



## Security And Sustainability Forum

Convening Global Experts to Guide Decision Making



# Decarbonize with Big Data:

*Why should I give you my data, and what do I get?*

Thursday, October 21, 1:15- 2:45 pm EDT



**Bill Brandt**, Moderator

Director of Strategic  
Integration  
[ASU LightWorks](#)



**Shade Shutters**

Research Scientist, School  
of Complex Adaptive  
Systems, College of Global  
Futures, ASU



**Timothy Slaper**

Research Director  
IU Kelley School of  
Business' Indiana  
Business Research  
Center



**Pavan Turaga**

Director, ASU School of  
Arts, Media and  
Engineering, Director, Ge  
ometric Media Lab, ASU



**Michael Simeone**

Director for Data Science  
& Analytics,  
ASU Libraries.  
Assistant Research  
Professor, Biosocial  
Complexity Initiative, ASU



**Edward Saltzberg**

Executive Director  
[Security & Sustainability  
Forum](#)

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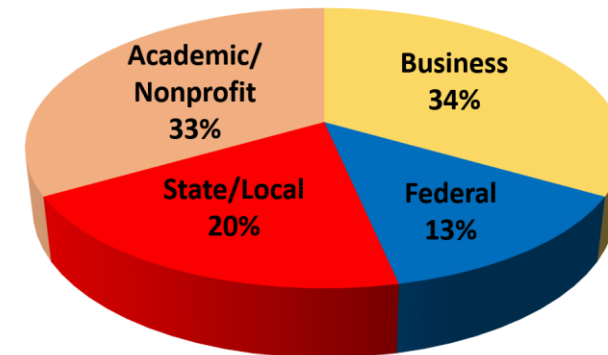
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- Smart Energy/Smart Cities
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- Restoring the Carbon Balance
- Climate Adaptation
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>25,000 Global Sustainability Professionals

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## Agenda

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1. **Welcome:** Ed Saltzberg, *Executive Director, SSF*
2. **Panel Introduction & Context:** [Bill Brandt](#), **Moderator**, Director of Strategic Integration [ASU LightWorks](#)
  - **Shade Shutters**, *Research Scientist*, School of Complex Adaptive Systems, College of Global Futures, ASU
  - **Timothy Slaper**, *Research Director*, IU Kelley School of Business' Indiana Business Research Center
  - **Pavan Turaga**, *Director*, ASU School of Arts, Media and Engineering. *Director*, Geometric Media Lab, ASU
  - **Michael Simeone**, *Director for Data Science & Analytics*, ASU Libraries. *Assistant Research Professor*, Biosocial Complexity Initiative, ASU
3. **Panel Discussion with Audience Q + A:** *Use the box in the Go To Webinar window*
4. **Panel Summary**
5. **Closing**

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# Laboratory for Regional Dynamics and Development - <https://complexity.asu.edu/lrdd>

Shade T. Shutters - [shade.shutters@asu.edu](mailto:shade.shutters@asu.edu)

$$LQ_i^{(m)} = \frac{(x_i^{(m)} / \sum_i x_i^{(m)})}{(\sum_m x_i^{(m)} / \sum_m \sum_i x_i^{(m)})}$$

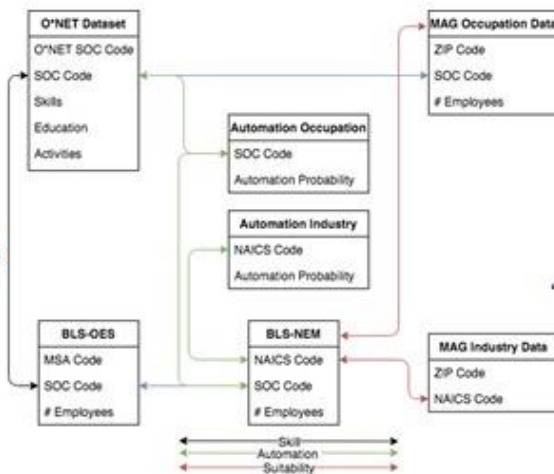
1. We start with a theory of urban economic change

$$\zeta_{ij} = \frac{P[LQ_i^{(M)} > 1, LQ_j^{(M)} > 1]}{P[LQ_i^{(M)} > 1]P[LQ_j^{(M)} > 1]} - 1$$

$$V_i(SOS_m) = 1 - \prod_{j \in SOS_m} (1 - c(\zeta_{ij} + 1)P[LQ_i^{(m)} > 1])$$

$$R_{i,m} = \frac{1}{N_i} \sum_{i \in SOS_i} V_i(SOS_m)^{1-\delta_i}$$

2. Map that theory onto open source data



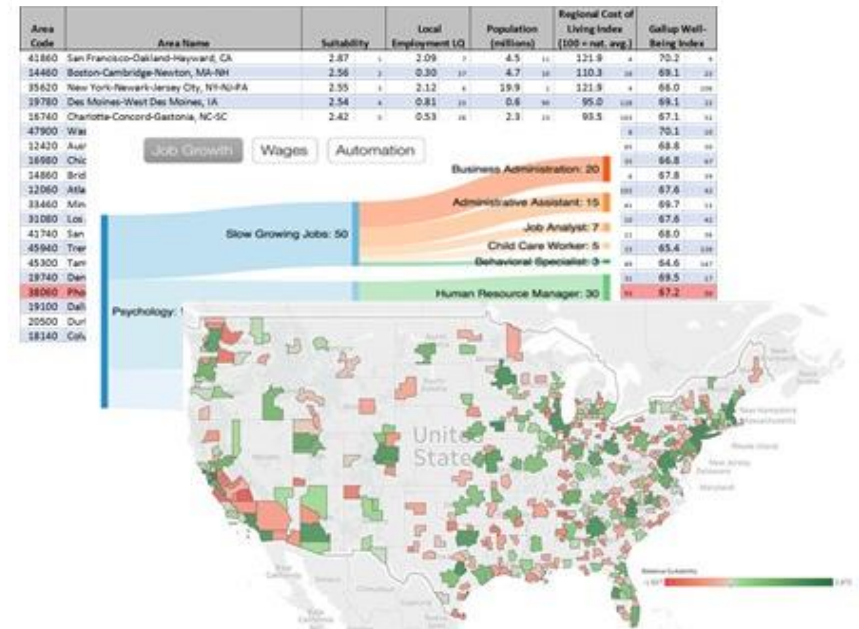
```

1 library(data.table)
2 library(tidyverse)
3 library(stringr)
4 library(readr)
5
6 # Matrix amount of some attribute by area (e.g., amount of workers)
7 amt.list <- fread("D:/LRDD/output/osa_list_aggregated.csv") %>%
8   select(amt)
9
10 # Calculate location quotients for each attribute-area combination
11 lq.list <- amt.list %>% mutate(all_amt = sum(amt)) %>% group_by(are) %>%
12   mutate(attribute_amt = sum(amt)) %>% ungroup %>% mutate(lq = (am
13
14 specialty.list <- lq.list %>% spread(area_id, lq) %>% gather(area,
15   mutate(presentflag = replace_na(presentflag, 0)) %>% select(attrib
16
17 # Use groups/advance list to calculate attribute-attribute inter
18
19 specialty.wide <- spread(specialty.list, attribute_id, presentflag)
20 specialty.matrix <- data.matrix(specialty.wide)
21 area.list <- rownames(specialty.matrix)
22 attribute.list <- colnames(specialty.matrix)
23
24 area.count <- length(area.list)
25 prob.above <- colSums(specialty.matrix) / area.count
26 attribute.count <- length(attribute.list)
27 zetas <- matrix(0, nrow = attribute.count, ncol = attribute.count)
28
29 for (attribute.1 in attribute.list) {
30   for (attribute.2 in attribute.list) {
31     if (which(attribute.list == attribute.2) > which(attribute.list
32       prob.both <- sum(specialty.matrix[, attribute.1] + specialt
33       zetas(attribute.1, attribute.2) <- (prob.both / (prob.above[
34       zetas(attribute.2, attribute.1) <- zetas(attribute.1, attrib
35     }
36   }
37
38 zeta.out <- as.data.frame(zetas)
39 zeta.list <- cbind(attribute.1 = rownames(zeta.out), zeta.out, row
40
41 # Use interdependence values and area attributes amounts to calculat
42 amt.wide <- amt.list %>% spread(attribute_id, amt) %>% gather(attr
43   spread(attribute_id, amt) %>% remove_rownames %>% column_to_rownam
44   amt.matrix = data.matrix(count.wide)
45
46 specialties.per.area <- rowSums(specialty.matrix)
47 areas.per.specialty <- colSums(specialty.matrix)
  
```

3. Code theory and data into an analytic engine

4. Parameterize the engine with stakeholder priorities to generate decision support tools

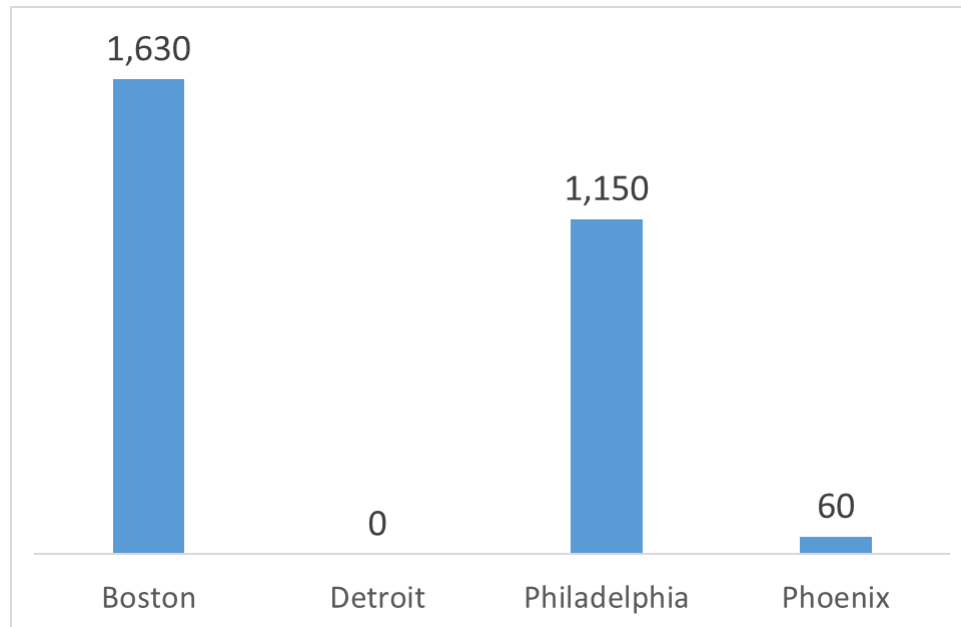
Optimal growth industries for: **Phoenix-Mesa-Glendale MSA**



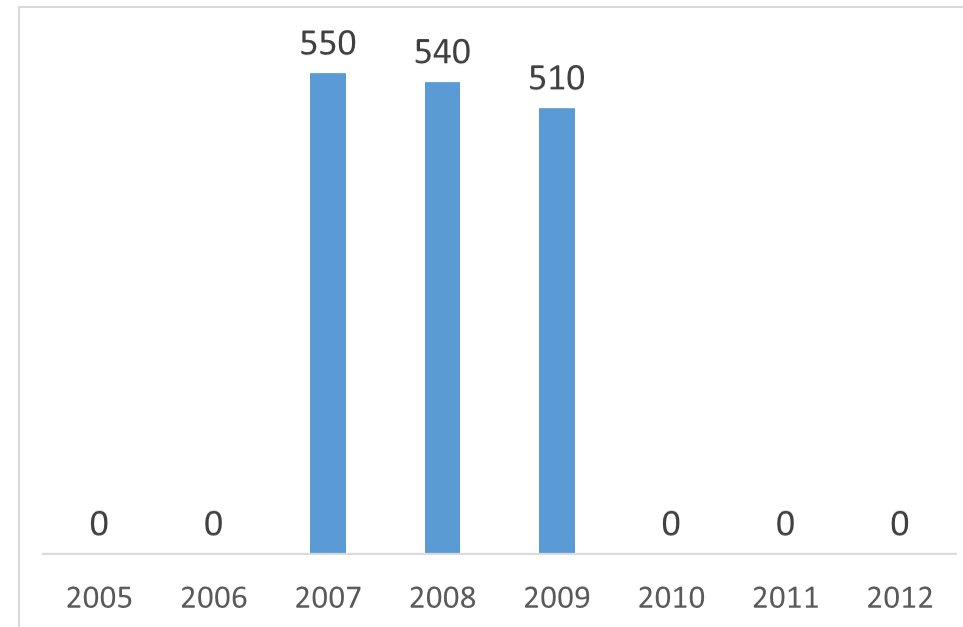
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US Bureau of Labor Statistics, Occupational Employment Statistics



Number of Surgeons by Metropolitan Area, 2015



Number of Police Officers by year, Fort Wayne, Indiana

# What is Truth?

## Tim Slaper

- Theory and Measures grow up together
  - Kuznets, Keynes and Hayek all asked “What is most important?”
  - ...and went out to collect data
- Economics is theory laden
  - Create measures and collect data based on theoretic frame
- Data Science has been accused of being a theory free zone
- This creates conflict when researchers from these two disciplines are in the same conference room
- Is “Truth” invented or discovered?
- Is **Synthetic Data** invented, discovered or something in-between?



# Is *Truth* invented or discovered?

		<b>JOBS</b>			
		STEM	ARTS	OTHER	
<b>REGION</b>	1	50	?	130	200
	2	?	25	?	?
	3	?	?	50	?
		100	50	250	<b>400</b>

As background: the federal statistical agencies are prohibited from publishing data that may disclose or identify a reporting entity – person/firm/etc. This may create a lot of **question marks** in datasets that we need for **evidence-based policy**.

Is *Truth* invented or discovered?

		<b>JOBS</b>			
		STEM	ARTS	OTHER	
<b>REGION</b>	1	50	?	130	200
	2	?	25	?	?
	3	?	?	50	?
		100	50	250	<b>400</b>

To estimate the suppressed cells – the ??? – we need “**Truth**” as **control totals**  
Then, we can **balance the matrix** and **fill-in the holes**

# Human activity modeling as key to decarbonization

Pavan Turaga



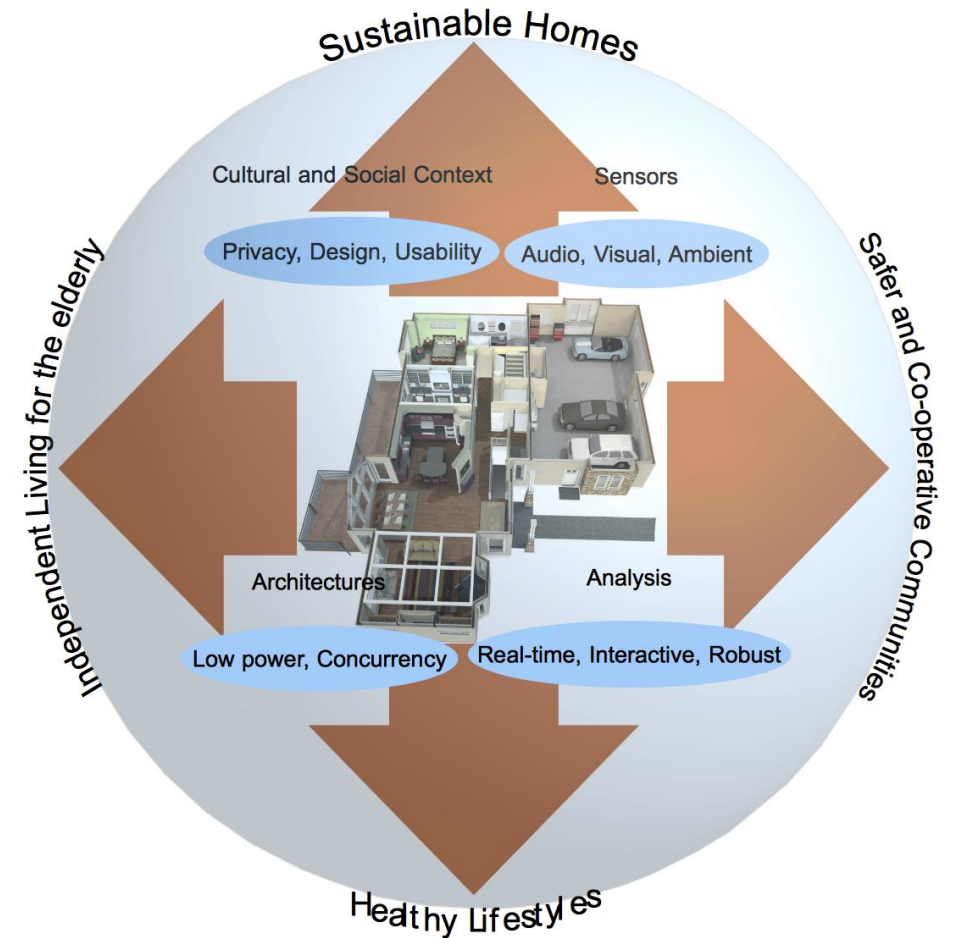
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**ASU** Herberger Institute  
FOR DESIGN AND THE ARTS  
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# The promise of big data in understanding human activity

- Big data presents us with unprecedented ways to understand human activity.
- Sensor data is challenging to store and label.
- Much of the advances in AI over the past decade are related to converting sensor data to actionable labels and insights.
- This endeavor needs trusted annotations with considerations of privacy, policy, ethics, and bias.





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Marketplace	Library
Data is a commodity	Data is an asset for public good
Open data will level the playing field	Information doesn't come from data without resources
Data is stored because it is useful	Archives are a way for people to preserve their histories
Security	Chain of custody, sovereignty
"How can we earn your trust?"	Trust comes from building things from shared interests

Trust is not a retrofit

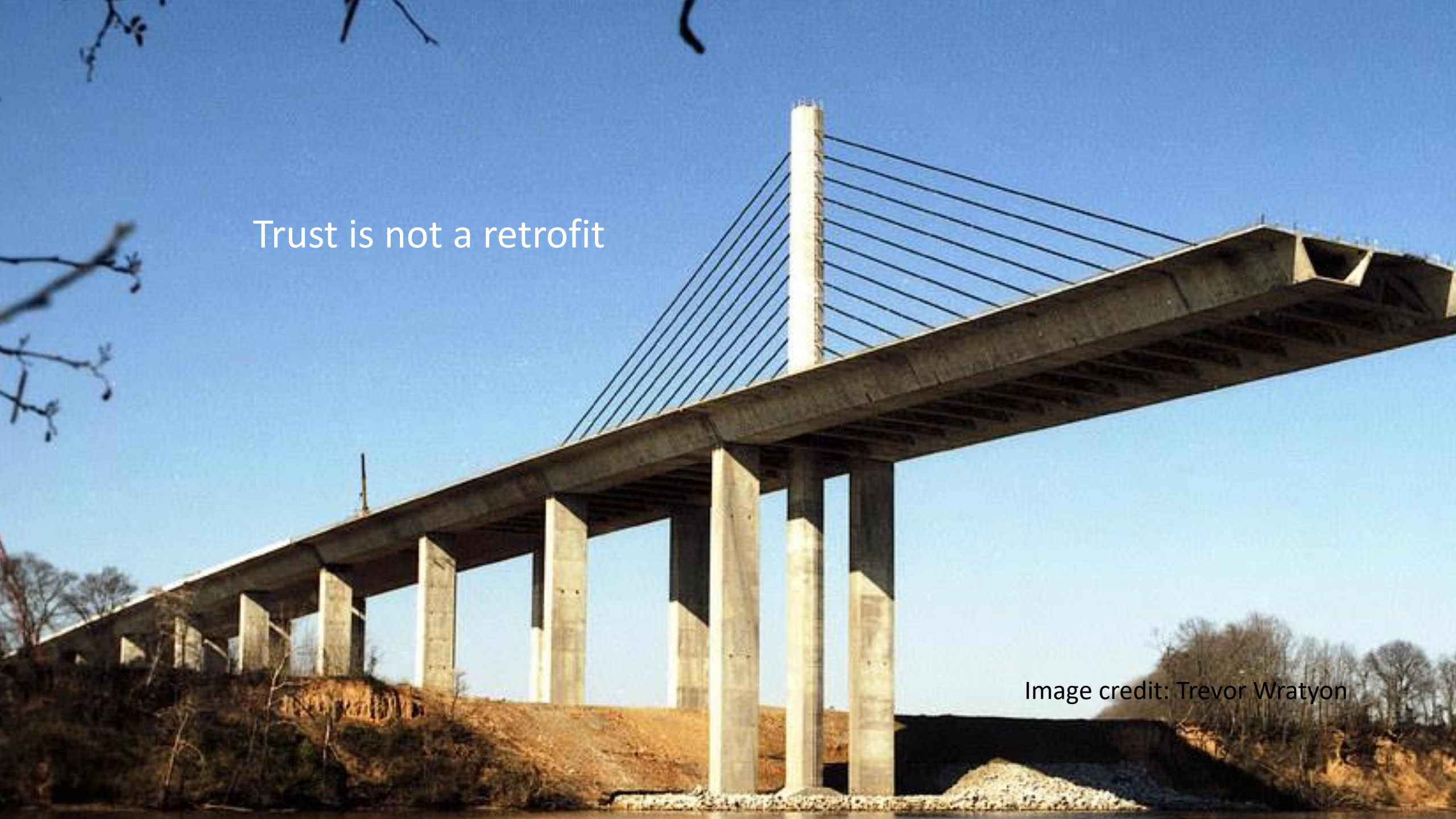


Image credit: Trevor Wratyon

## Audience Q&A

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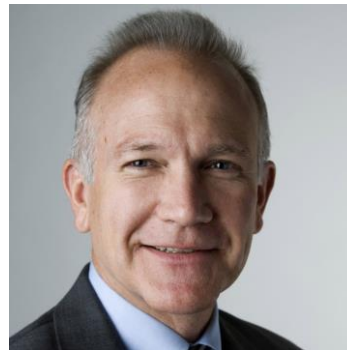
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[bill.brandt@asu.edu](mailto:bill.brandt@asu.edu)



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[Shade.Shutters@asu.edu](mailto:Shade.Shutters@asu.edu)



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[tslaper@indiana.edu](mailto:tslaper@indiana.edu)



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[pturaga@asu.edu](mailto:pturaga@asu.edu)



**Michael Simeone**  
[Michael.Simeone@asu.edu](mailto:Michael.Simeone@asu.edu)



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[esaltzberg@ssfworld.org](mailto:esaltzberg@ssfworld.org)

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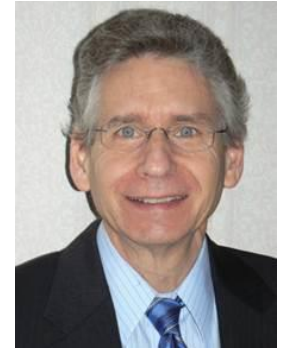
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