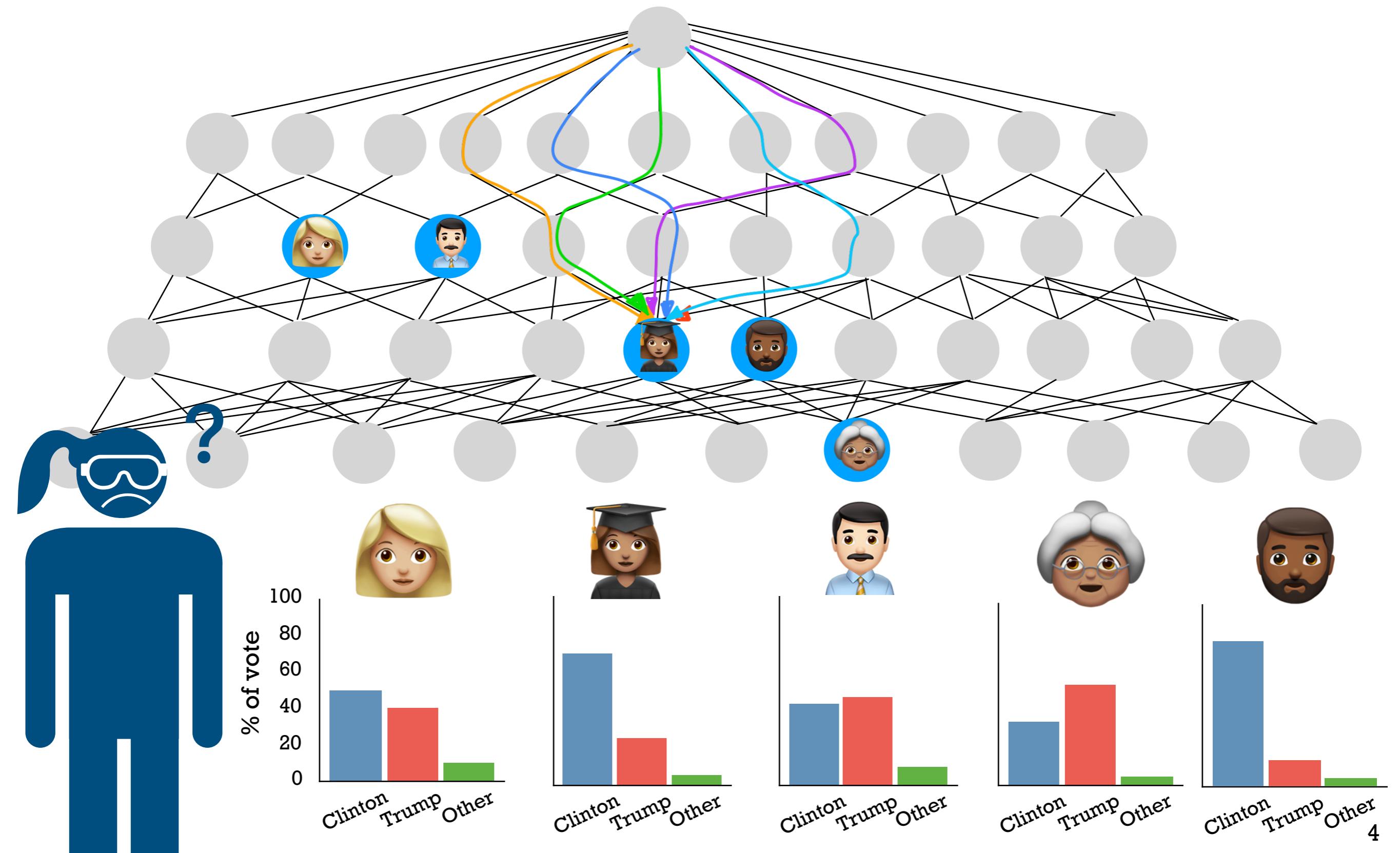
Lattice is HUGE !



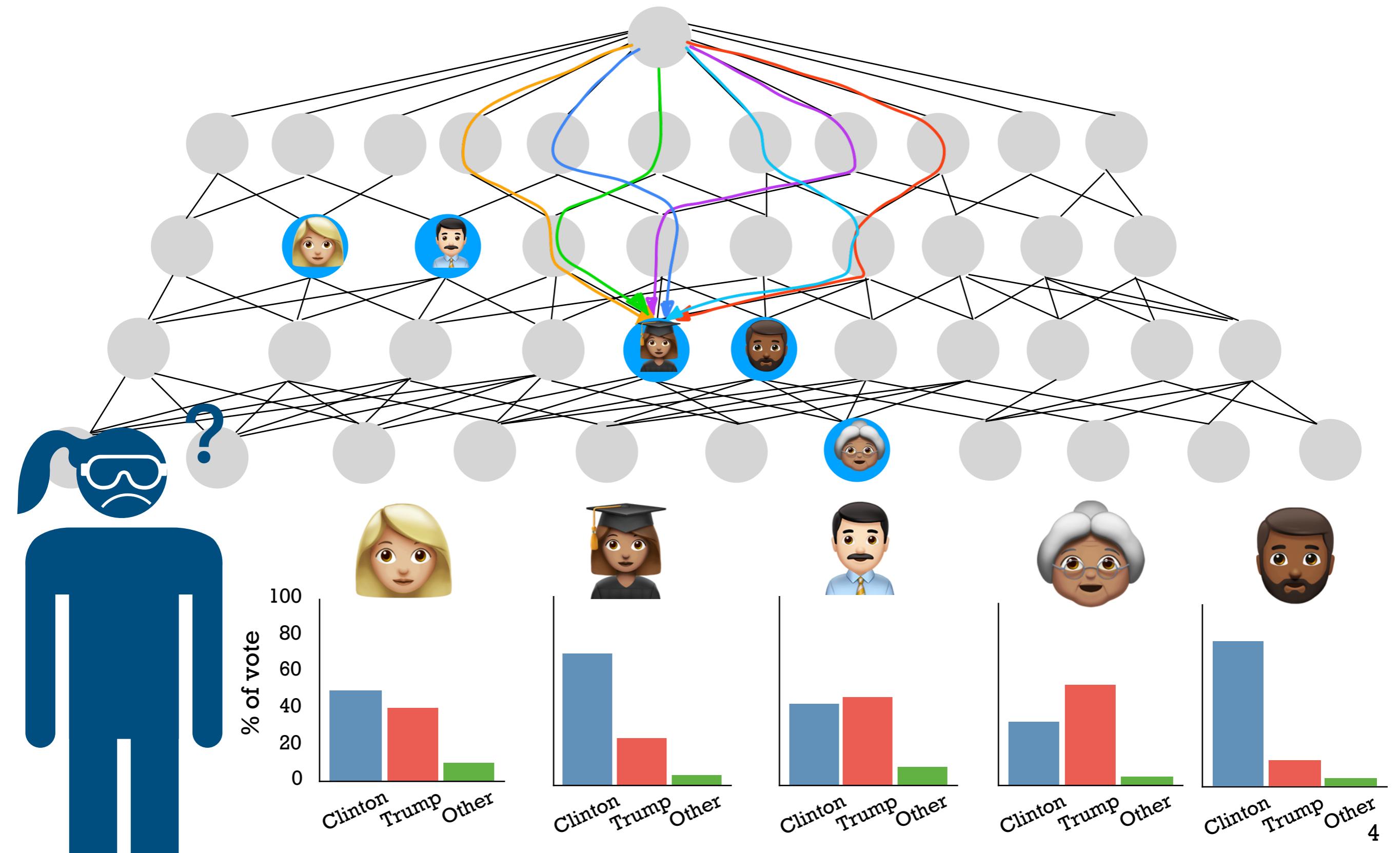
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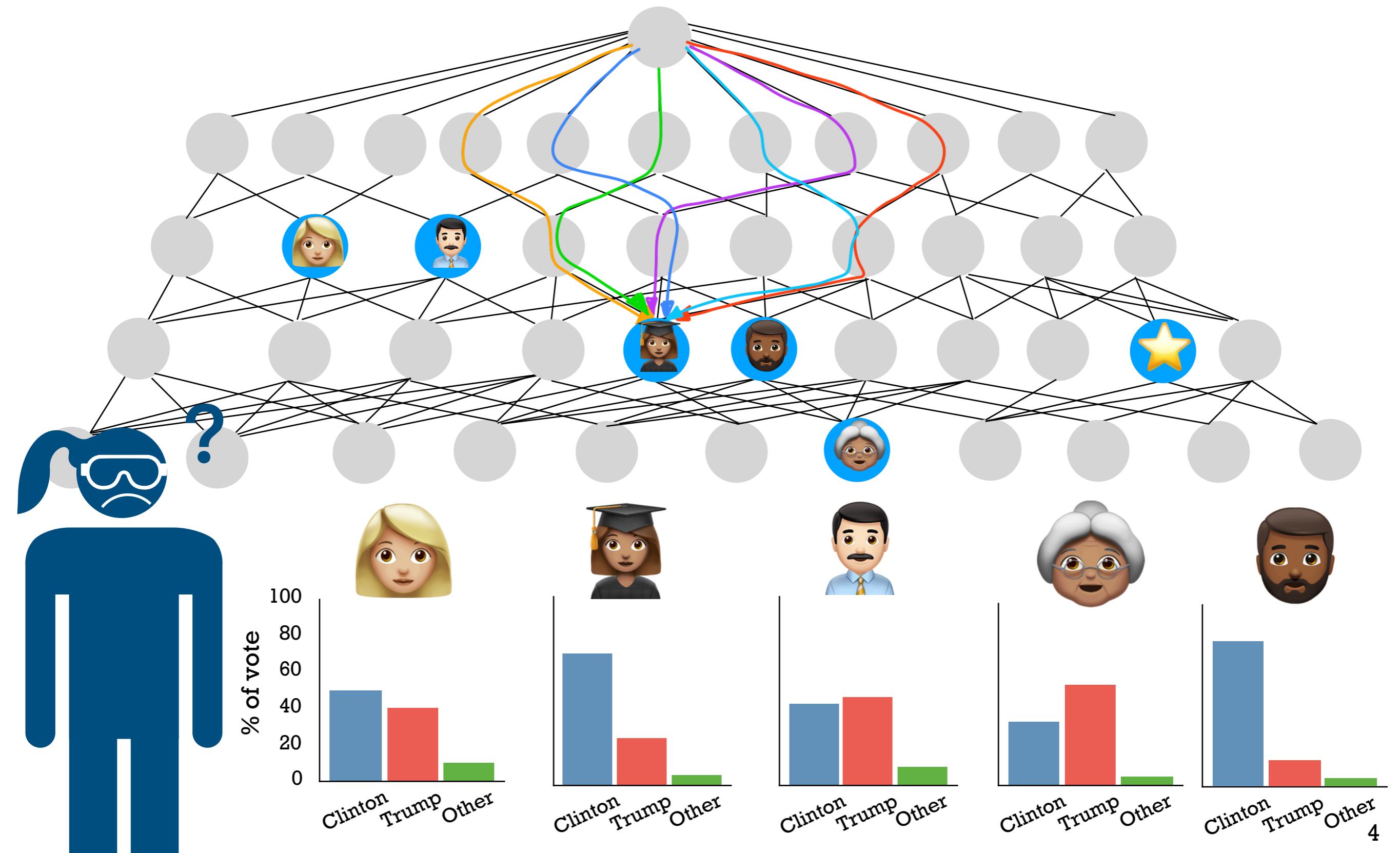
Lattice is HUGE !



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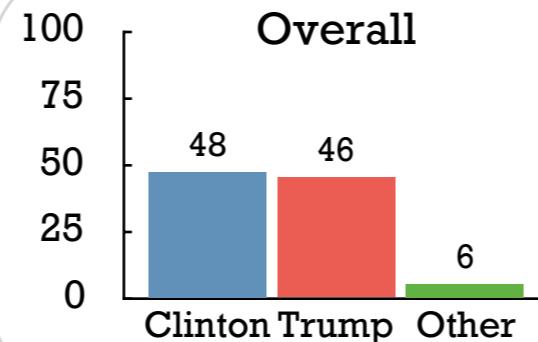


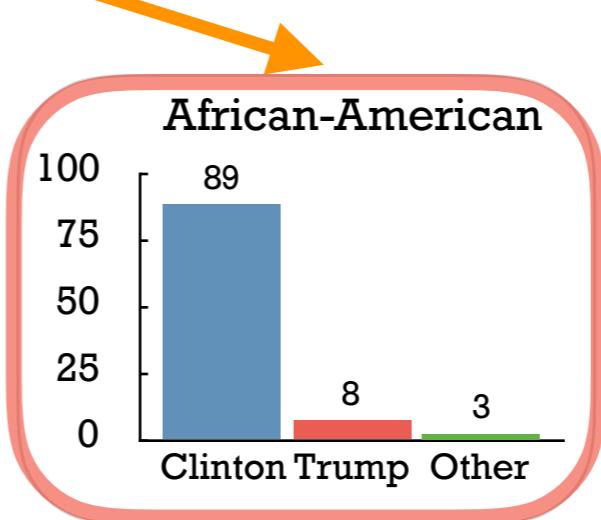
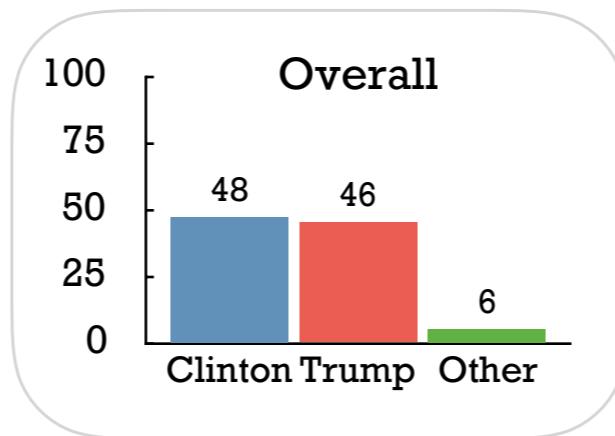
Lattice is HUGE !

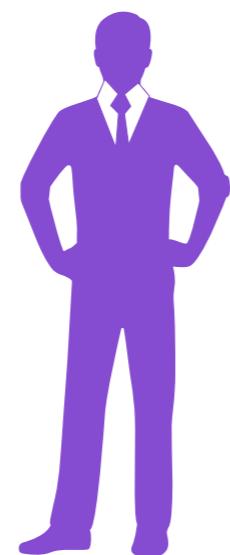
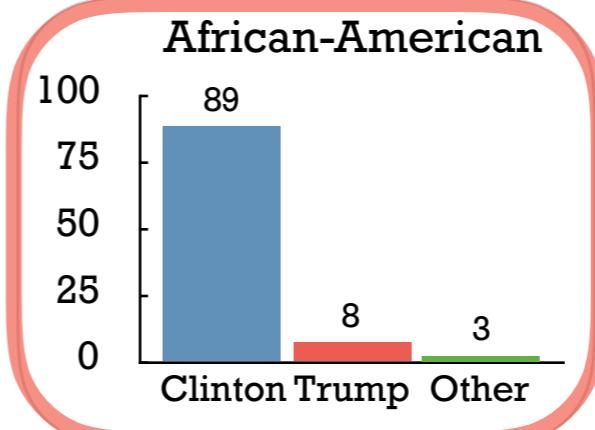
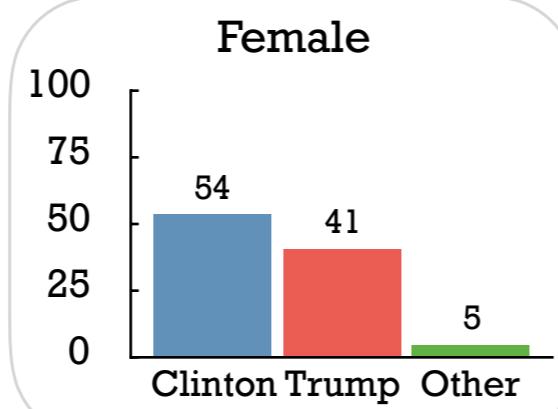
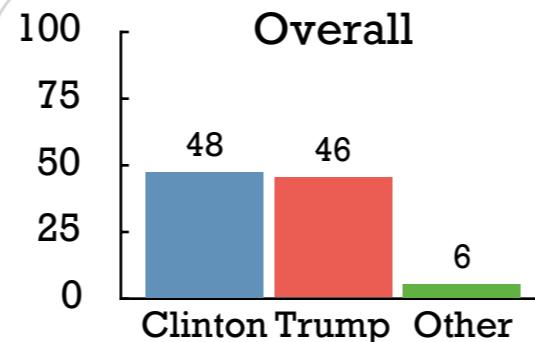


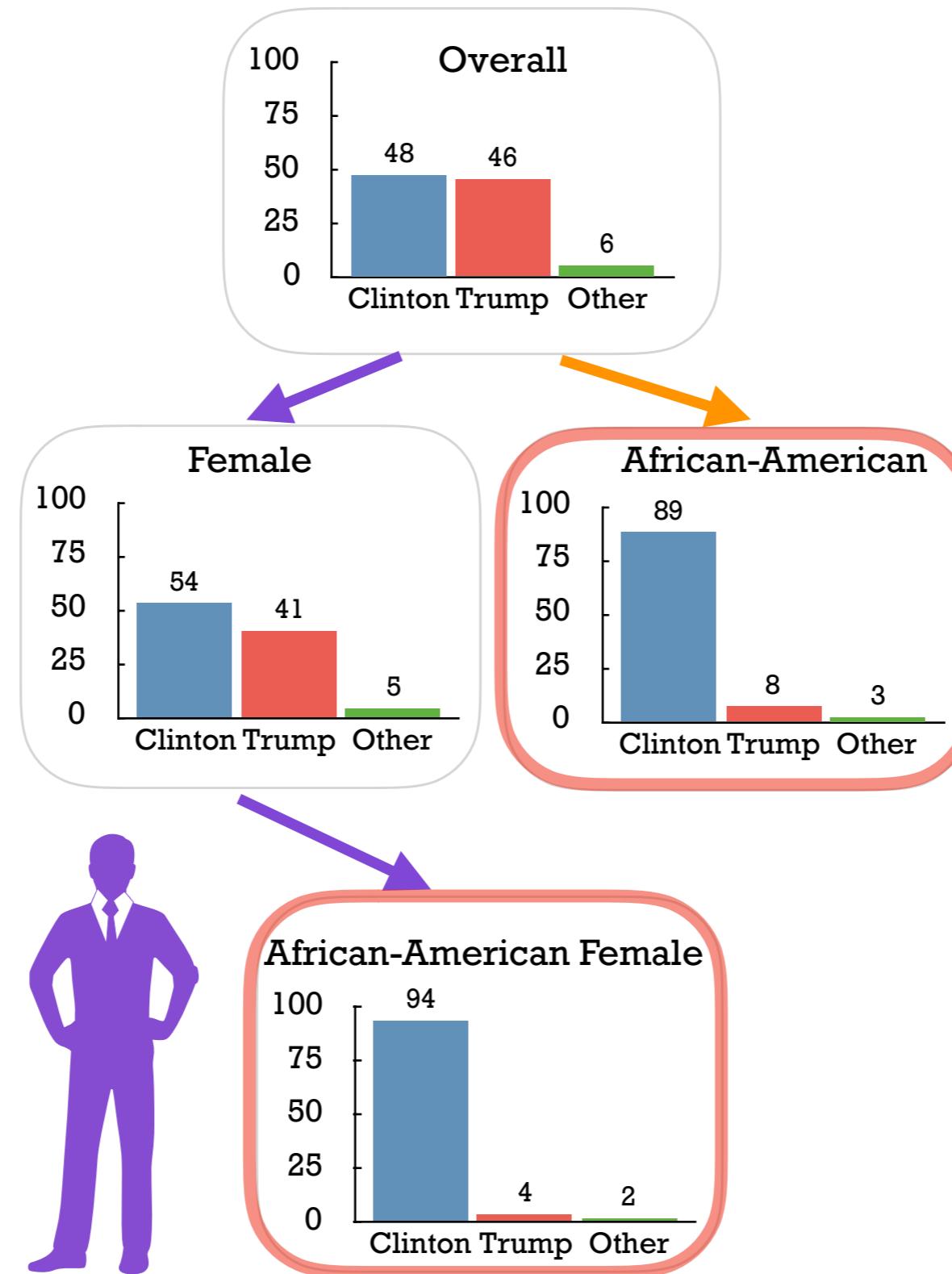
Outline

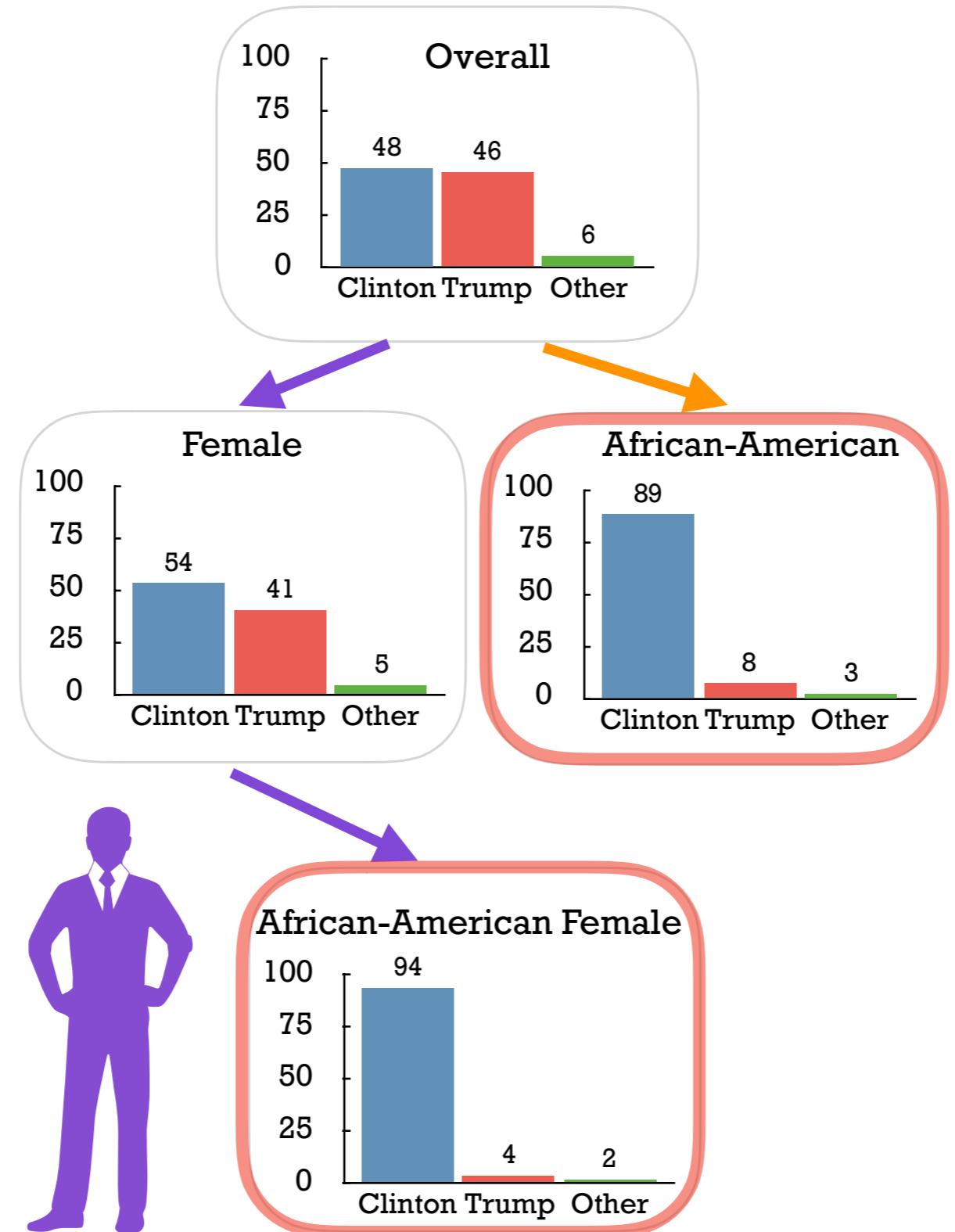
- ★ Challenges of Manual Drill-Downs
- ★ Design Objectives for Assistive Drill-Downs
- ★ System Overview: VisPilot
- ★ User Study Results

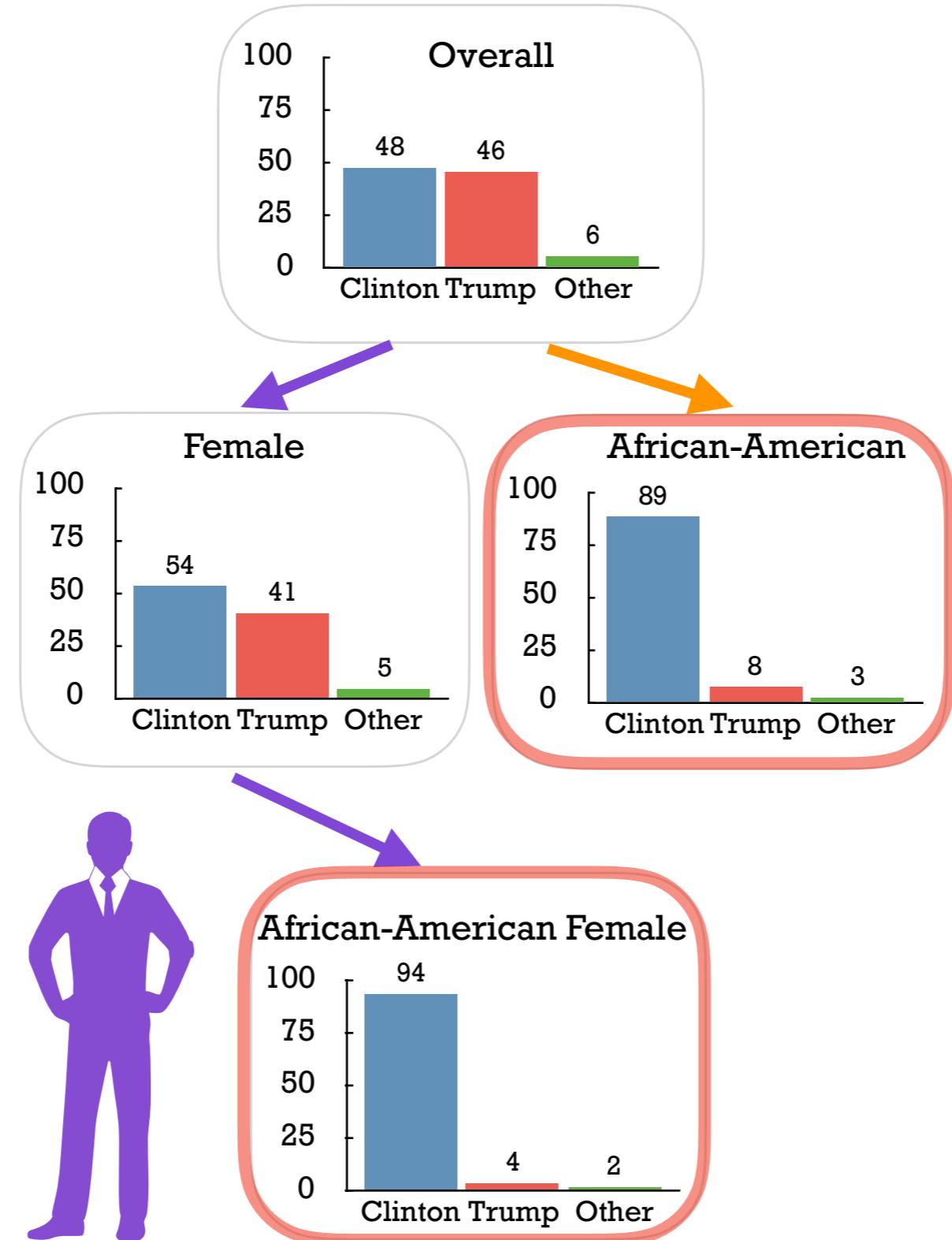




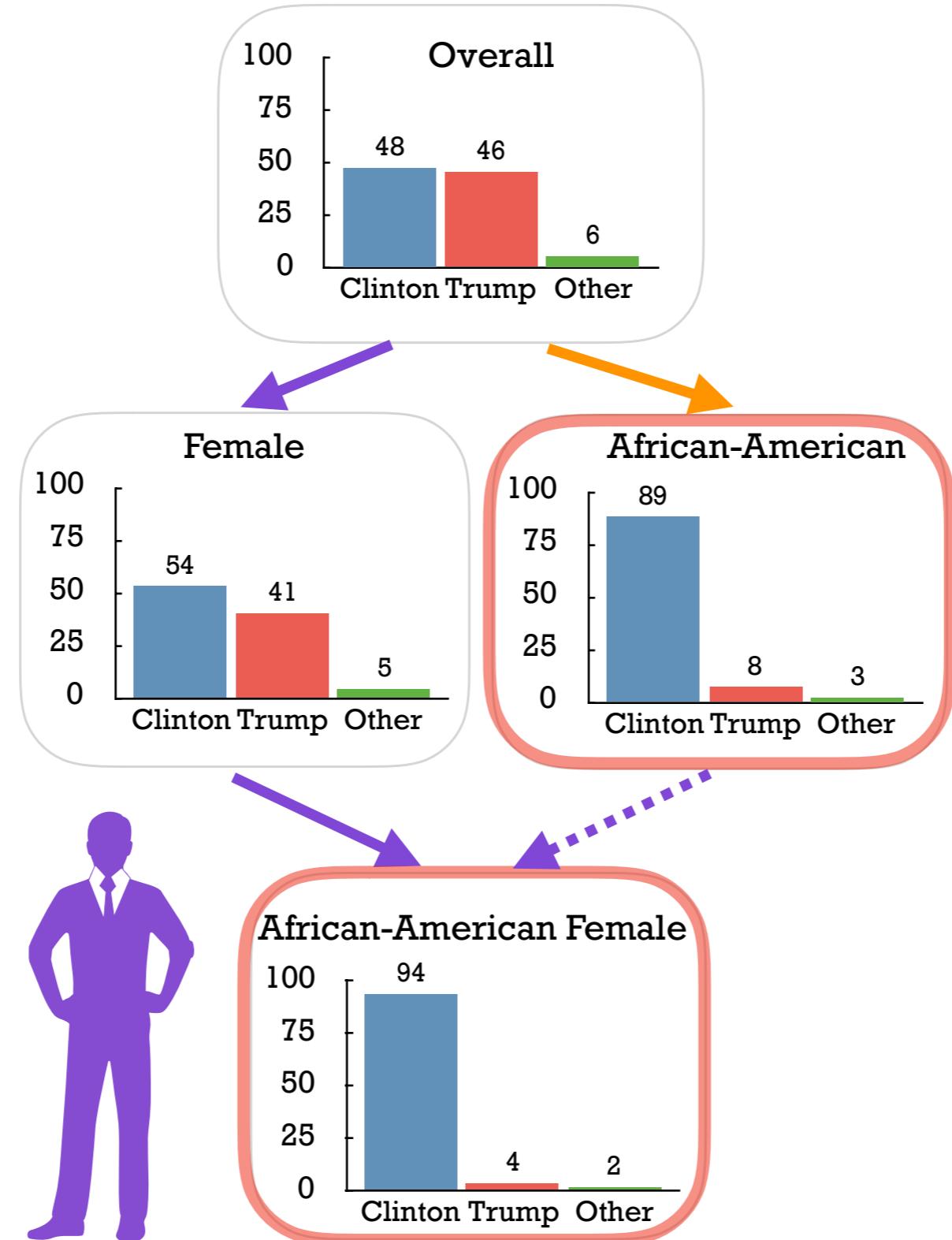








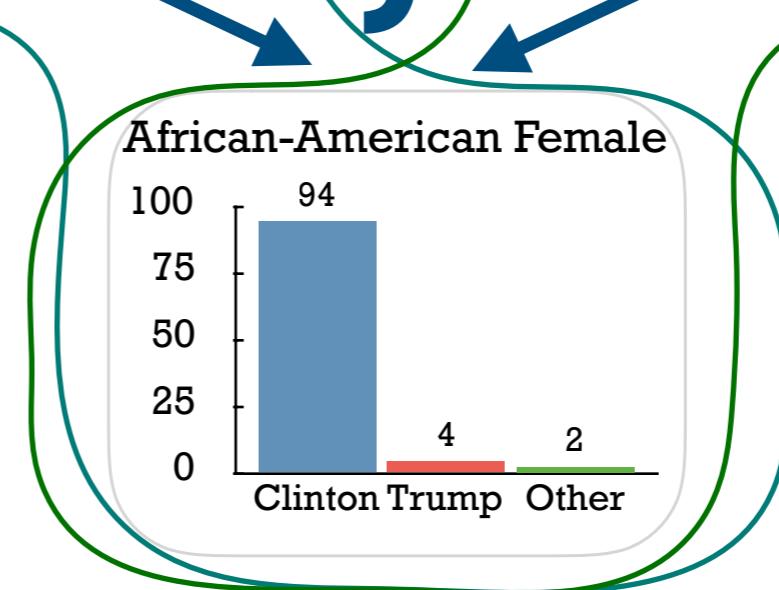
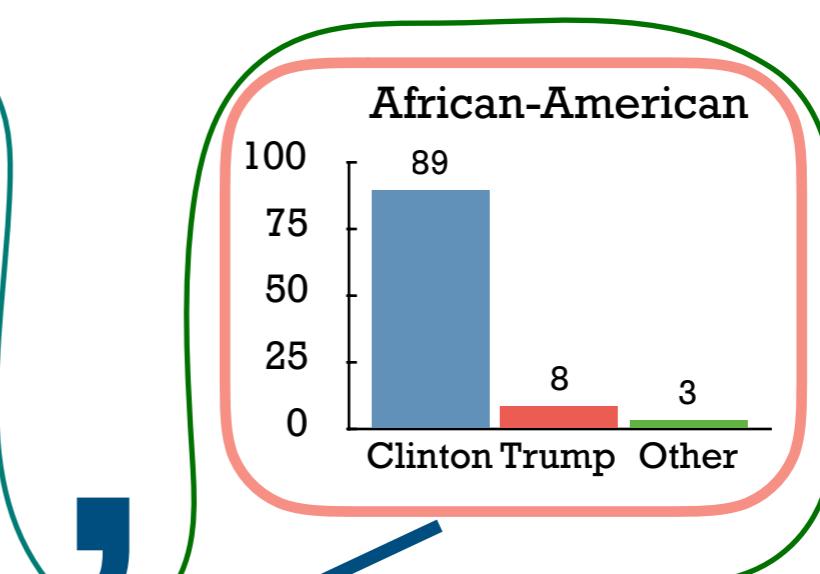
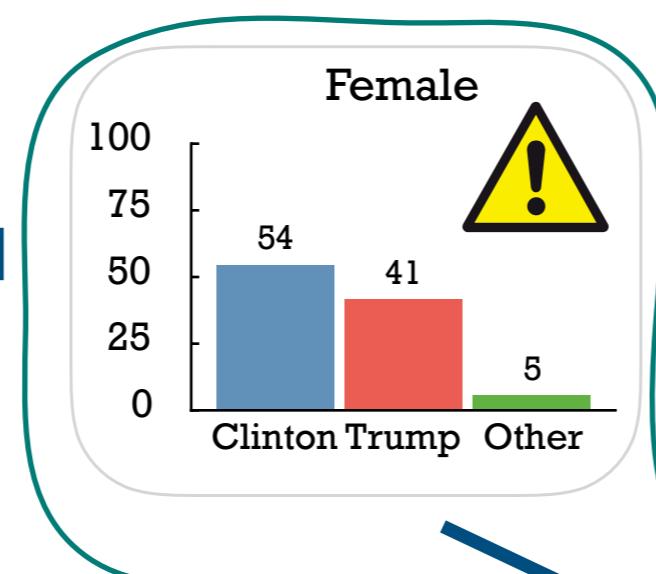
**Uninformative reference visualizations result in
Drill-Down Fallacy**



**Uninformative reference visualizations result in
Drill-Down Fallacy**

To ensure *safety* (avoid drill-down fallacy):
Select proper parent reference to compare against

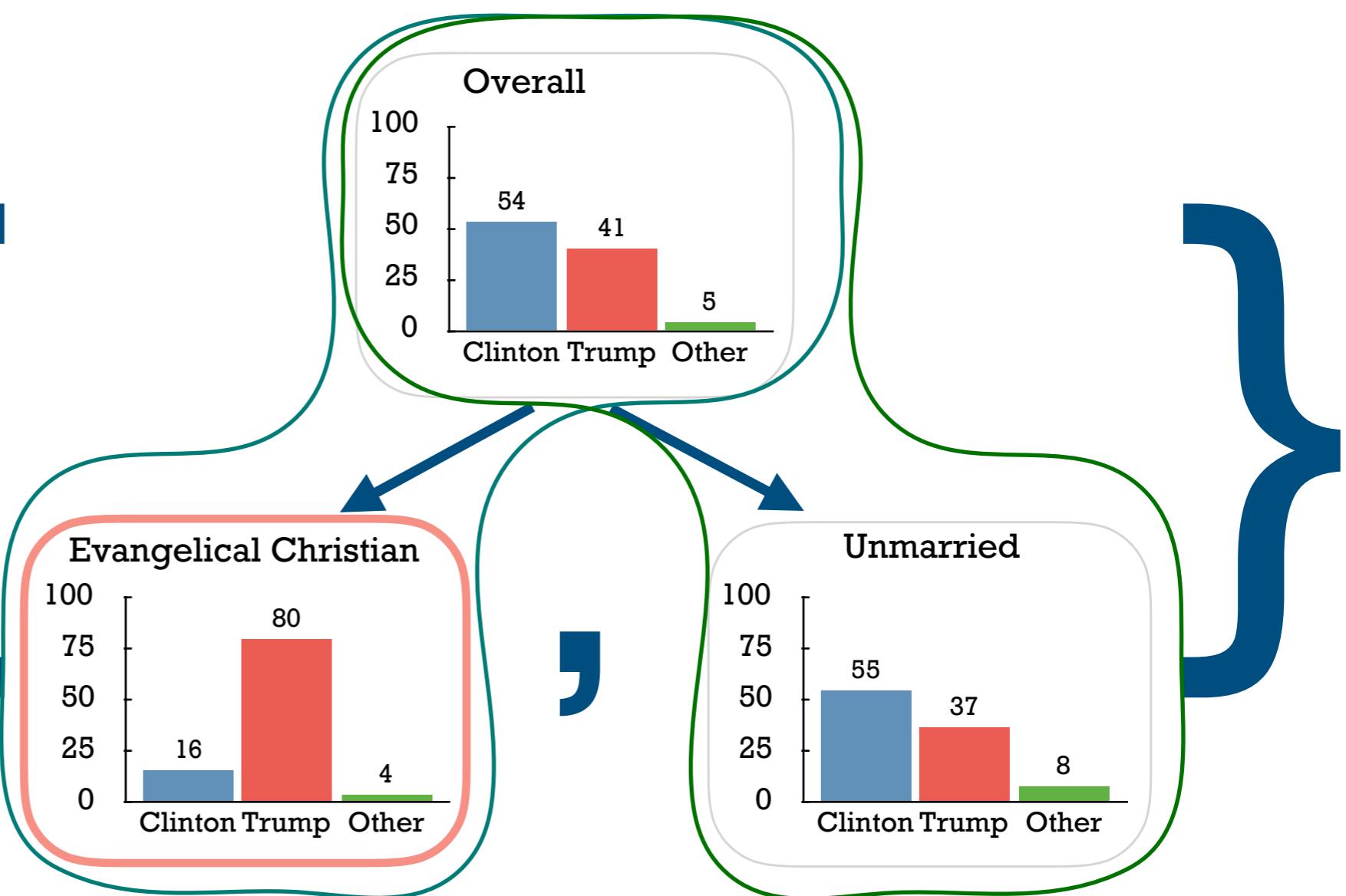
min D {



To find *salient distributions*:

Select visualizations that look different from its parents

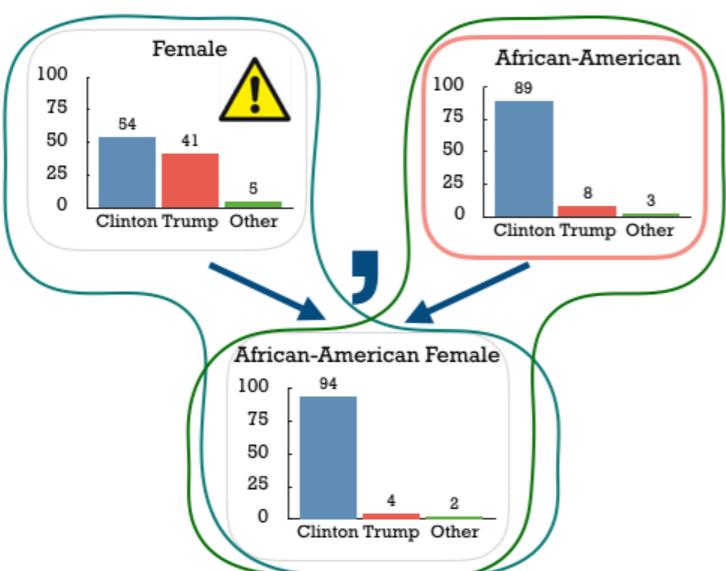
max D



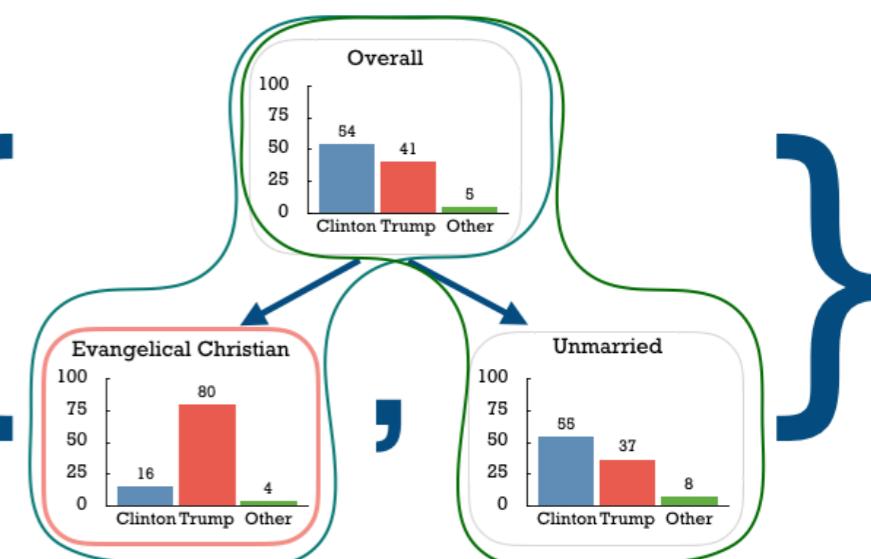
★Key Insight

A visualization is interesting if even its closest parent is unable to explain its behavior.

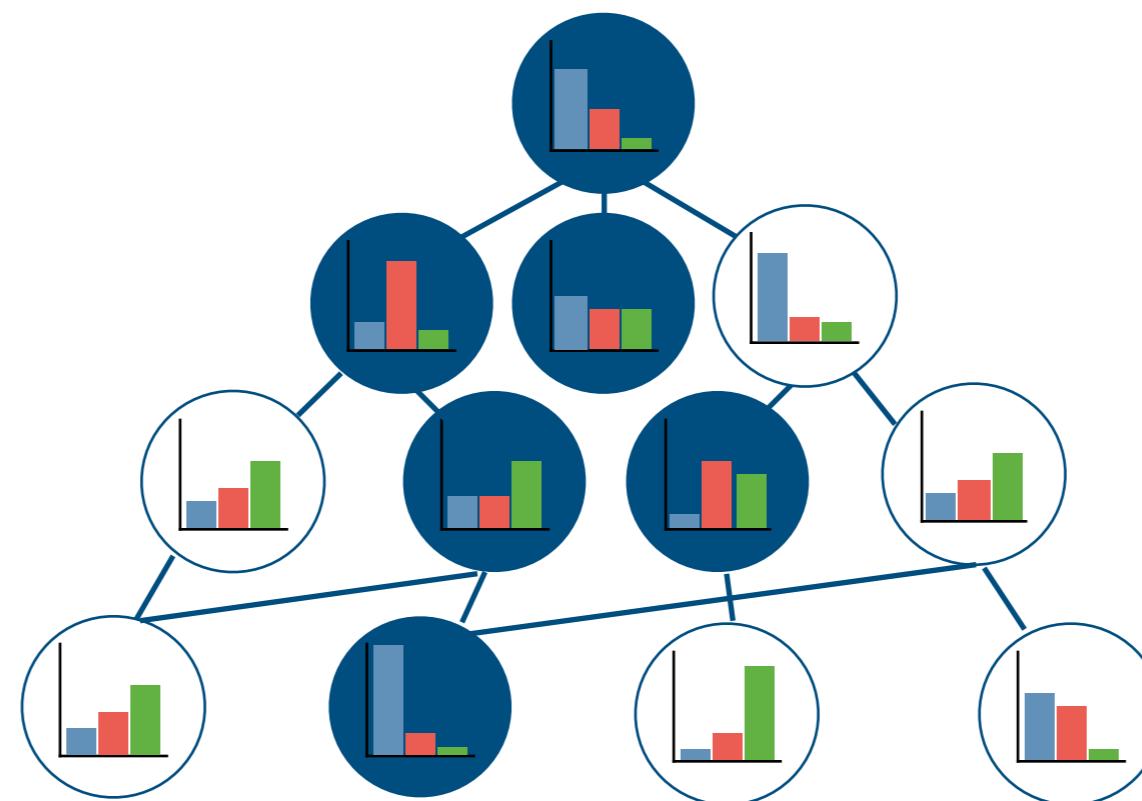
Safety



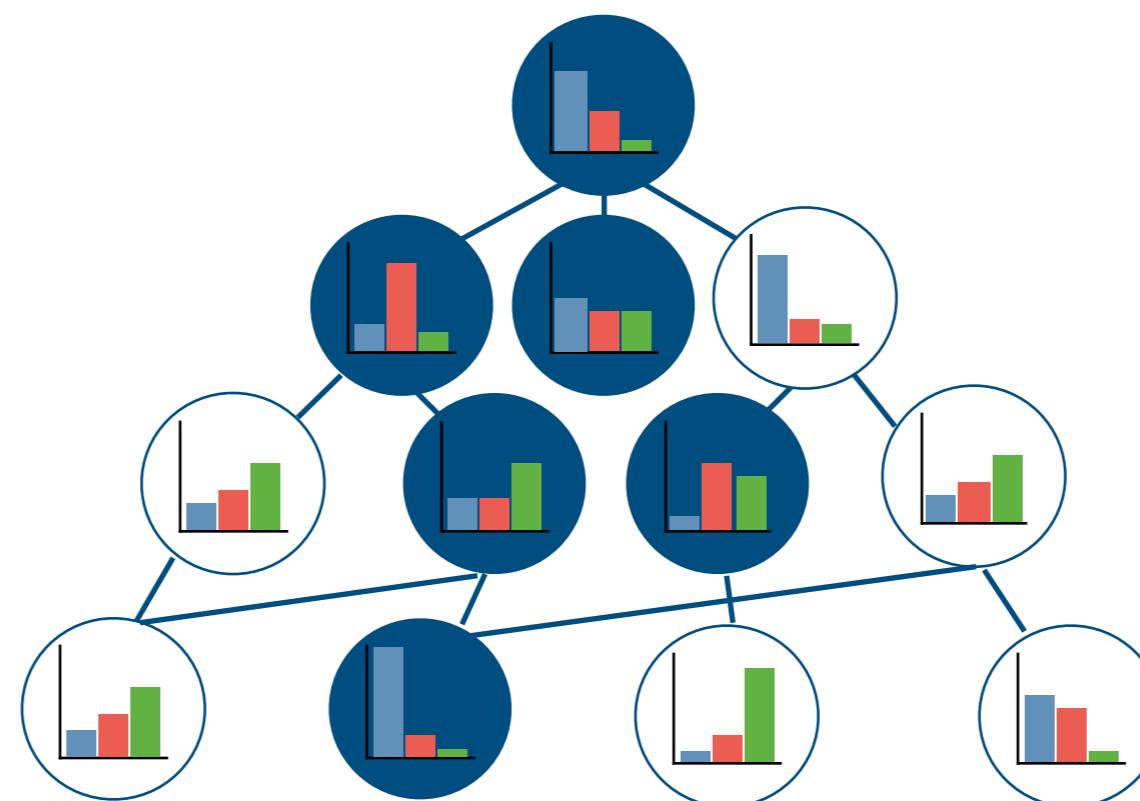
Saliency



**Select k visualizations that are maximally salient,
while enforcing ≥ 1 informative parent for context.**

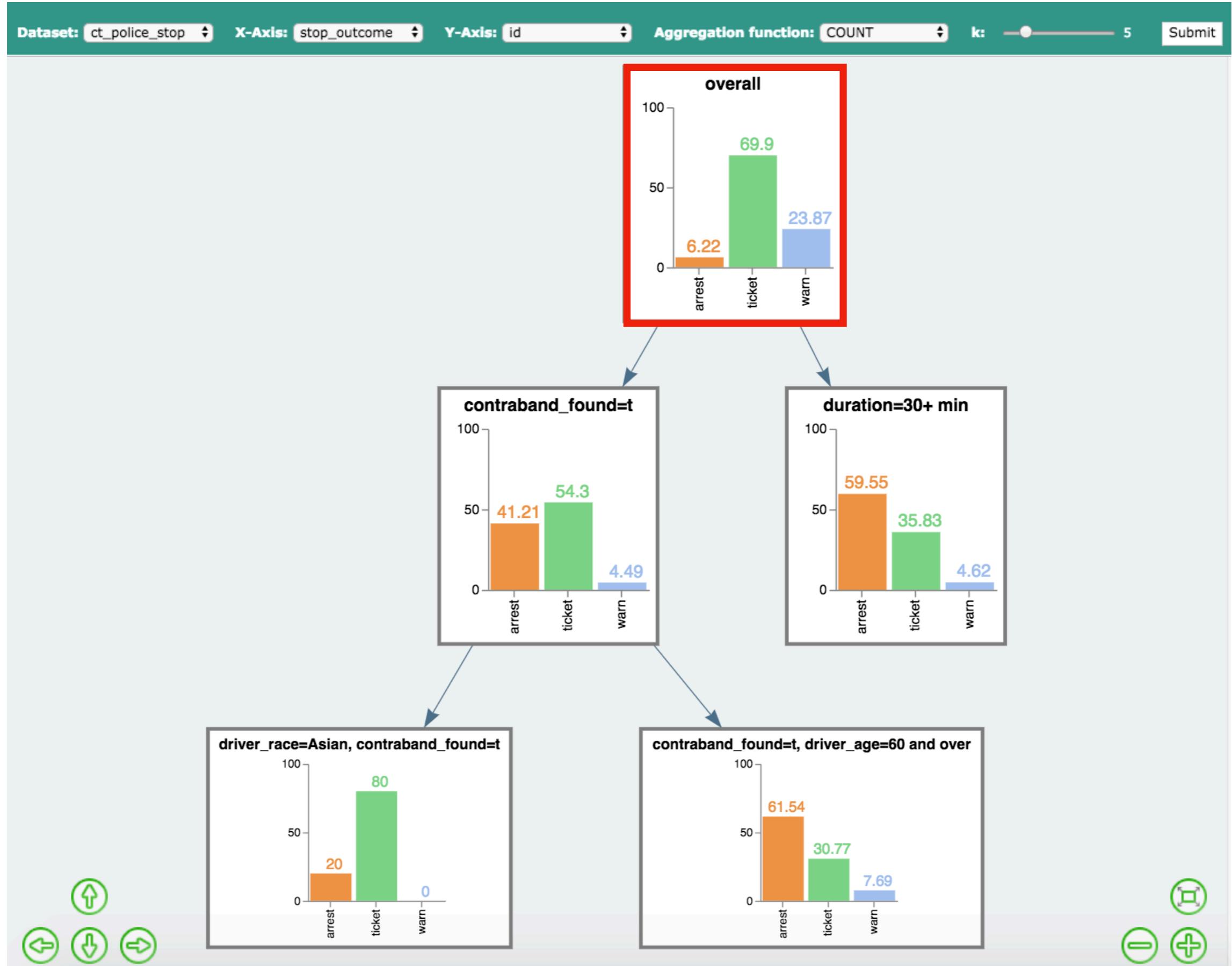


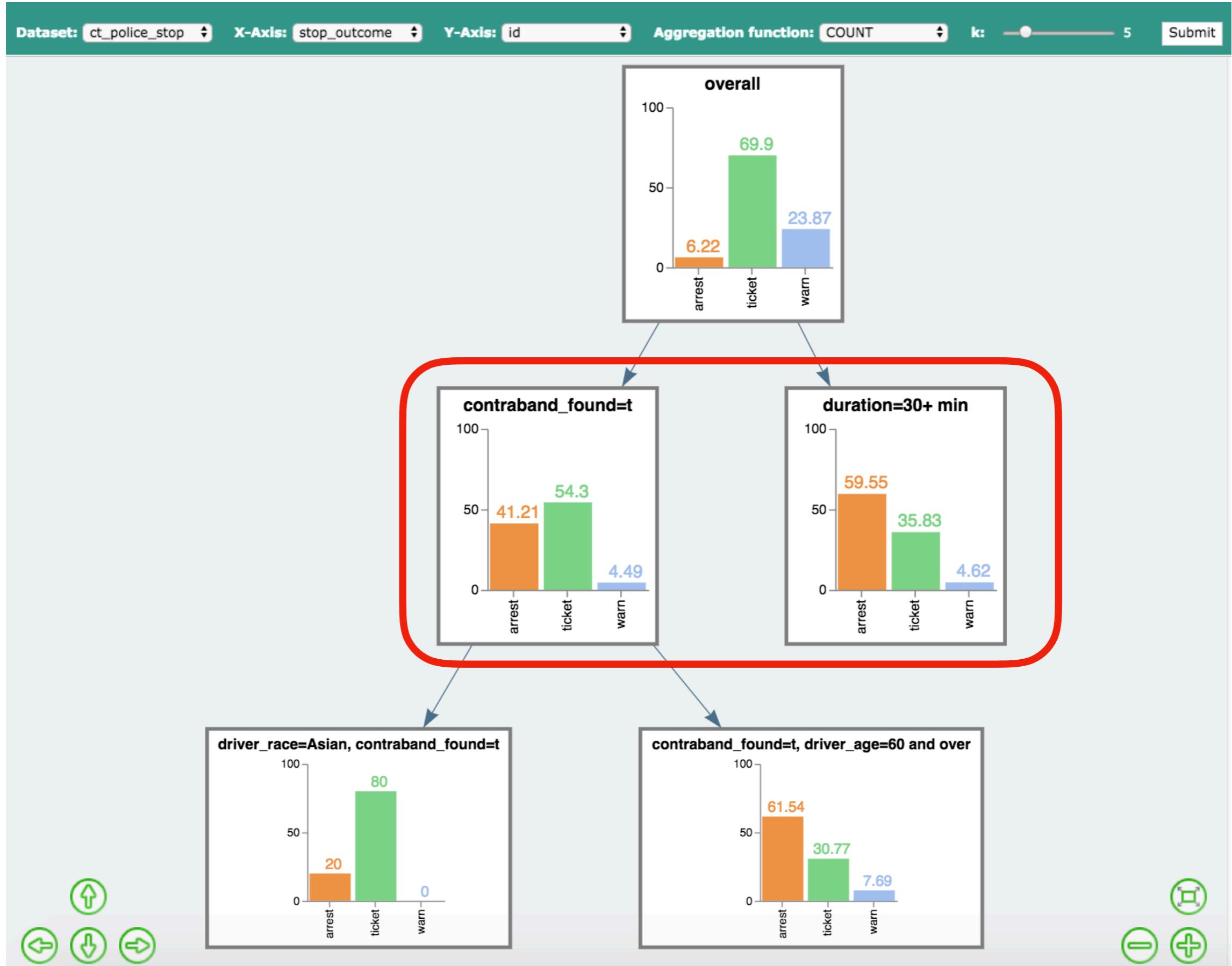
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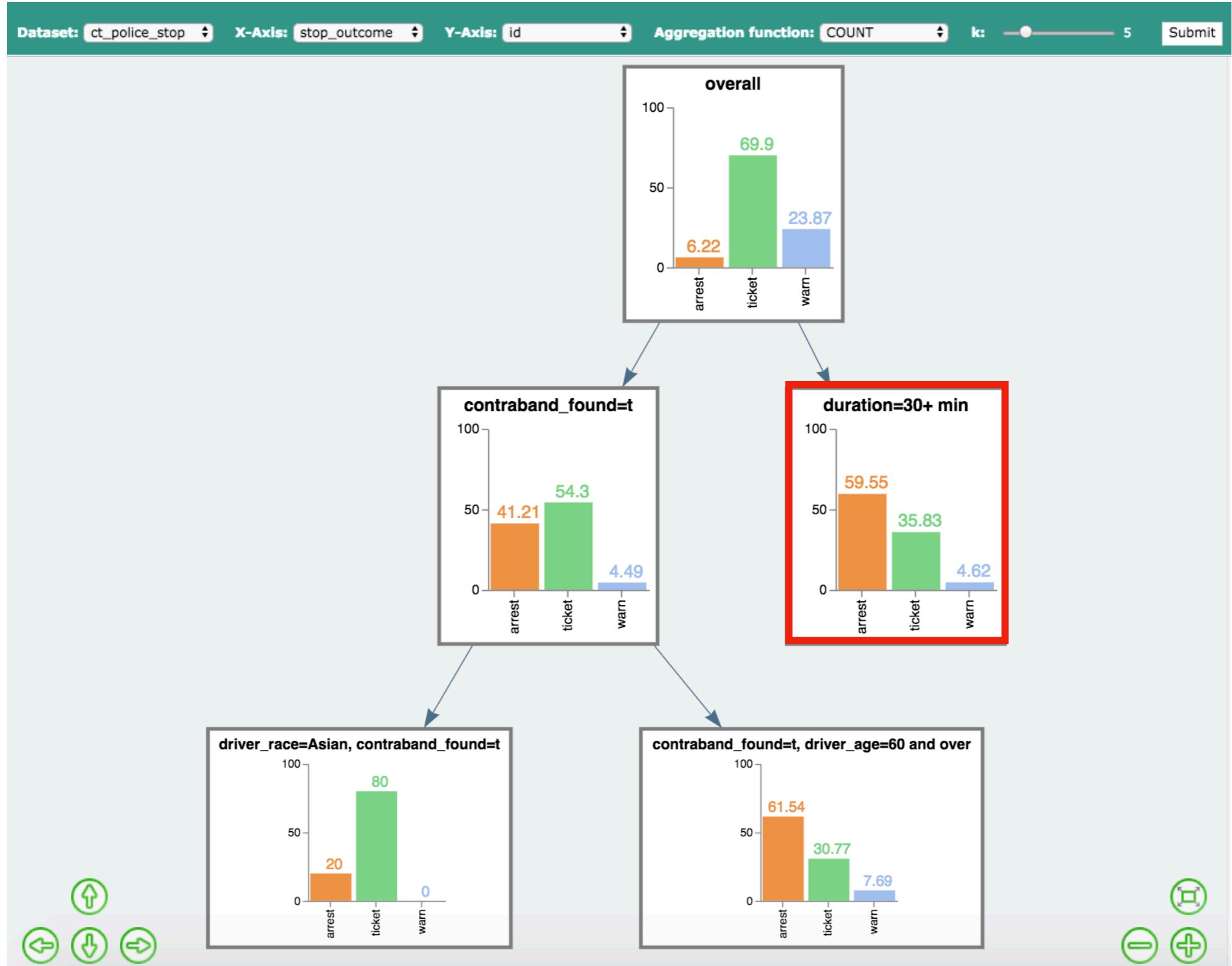
Max-Utility Connected Subgraph Problem \rightarrow NP-Hard!

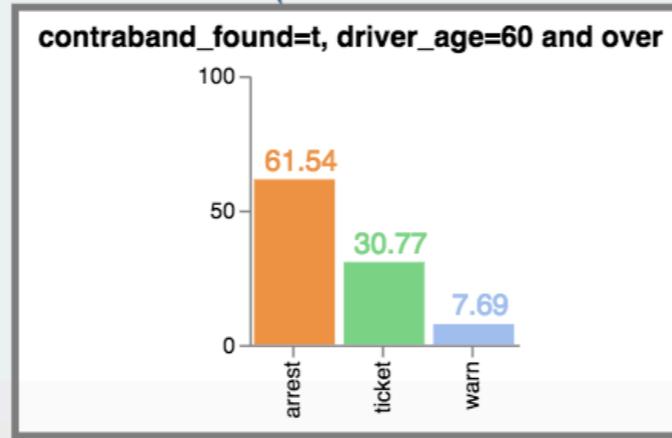
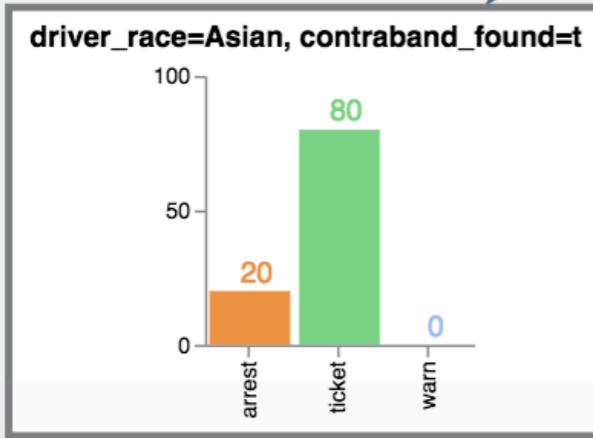
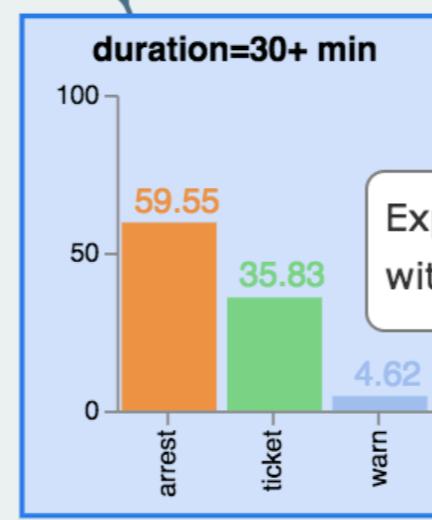
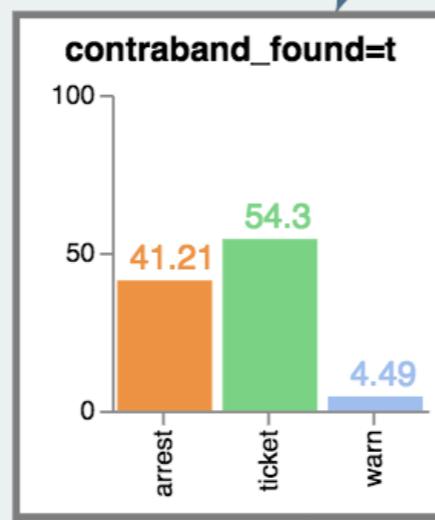
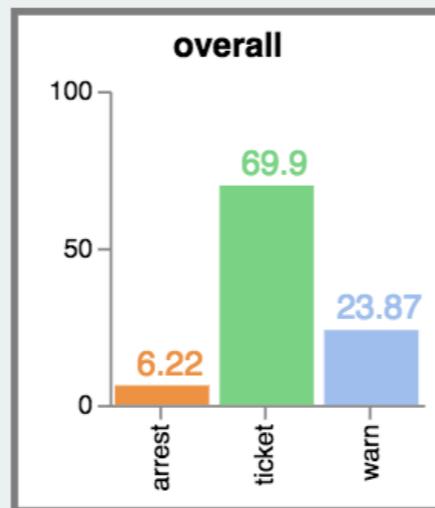


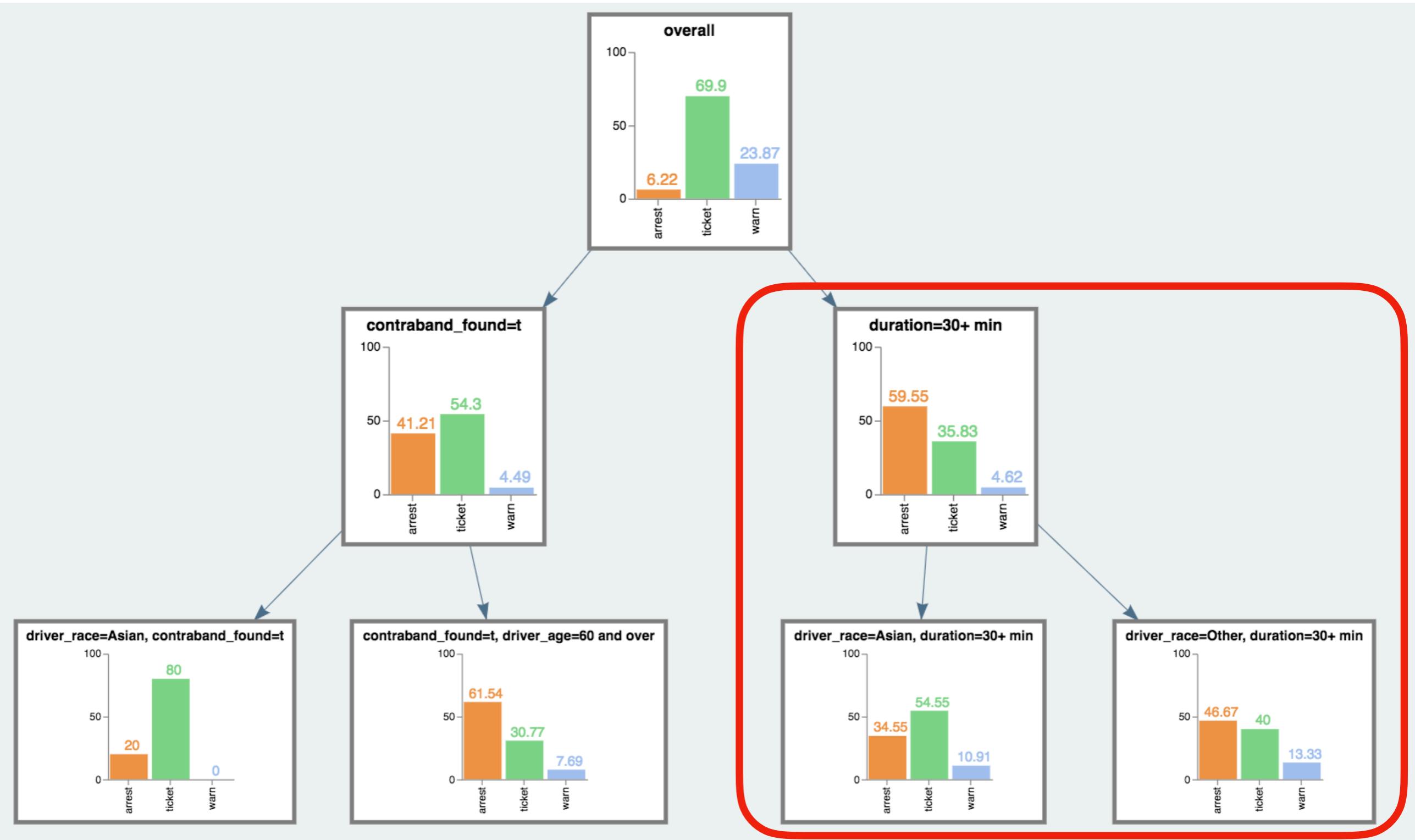






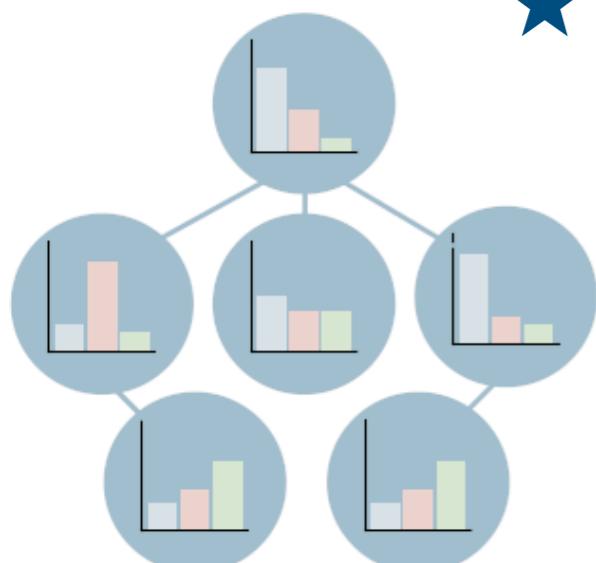




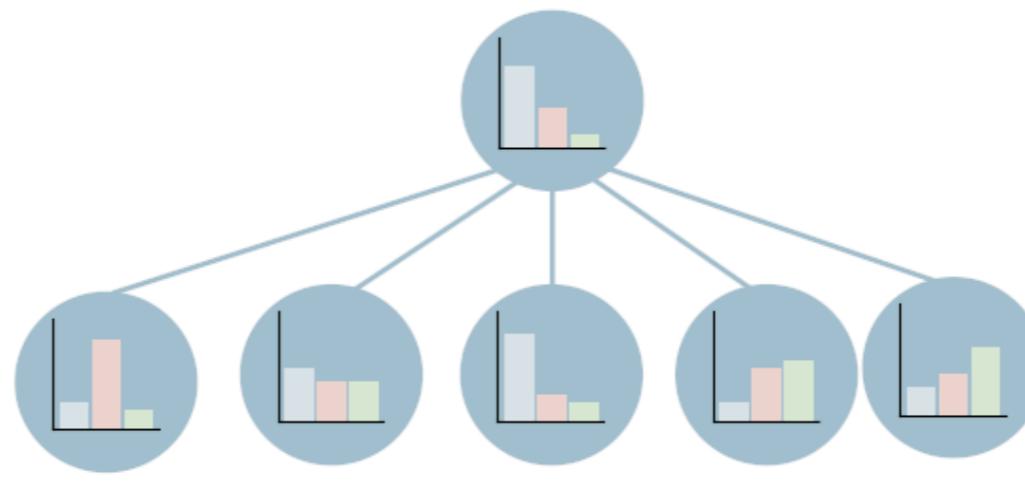


Study Methodology

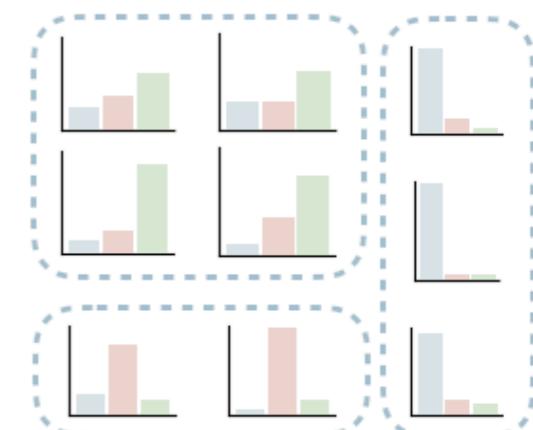
★ Dashboard Generation Conditions



VisPilot



BFS



Cluster

★ Study Tasks



Labeling



Prediction

1. Age
2. Gender
3. Race
4. Income
-

19

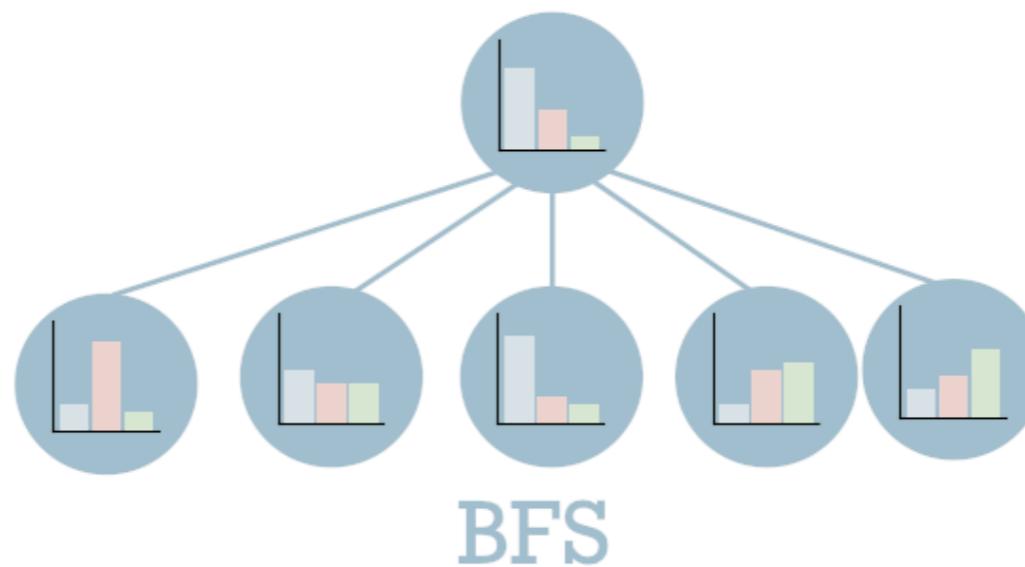
Ranking

Study Methodology

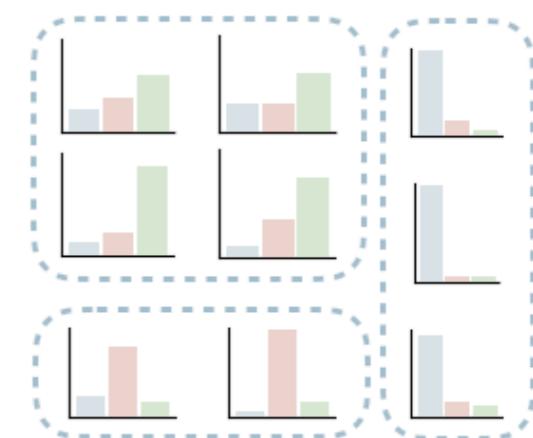
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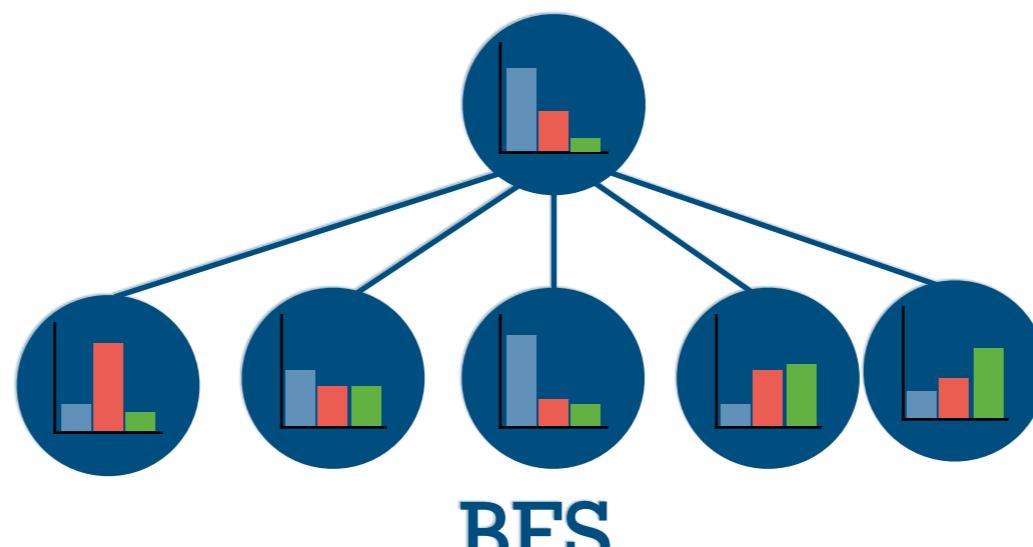
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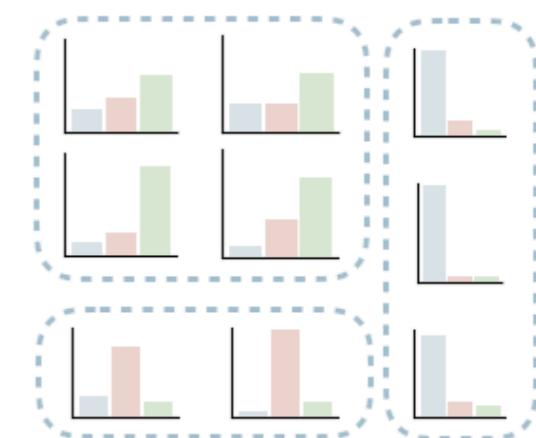
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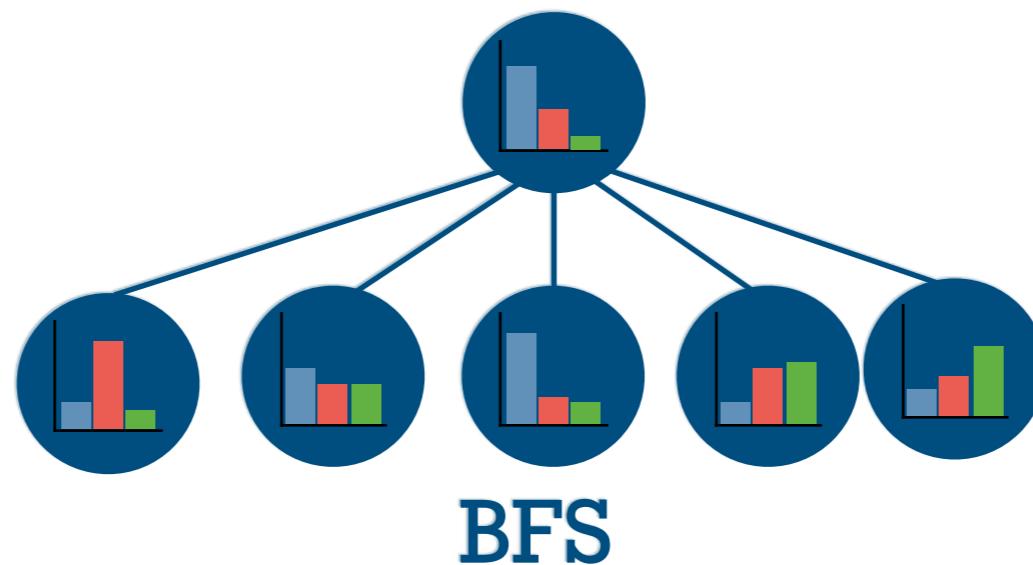
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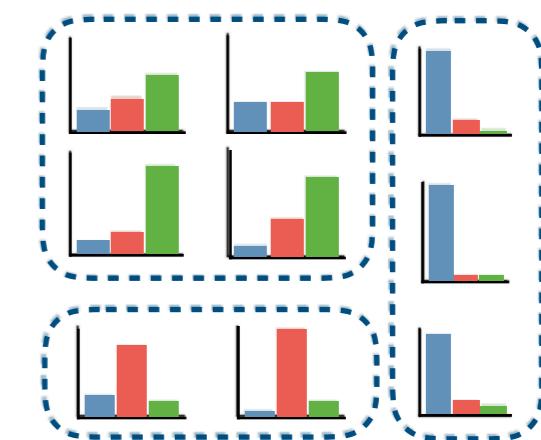
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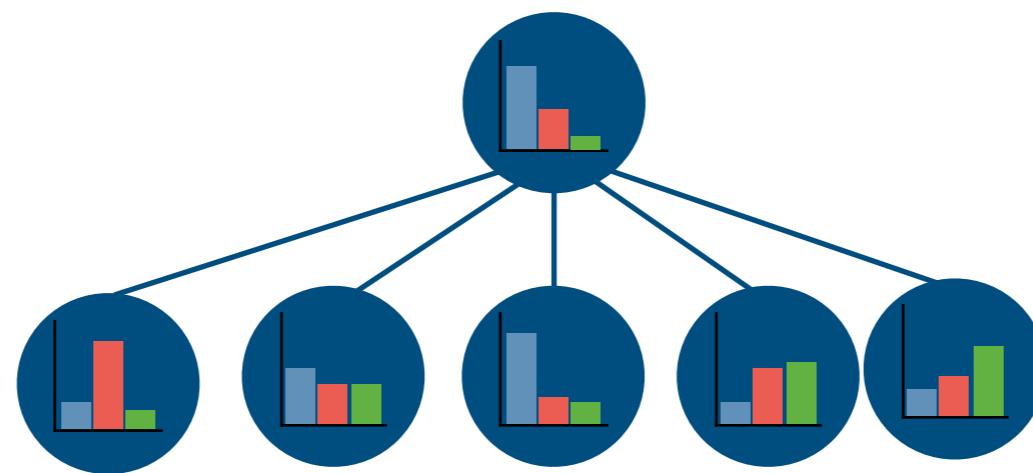
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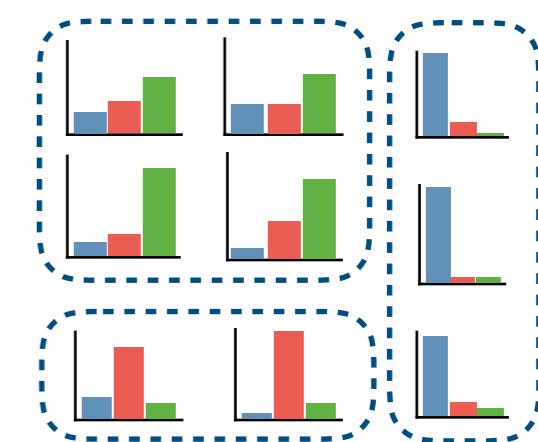
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VisPilot



BFS



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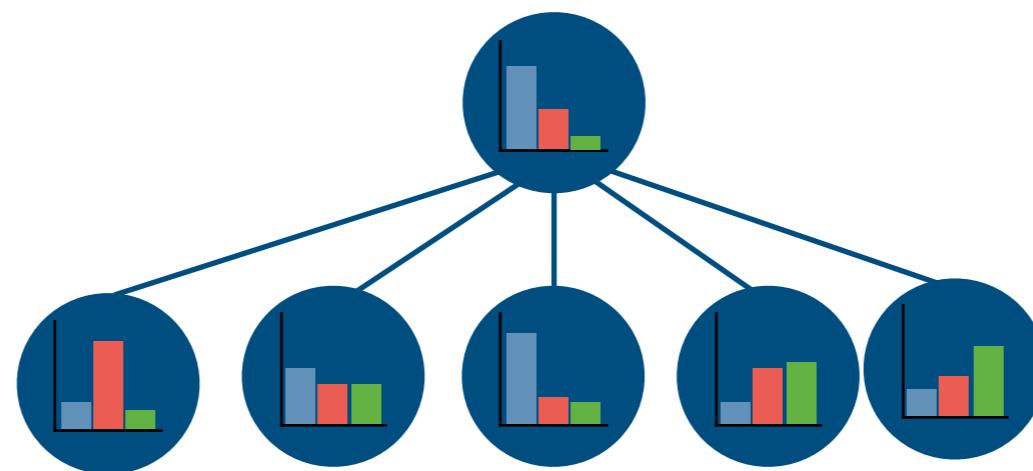
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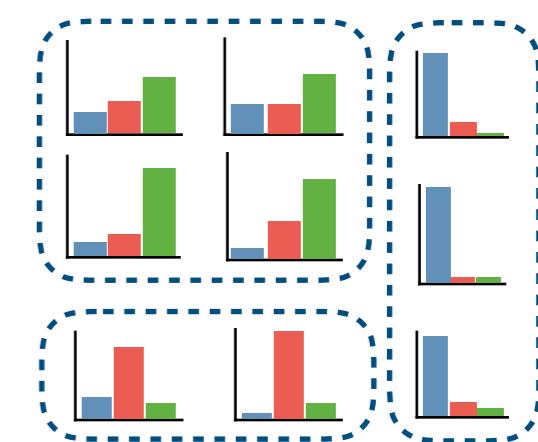
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VisPilot

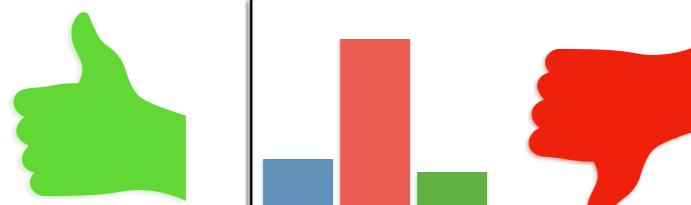


BFS



Cluster

★ Study Tasks



Labeling



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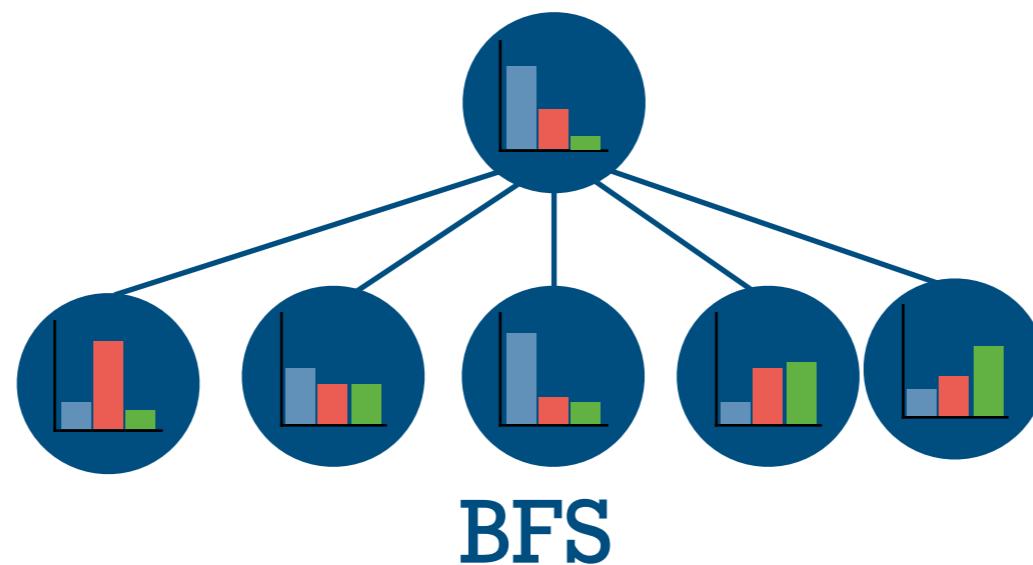
Ranking

Study Methodology

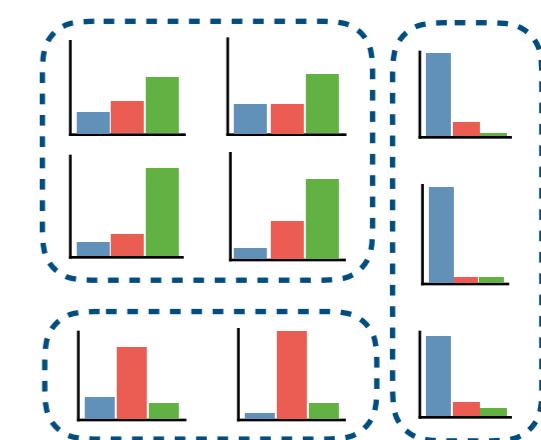
★ Dashboard Generation Conditions



VisPilot

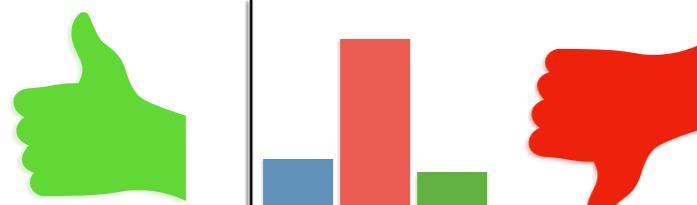


BFS



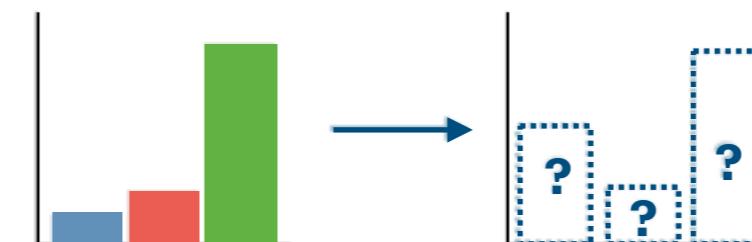
Cluster

★ Study Tasks



Labeling

Gender = F



Prediction

Gender = F
& Age > 60

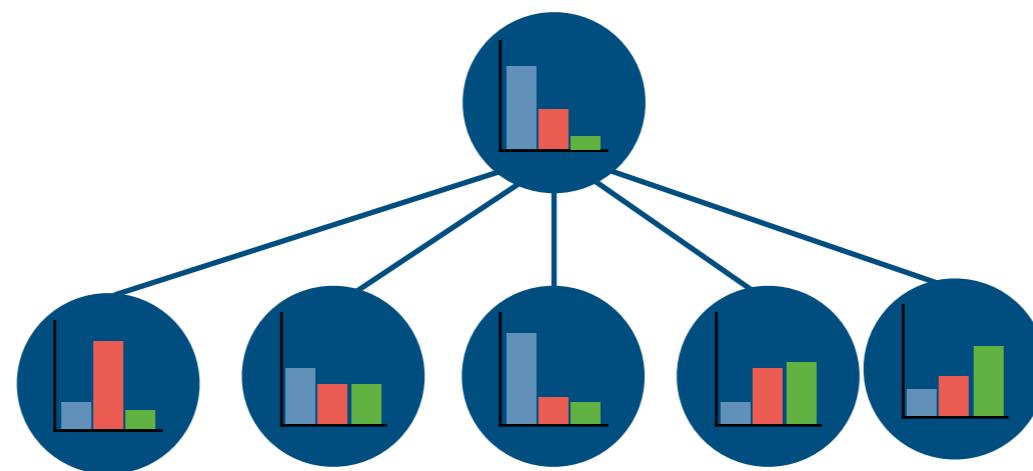
1. Age
2. Gender
3. Race
4. Income
-

Study Methodology

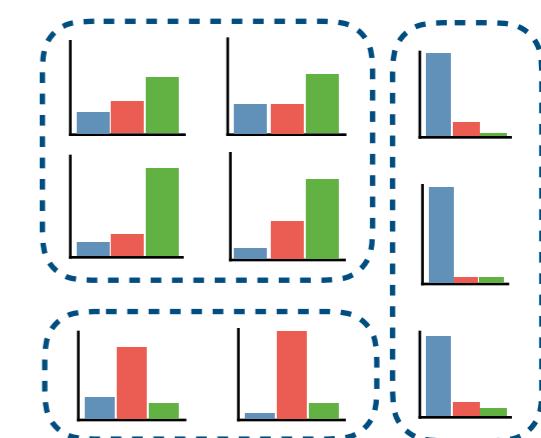
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VisPilot

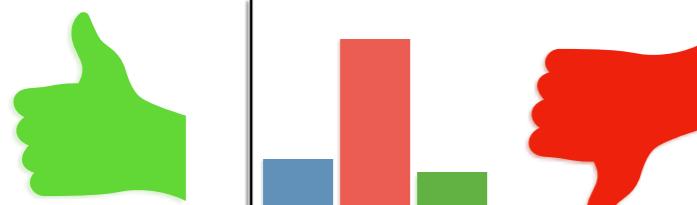


BFS

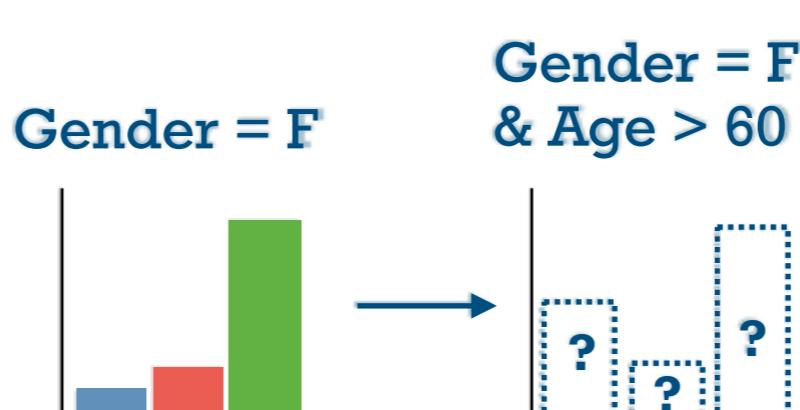


Cluster

★ Study Tasks



Labeling



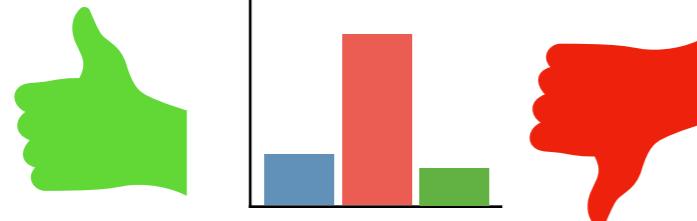
Prediction

1. Age
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-

20

Ranking

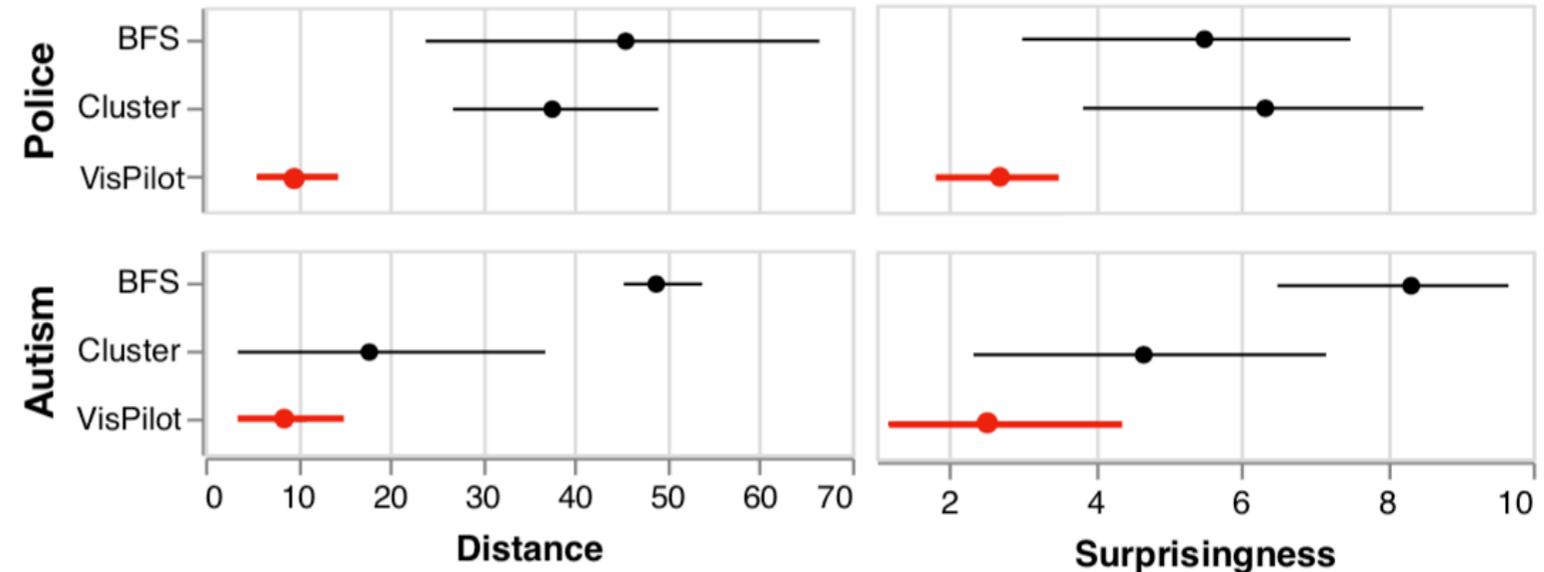
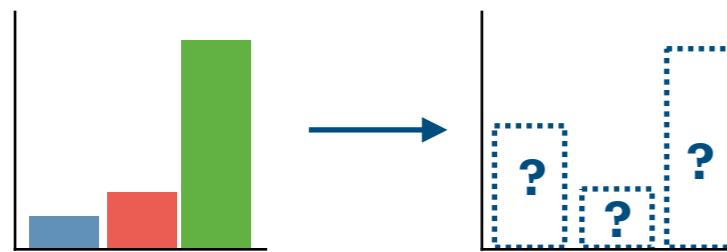
Labeling



Condition	VisPilot	BFS	CLUSTER
Interesting	66	61	51
Not Interesting	10	20	22
Interesting (Normalized)	0.87	0.75	0.7

Prediction

Gender = F
 & Age > 60



Ranking

1. Age
 2. Gender
 3. Race
 4. Income
-

Metric	Police		Autism	
	F	AP	F	AP
VisPilot	0.750	0.867	0.723	0.600
CLUSTER	0.739	0.691	0.725	0.665
BFS	0.739	0.592	0.222	0.200

Key Findings

★ Better Task Performance

VisPilot helps users in *finding* interesting vis, *predicting* unseen vis, and *judging* attribute importance.

★ More Informed Context

★ More Interpretable

Key Findings

★ Better Task Performance

VisPilot helps users in *finding* interesting vis, *predicting* unseen vis, and *judging* attribute importance.

★ More Informed Context

VisPilot leads to *more contextual comparisons overall* and against *more informative contextual references*.

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Key Findings

★ Better Task Performance

VisPilot helps users in *finding* interesting vis, *predicting* unseen vis, and *judging* attribute importance.

★ More Informed Context

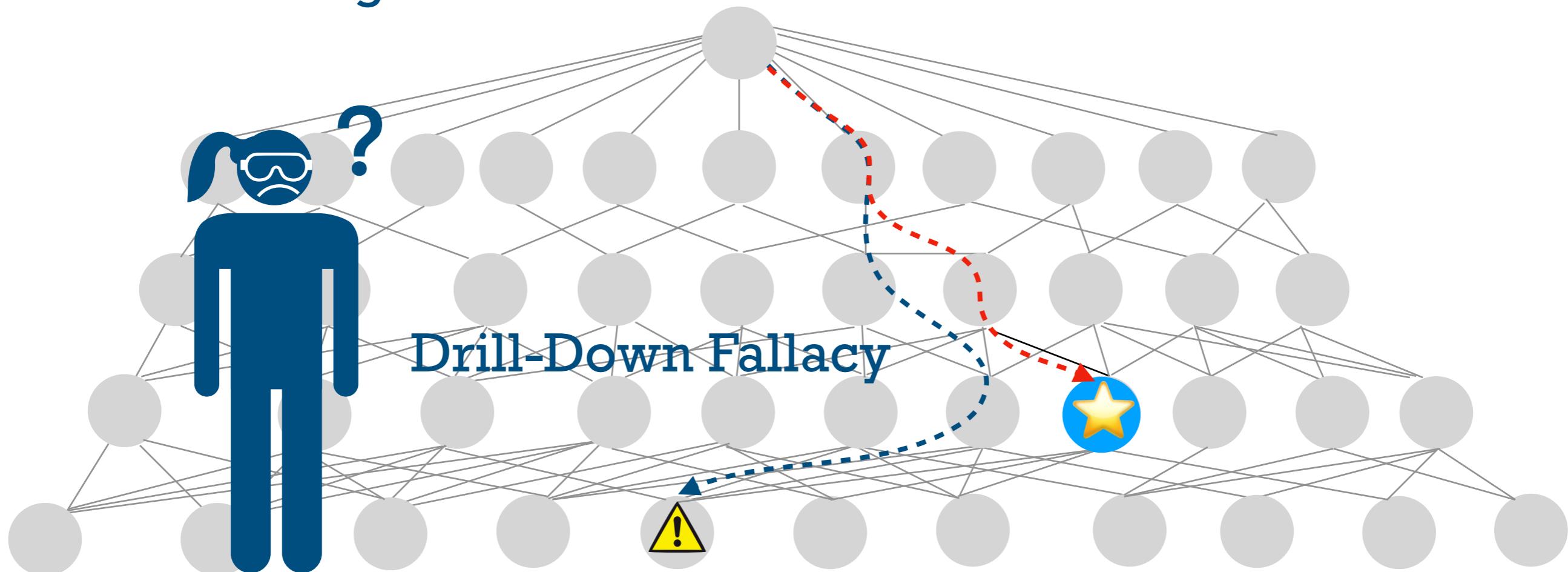
VisPilot leads to *more contextual comparisons overall* and against *more informative contextual references*.

★ More Interpretable

VisPilot was described as more *natural* and “*human-like*”.

Conclusion

★ Challenges of Manual Drill-Downs

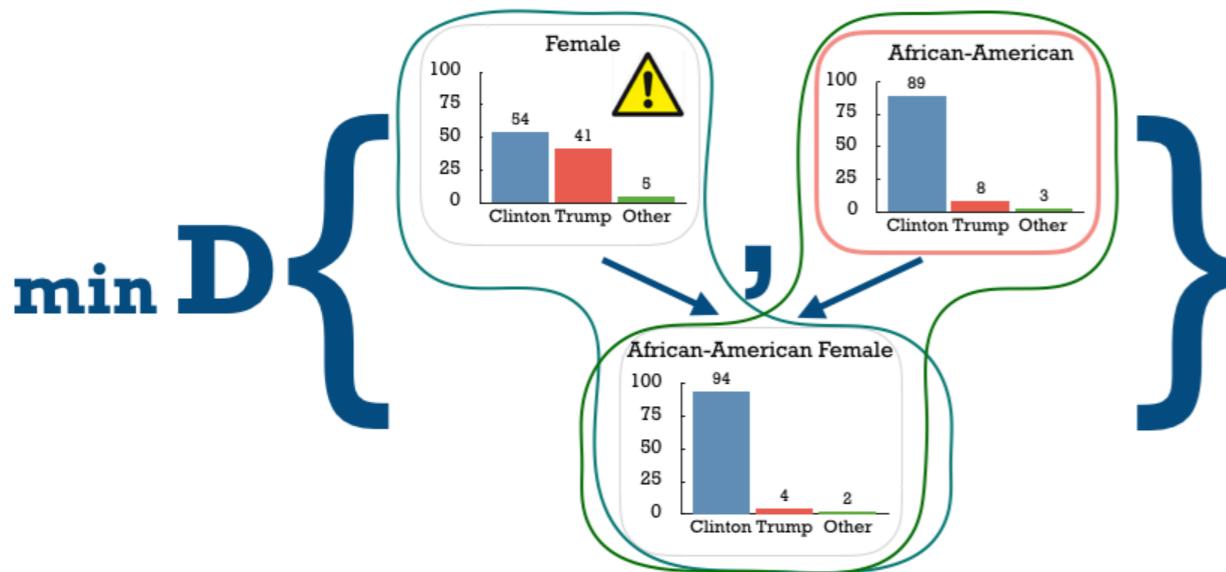


- ★ Design Objectives for Assistive Drill-Downs
- ★ System Overview: VisPilot
- ★ User Study Results

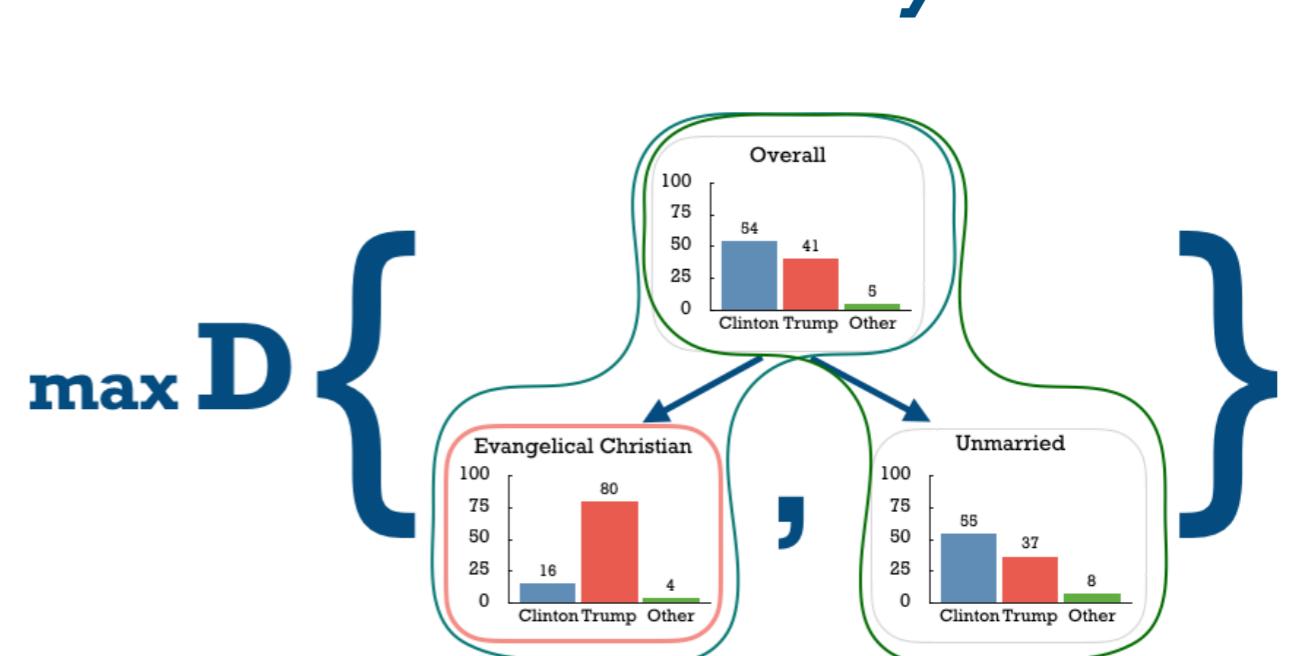
Conclusion

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Safety



Saliency



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Avoiding Drill-down Fallacies with *VisPilot*: Assisted Exploration of Data Subsets

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Hazem Elmeleegy, Aditya Parameswaran



github.com/zenvisage/vispilot

