

# PETALS: Improving Learning of Expert Skill in Humanitarian Demining

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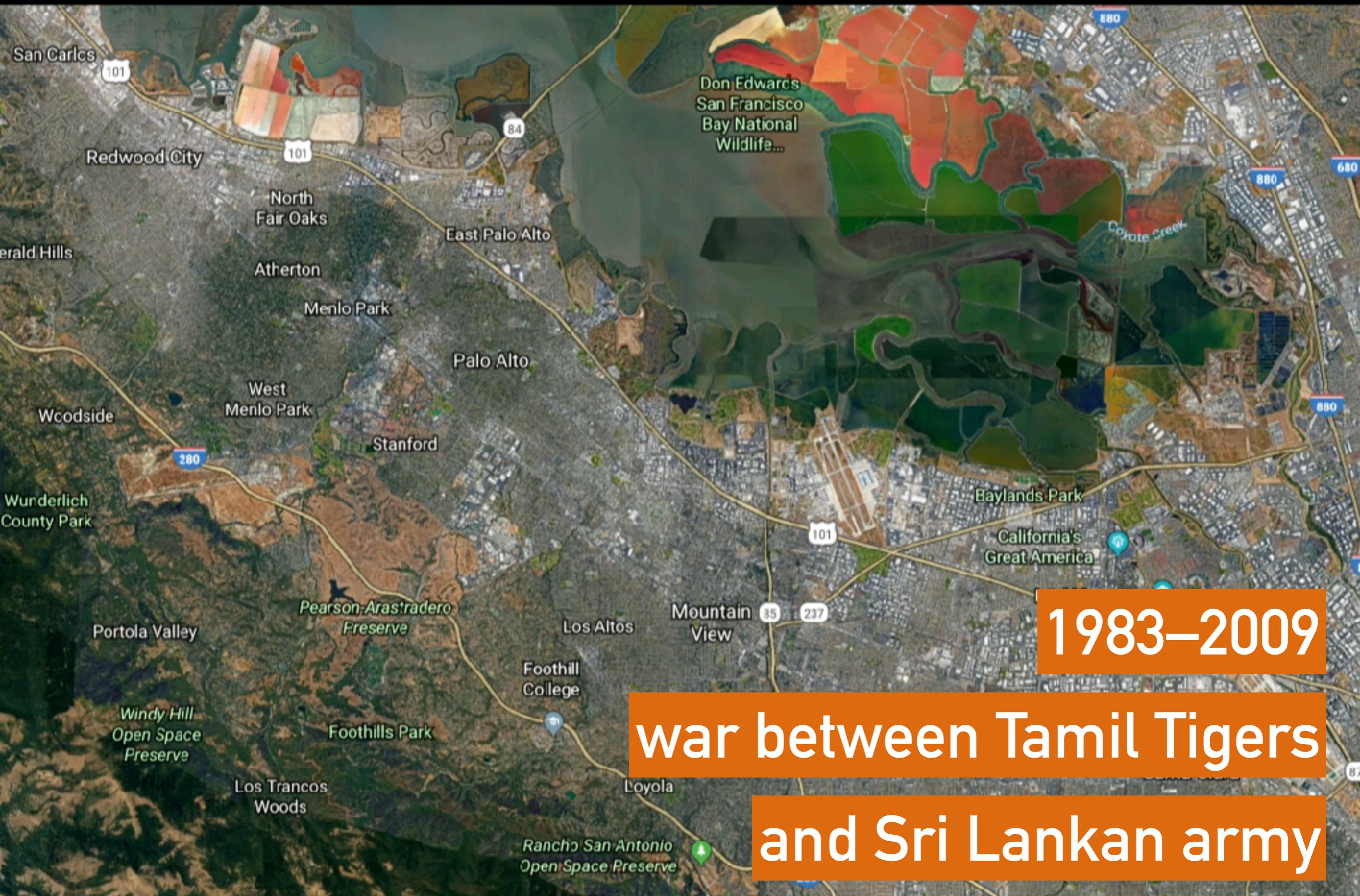
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Lahiru

Jayatilaka

Photo: Justin Ide/Harvard Staff Photographer



1983–2009  
war between Tamil Tigers  
and Sri Lankan army



1983–2009

war between Tamil Tigers

and Sri Lankan army

Photo: Devaka Seneviratne





**6,461 casualties in 2015**

**in 61 countries**

**78% were civilians**

**38% were children**

Source: Landmine Monitor 2016



DANGER MINES!

මෙම පිටත අනුමත සෞද්‍ය නොවේ!  
මින් මෙම එපායම්!



Photo: HALO Trust Archives

**Lahiru's Mission:**  
Use the power of Computer  
Science to improve the safety  
and efficiency of humanitarian  
landmine clearance

# Landmine Clearance Basics

- Landmine detection still performed primarily with handheld metal detectors



Photo: Halo Trust Archives

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- For every landmine, 100 pieces of metallic debris are found



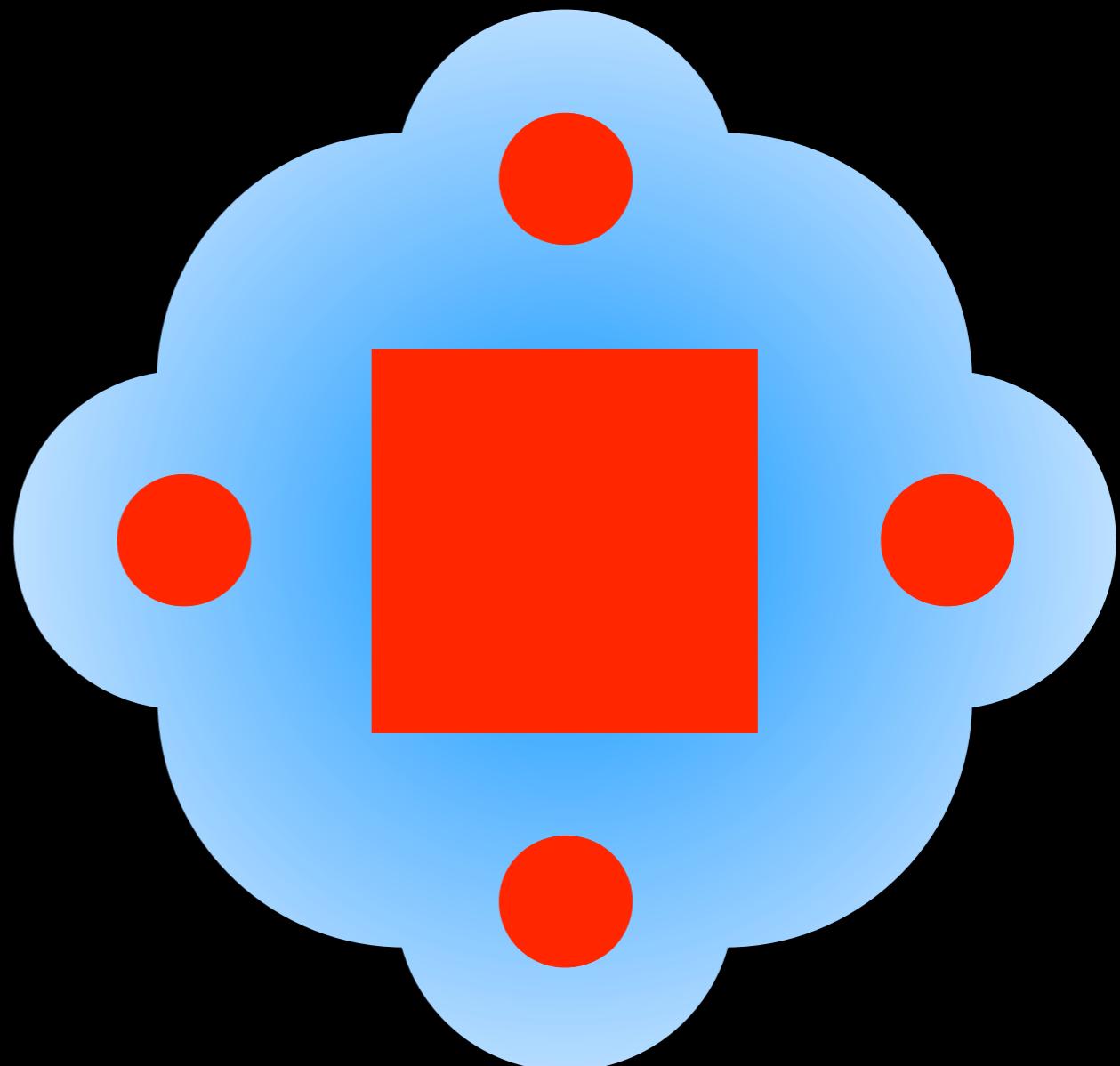
# Landmine Clearance Basics

- Landmine detection still performed primarily with handheld metal detectors
- For every landmine, 100 pieces of metallic debris are found
- When mines are placed in a cluster configuration, it is hard to tell how many mines there are and where they are located



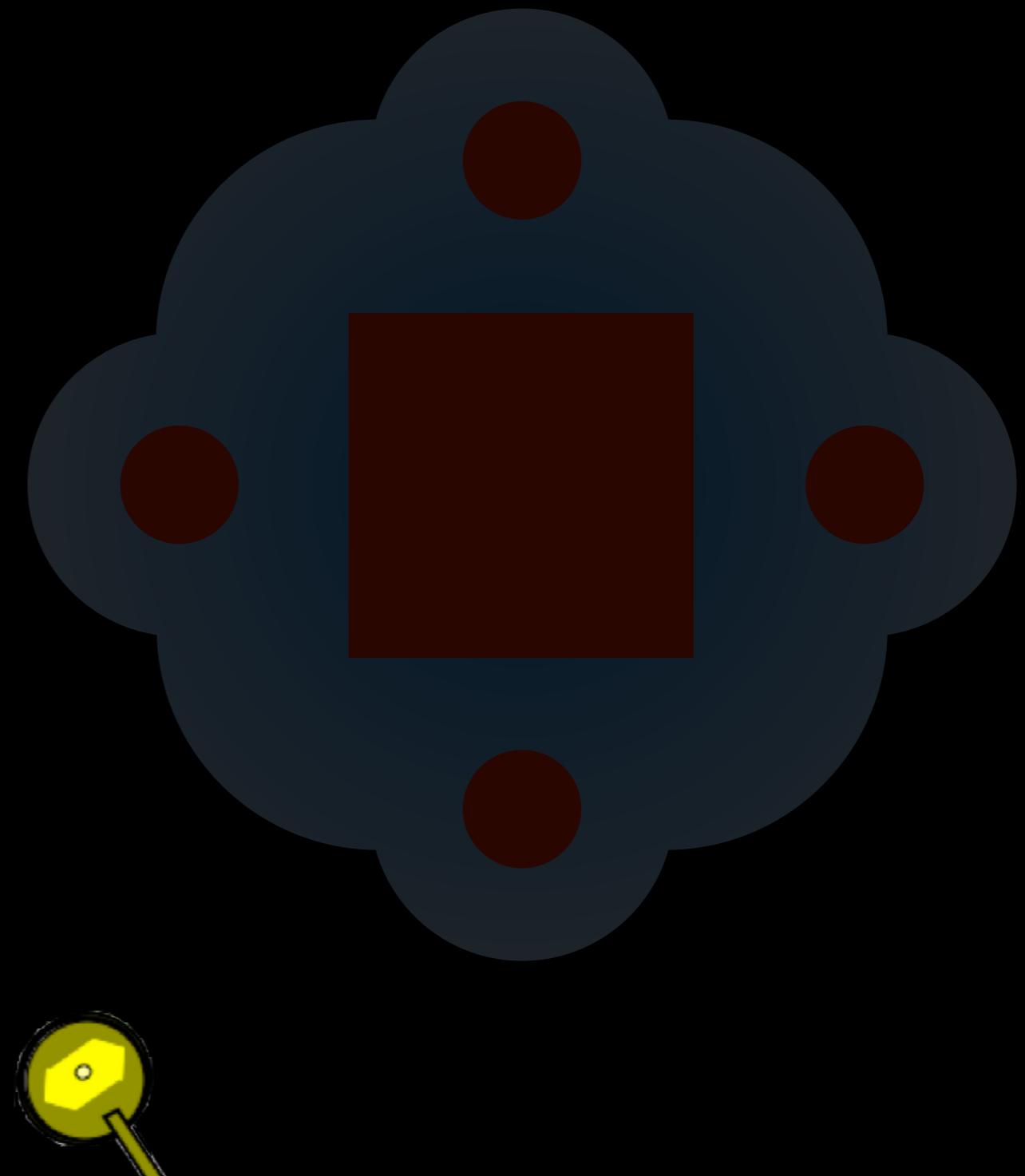
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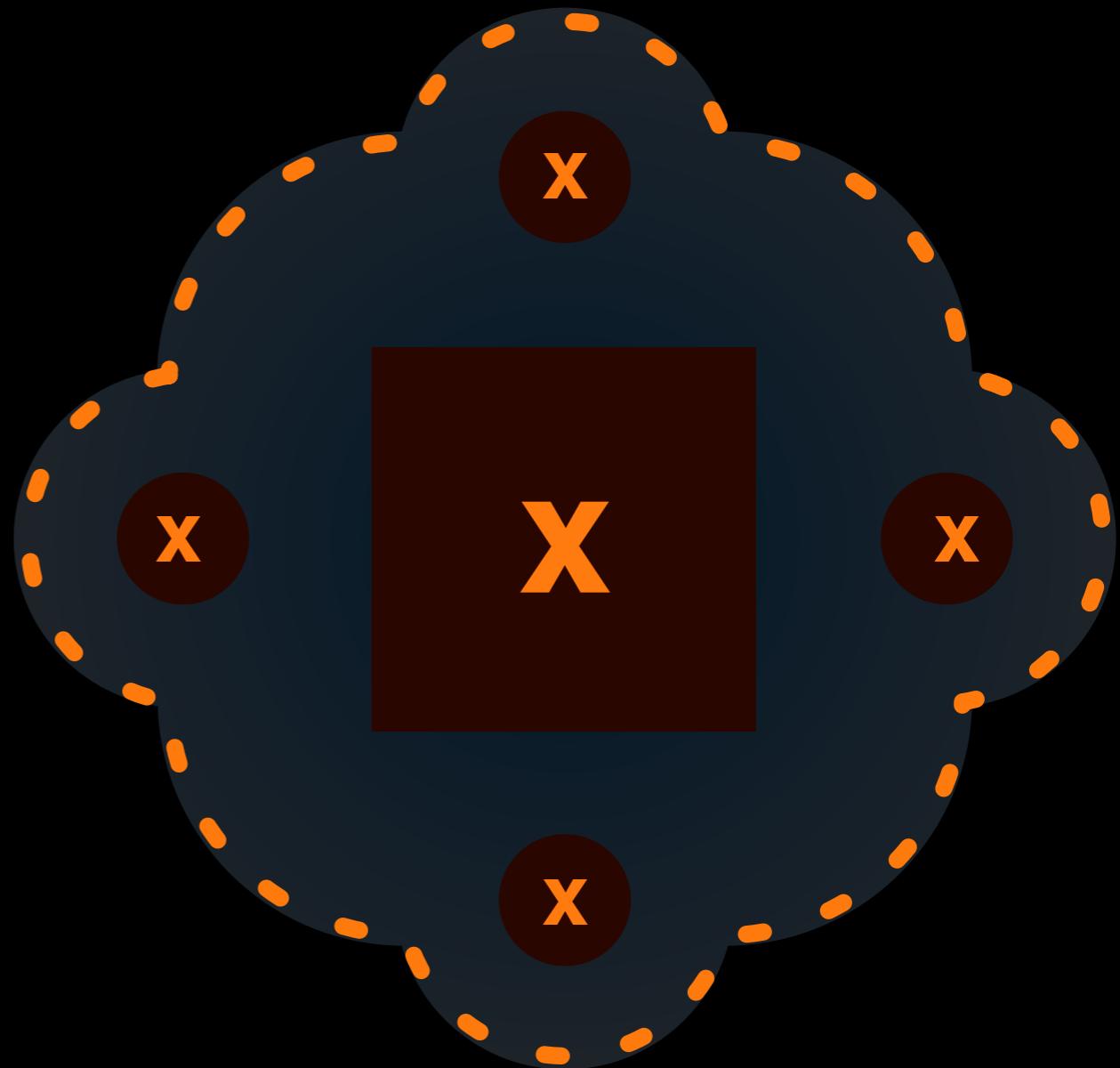
# Expert Approach: Metallic Signature Method

- Landmine detection still performed primarily with handheld metal detectors
- For every landmine, 100 pieces of metallic debris are found
- When mines are placed in a cluster configuration, it is hard to tell how many mines there are and where they are located
- Experts have a way of dealing with clutter and cluster configurations, but their method is hard to teach

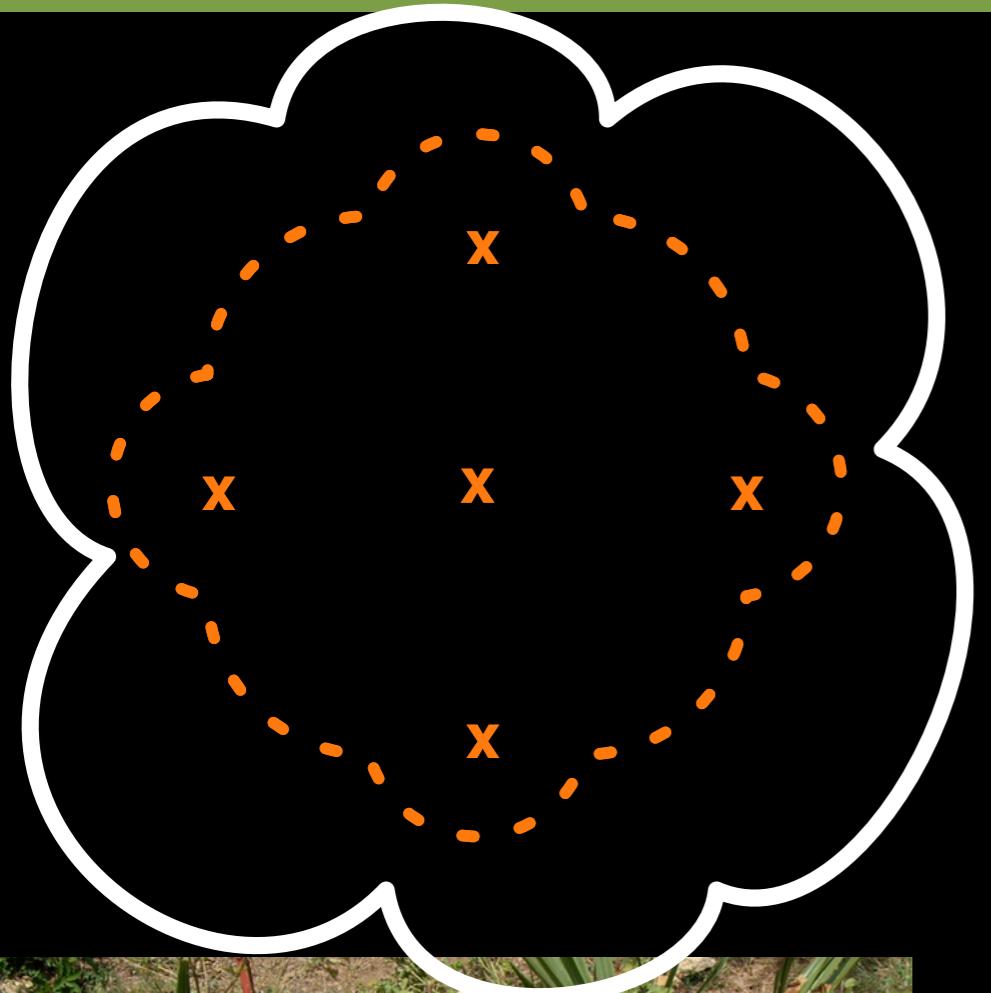


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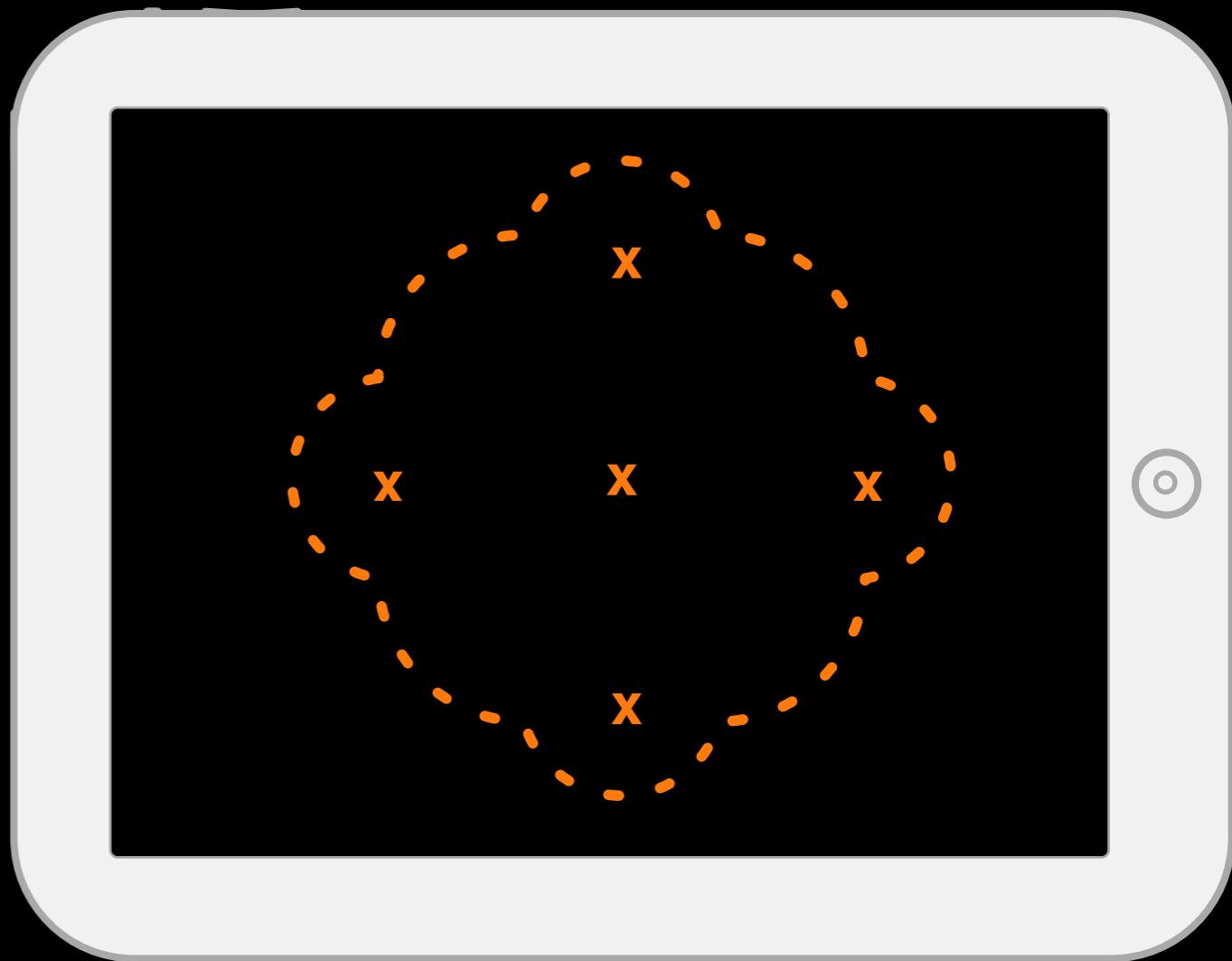
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# Key Idea: Visualize Metallic Signatures

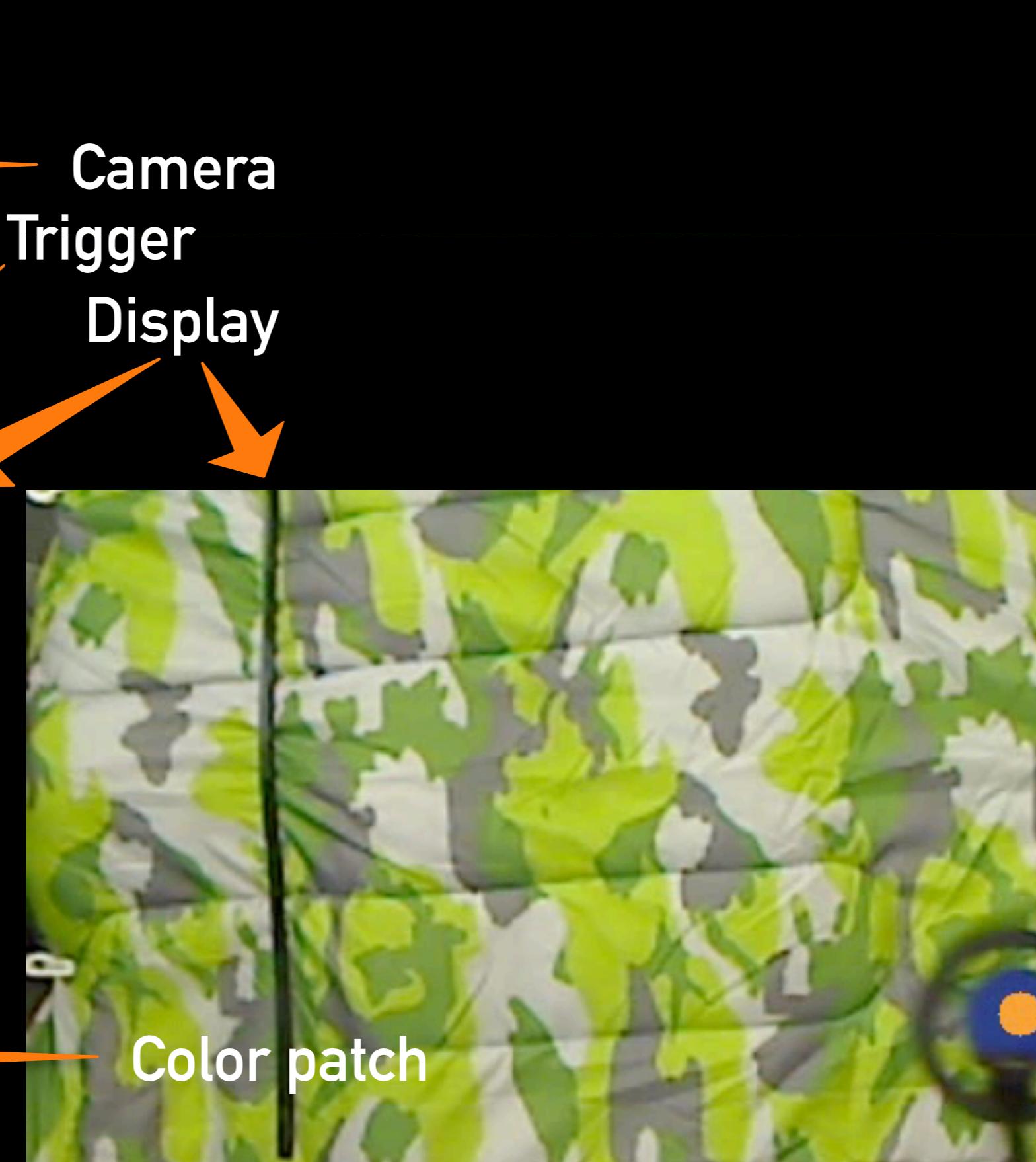
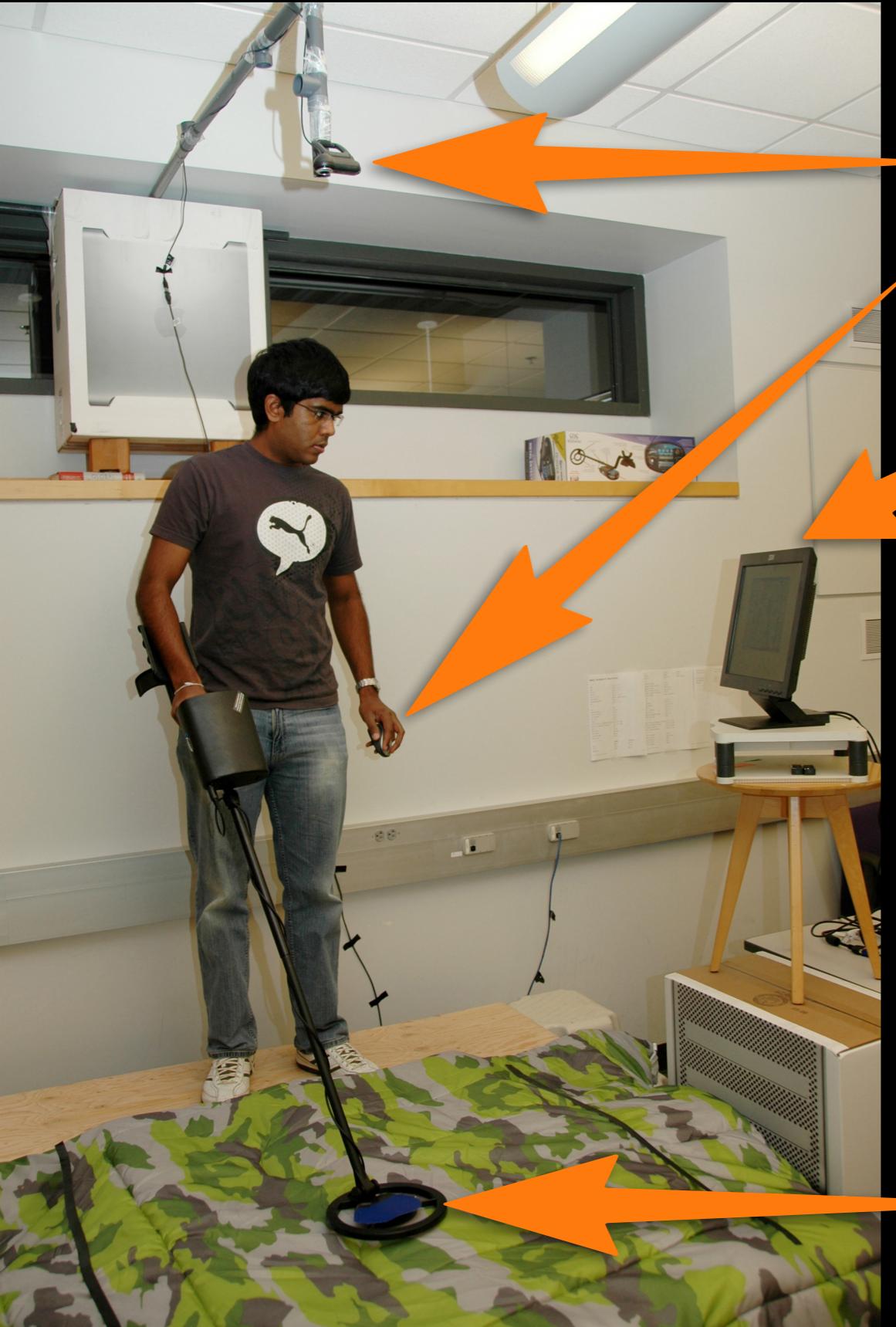


# Key Idea: Visualize Metallic Signatures



# Approach 0: Support Deminer in the Field

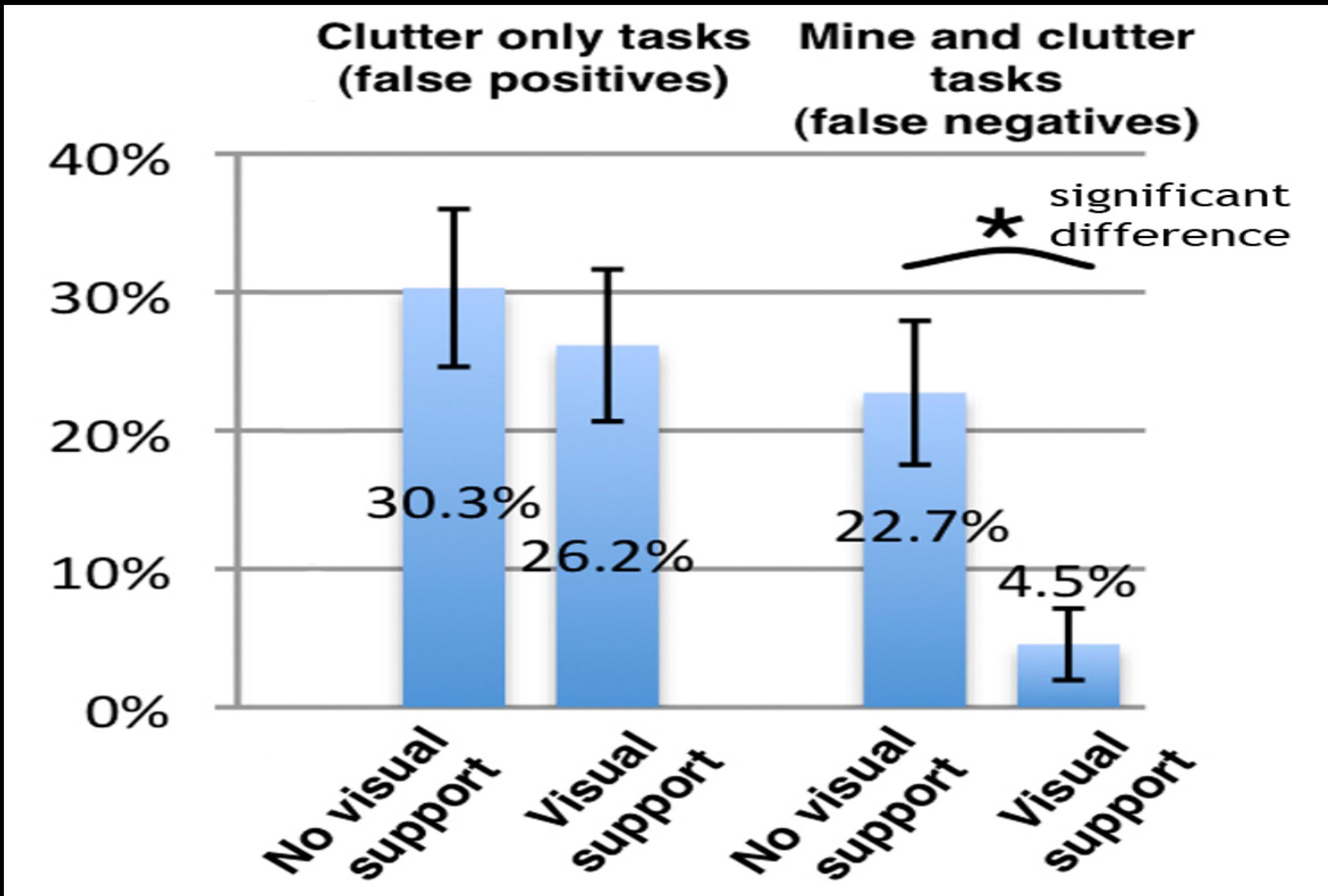
# Approach 0: Support Deminer in the Field



Camera  
Trigger  
Display

Color patch

# Approach 0: It Works! But...



# Approach 1: Scaffold Trainees' Learning

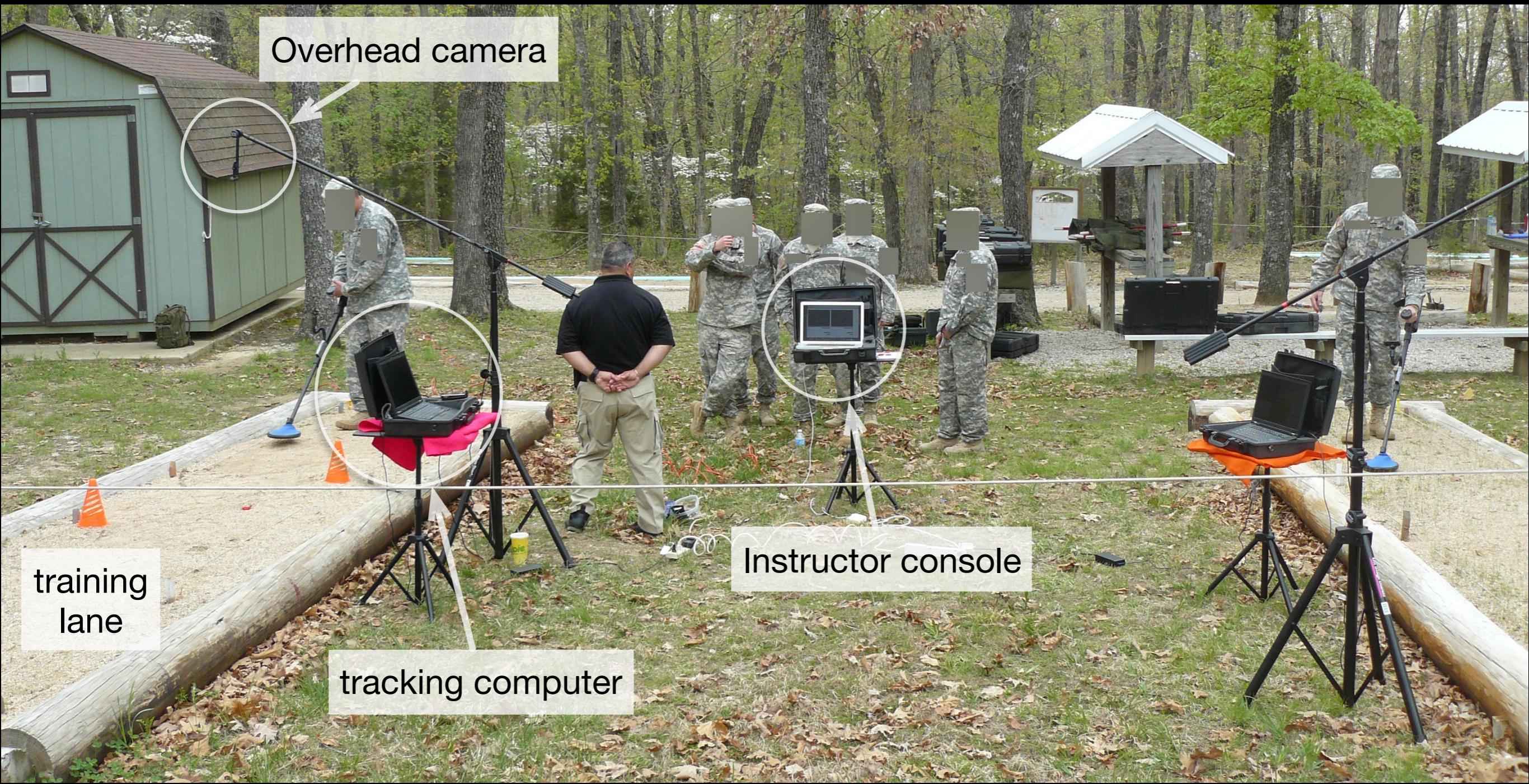
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Display

# Approach 1: Scaffold Trainees' Learning



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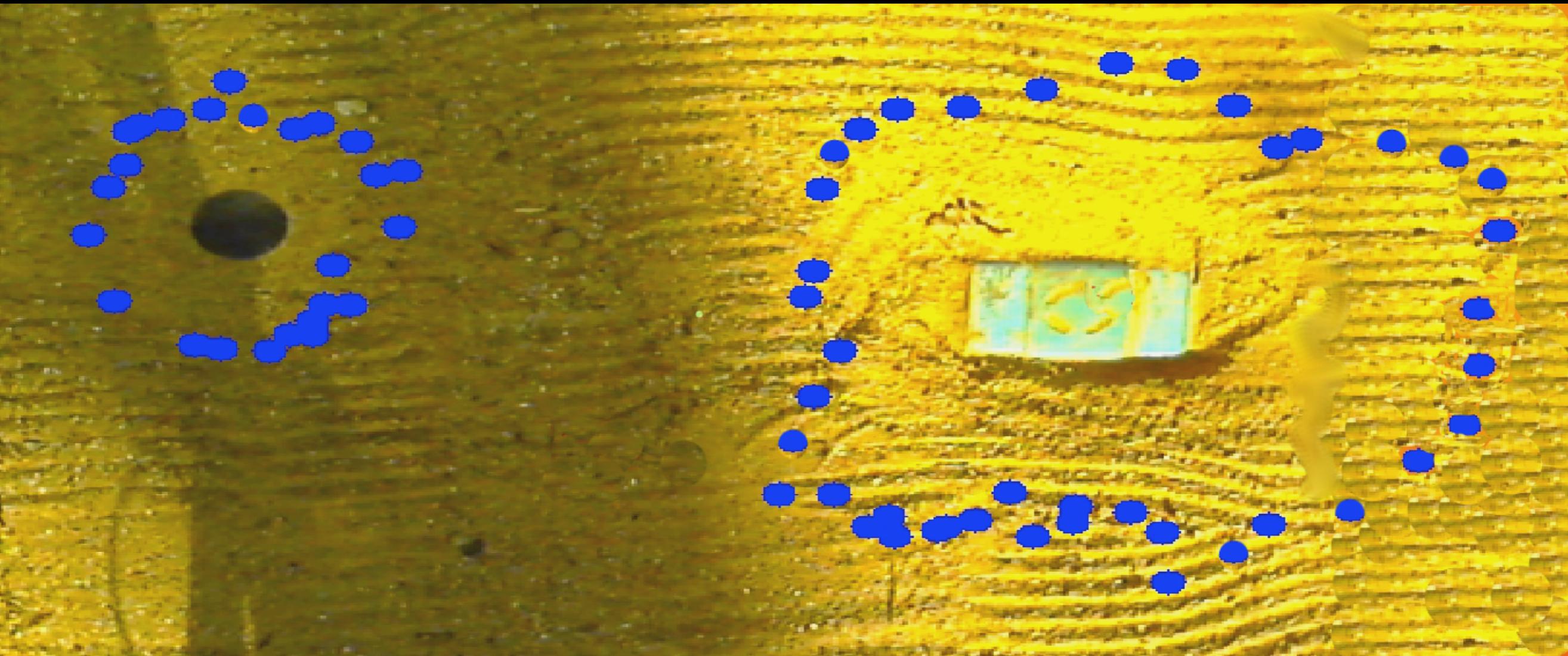
# Approach 1: Lessons Learned

- Real-time visualizations were not effective
- PETALS allowed instructors to monitor performance of multiple trainees simultaneously
- PETALS allowed instructors to communicate personalized process feedback after completion of each practice lane



# Approach 2: Support Instructors

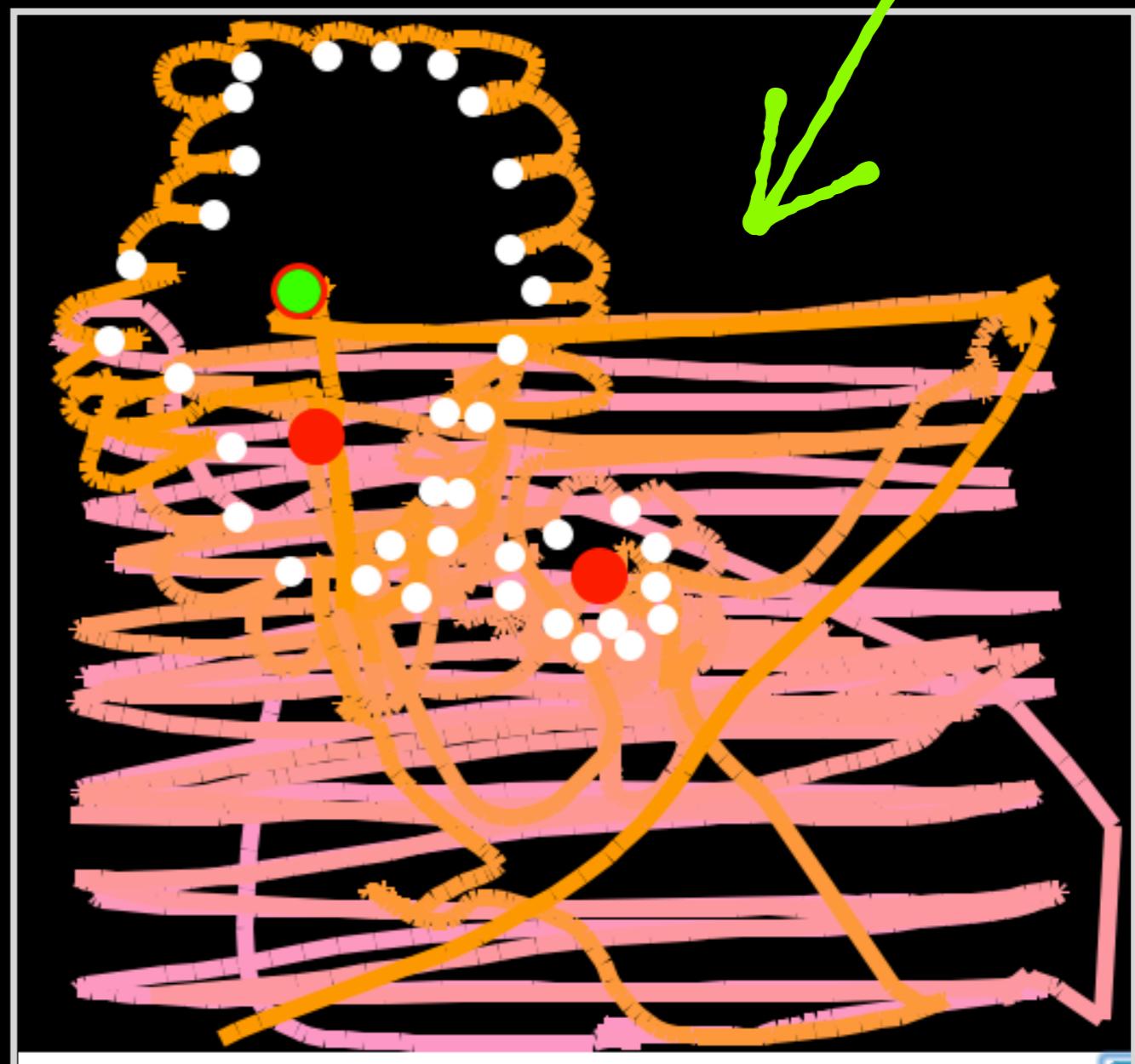
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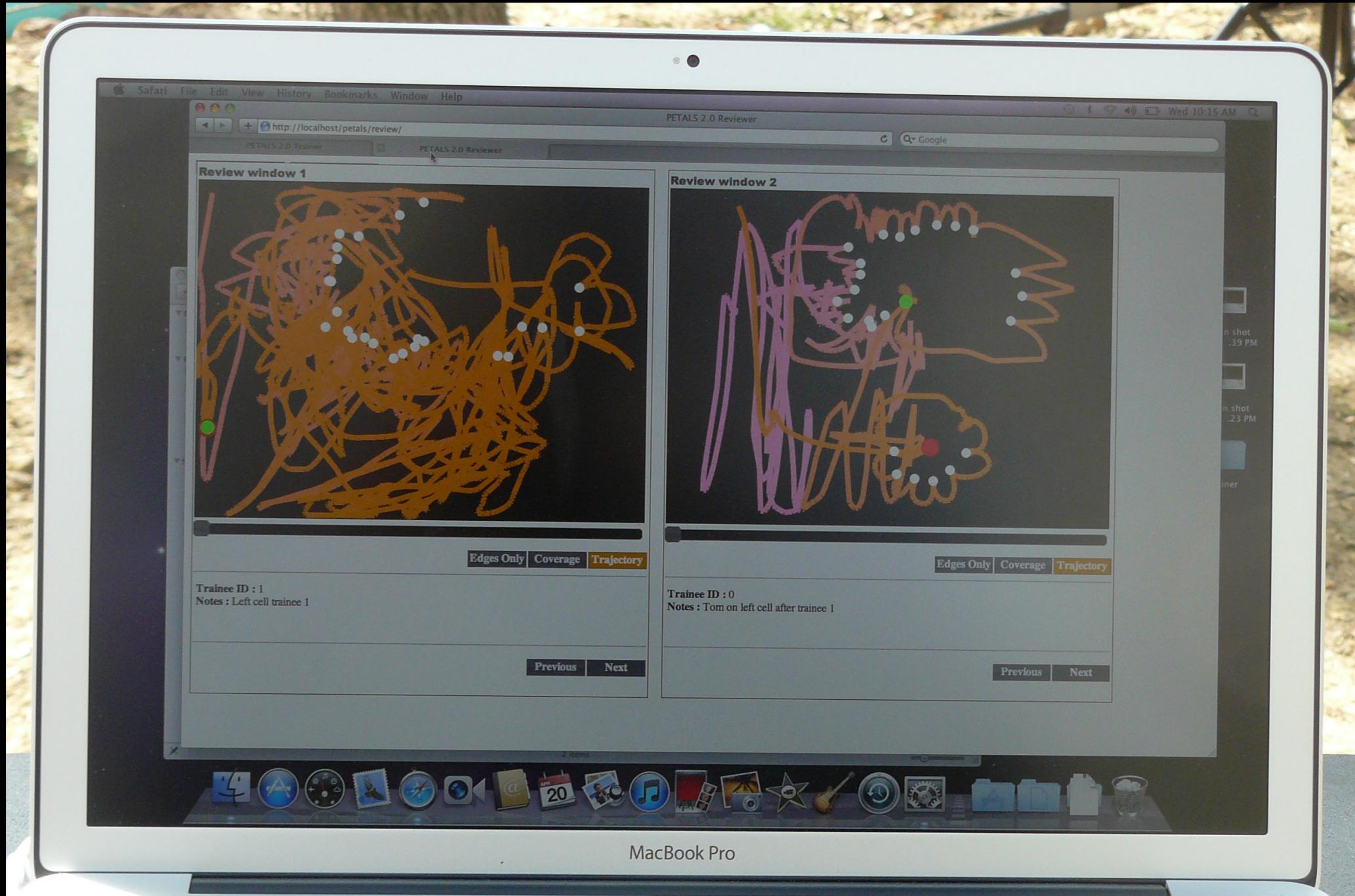


Gapping

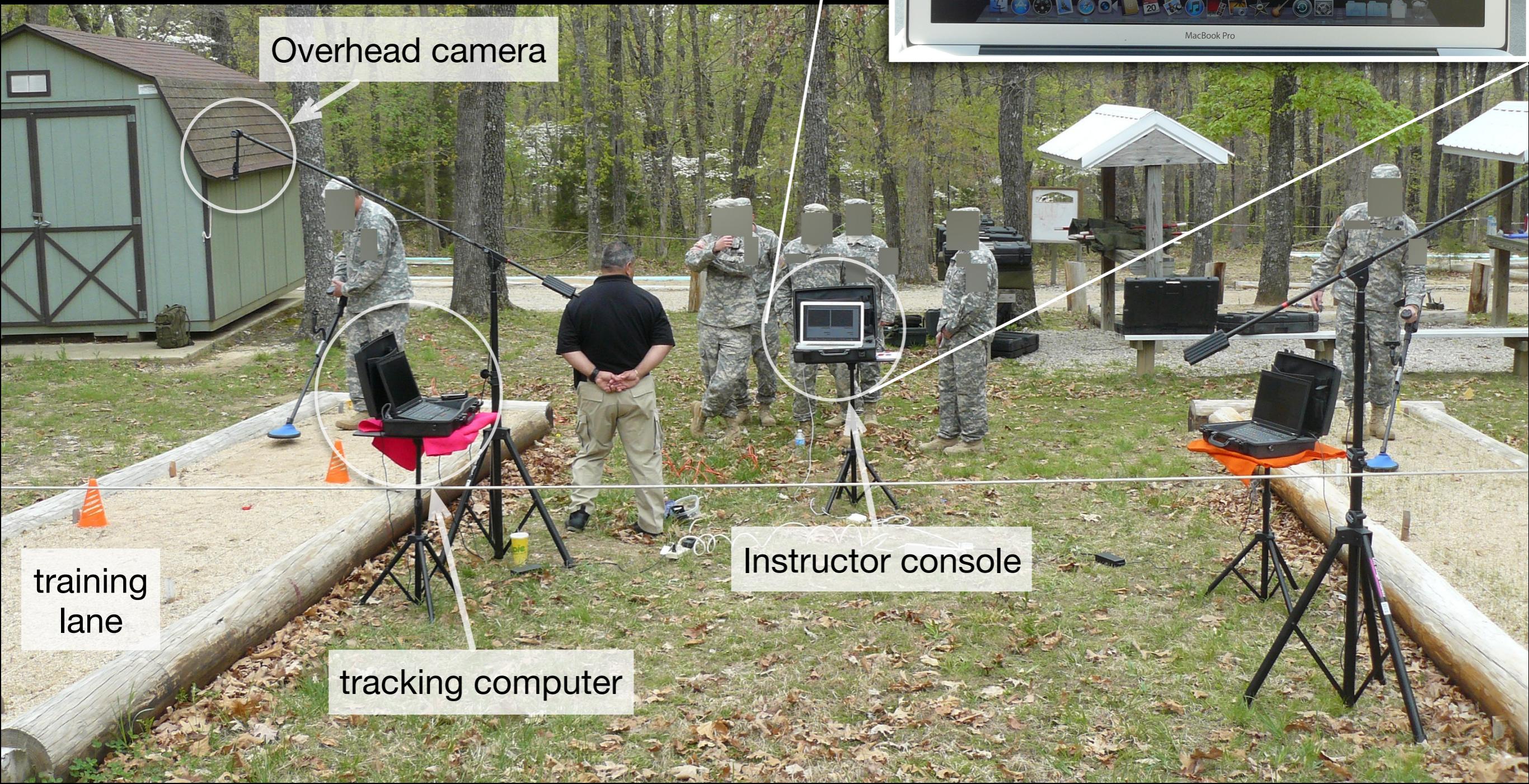


Target Lock

# Approach 2: Support Instructors



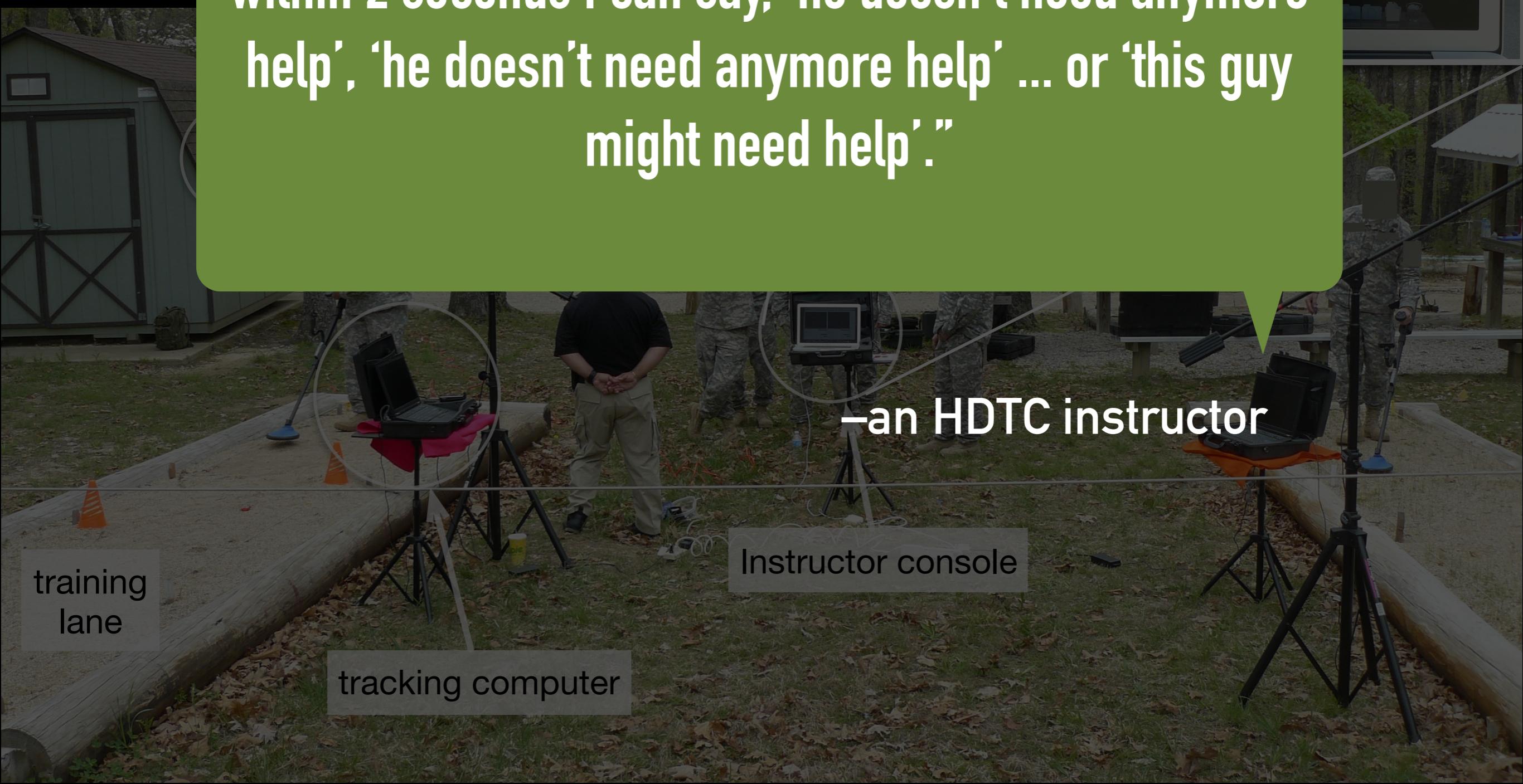
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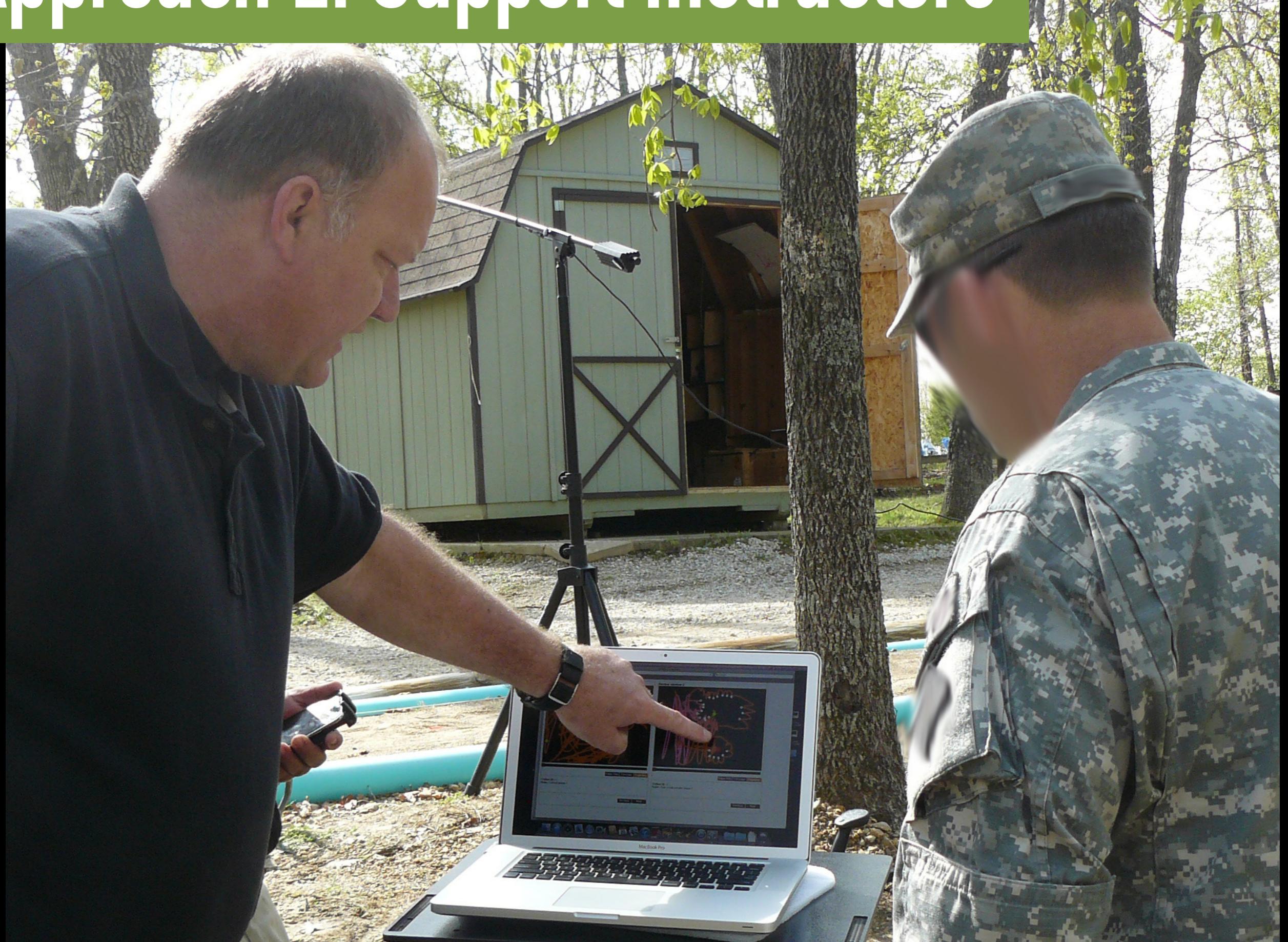
# Approach 2: Support Inst



**“I can walk up here [to the instructor console] and within 2 seconds I can say, ‘he doesn’t need anymore help’, ‘he doesn’t need anymore help’ ... or ‘this guy might need help’.”**



# Approach 2: Support Instructors



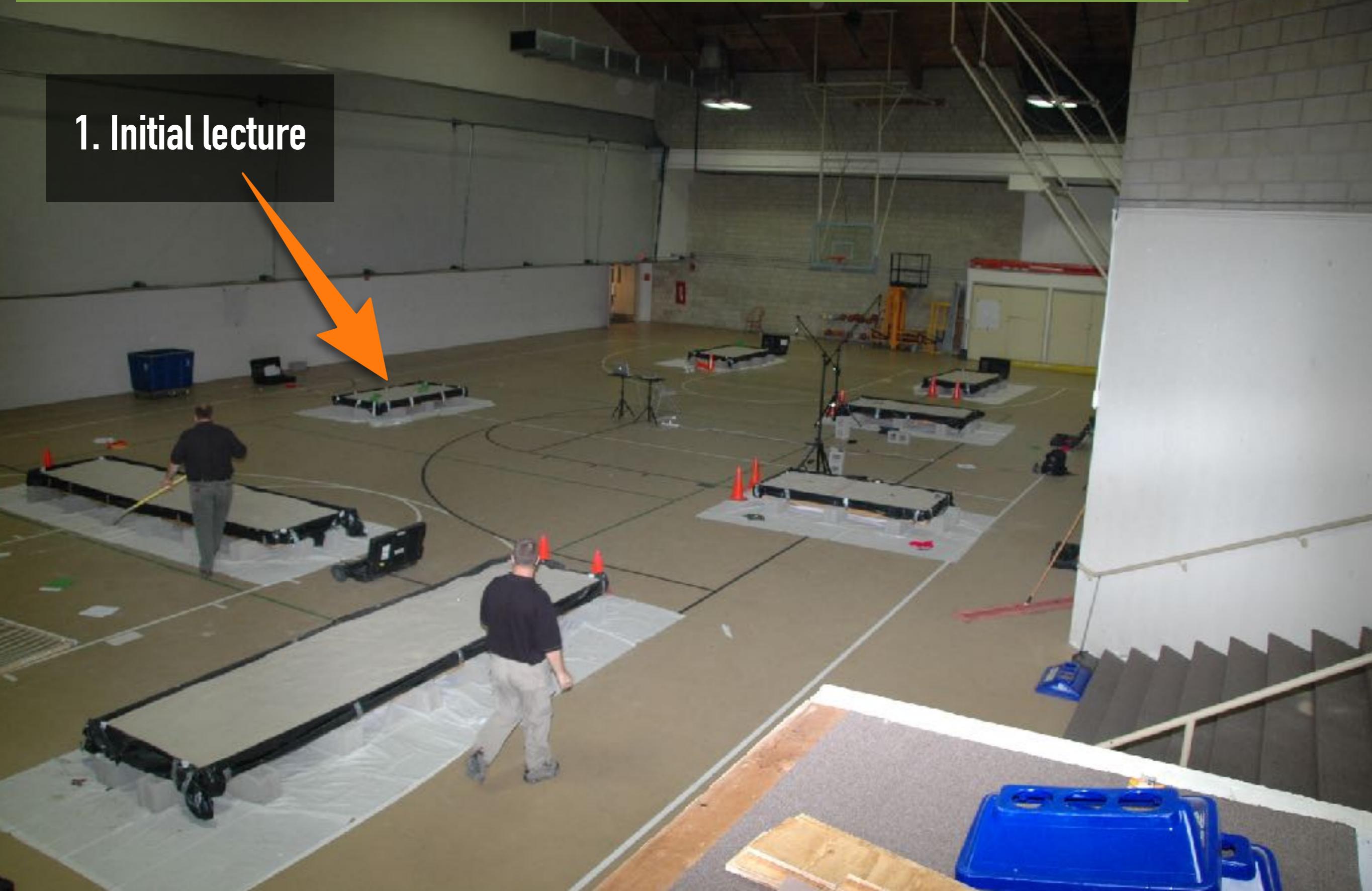
# Summative Evaluation

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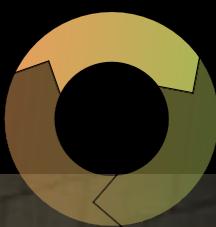


# Summative Evaluation

1. Initial lecture



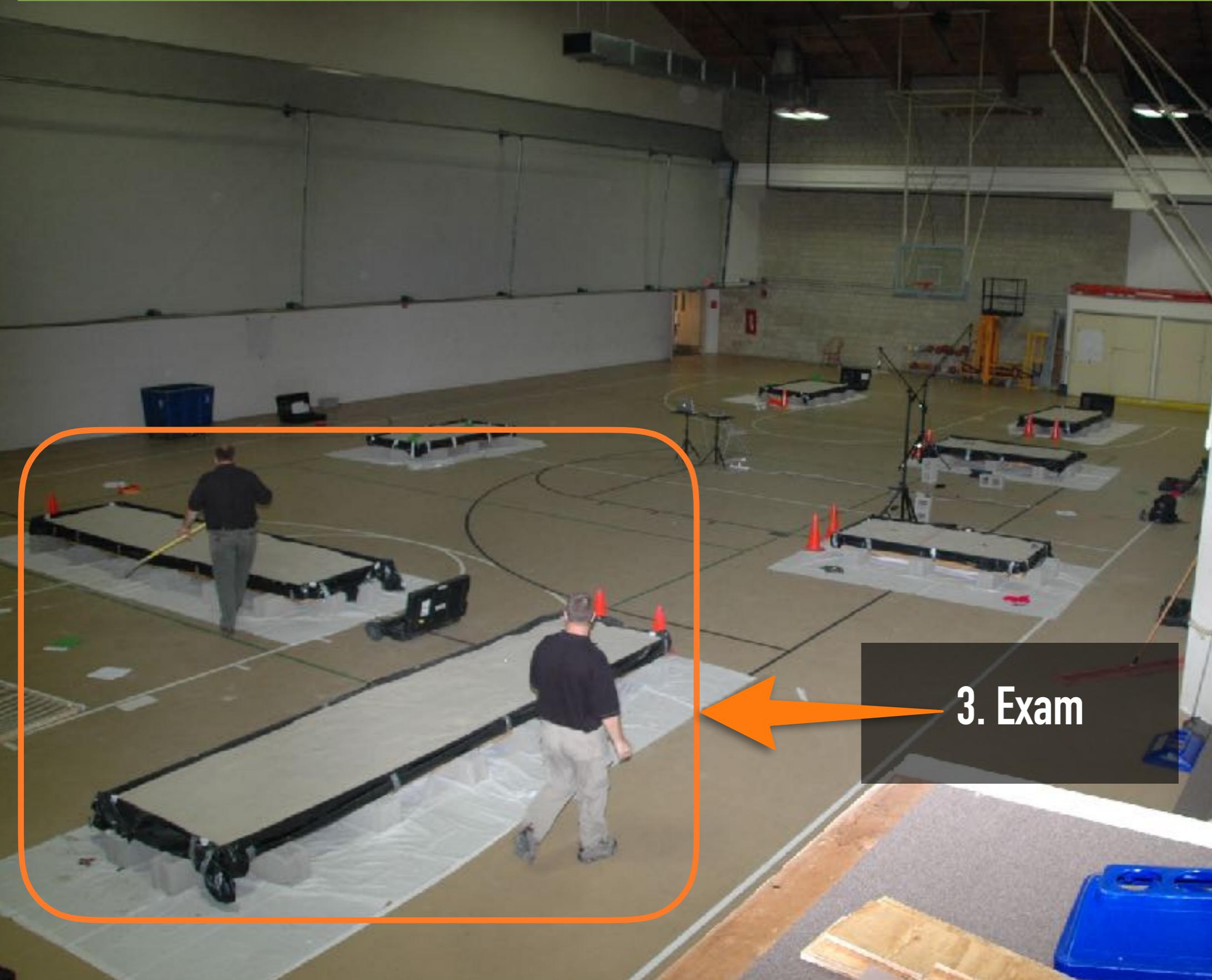
# Summative Evaluation



2. Training



# Summative Evaluation



# 1. Initial lecture



## 2. Training



## 2. Training



## 2. Training



# 3. Exam



# Take Aways

- Metal detectors are still the primary tool in humanitarian landmine clearance



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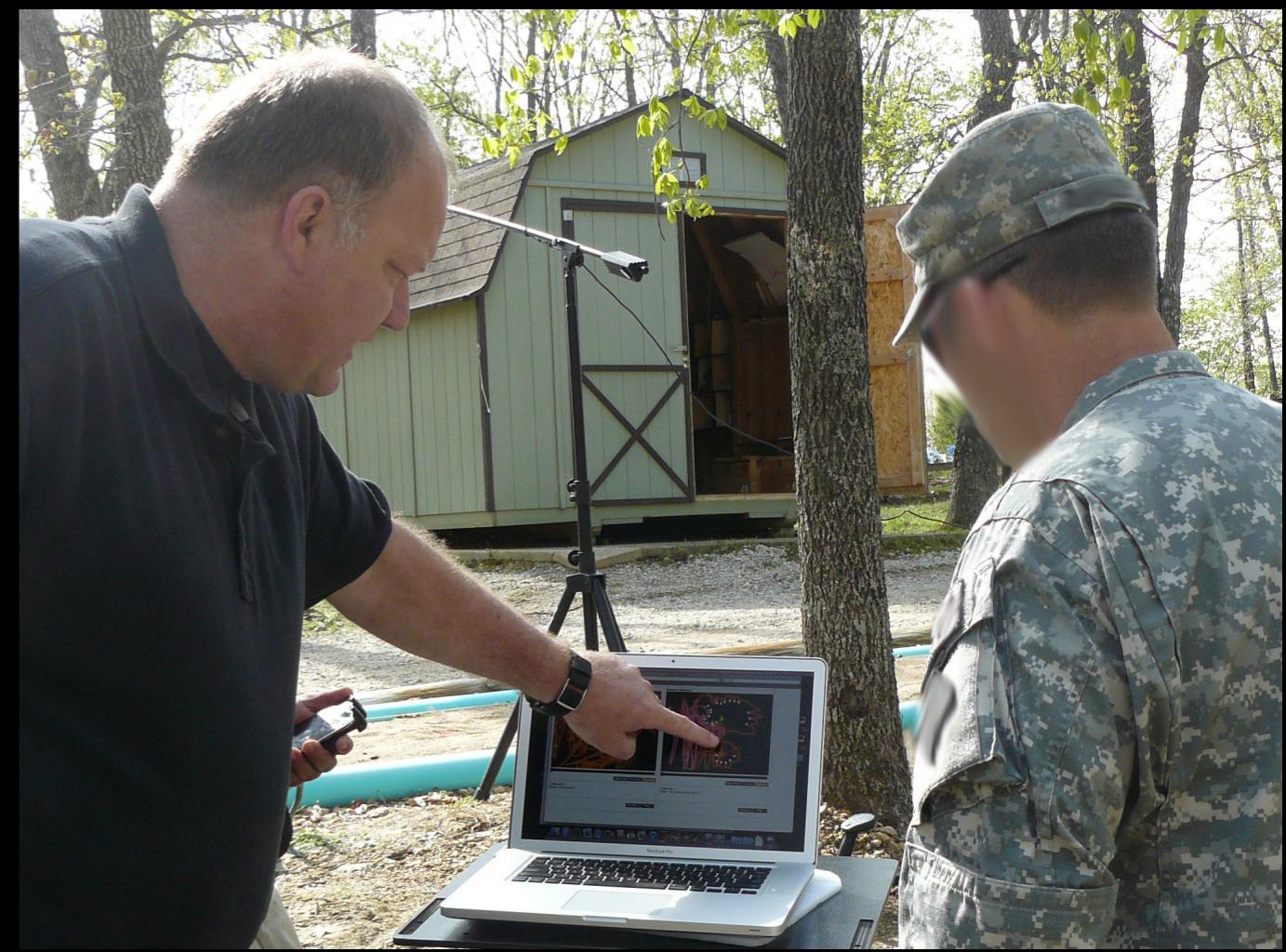
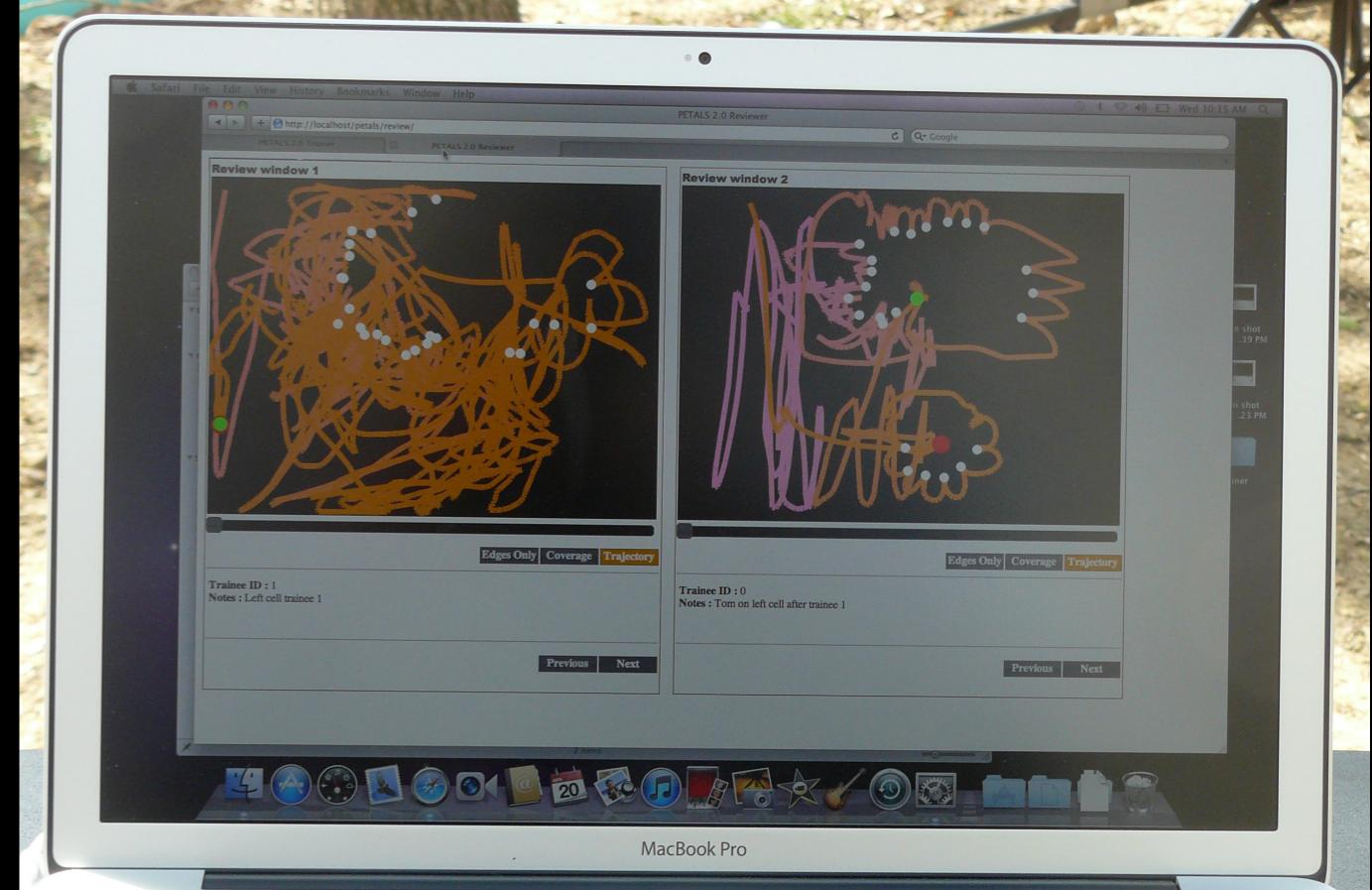
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# Innovation = Invention + Implementation

