

# INTERACTION DESIGN for SITUATION AWARENESS

Case studies in childbirth support  
and Deep Space Network operations



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Caltech / Jet Propulsion Laboratory



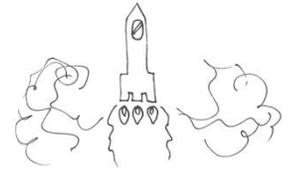


UNIVERSITY OF CALIFORNIA  
**SANTA CRUZ**

+

**JPL**

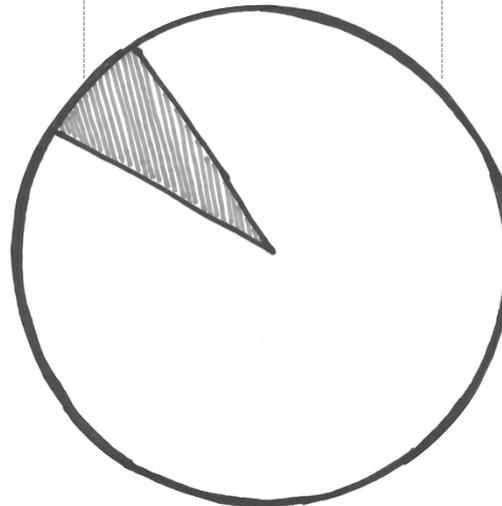
Computer Scientist  
Software Engineer  
Interaction Designer



### Building stuff (10%)

#### Prototype

Creating low- to high-fidelity prototypes to support the work



### User research (90%)

#### Ethnography

Examining how people work within their sociotechnical system

#### Design methods

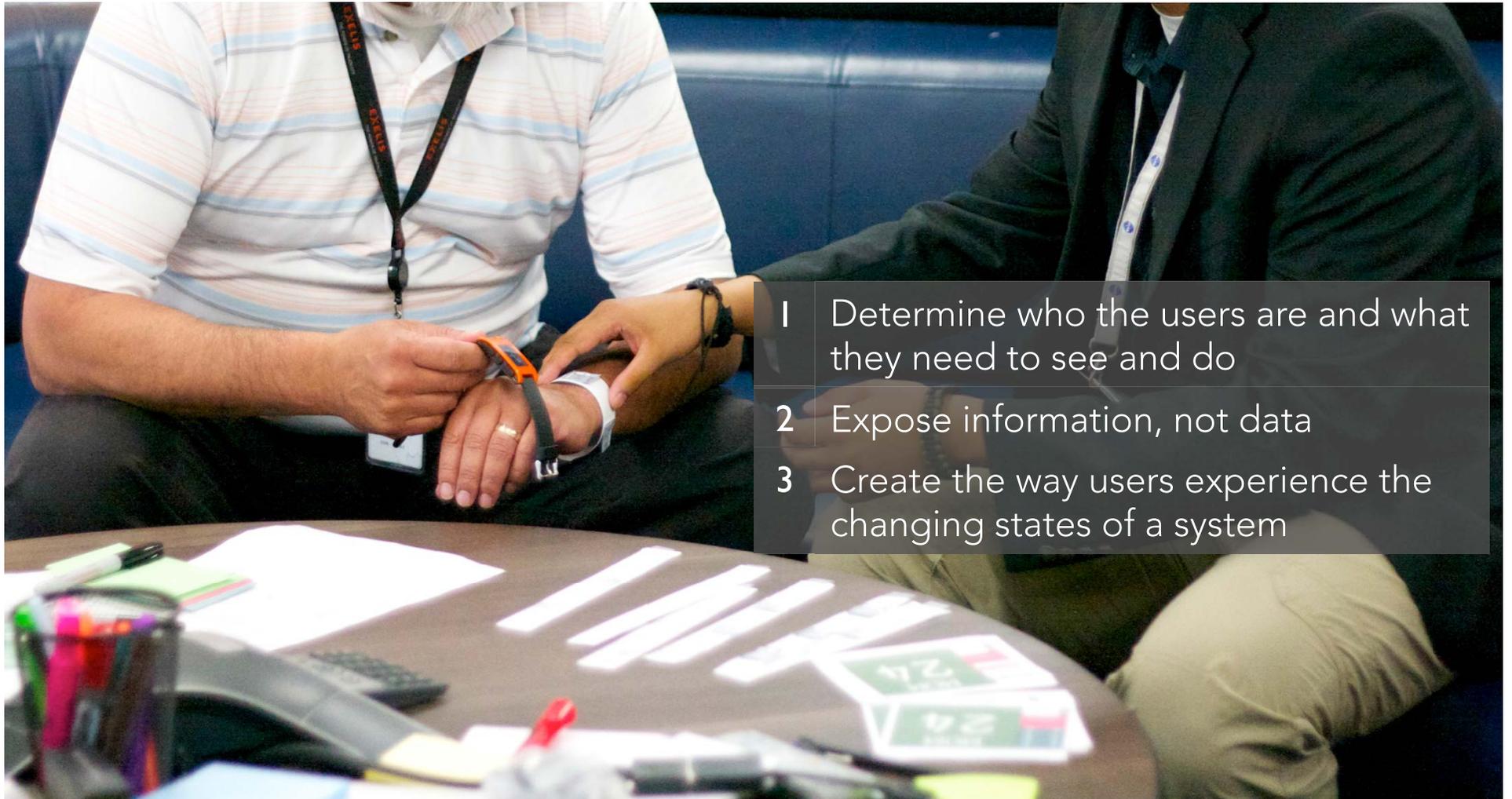
Using design activities and techniques to elicit responses to specific inquiries

# Goals for user research

- 1 Perceive the same things as users
- 2 Understand how users reason about the perceptions
- 3 Become adept at predicting the future state of a system, as the users do



# Goals for interaction design



- 1 Determine who the users are and what they need to see and do
- 2 Expose information, not data
- 3 Create the way users experience the changing states of a system

Interaction design for  
complex  
dynamic  
real-time  
semi-automated  
systems

# Interaction design for **complex** dynamic real-time semi-automated systems

## **Complex**

Many interconnected variables  
and system states

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between *human* and *system*

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1



Two case studies:  
complex  
dynamic  
real-time  
semi-automated  
systems

2



1



**Field work results**

The best way to prepare for childbirth support is to have done it before

2



**Field work results**

The best way to learn to be a Deep Space Network operator is to operate the Deep Space Network



# If you have this problem

## **Complex**

Describing the real system is impossible or impractical

## **Subsetting**

We are only interested in a subset of the real system

## **Quick iteration**

We are designing something and need to iterate quickly

## **Evaluation**

We have specific evaluation requirements

# Use a simulator

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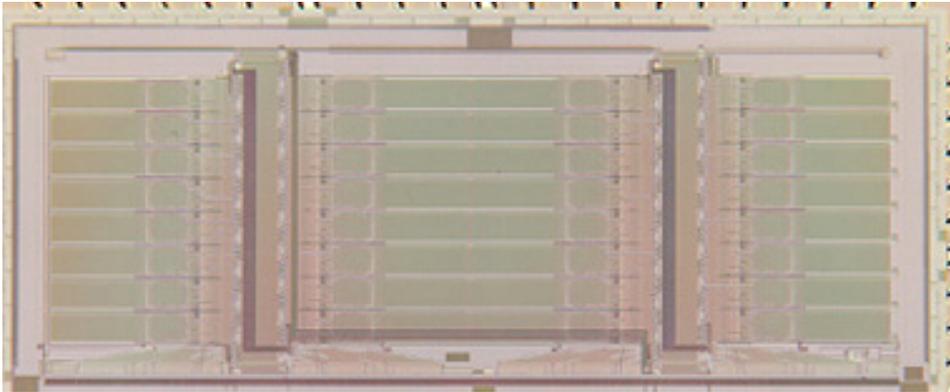
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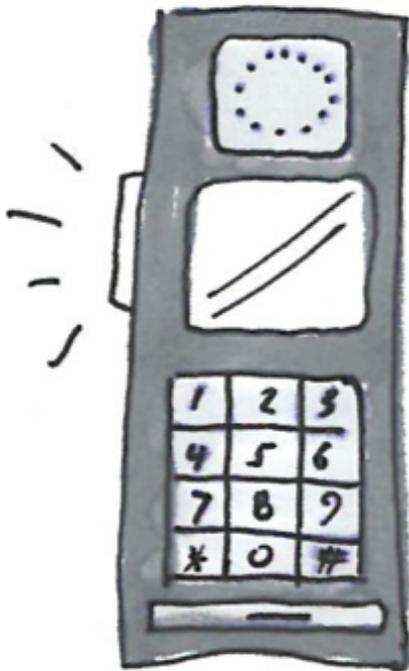
## **Evaluation**

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### **Kestrel Massively Parallel Processor**

A thousand fast little processors, all doing the same thing but on different data, Kestrel computes things quickly!



### **QChat by Qualcomm**

Push-to-talk cellphone technology

# A non-exhaustive list of what makes simulators useful

## **Verification and validation**

Using simulation output to verify or  
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E.g. Kestrel simulator, QChat emulator

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Rapidly prototyping new ways of interacting with a system

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"How did this happen?"

# Interaction design for complex dynamic real-time semi-automated systems

Q: What should I pay attention to?



A: Only the things that need it.

**How birth partners prepare**

“That book has been in the bathroom for 2 months.”



**How birth partners spend their time**

Games, of course



**How birth partners perceive labor support**

“I don't know what I'm doing.”

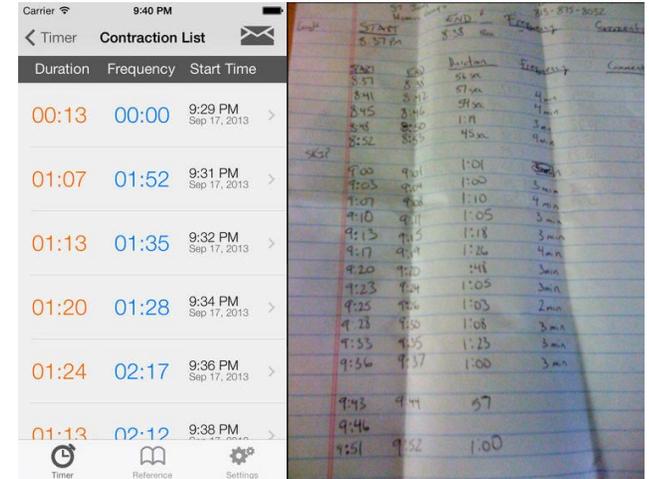
Can we do better?







At home, birth partners time contractions, on app and paper



### How birth partners perceive labor support

Contractions are the heartbeat of labor

"Useful" only when things are intense

In the hospital, birth partners focus on the contraction monitor

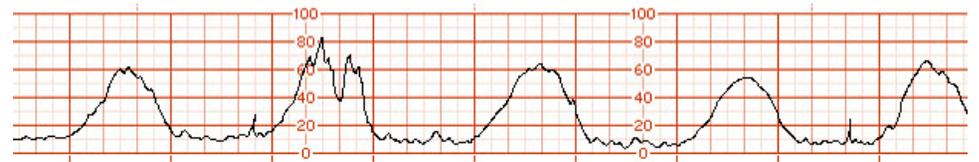


### How moms perceive labor support

"Sometimes I don't want to be touched."

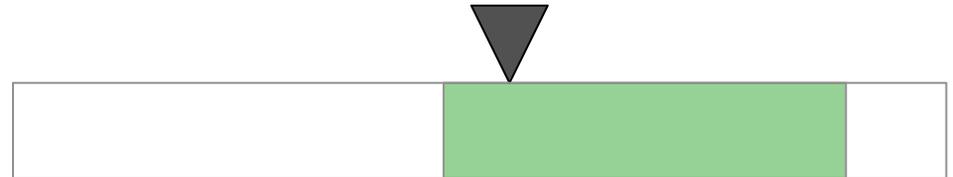
**How birth partners perceive labor support**

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**How moms perceive labor support**

"Sometimes I don't want to be touched."



**Game Speed:** 1x (real time)



**Starting dilation:** 4 cm (active labor) (recommended)



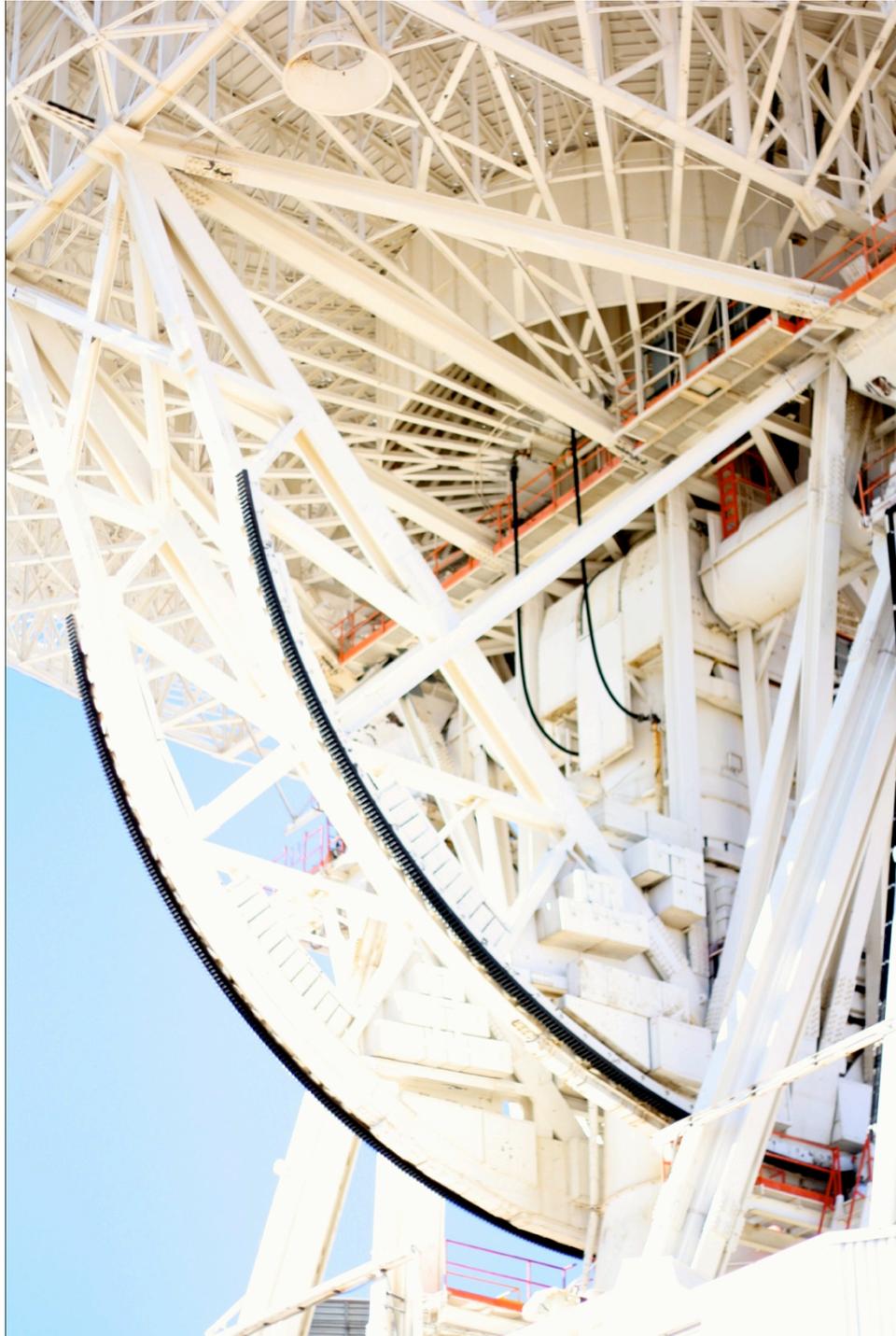
**In-game tooltips:**

**ON**



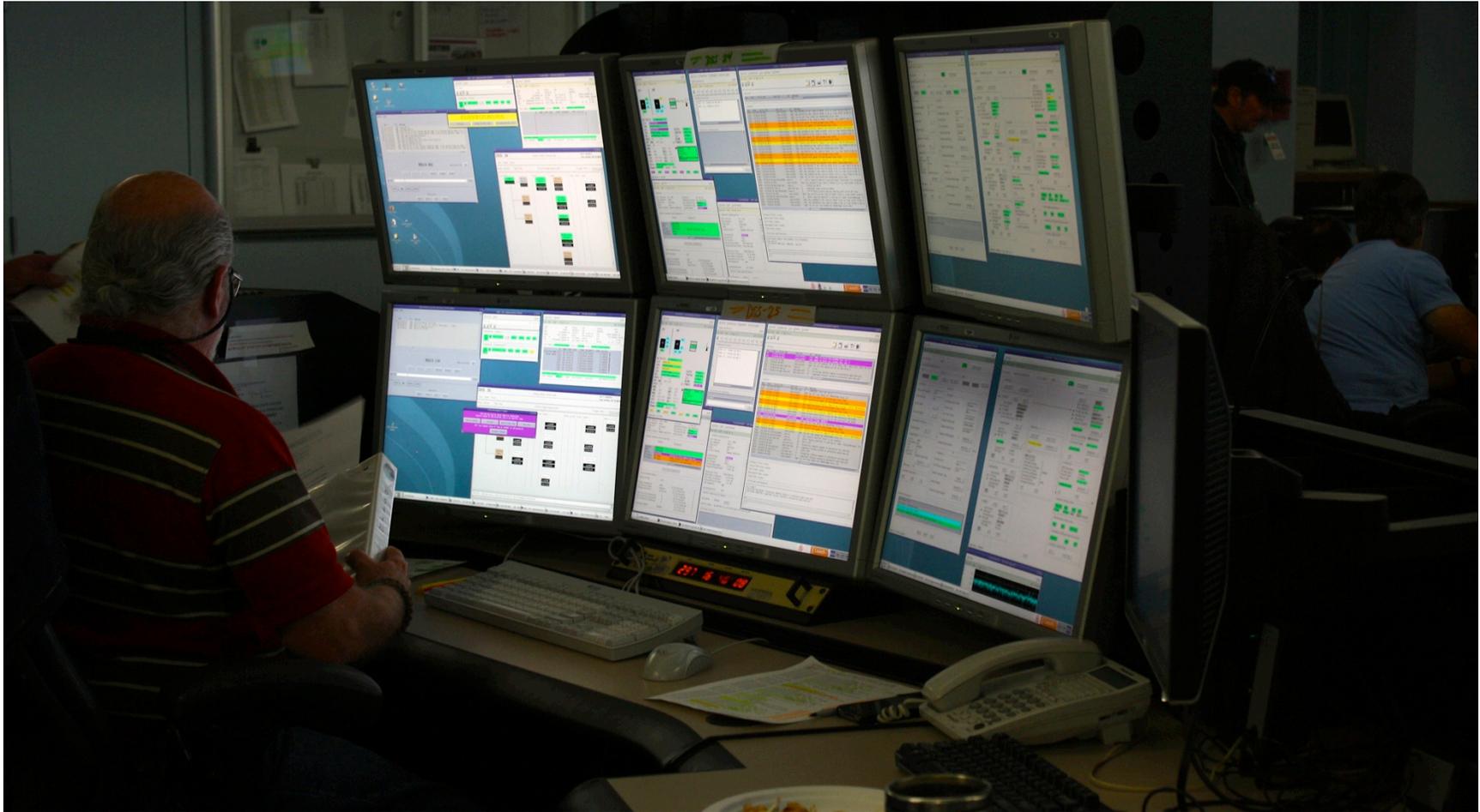
**Start Game**

# **Debut 2015 in UC San Francisco School of Nursing and Midwifery**



# Interaction design for complex dynamic real-time semi-automated systems

Q: What should I pay attention to?



A: Only the things that need it.



## Prepare

Verify necessary support documents and equipment

**Step 1**



## Pre-cal

Configure, calibrate equipment

**Step 2**



## In-Track

Provide necessary support

**Step 3**



## Post-cal

Cool down and stow equipment

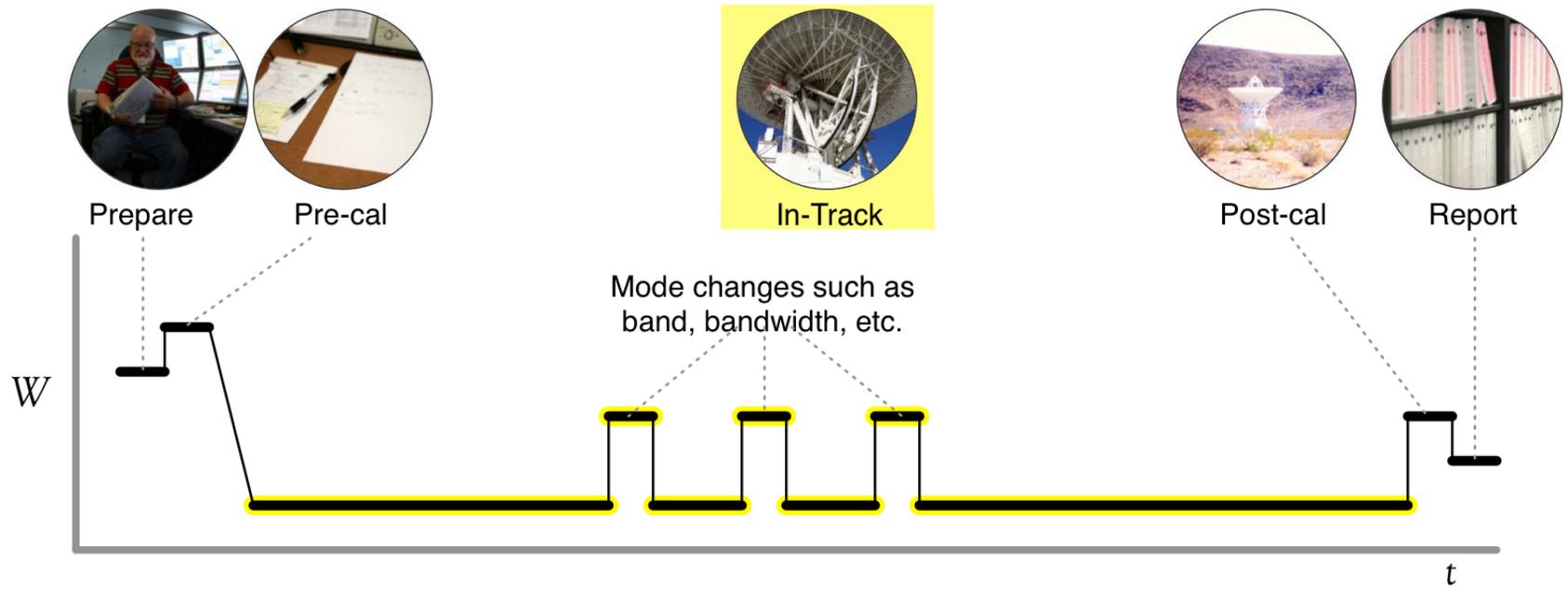
**Step 4**



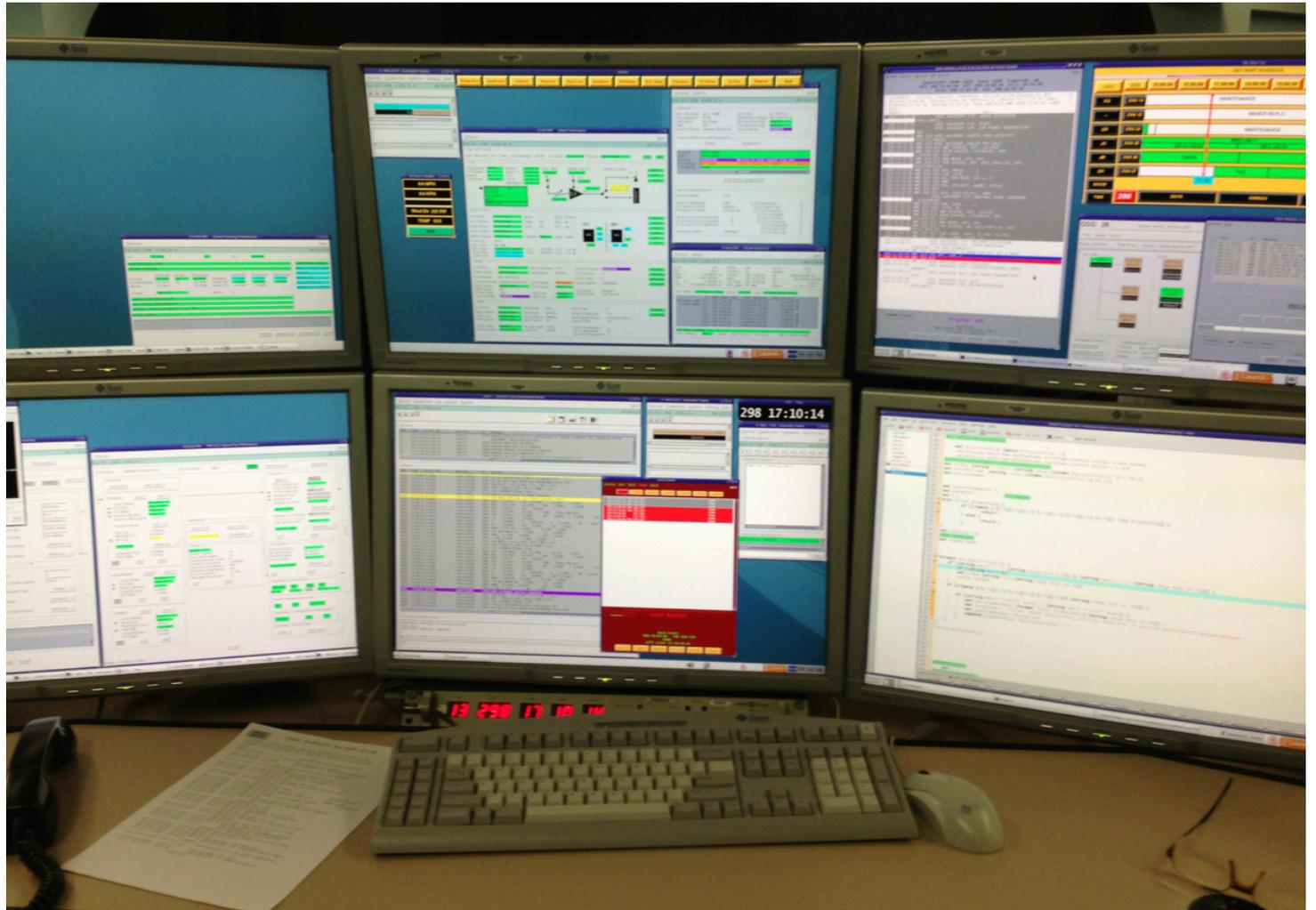
## Report

Document discrepancies

**Step 5**



Can we  
do  
better?



**Is everything okay?**  
This display contains 12 critical pieces of information

**Simulate with fake data**  
Lower-fidelity data simulation

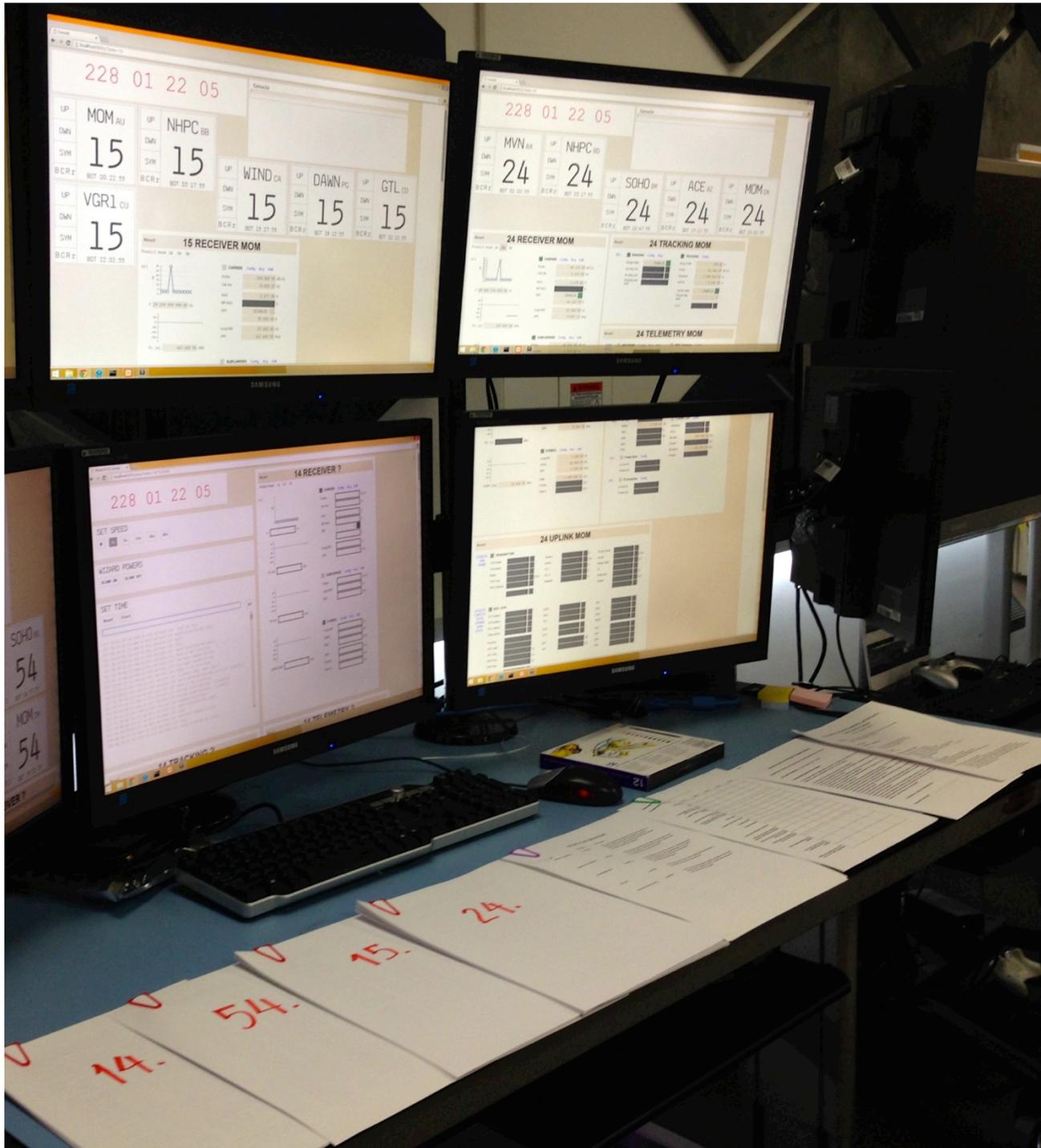
UP	VGR2
DWN	43
SYM	
CBR r	
BOT 01:39:34	

UP	VGR1
DWN	14
SYM	
CBR r	
BOT 00:49:34	

UP	MOM
DWN	24
SYM	
CBR r	
BOT 03:09:34	

UP	CLU1
DWN	45
SYM	
CBR r	
BOT 02:34:34	

149 07 05 26



# Pitfalls in designing simulations

## Pitfall 1

Real data is difficult to obtain;

Realistic data is difficult to create

Status: ●

14 <sup>164</sup> <sub>36.72</sub> 61:12:13:51					15 <sup>188</sup> <sub>36.20</sub> 61:12:13:51				
MOM <sup>1W</sup> <sub>IW</sub>	5e-6	2.33	11.49	B C R T	ACE <sup>2W</sup> <sub>IT</sub>	--	2.08	-300	B C R T
24 <sup>119</sup> <sub>36.38</sub> 61:12:13:51					25 <sup>..</sup> 61:12:13:51				
PLC <sup>2W</sup> <sub>IO</sub>	--	1.84	16.98	B C R T	1W	UP	DWN	SYM	B C R T

## **Pitfall 1**

Real data is  
difficult to  
obtain;

Realistic data is  
difficult to create

### **Start slow**

Simulate the data stream and incrementally increase the fidelity of data

E.g., Postage stamp initial prototype used simulated data stream

### **Test the concept, not the design**

Identify the concept under test, and tailor the design to the data

E.g., Concept is summary display for increased SA; design is the physical layout of the display

### **Use people where you lack data**

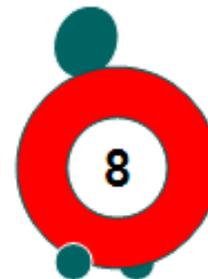
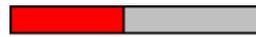
Wizard-of-Oz techniques that apply experts to the problem

E.g., Expert-as-simulator in DSN ops



## Pitfall 2

Real-time  
simulations are  
slow and boring



## **Pitfall 2**

Real-time  
simulations are  
slow and boring

### **Use expert subjects**

And make sure they are invested in the design under test

E.g., Expectant dads, not random students;  
Link control operators, not designers

### **Experience prototype**

Little environmental things give the experience realism

E.g., Provide documentation, desk, environment, and distractions similar to work

**“This is so cool.”**

**“I take back everything I was thinking about you guys. The display looks good.”**

**Fin**

## Allocate resources

Set up and ensure proper working order of equipment for support activities

### Goal 1

## Operate and troubleshoot

Ensure supports are handled according to project instructions; prevent and respond to anomalies

### Goal 2

## Coordinate activities

Work with maintenance and test crews

### Goal 3

## Report and verify

Ensure and assist discrepancy reporting

### Goal 4

## Ensure safety

Be up to date on training and aware of surroundings

### Goal 5



## Console



# 63

GBRA <sub>LI</sub>	19.9	-125	16.9	BC
				Rr