



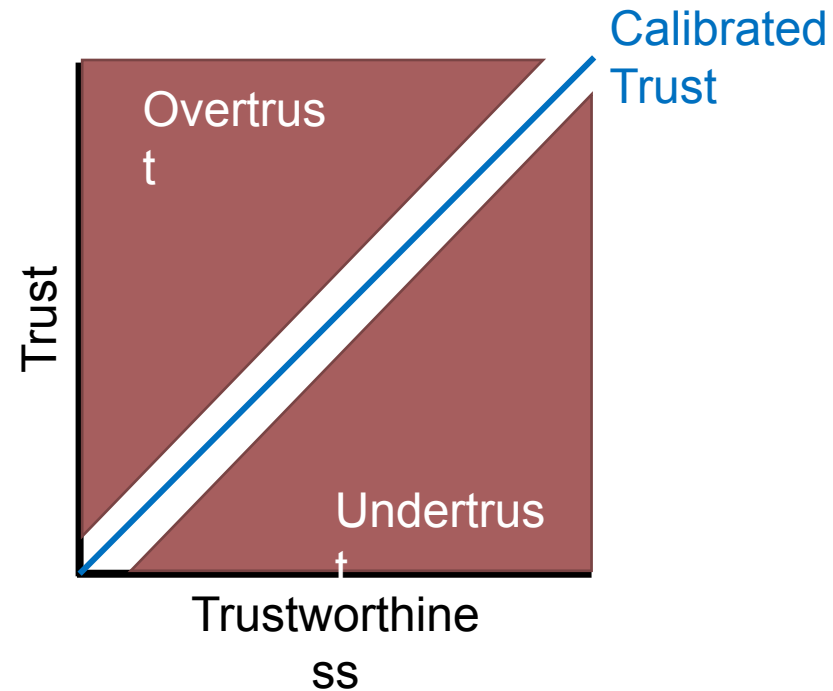
UAH
THE UNIVERSITY OF
ALABAMA IN HUNTSVILLE

**TEAMING AND TRUST:
INFLUENCES OF DESIGN
ON OPERATOR COGNITION**

NATE TENHUNDFELD, PH.D.

WHAT IS TRUST?

- “The attitude that an agent will help achieve an individual’s goals in a situation characterized by uncertainty and vulnerability.” (Lee & See, 2004)



WHY IS UNDERSTANDING TRUST IMPORTANT?

- **Trust is a predictor of:**
 - Workload
 - Situation Awareness (SA)
 - Performance
 - Resiliency to errors
- **Trust is essential** to understand in the promotion of appropriate system use, in an effort to avoid:
 - **Disuse:** the cessation of reliance on the system
 - **Misuse:** using the system in ways it wasn't designed to be used, or failing to appropriately monitor it in correct settings

WHAT FACTORS IMPACT TRUST?

- We know that influences on trust can fall into several categories:

<u>Learned</u>	<u>Situational</u>	<u>Dispositional</u>
Attitudes/expectations	Type of system	Culture
Reputation of system	System complexity	Age
Prior experience	Task difficulty	Gender
Understanding	Workload	Personality Traits
System performance	Perceived risks	
Appearance (indirectly)	Perceived benefits	
Ease-of-use (indirectly)	Self-confidence	
Communication style	Subject matter expertise	
Level of control	Mood	
	Attentional capacity	

UNDERTRUST



DISUSE

UNCLASSIFIED



OVERTRUST



MISUSE

CLINT OLIVER VIA STORYFUL

USA
TODAY





THE MACHINE KNOWS

Man following GPS navigation drives car into Charlton lake

The driver managed to escape the vehicle on his own, according to the Charlton Fire Department.

SAFETY · Published October 3, 2019

Crews rescue two men and dog after driver follows GPS directions into raging river

Man Blindly Following GPS Drives Jeep Into Icy Lake

The navigation app the driver was referring to reportedly uses user-supplied data to help people find alternate routes to avoid traffic jams or speed cameras.

Offbeat | Agence France-Presse | Updated: January 25, 2018 4:15 pm IST

SELECT ALL | JAN. 24, 2018

Yet Another Person Listens to GPS App and Drives Car Into Lake

By Madison Malone Kircher [@4evr Malone](#)

Woman Follows GPS, Drives Car Into Canada's Georgian Bay

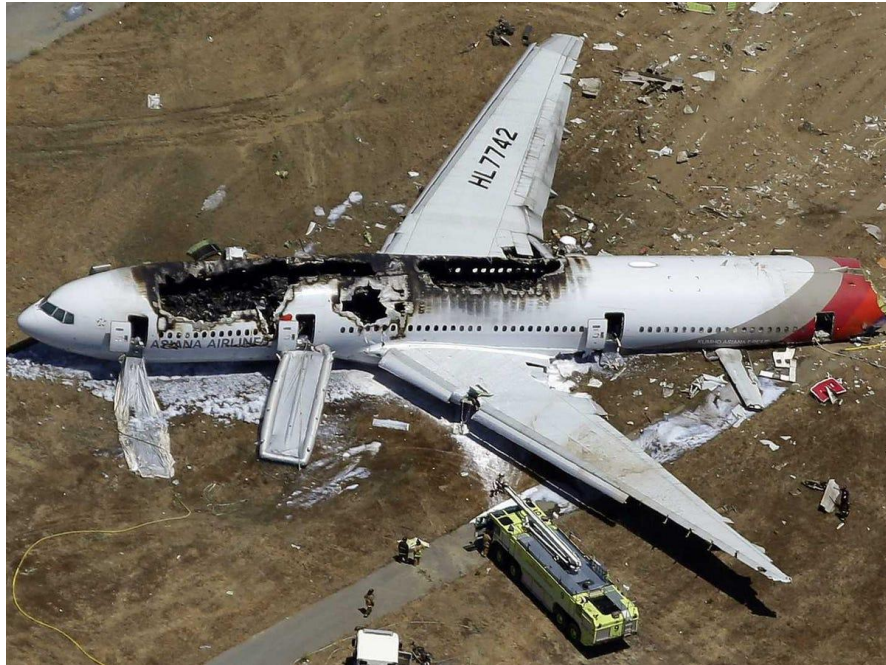
The 23-year-old Canadian woman took a wrong turn onto a boat ramp to the bay.

By JULIA JACOBO

May 14, 2016, 11:09 AM • 3 min read



OVERTRUST CAN BE FATAL



CALIBRATION OF TRUST

- In order to calibrate trust, undertrust must be **repaired**, while overtrust must be **dampened**

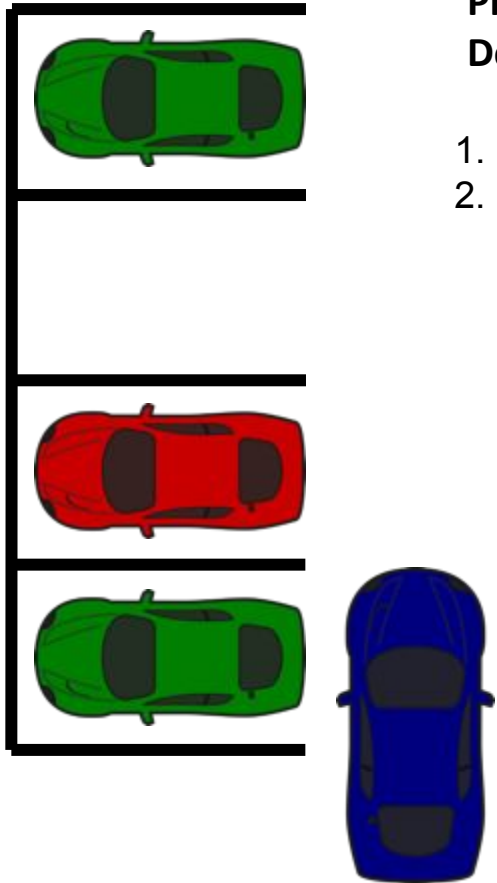
Apology	Lower expectations
Denial	Express reduced confidence
Recognition	Provide caveats to behavior
Explanation	Convey system limitations
Blaming	Request for assistance
Gas-lighting	Provide timely warnings

CALIBRATION OF TRUST

- Another proactive approach would be to enhance **transparency** of the system through:
 - Conveying a **history of performance**
 - Providing **performance feedback**
 - Conveying **uncertainty** directly
 - Providing **verification** methods
 - Enhancing **mode awareness**
 - Showing **critical states**
 - Explaining **why** things fail
 - **Mimicking** the social behavior of a user
 - Equipping the machine with **social behaviors**

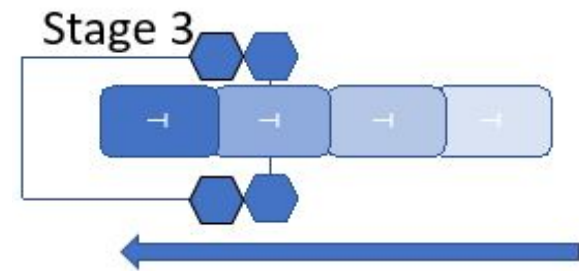
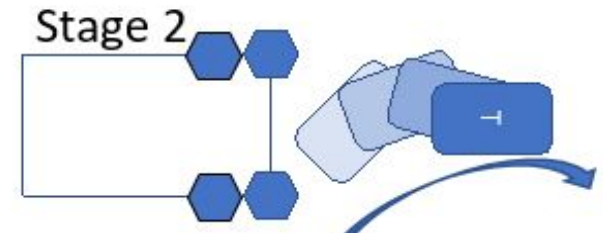
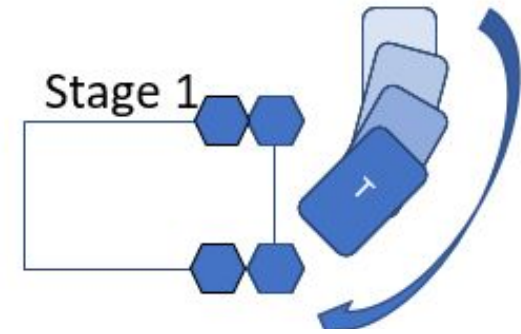
SOME OF MY RESEARCH

AUTOPARKING SETUP



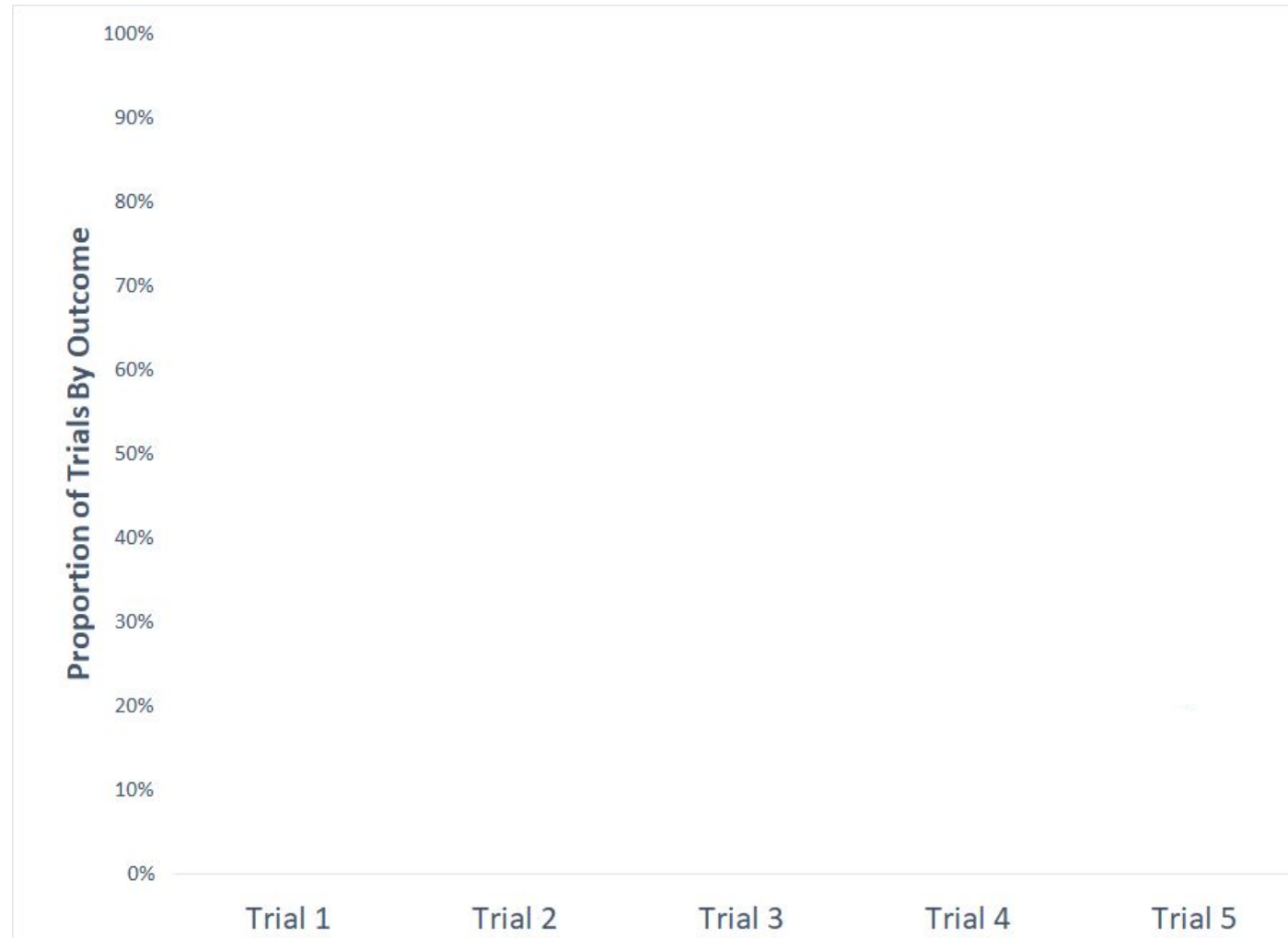
**Primary Interest:
Develop Measures of Trust in Autonomy**

1. Do they stop the car? (Intervention)
2. At what point do they stop the car?

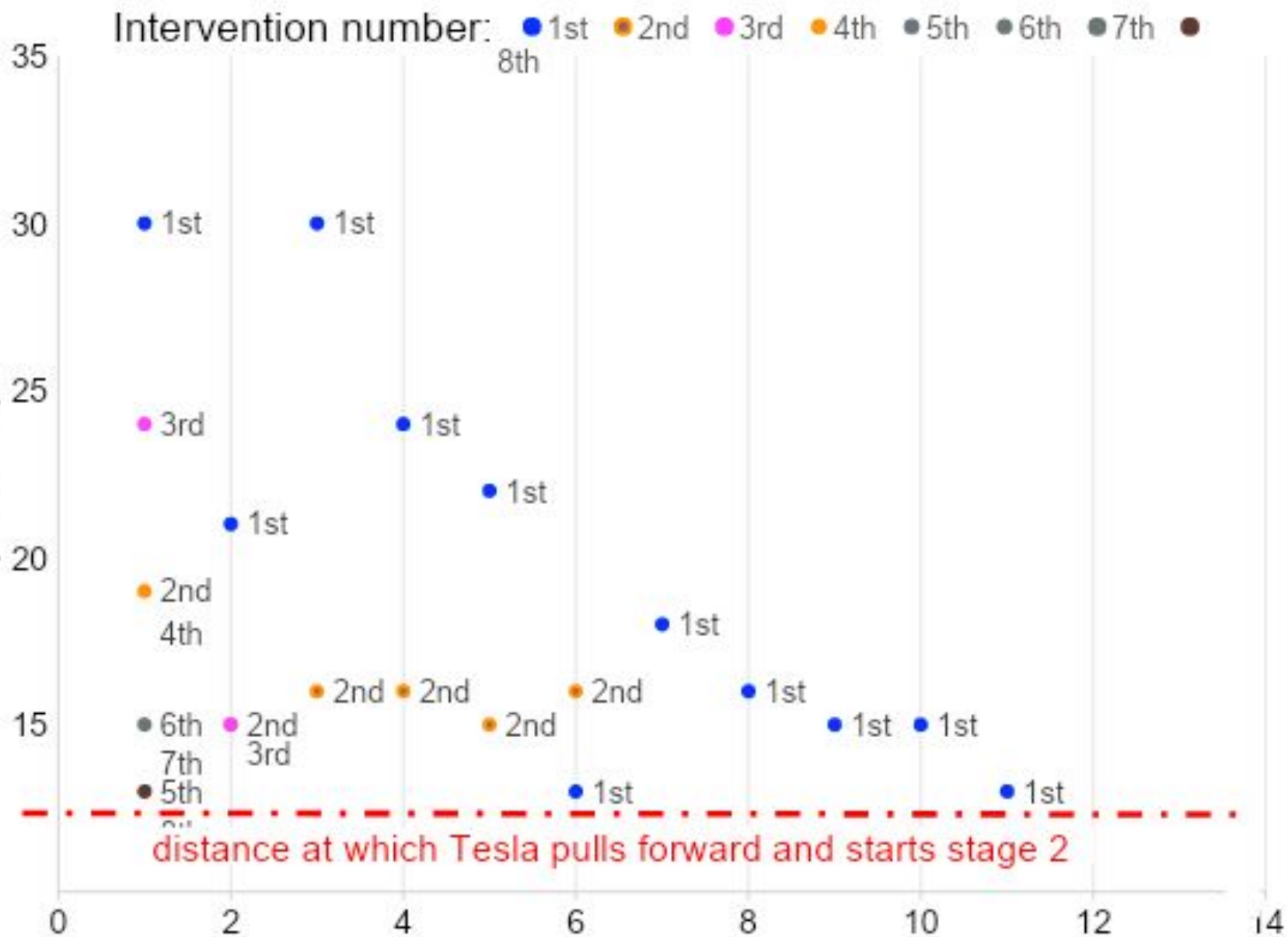


The car proceeds to park itself...

USE AND DISUSE OF AUTOPARKING



Distance from target trashcan
(Inches)



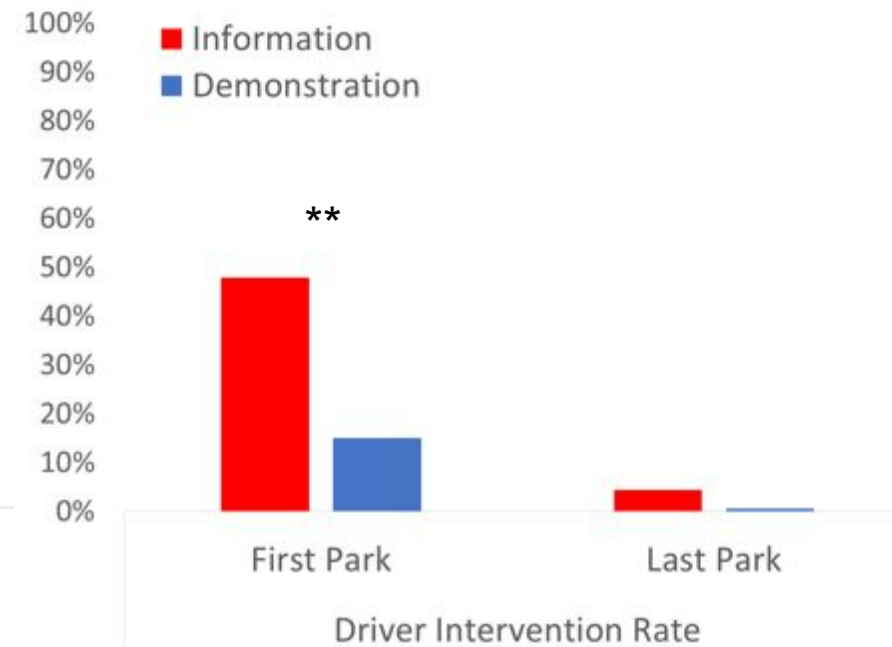
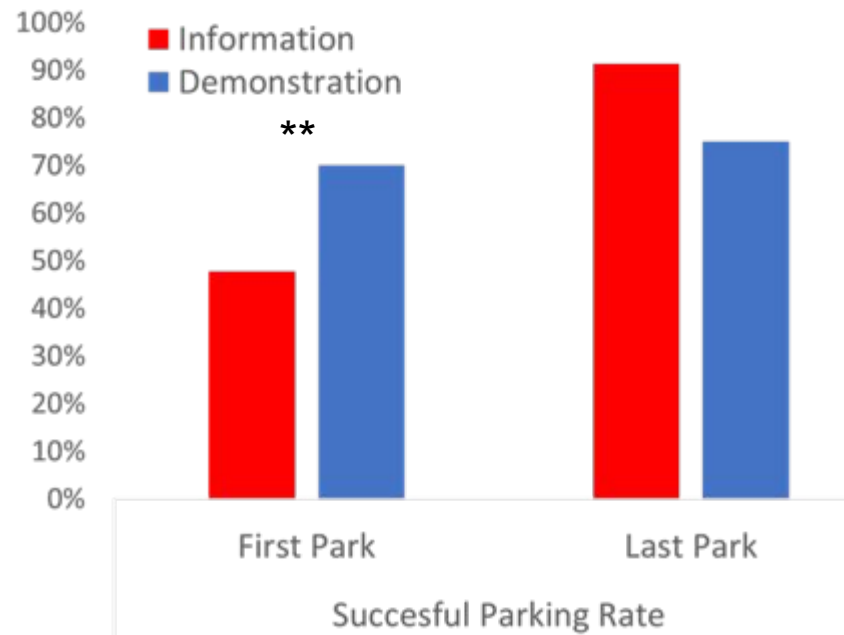
distance at which Tesla pulls forward and starts stage 2

The eleven drivers that intervened

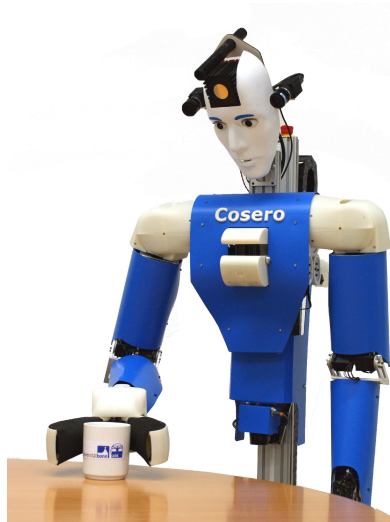
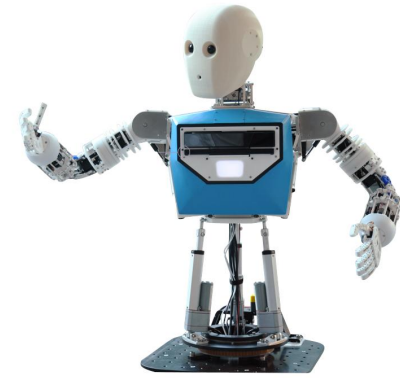
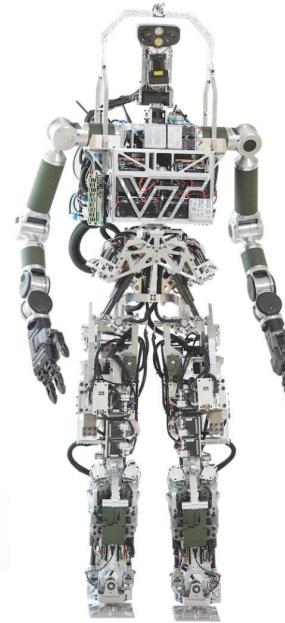
INFORMING VS DEMONSTRATING



VS

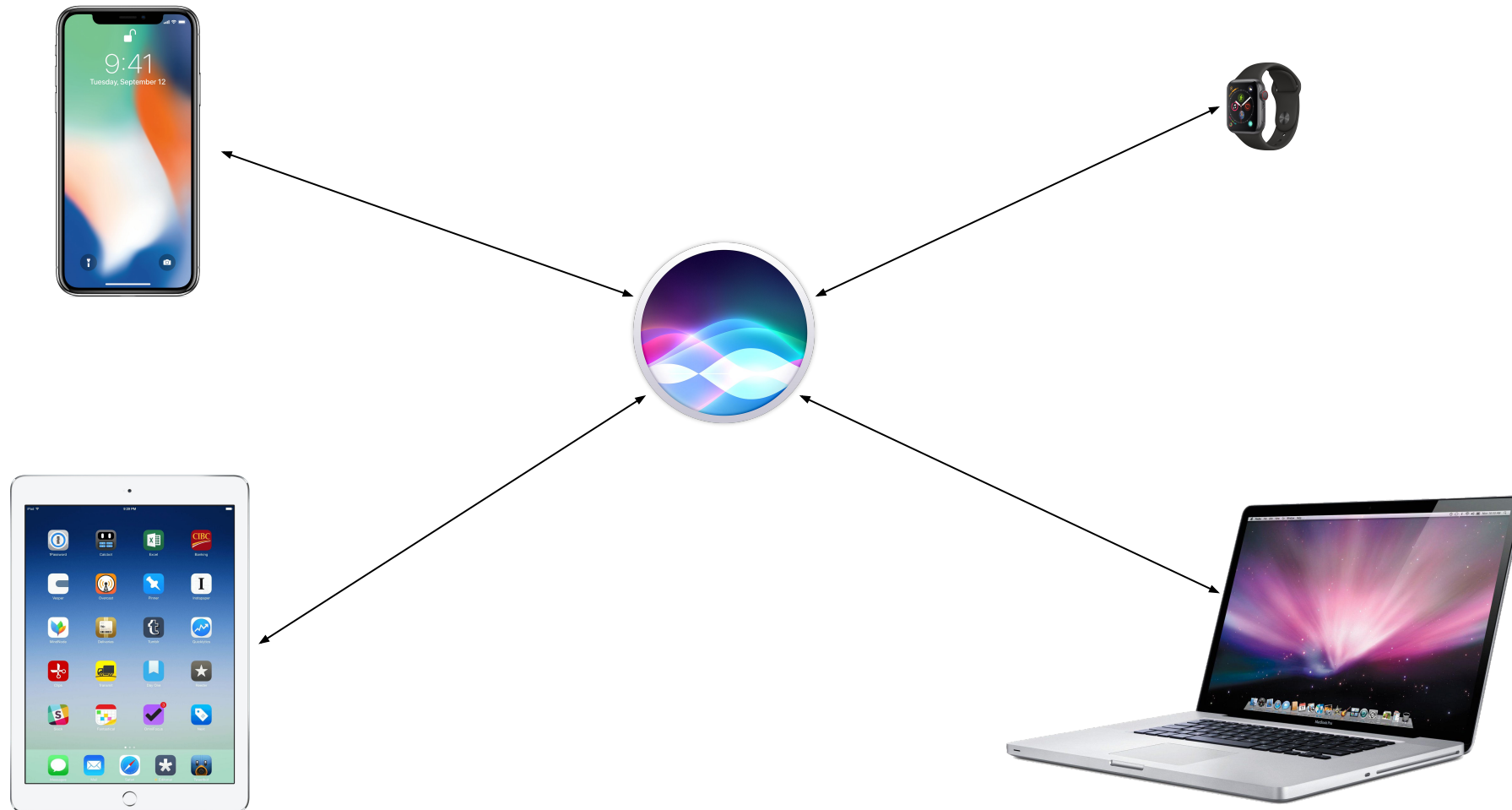


ROBOT CAREER FAIR

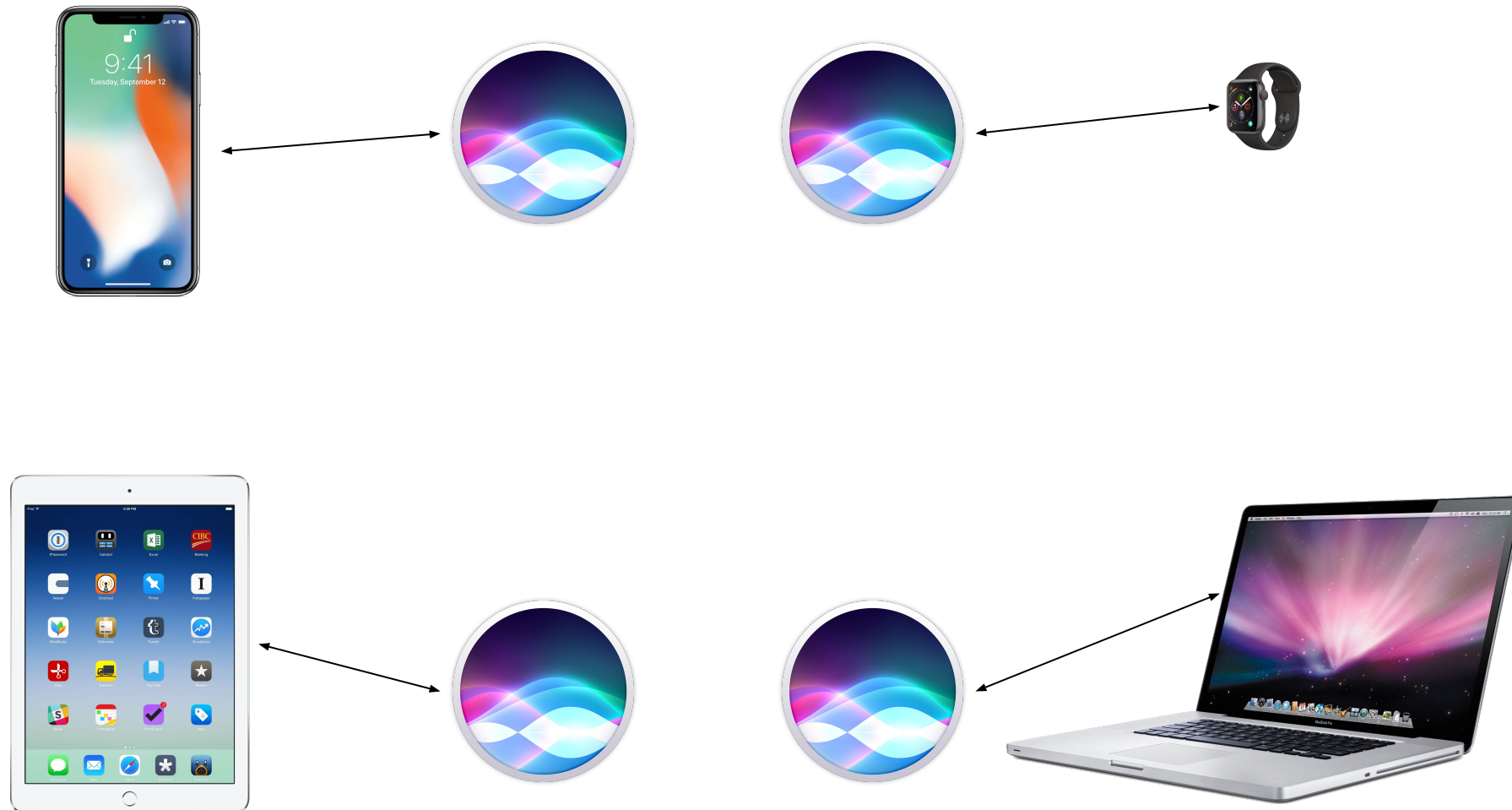


Career Field	r
Agriculture, Food, & Natural Resources	.083
Architecture & Construction	.108
Arts, Audio/Video Technology, & Communications	-.056
Business Management, & Administration	.395
Education & Training	.356
Finance	.318
Government & Public Administration	.463
Health Science	.453
Hospitality & Tourism	.176
Human Services	.179
Information Technology	-.086
Law, Public Safety, Corrections, & Security	.284
Manufacturing	.021
Marketing	.131
STEM	.226
Transportation, Distribution, & Logistics	-.054

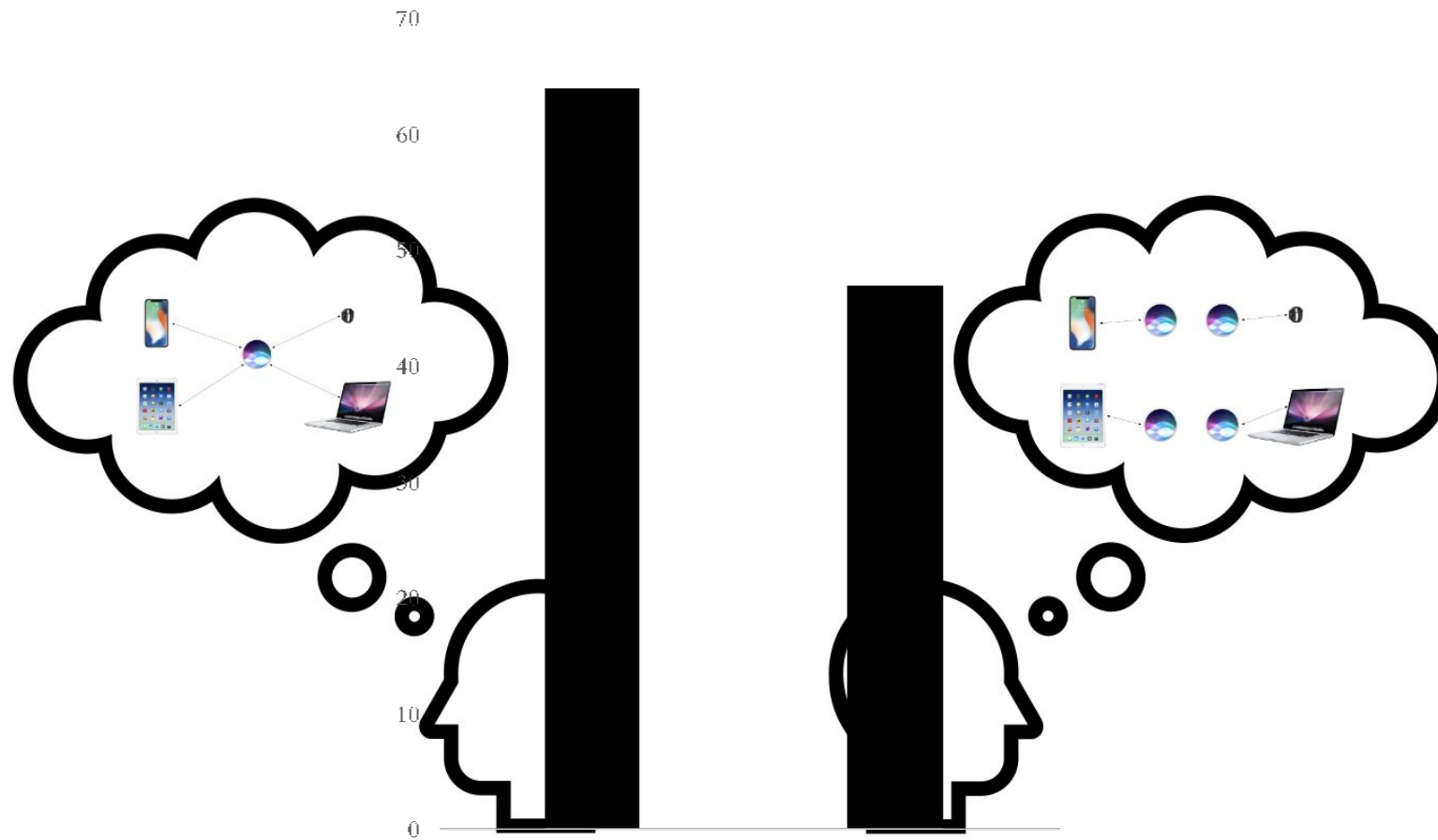
MENTAL MODELS OF INTERCONNECTED SYSTEMS



MENTAL MODELS OF INTERCONNECTED SYSTEMS



MENTAL MODELS OF INTERCONNECTED SYSTEMS



GAPS TO BE FILLED IN

- We are trying to answer some identified gaps in the literature which we feel are essential to the understanding of HMT
 - Inconsistencies in **individual differences** results (e.g. personality traits)
 - The **nature of system-wide trust** (SWT)
 - Network analyses of **temporally displaced teams**, and shared information

THANK YOU



Dr. Sampson
Gholston



Dr. Bryan
Mesmer



Dr. Kristin
Weger



Dr. Vineetha
Menon

Other Collaborators on These Projects

Dr. Ewart de Visser (USAFA)

Dr. Victor Finomore (WVU)

Dr. Kerstin Haring (UD)

Dr. Elizabeth Phillips (GMU)

Dr. Anthony Ries (ARL)

Lt Col Chad Tossell, PhD
(USAFA)

**As well as the army of
students!**



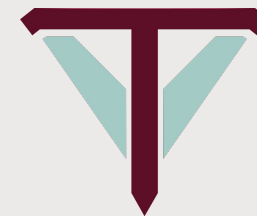
QUESTIONS?



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