

Discrete outcome encodings: Icon arrays and dotplots

SIADS 542: Presenting uncertainty – Week 2, Lecture 3

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Today

We've seen how to formally describe **continuous uncertainty encodings** and **intervals**

Today

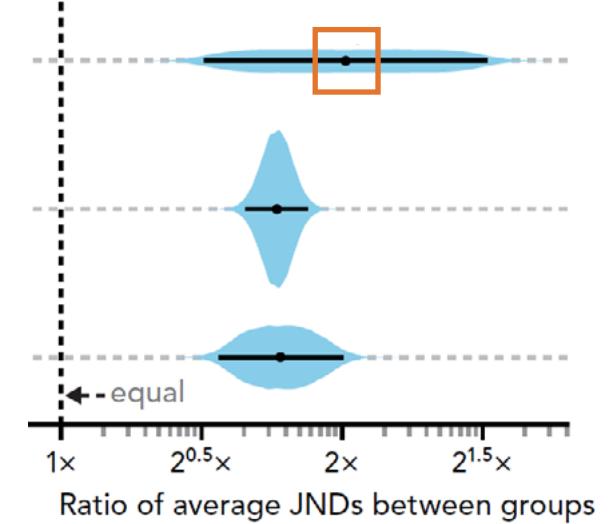
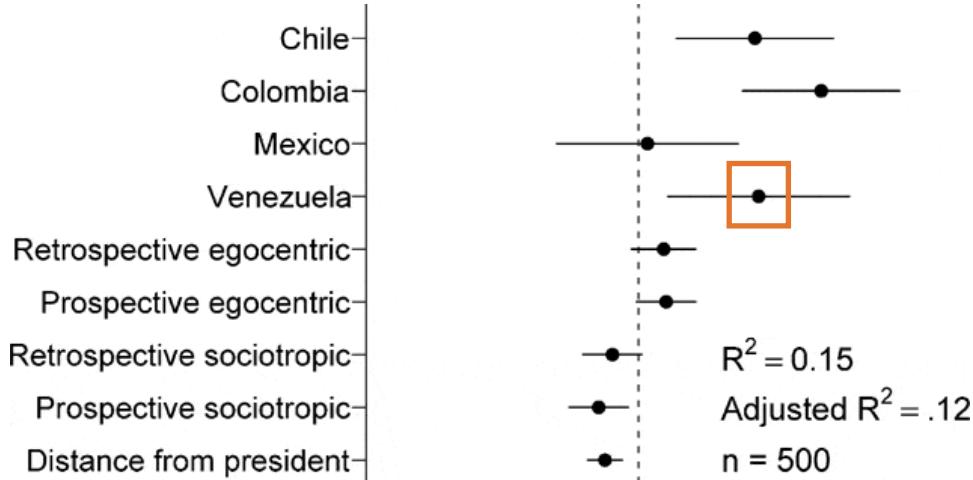
We've seen how to formally describe **continuous uncertainty encodings** and **intervals**

Let's look at **discrete outcome** uncertainty vis

Dichotomania...

How easy is it to ignore the uncertainty?

Variable	(Standard Error)
Constant	.41 (.93)
Countries	
Argentina	1.31 (.33)**B,M
Chile	.93 (.32)**B,M
Colombia	1.46 (.32)**B,M
Mexico	.07 (.32)A,CH,CO,V
Venezuela	.96 (.37)**B,M
Threat	
Retrospective egocentric economic perceptions	.20 (.13)
Prospective egocentric economic perceptions	.22 (.12) [#]
Retrospective sociotropic economic perceptions	-.21 (.12) [#]
Prospective sociotropic economic perceptions	-.32 (.12)*



This contributes to dichotomania

Predictions from 2016 US presidential election

[Based on Justin H. Gross, Washington Post, <http://wapo.st/2fCYvDW>]

FiveThirtyEight

28%

NYT Upshot

15%

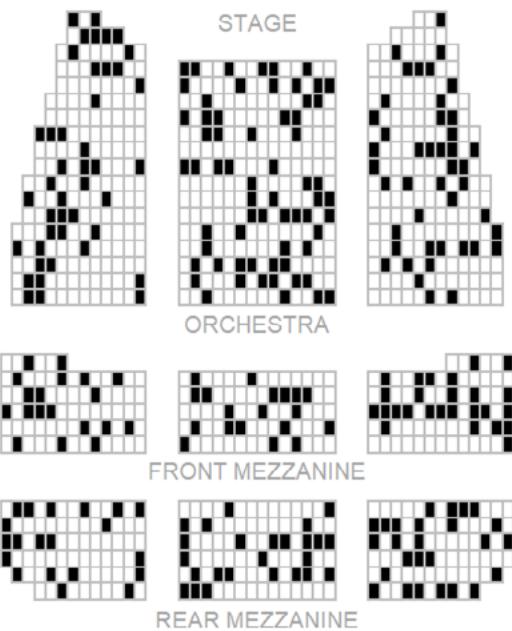
HuffPo Pollster

2%

Predictions from 2016 US presidential election

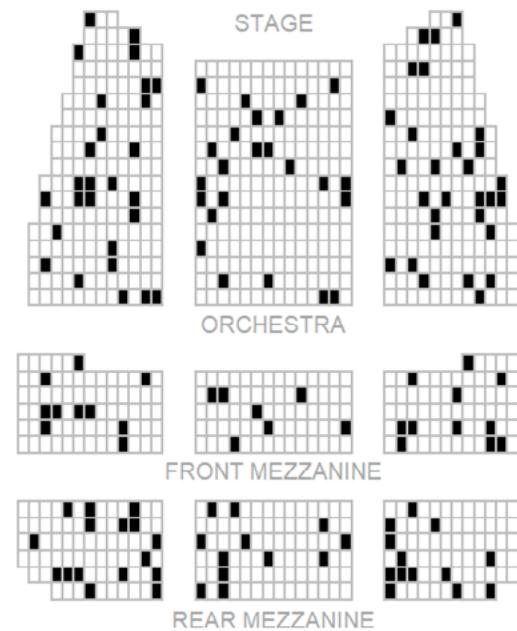
[Based on Justin H. Gross, Washington Post, <http://wapo.st/2fCYvDW>]

FiveThirtyEight



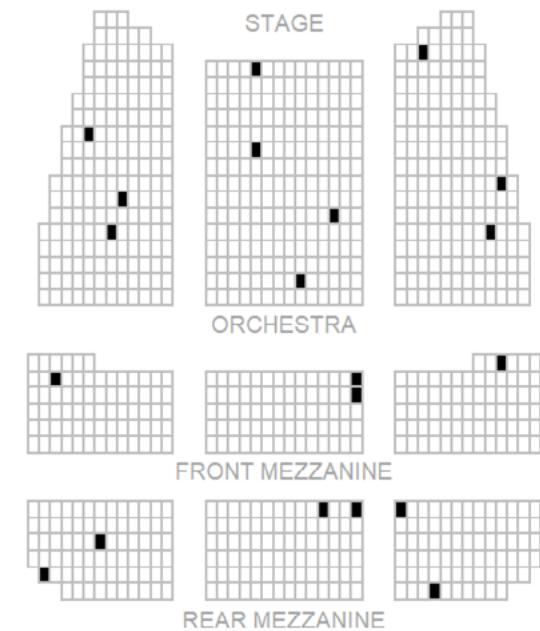
286 in 1,000

NYT Upshot



150 in 1,000

HuffPo Pollster



20 in 1,000

People are very good at ignoring uncertainty...

People are very good at ignoring uncertainty...

Especially when we provide bad
uncertainty representations

Icon arrays in medical risk communication

[Figure from Fagerlin, Wang, Ubel. Reducing the influence of anecdotal reasoning on people's health care decisions: Is a picture worth a thousand statistics? Medical Decision Making 2005; 25:398–405]

Success Rate of Balloon Angioplasty



Successfully cured
of angina



Not successfully cured
of angina

Success Rate of Bypass Surgery



Successfully cured
of angina



Not successfully
cured of angina

Frequency framing or discrete outcome visualization

What is an icon array for a
continuous distribution?

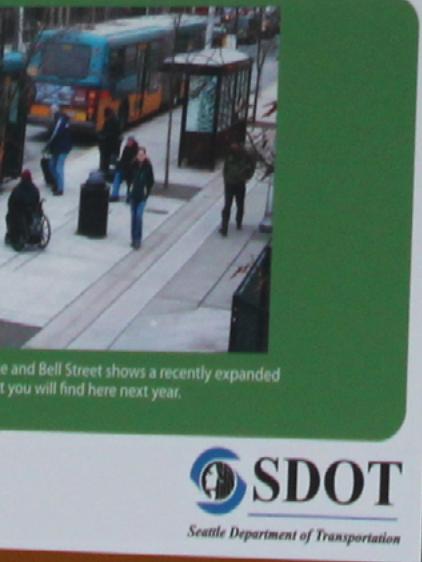
What is an icon array for a
continuous distribution?

We'll return to the bus tracking scenario...



ing to this bus stop.
ing number of buses serving this stop in
et, to provide more room for pedestrians

portation/transit.htm



28	BROADVIEW FREMONT 11:09 - on time	5
16	NORTHGATE WALLINGFORD 11:10 - on time	6
358E	AURORA VILLAGE VIA AURORA AVE N 11:12 - on time	8
120	DOWNTOWN SEATTLE WHITE CENTER 11:15 - 6 min delay	11
5	NORTHGATE GREENWOOD 11:17 - 3 min delay	13

Be advised:

Bus arrival estimates are based on the best available information but actual times will vary.
Traffic and other conditions can affect the accuracy of this information.



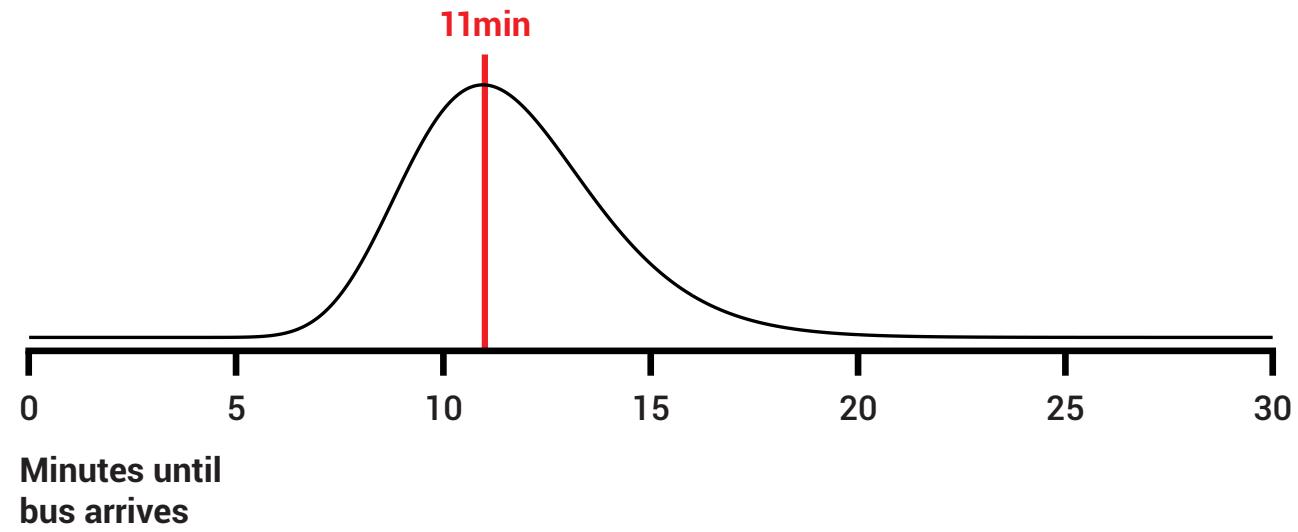
Seattle Department of Transportation

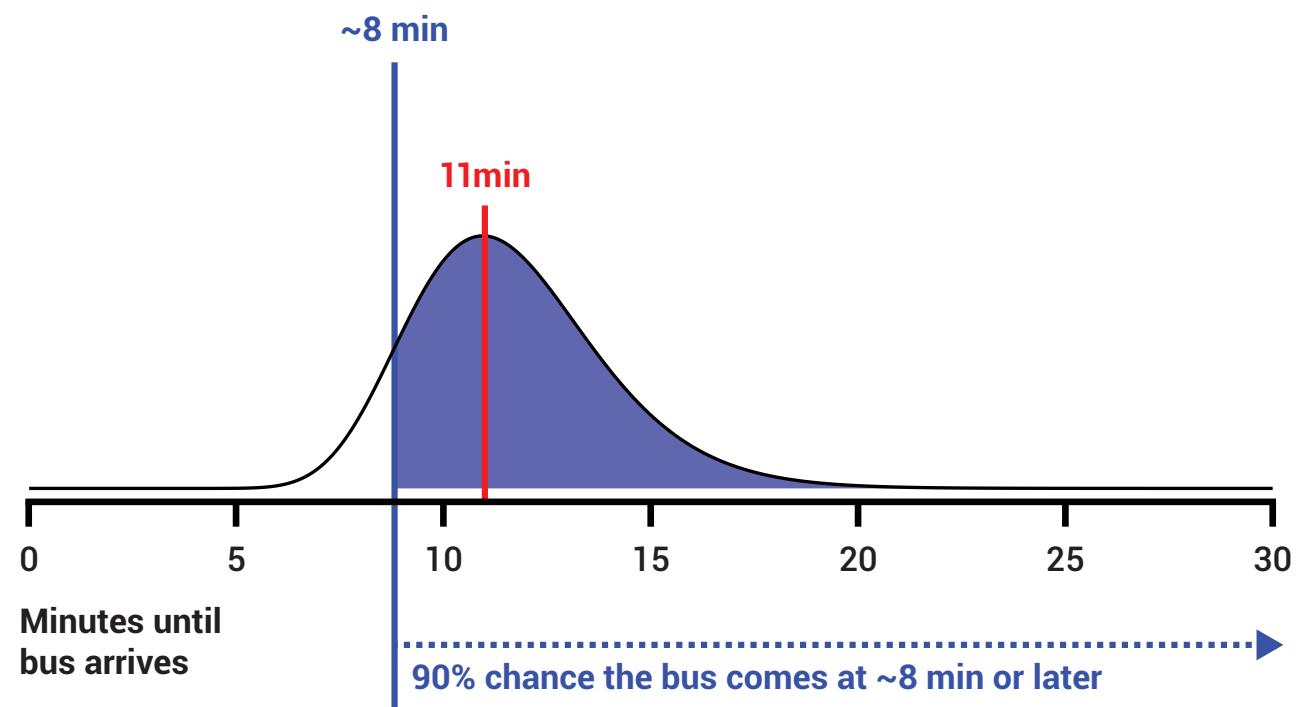


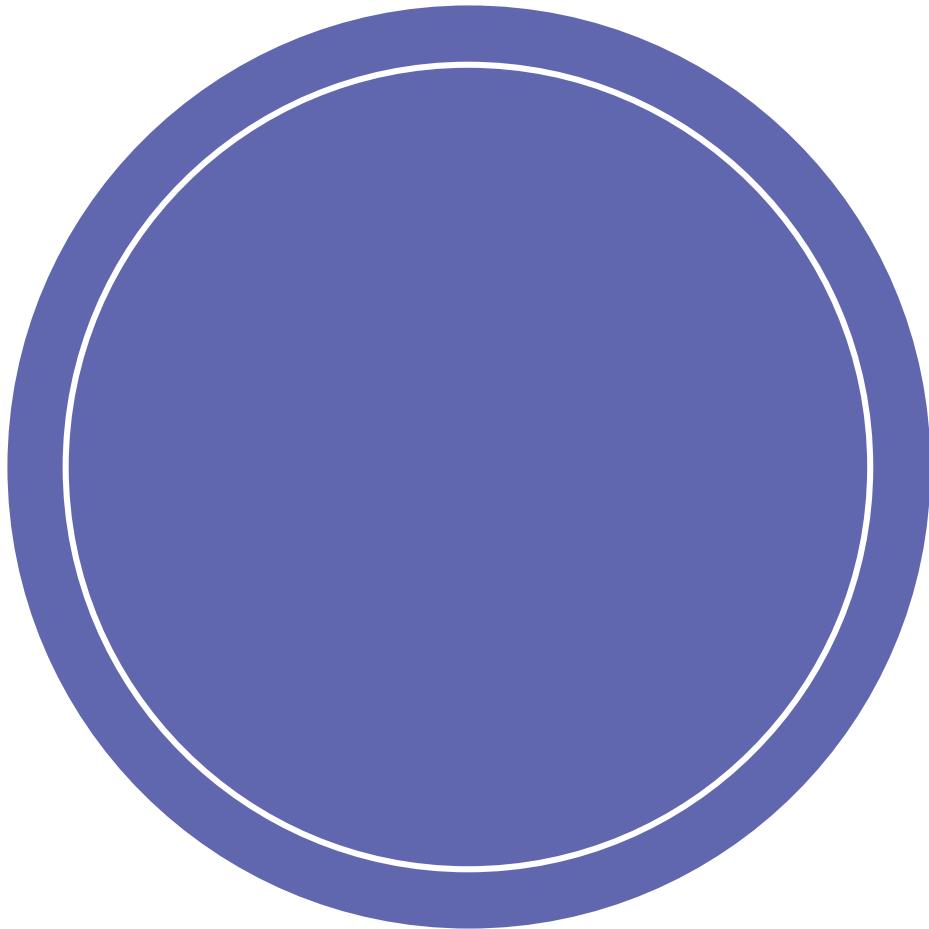
Seattle Department of Transportation

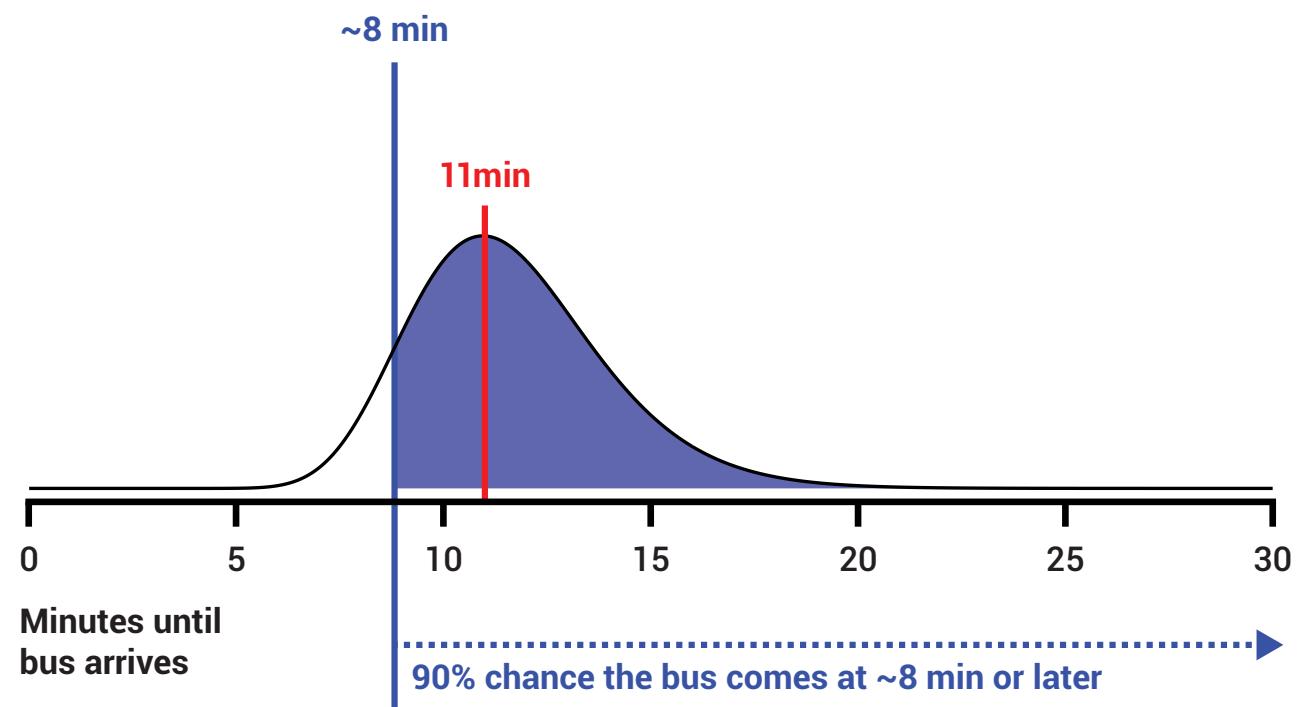
OneBusAway

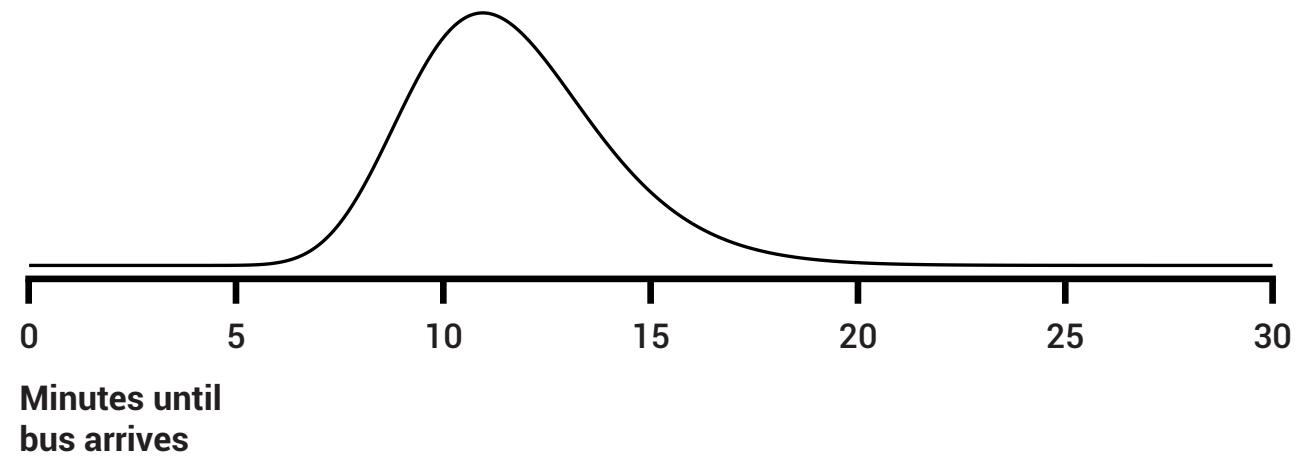


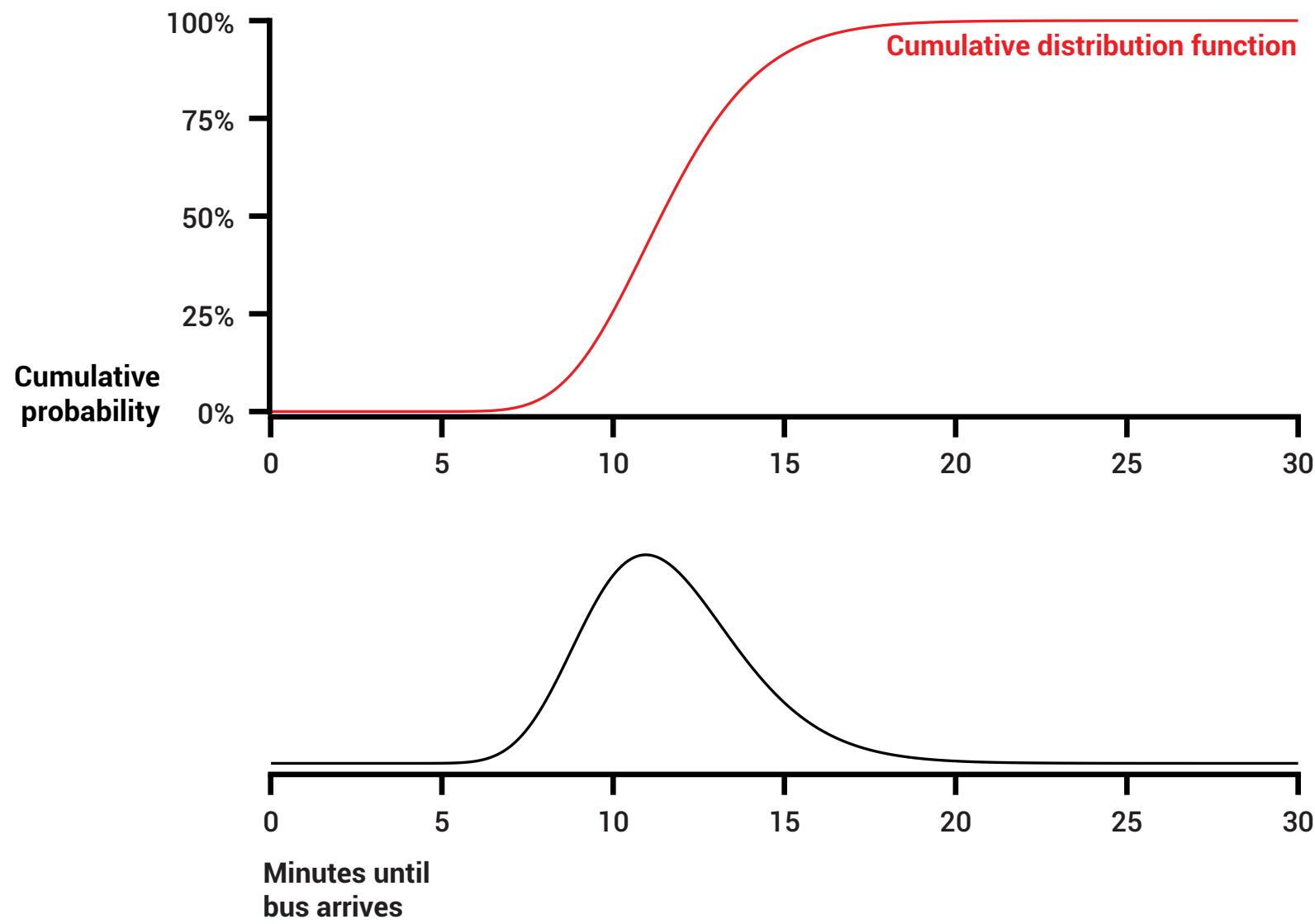


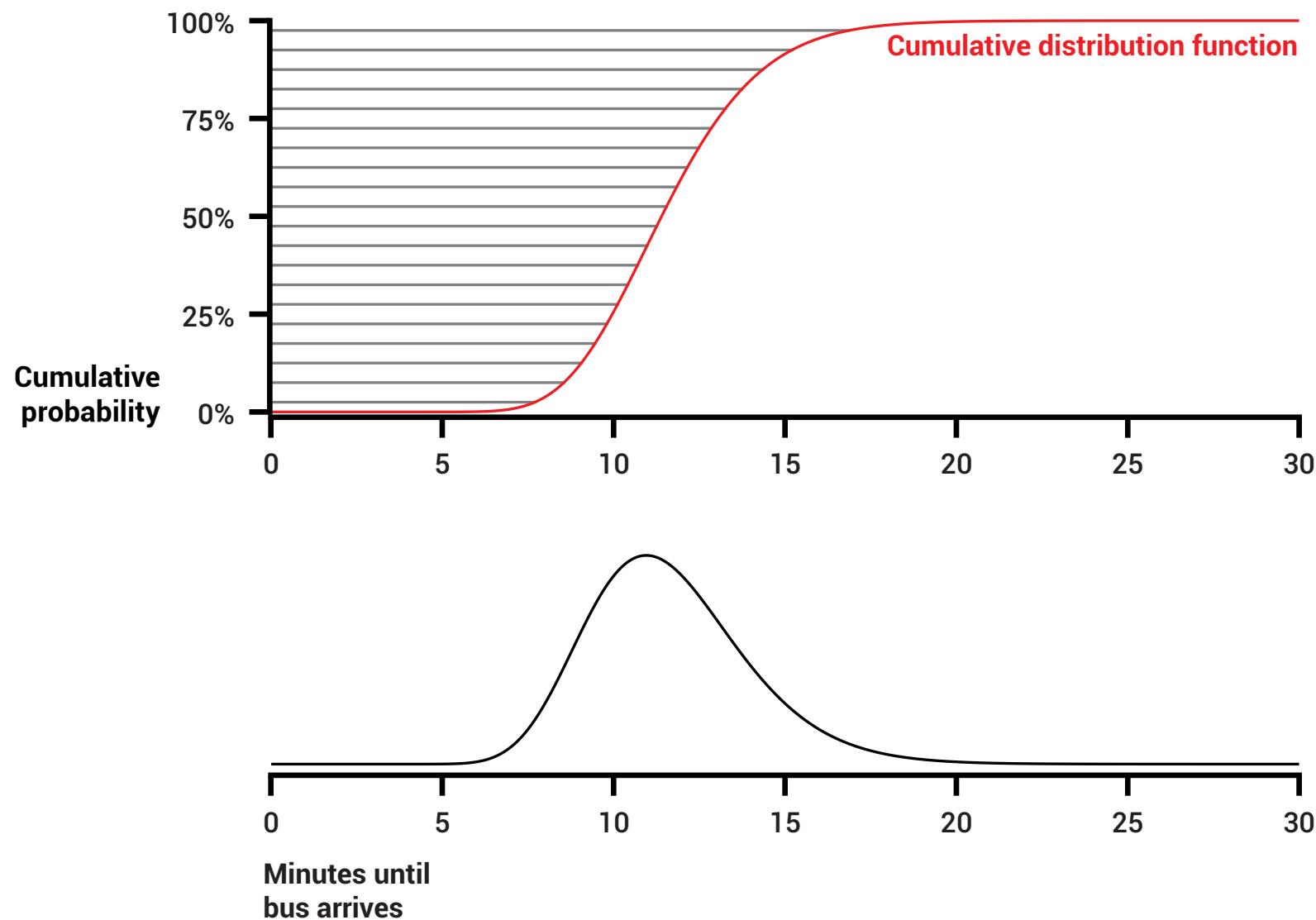


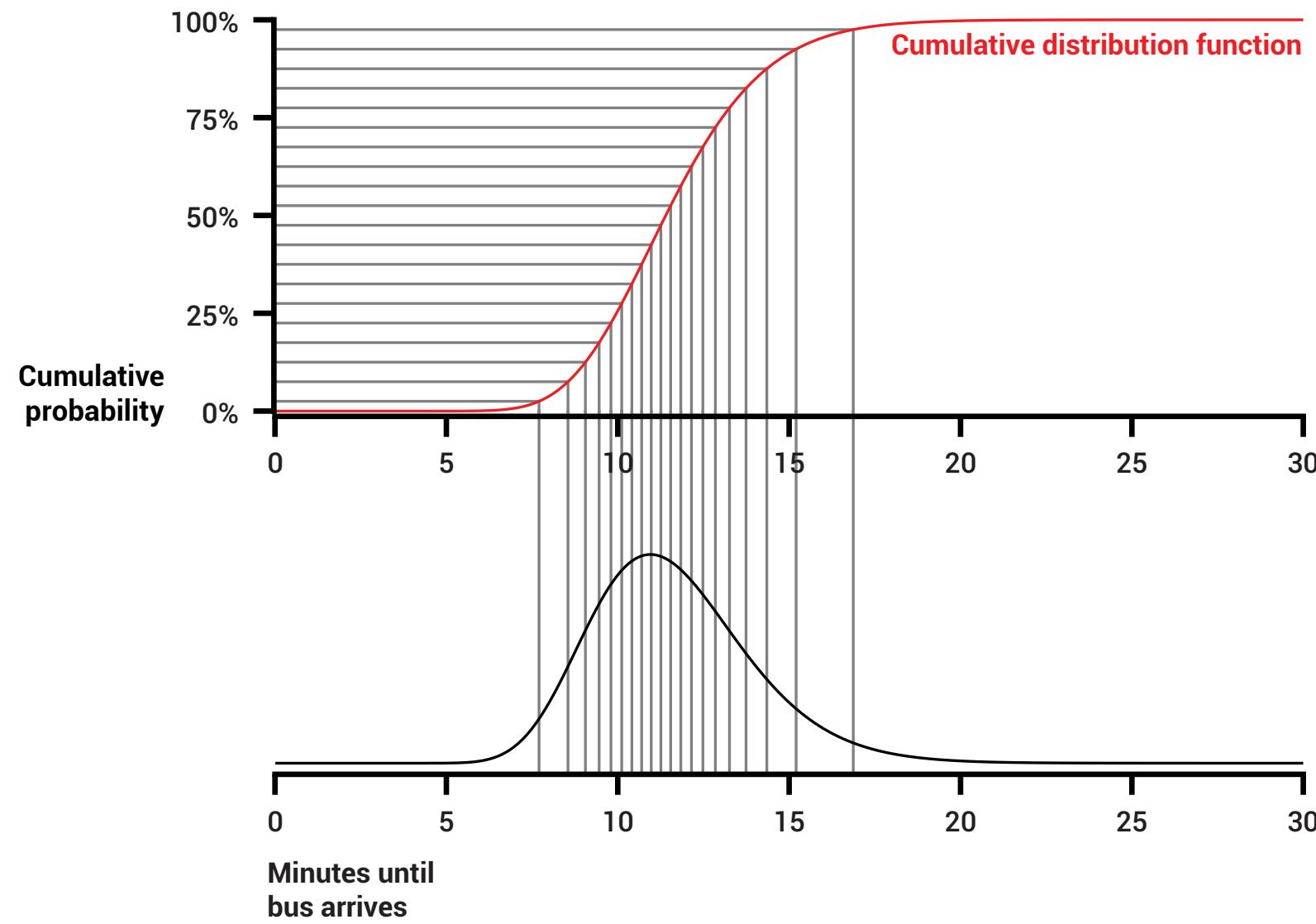


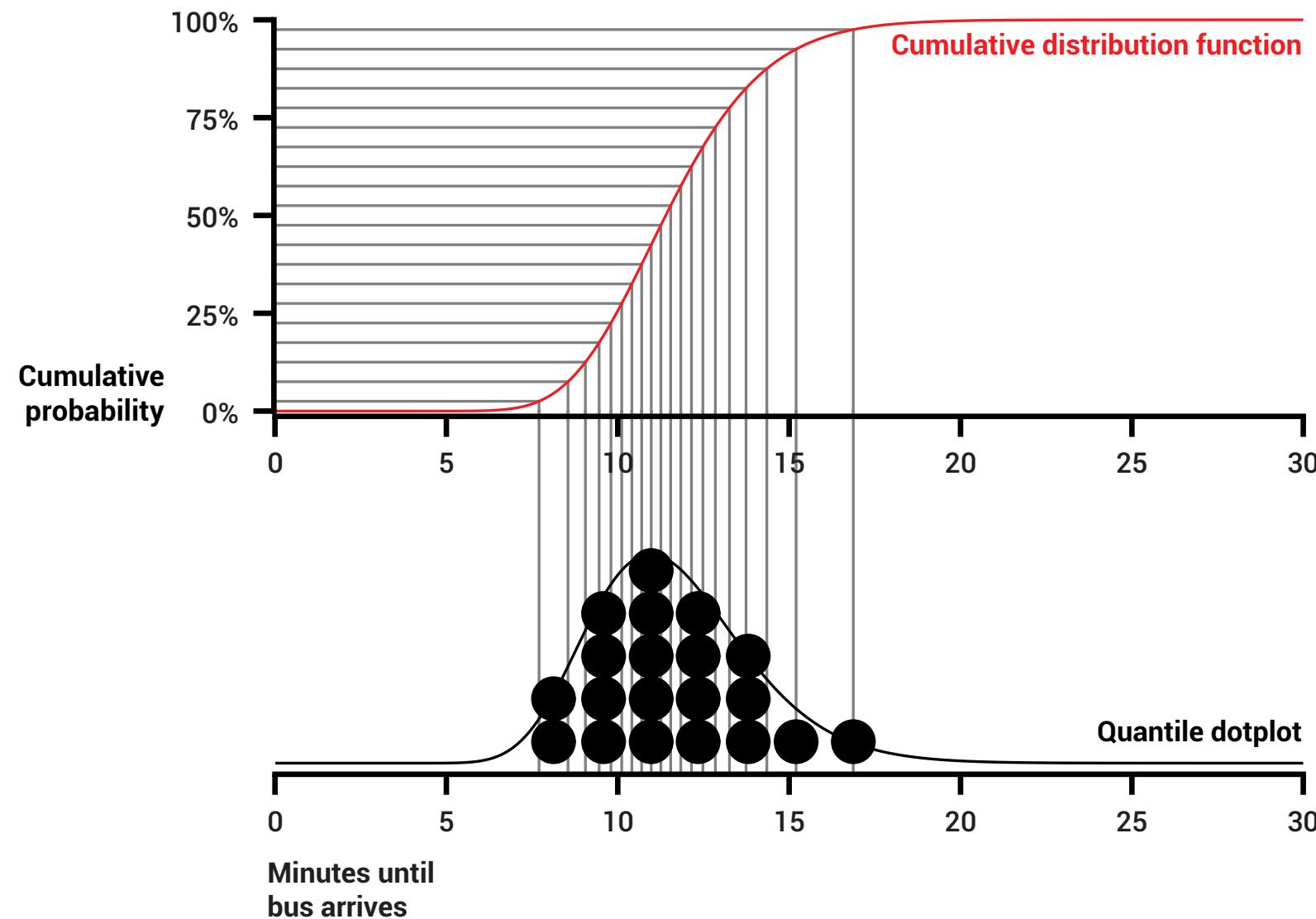


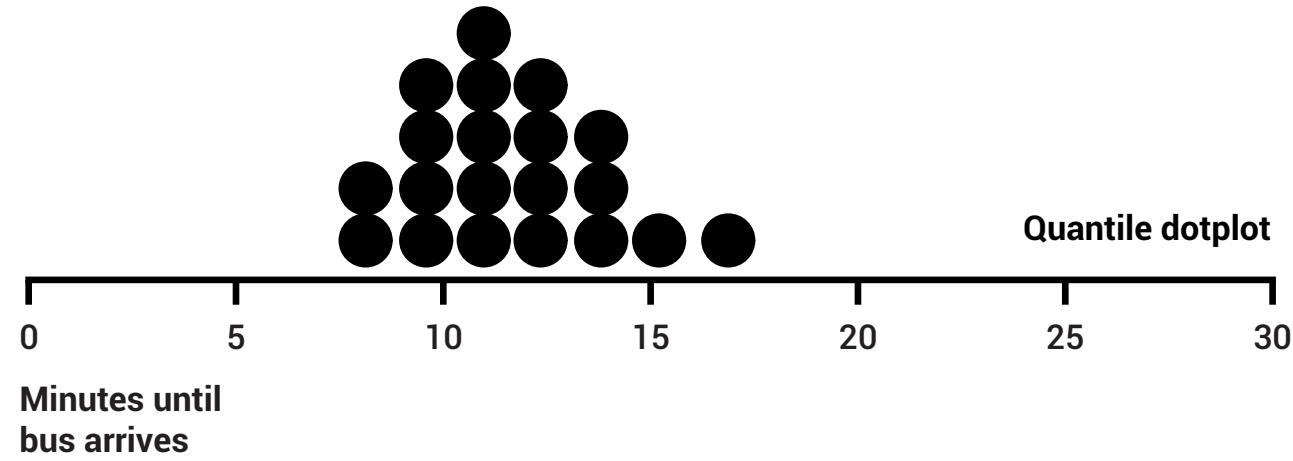
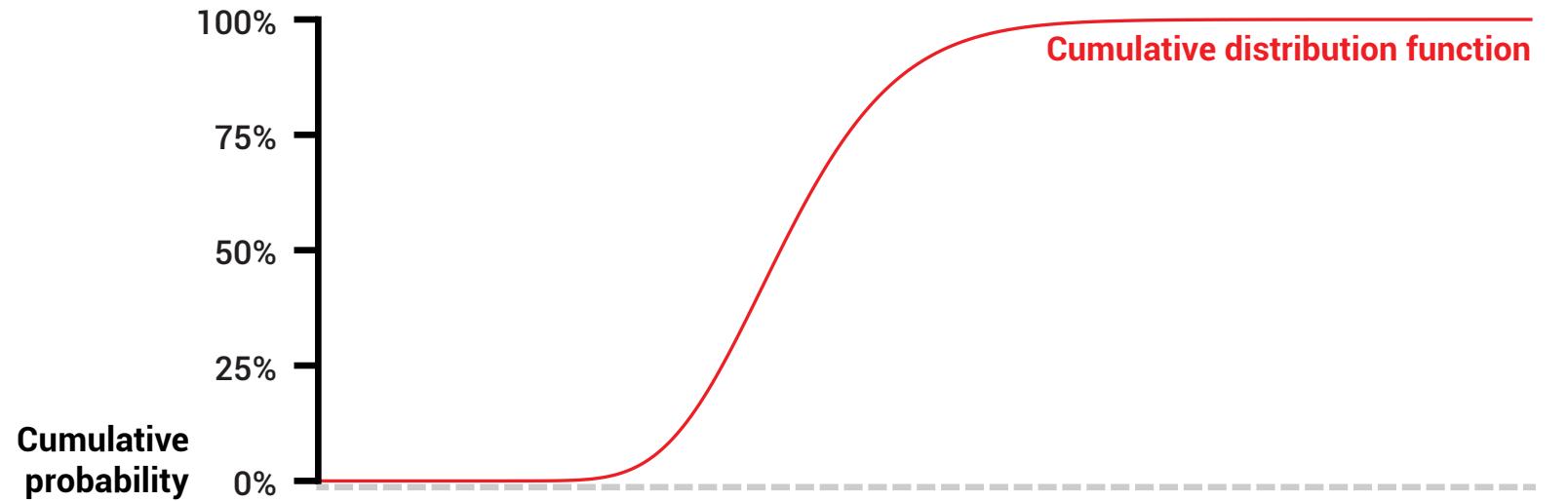


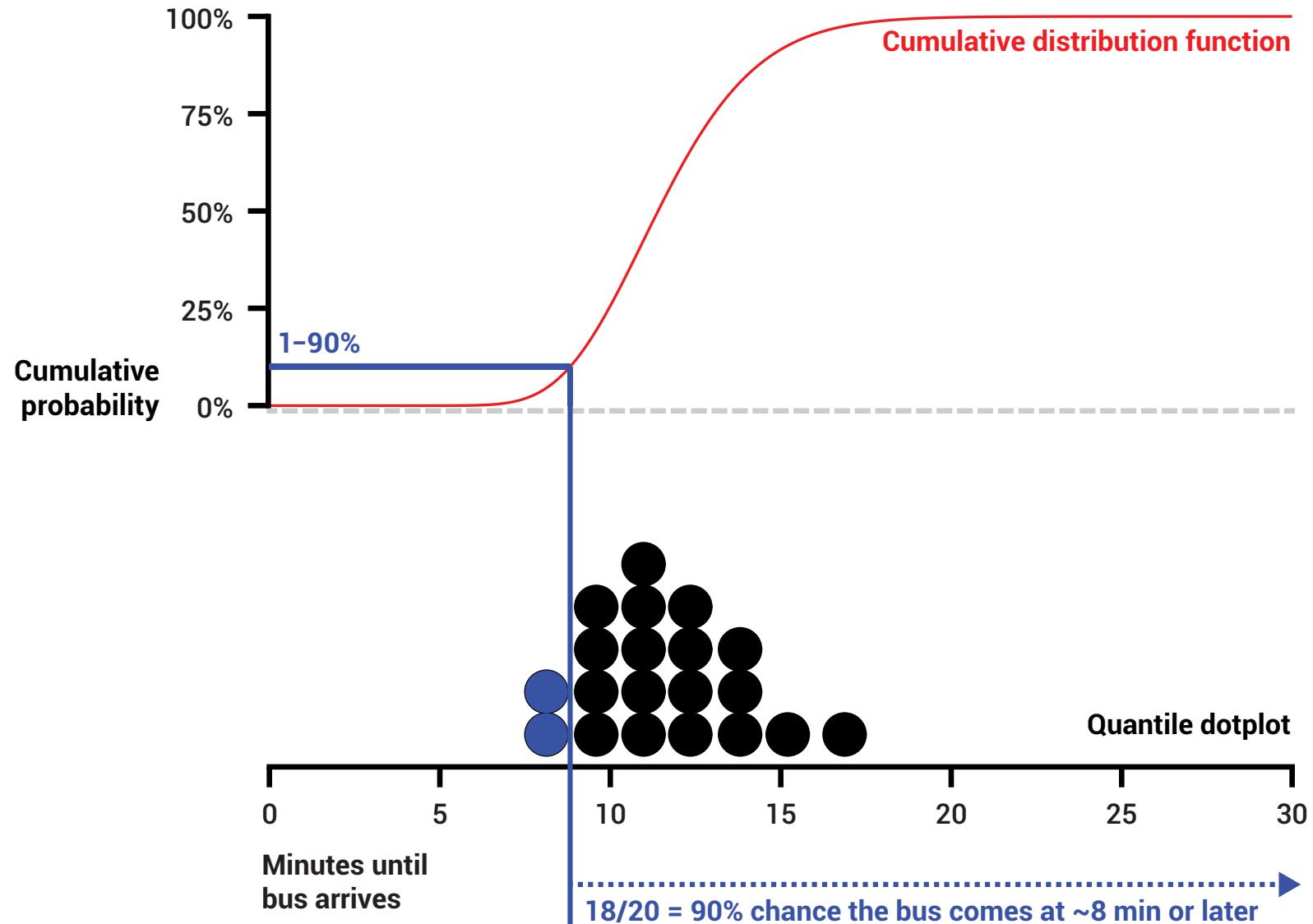


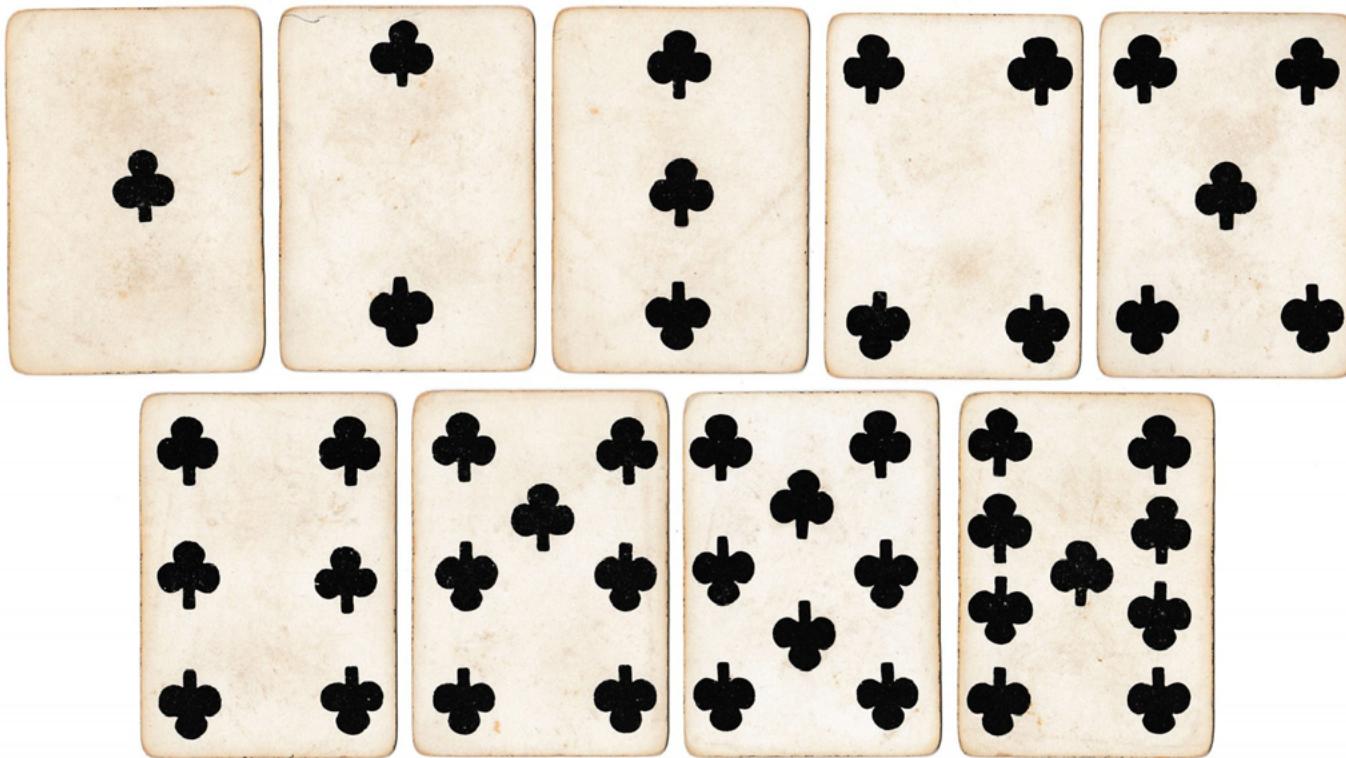


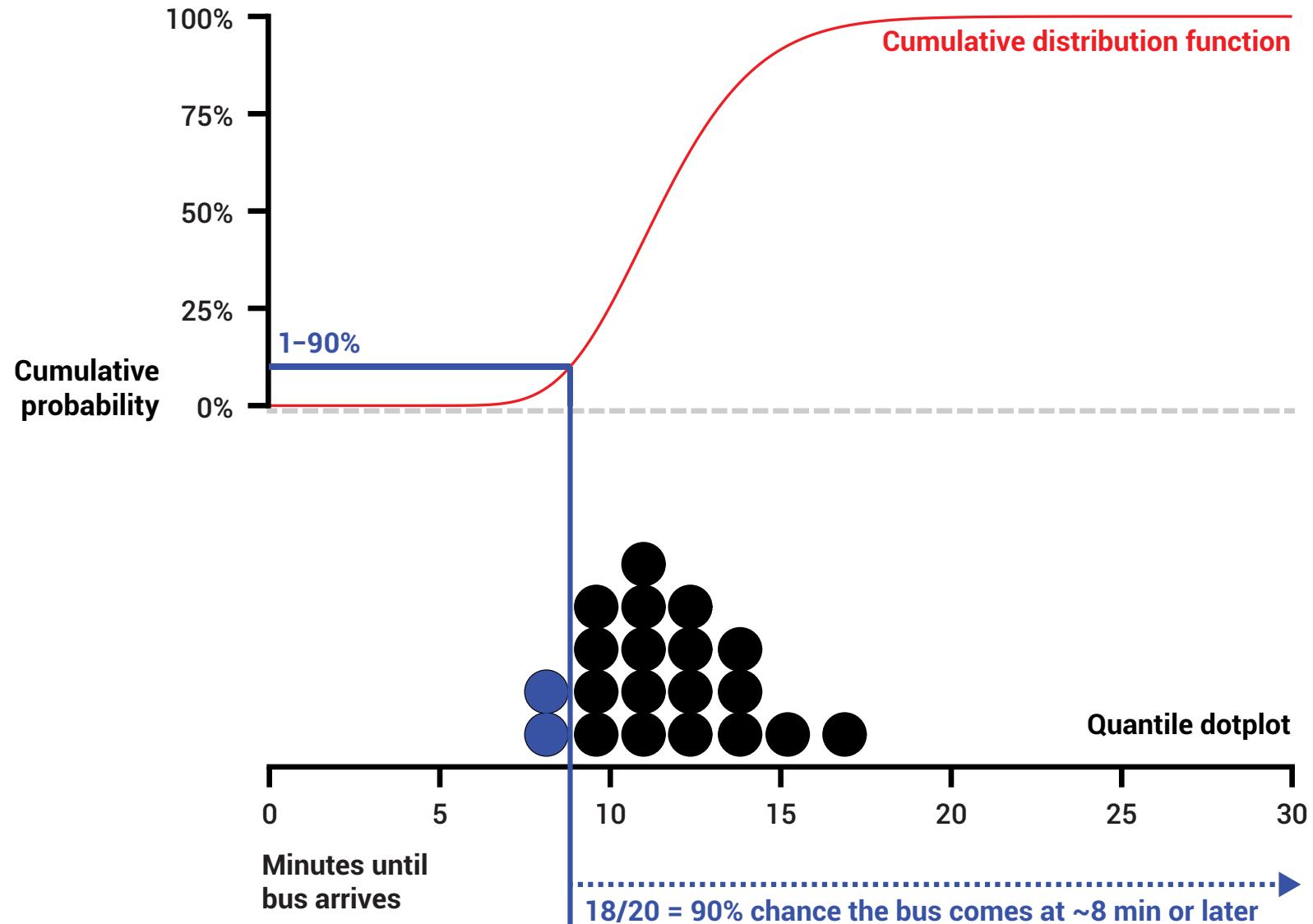








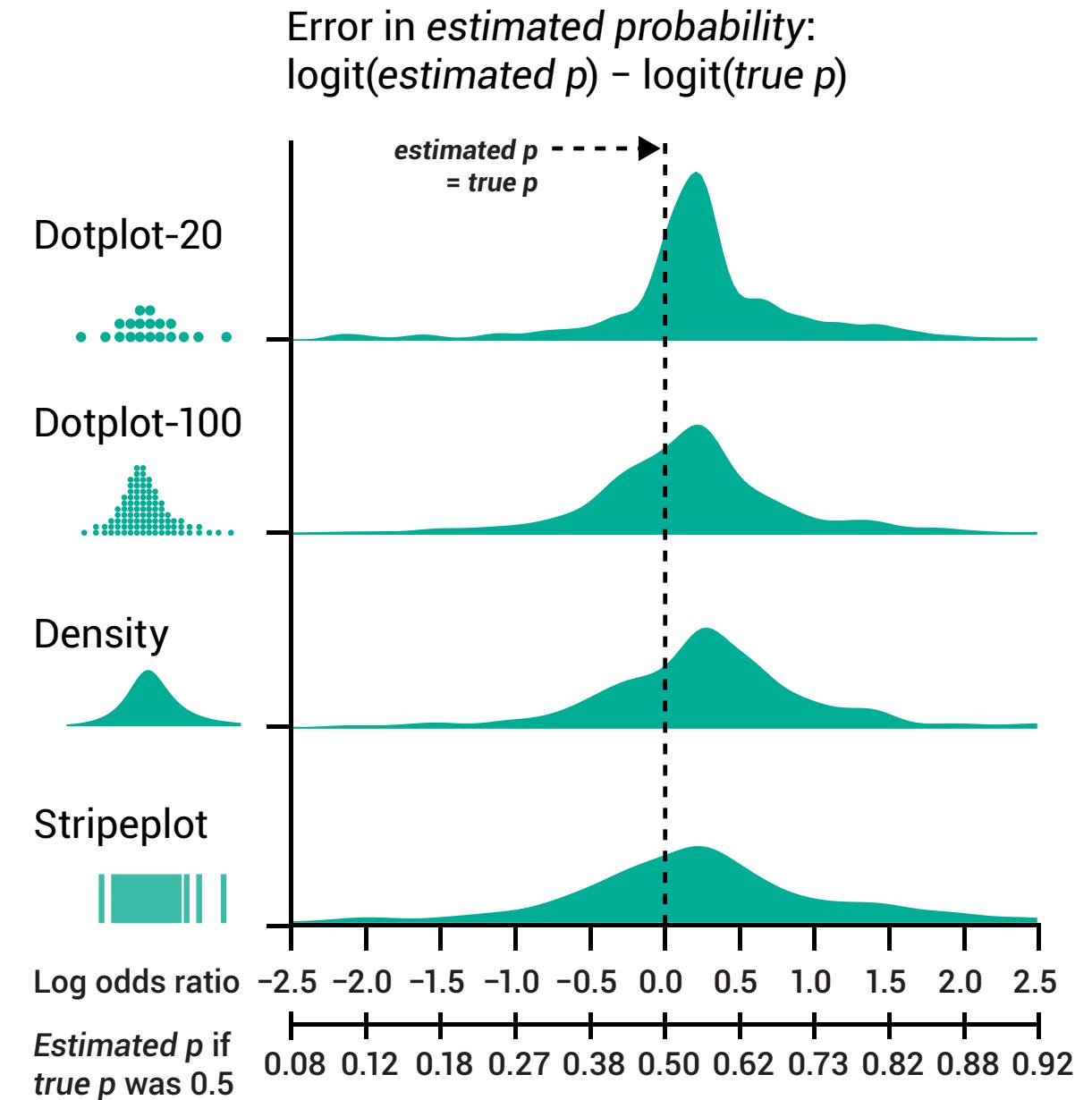




Quantile dotplots

[Kay, Kola, Hullman, Munson. When (ish) is My Bus? User-centered Visualizations of Uncertainty in Everyday, Mobile Predictive Systems. CHI 2016]

Better **estimates**
(perceptually)



Quantile dotplots

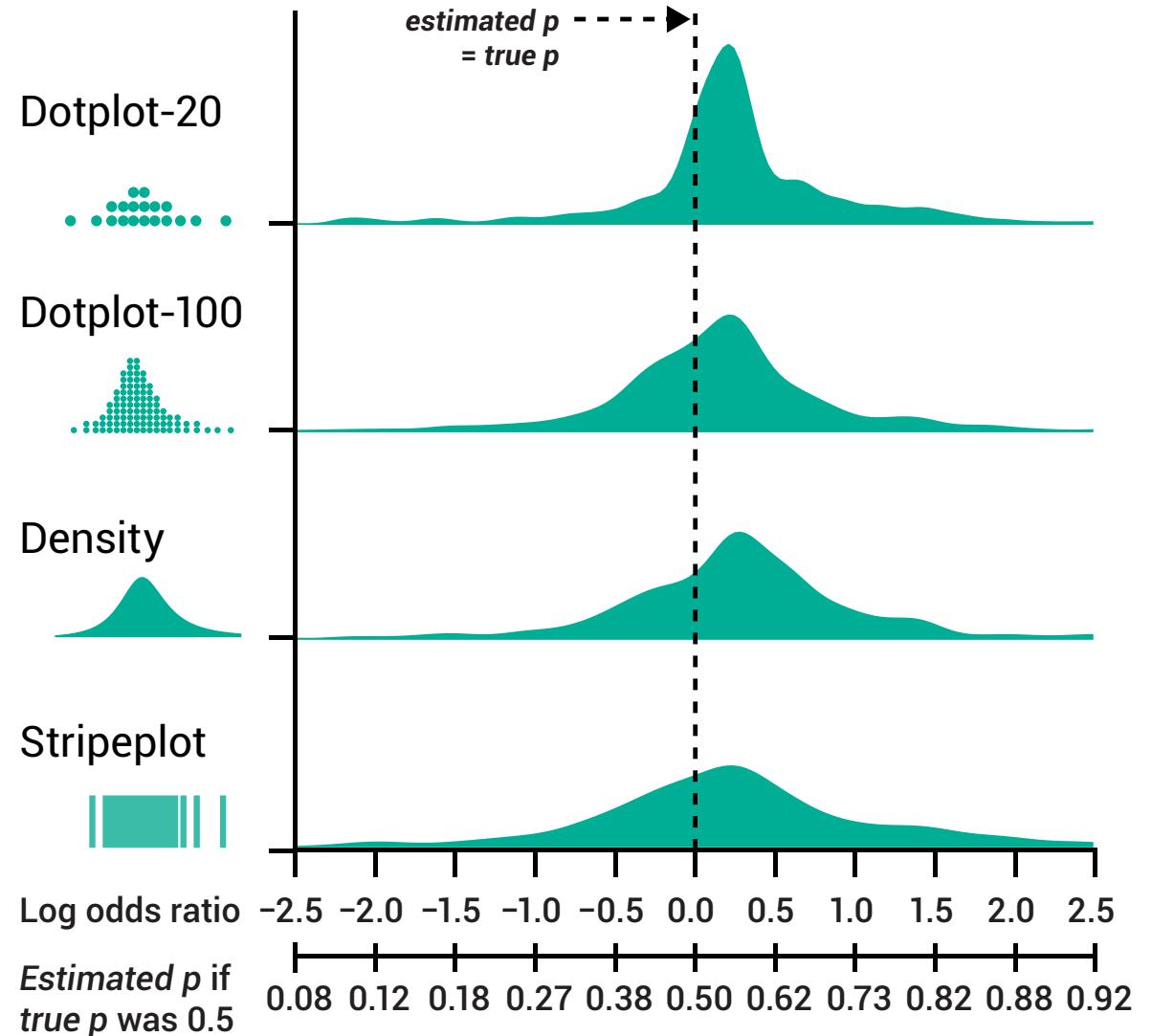
[Kay, Kola, Hullman, Munson. When (ish) is My Bus? User-centered Visualizations of Uncertainty in Everyday, Mobile Predictive Systems. CHI 2016]

Better **estimates**
(perceptually)



better **decisions**

Error in estimated probability:
 $\text{logit}(\text{estimated } p) - \text{logit}(\text{true } p)$



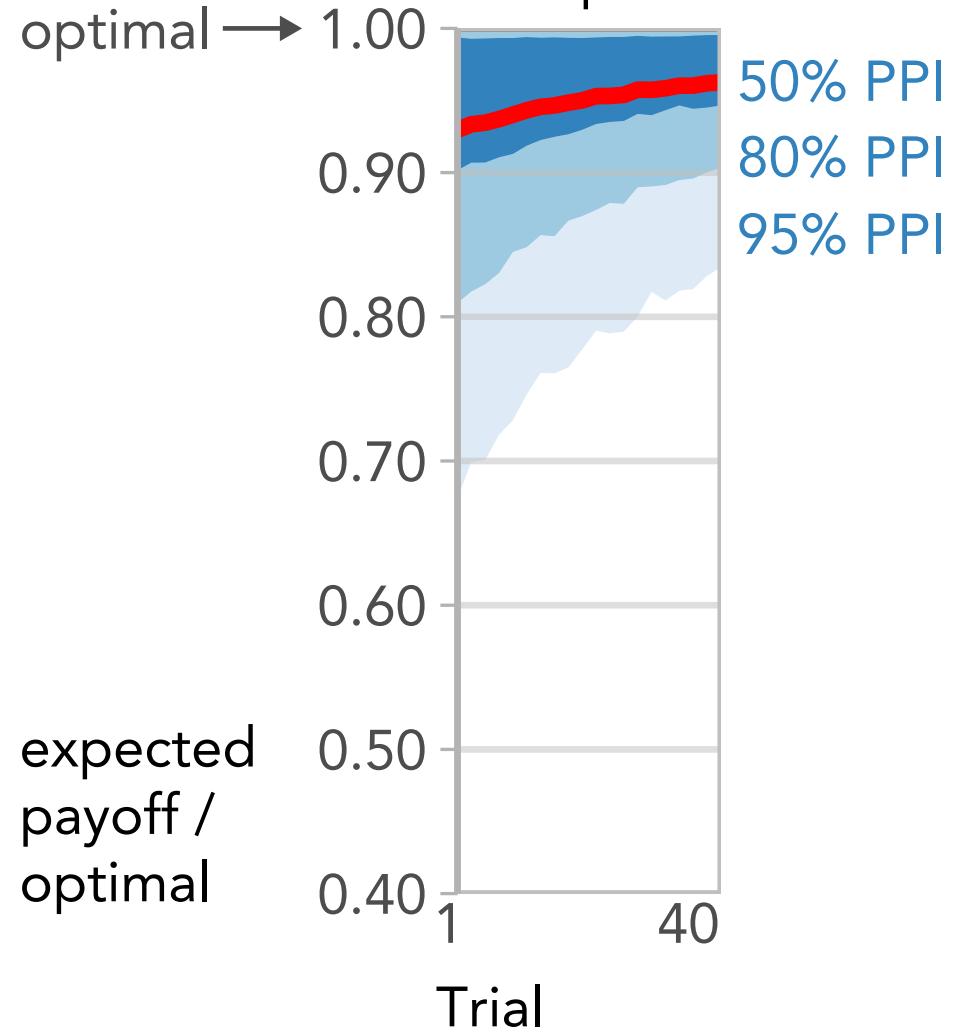
Quantile dotplots

[Fernandes, Munson, Hullman, **Kay**. Uncertainty Displays
Using Quantile Dotplots or CDFs Improve Transit
Decision-Making. CHI 2018. **Honorable Mention**]

Better **estimates**
(perceptually)



better **decisions**
(in this case)



Quantile dotplots

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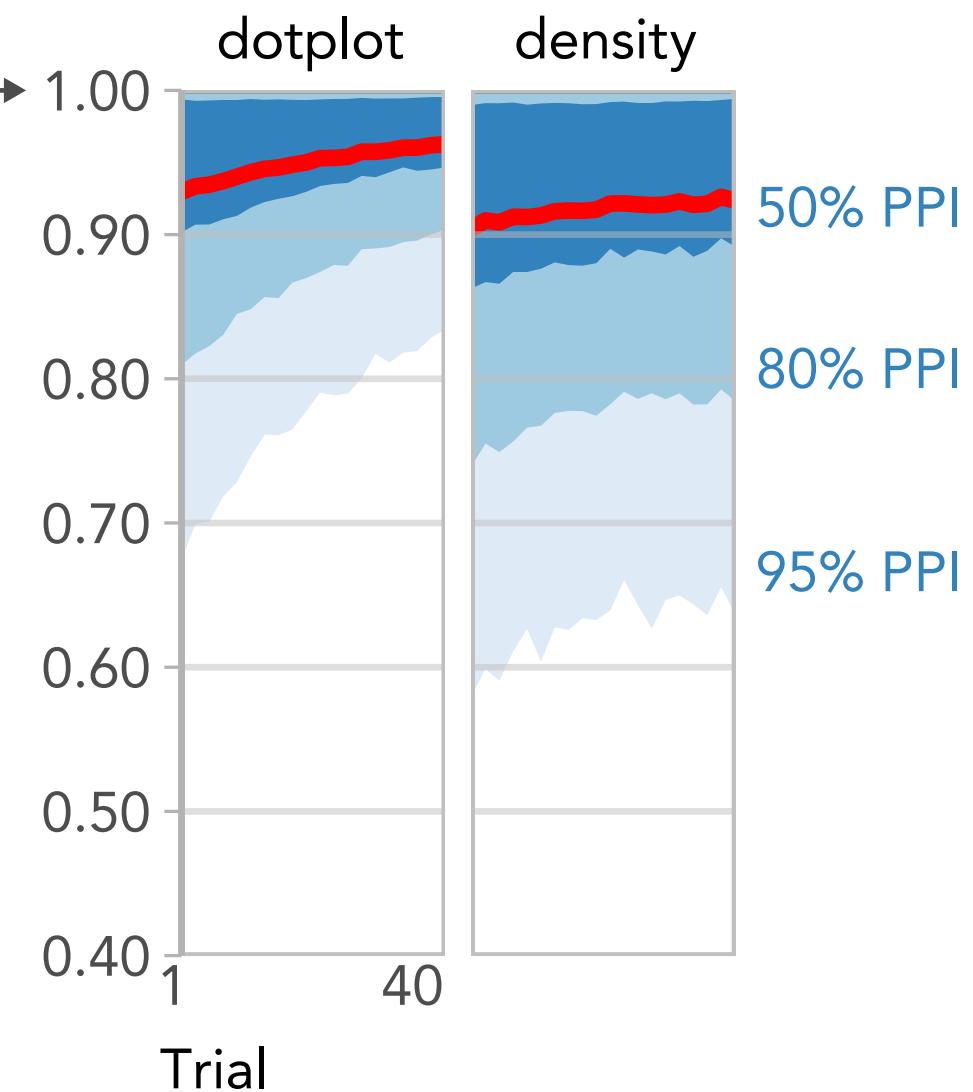
Better **estimates**
(perceptually)



better **decisions**
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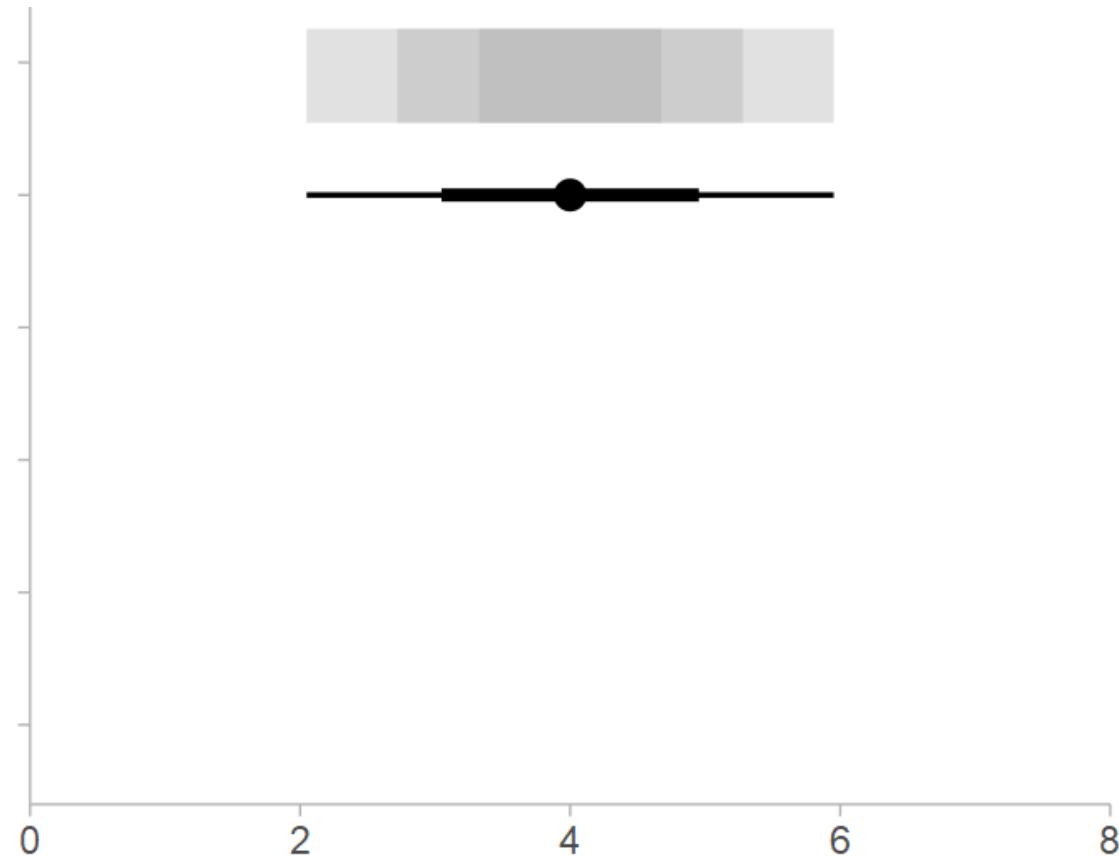
optimal →

expected
payoff /
optimal

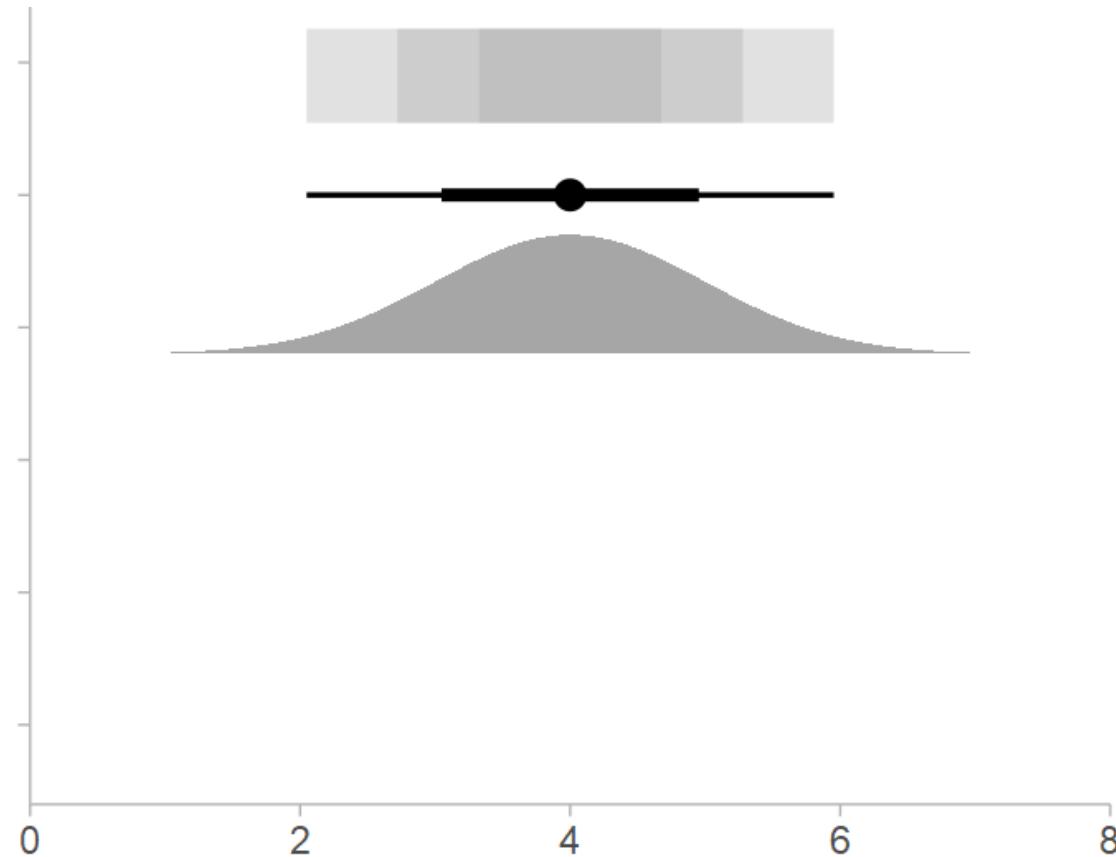


Combination charts may also be useful...

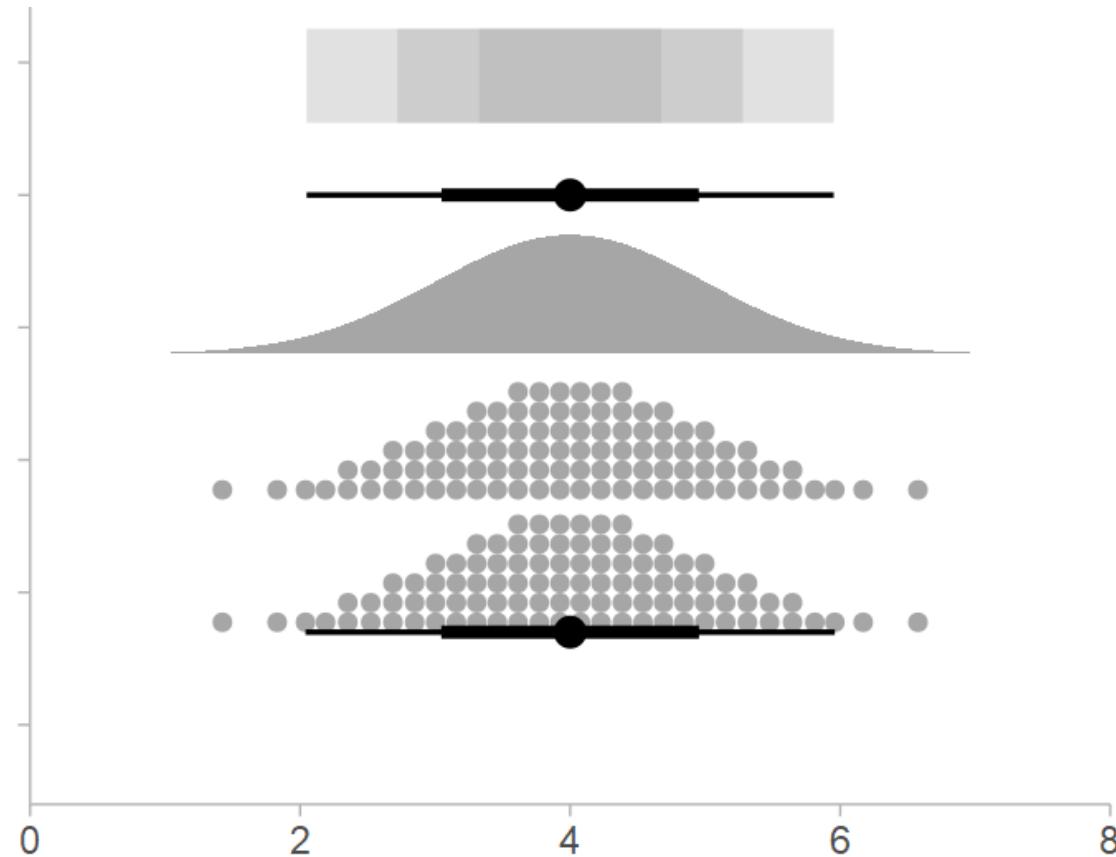
Charts and combinations to consider...



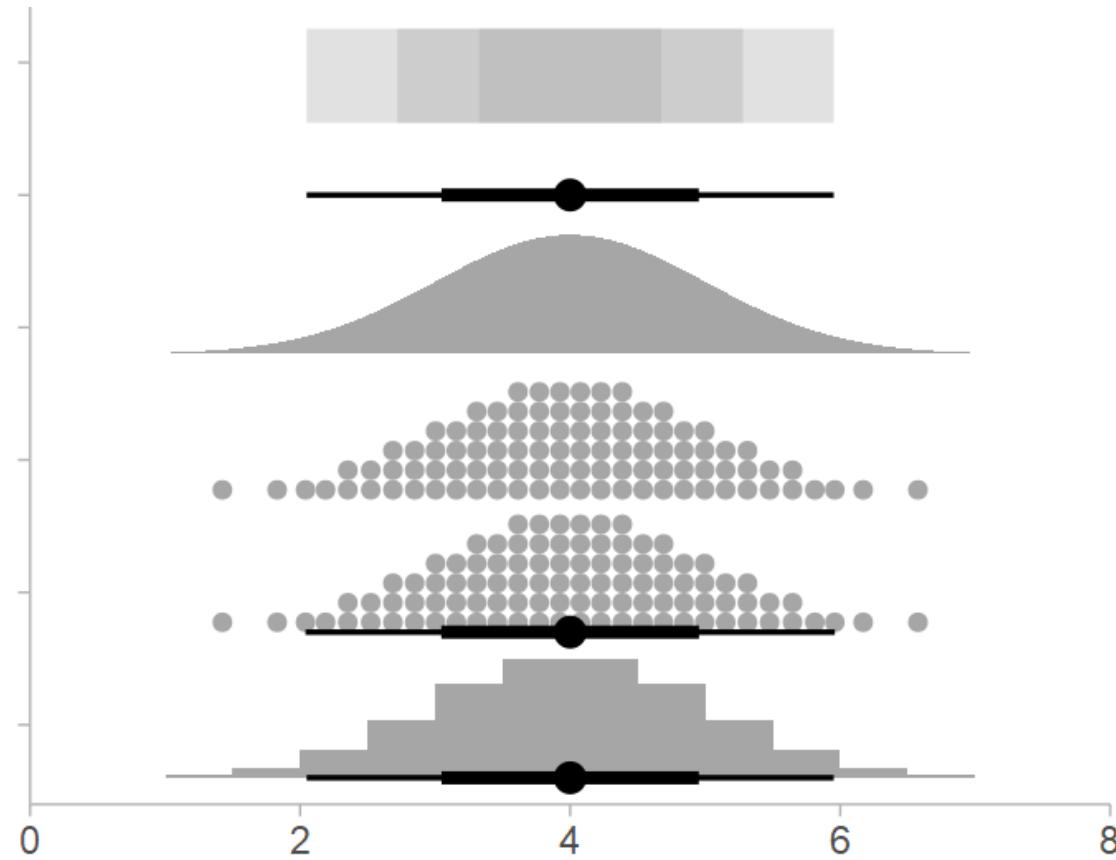
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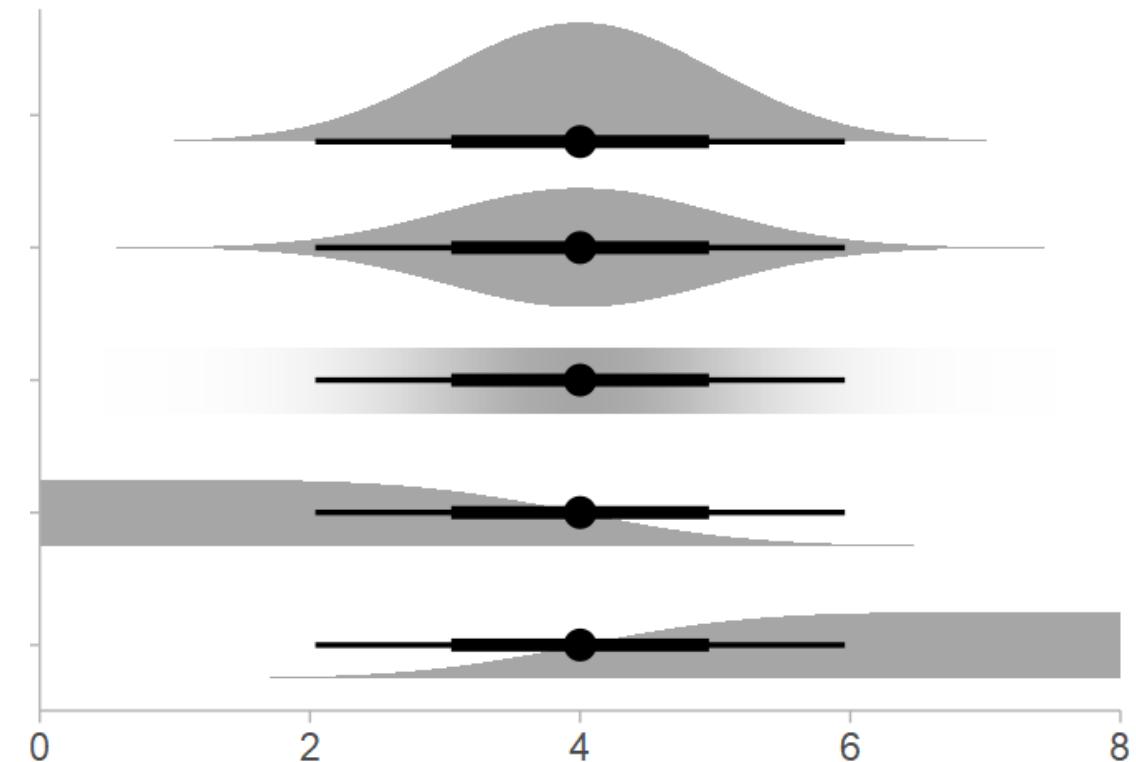
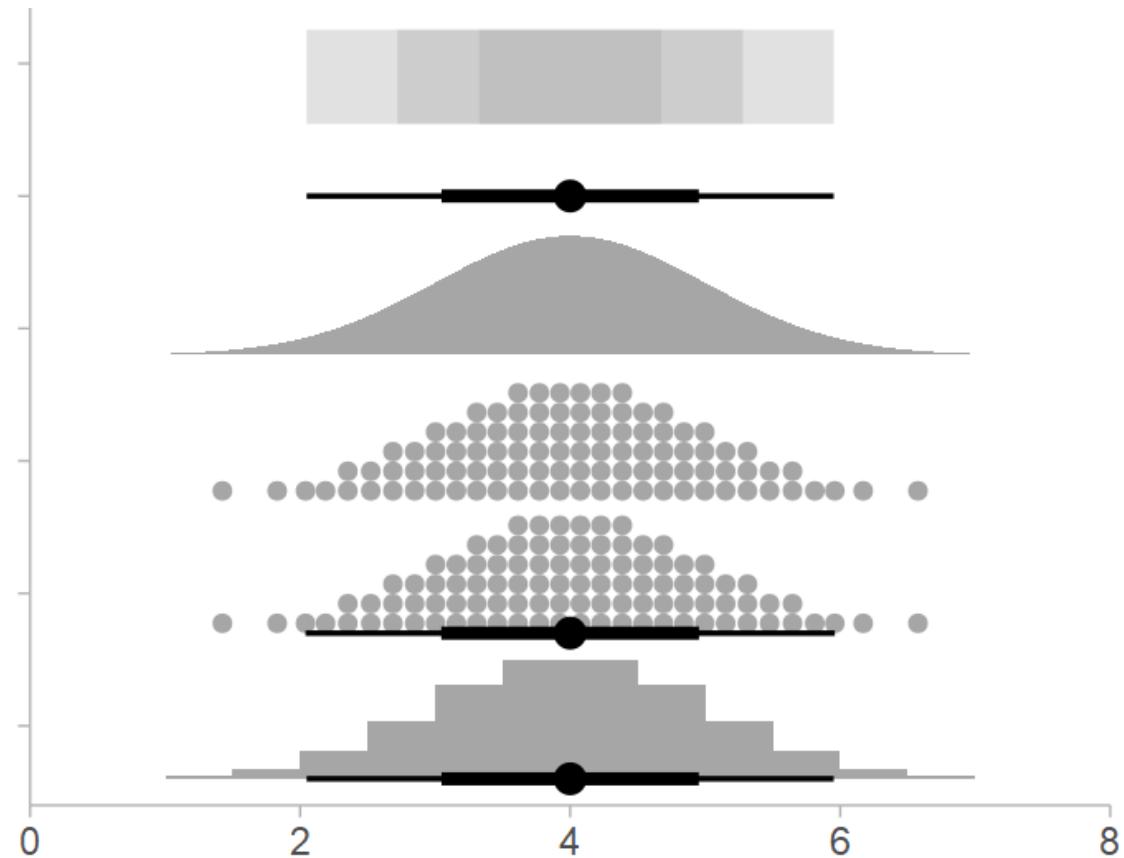
Charts and combinations to consider...



Charts and combinations to consider...



Charts and combinations to consider...



Summing up

Frequency framing / discrete outcome vis

May help **improve reasoning** about uncertainty

Implicit encoding for icon arrays and
dotplots is **spatial frequency**

More generally

Consider **combination charts** to address shortcomings
of any single encoding

Match encoding choice to your **communication goals**

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