Automated Credibility Assessment for Border Security

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Artificial Intelligence Lab

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Deception Defined

- **Deception is a message knowingly transmitted with the intent to foster false beliefs or conclusions**

- **Covers common outright deceptions**
  - **Fabrications, misdirections, bluffs, etc.**

- **Also covers:**
  - **Omissions, concealments, evasions, strategic ambiguity, etc.**

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Why?

- **Humans are poor lie-detectors**
  - **~54% accuracy rate for general population**
  - **Accuracy is a function of the quality of base rates**
  - **Poor performance affects novices and professionals**

- **Confidence in judgment is not correlated with accuracy**
  - **Affects attentiveness, verification efforts, and misallocation of resources**

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Some Facts About Lying

- **We hear 20-200 lies each day**
- **1 in 5 employees is aware of fraud in their workplace**
- **Some lies are considered polite or even beneficial**
- **Humans are poor lie detectors: 54% accurate by meta-analysis estimate (Bond and DePaulo 2006)**
  - **Untrained, unaided observers across 206 studies**
  - **47% accurate for lies**
  - **61% truths**

Real Problem

- **How do you identify a terrorist, fraudulent documentation, or contraband smuggling criminals among millions of legitimate borders crossers?**
  - **Can't simply clamp down security on ports**
    - **Approximately 400000 individuals cross the land border daily, most to make a living and conduct business**
  - **Airports need both profit and security to operate**
    - **Major airports reaching capacity**
    - **Demand steadily increasing**
  - **Additional screening time disrupts entire global airline system**

The Scientific Foundation

Interpersonal Deception Theory: Deception is Strategic, Dynamic

6
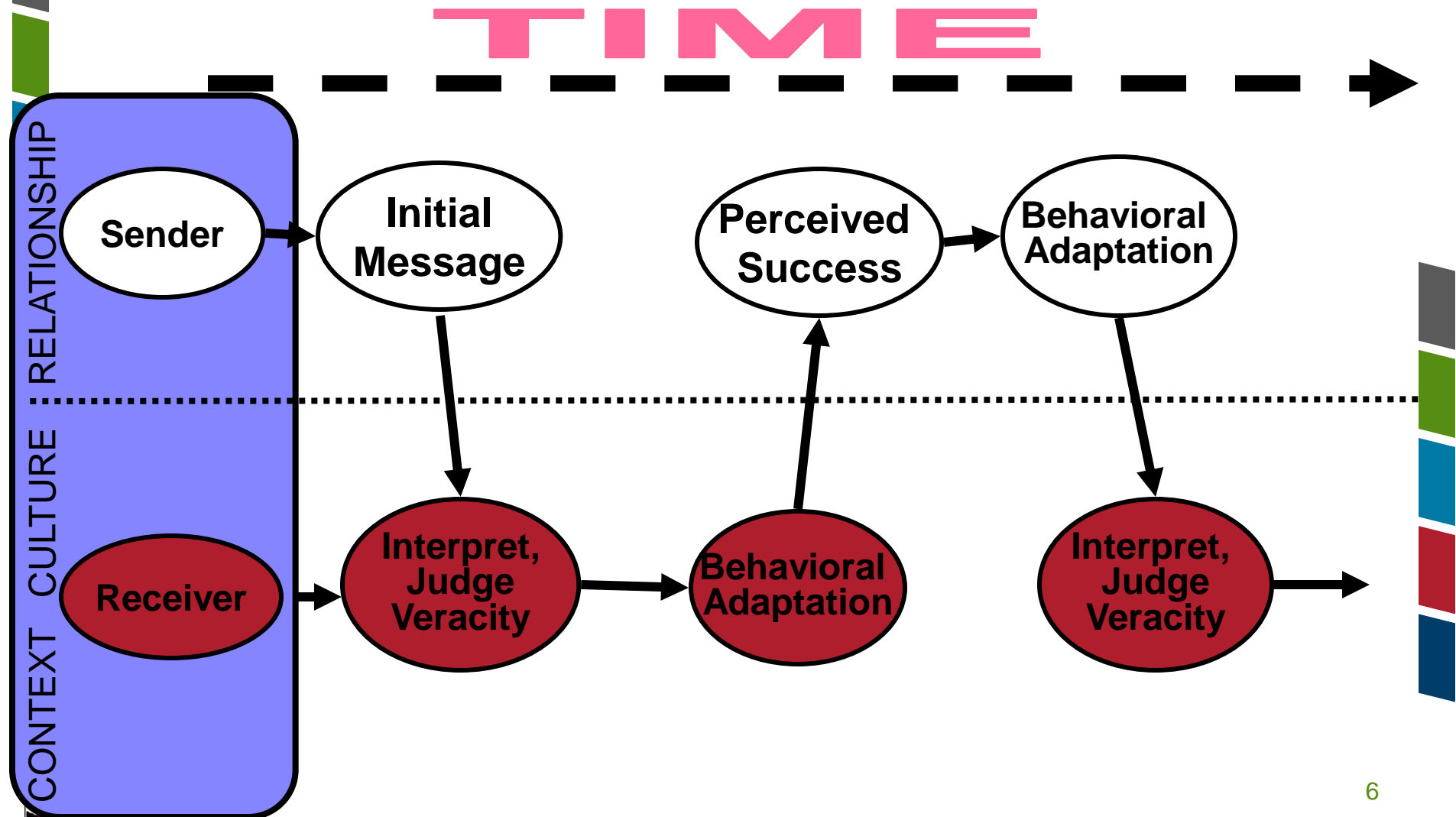
Five Classes of Indicators

Nonstrategic

Nonrational, uncontrollable, and/or uncontrolled behaviors

- **Arousal-based indicators**
  - **Higher psychophysiological activation with deception**
- **Emotion-based indicators**
  - **Nonverbal cues of guilt or fear and use of emotional language**
- **Memory-based processes**
  - **Recollections of imagined vs. real events**

Strategic

Thoughtful, premeditated, planned, rehearsed, and/or monitored behaviors

- **Behavioral control**
  - **Efforts to hide or control telltale signs**
- **Communication strategies and tactics**
  - **Deliberate efforts to manage what is said**
  - **Demeanor/self-presentation**

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Sample Deception Indicators

vocal tension	fewer sensory details	simpler language	unpleasant voice
false smiles	long response time	gaze avoidance	submissiveness
random trunk & limb movement	greater uncertainty	Increased loudness	message length
nervous laughter	higher pitch	lack of gestures	postural rigidity

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What is the AVATAR?

Capabilities of the AVATAR

- **Credibility assessment**
  - **Non-invasive**
  - **Non-intrusive**
- **Automated interviewing**
  - **Force multiplier**
- **Identification**
  - **Biometric**
  - **Documentation**
  - **Biographic (in progress)**
- **Processes and fuses multiple cues simultaneously**

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Non-Invasive Sensors

Psychophysiological & Behavioral Measures

Force Platform

Motion Sensors (Kinect)

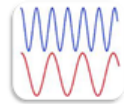HD Cameras

Thermal Cameras

Oculometric Cameras

Array Microphone
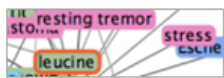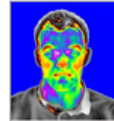
Natural Language Processing

Body Movement
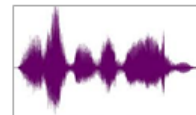Proxemics
Postural Anomalies

Heart Rate
Respiration

Facial Movement
Facial Expressions

Facial Temperature
Pore Activation

Gaze Patterns
Blinking Patterns
Pupil Dilation

Vocalics
Linguistics

DATA FUSION ENGINE

Risk Assessment

Screening Officer

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11

2008

Overview of Experiments and Studies

- **Over 7000   experiments subjects**
- **Over 35**

-Desert Survival	-Air Force Security
-Mock Crime	Police Statement
-Morphing	-Decision Support
-Vigilance	-Mock Theft
	-Bomb Screening
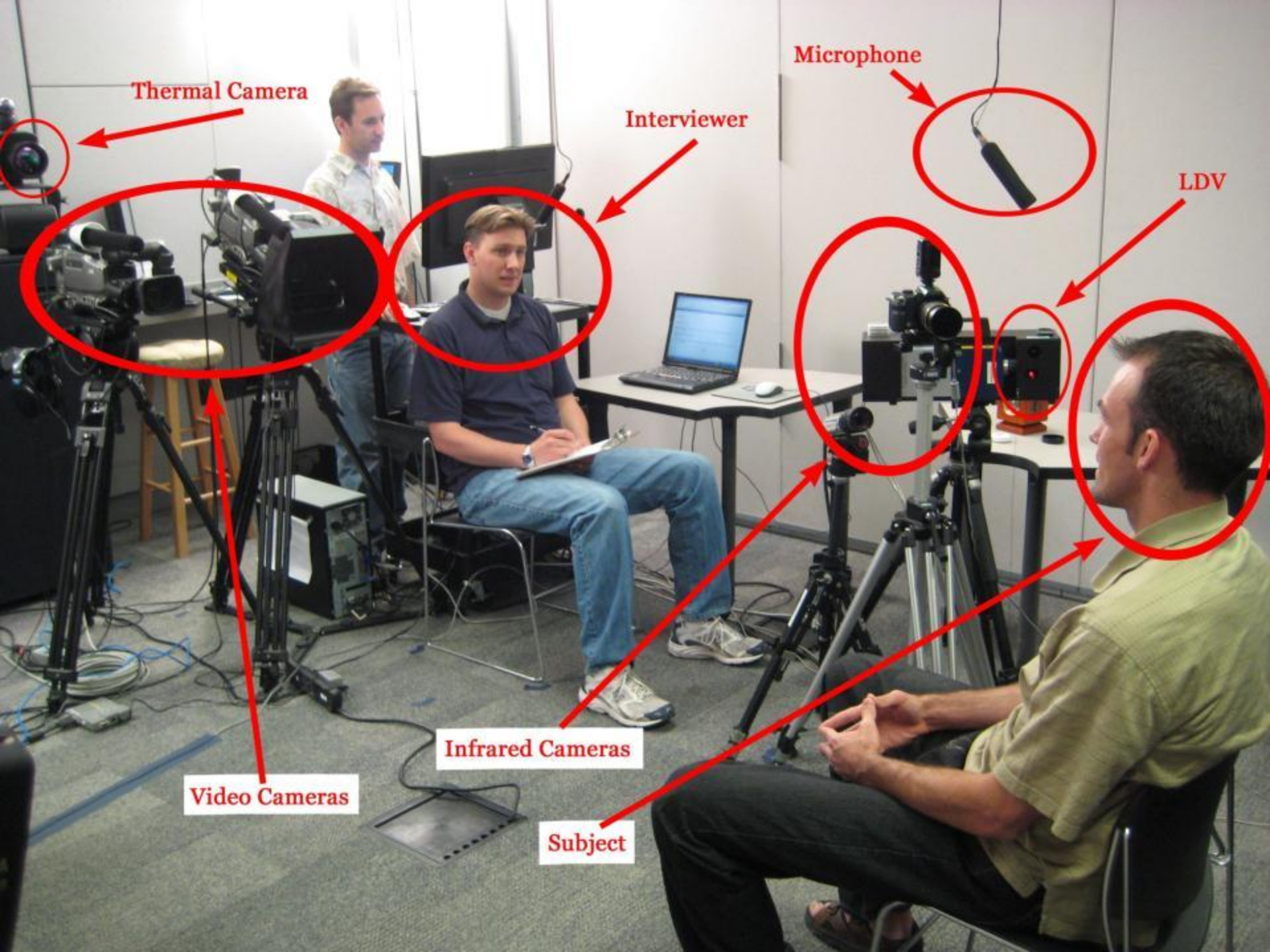
First Prototype

2009

Second Prototype

Dynamic AVATAR Interviewers

2010

Generation 3 Kiosk

Motorized Tilt and MS LifeCam

22" LCD

EyeTech Device

Microphone

19" Touchscreen LCD

pcProx proximity HID

Futronic Finger Print Scanner

ID Tech Insert Card Reader

Radius Corners

Radius Corners

Aim Height is 1753 mm

Aiming EyeTech Device

Distance from Device 686 mm

Half Tube / Cable Route

Mounting for EyeTech

Overhead Blade Attachment

Fans

Vent Holes

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Incorporating Identification Technology

- **Automated Kiosk**
- **Interactive intelligent agent**
  - **Embedded sensors**
  - **Avatar-based interviewer**
  - **Expert system**
- **Biometric reader**
- **Passport reader**
- **Multilingual capacity**

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The Importance of Appearance

FRONTEX 2010: Experiment 1

Artificial Intelligence for Screening and Decision Support at Border Crossings

- **BORDERS conducted a workshop in Warsaw, Poland**

- **Attendees included European Union Border Guards**

- **Workshop objectives included:**
  - **Understanding best practices and challenges of EU Border Guards**
  - **Demonstrating new technologies for screening**
 - **Exploring successful indicators for detecting deception and hostile intent**
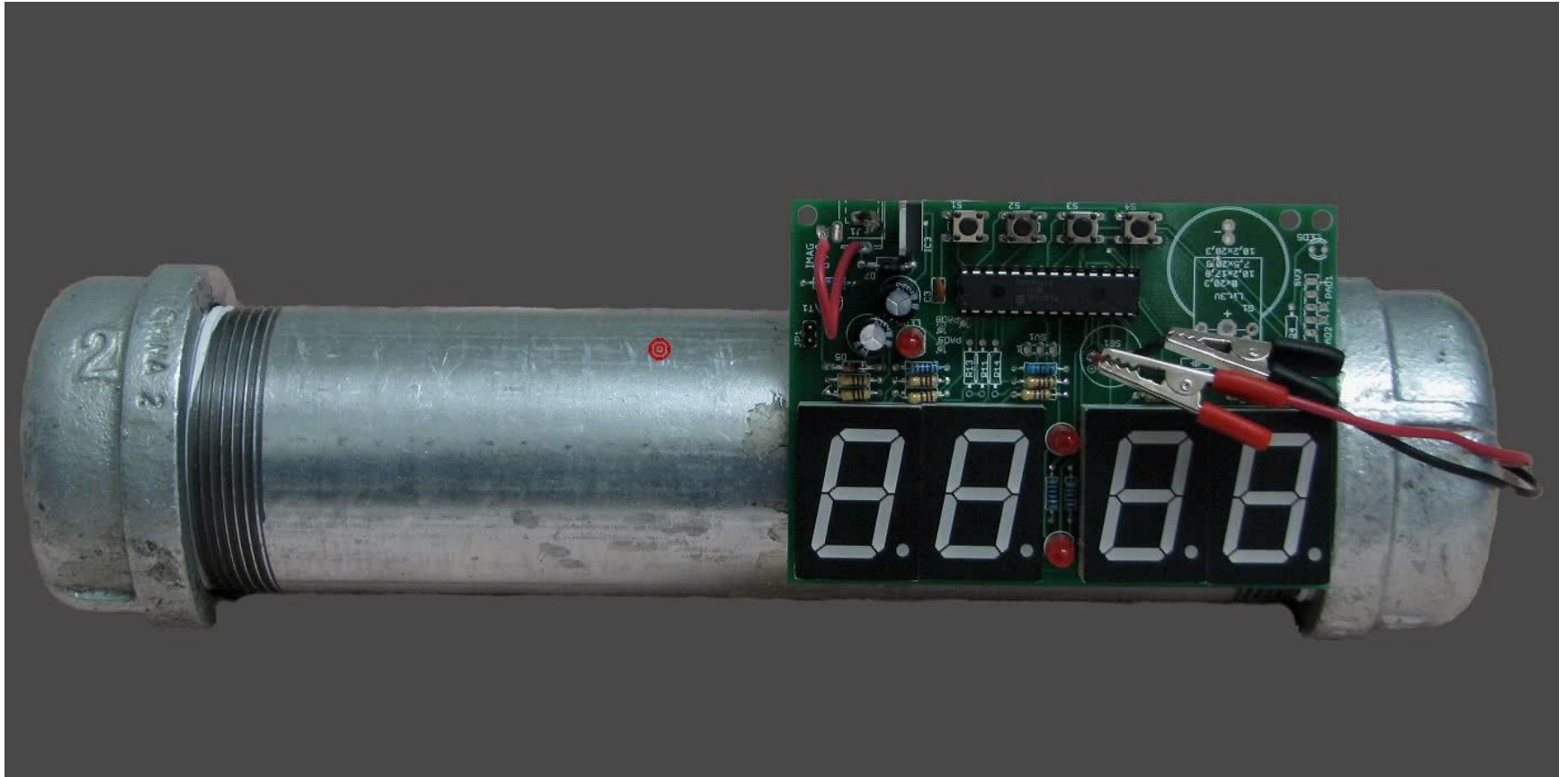
Polish
Border Guards

Study Overview

- Two-treatment, between-group design
- Control group (non-bomb-making condition)
- Simulated bomb and the bomb making materials
- Kiosk presents images of the bomb
- Eye tracker monitors eye behavior
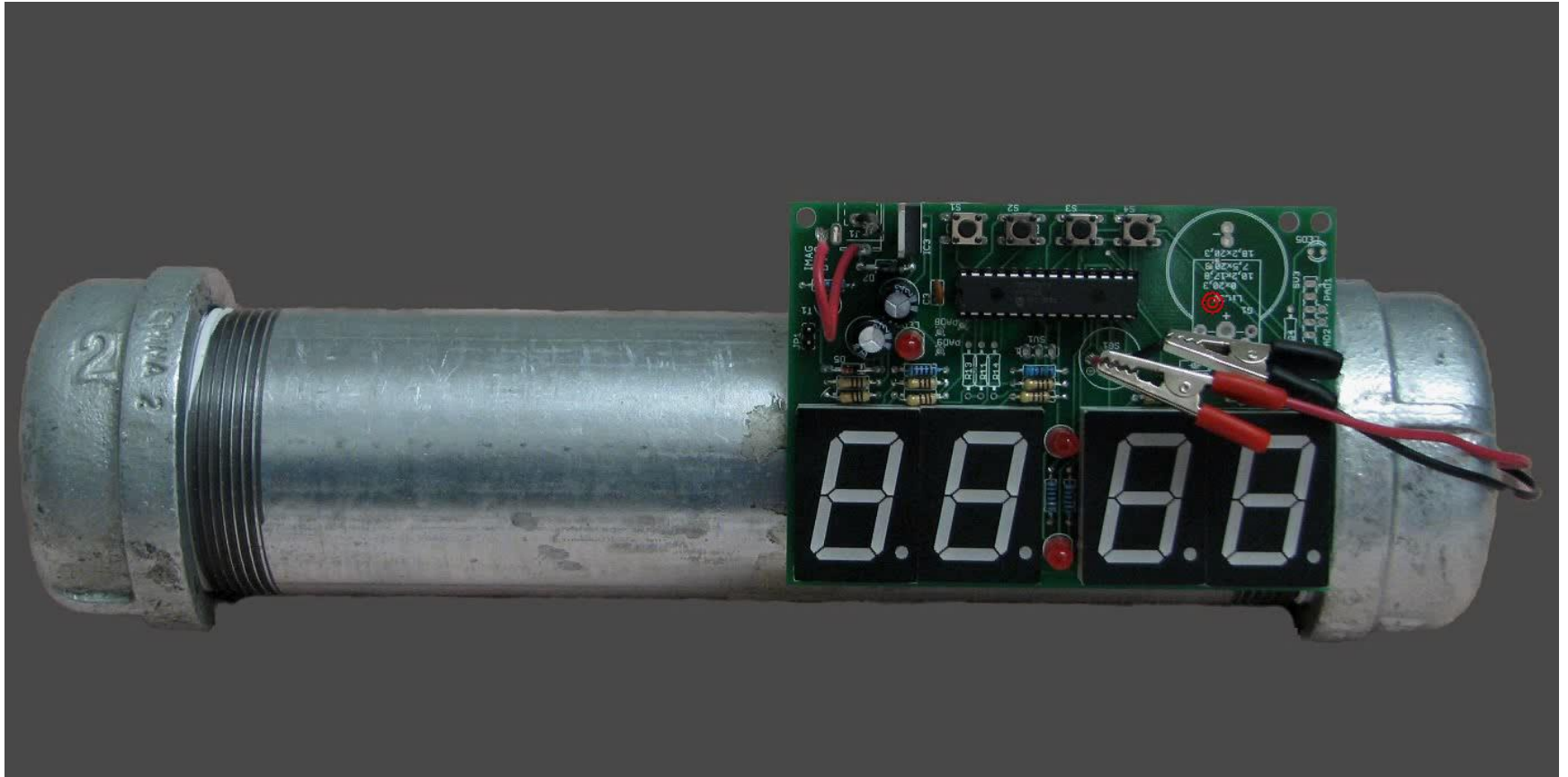- Classify the person as having guilty knowledge or not
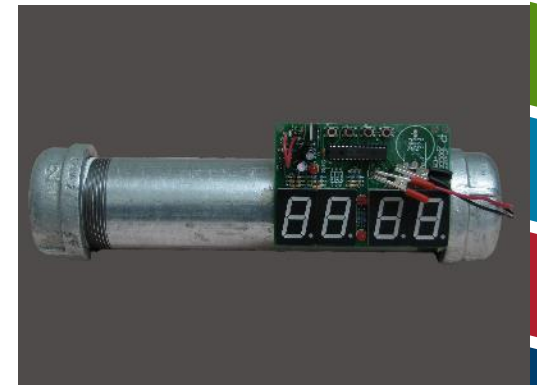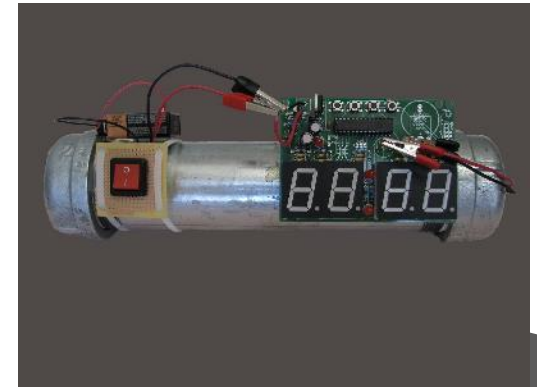
Sample

- **60 total participants**
  - **30 MIS students**
  - **30 professional EU border guards and research personnel from 17 countries**
- **Gaze behavior very similar**
- **Pupil dilation behavior not as similar**

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Eye Gaze: Guilty

Eye Gaze: Innocent

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2011

San Diego State University

First Modular Prototype

Frontex 2011: Experiment 2 Document Fraud Detection

- **4 "Terrorists" trying to get past a checkpoint using a valid document with false information**

- **Explore real-time information to officer (enhance decision making)**

- **Exercise conducted to identify false visa documents in Warsaw, Poland**

- **Interviews conducted in five language based on automated passport scan**

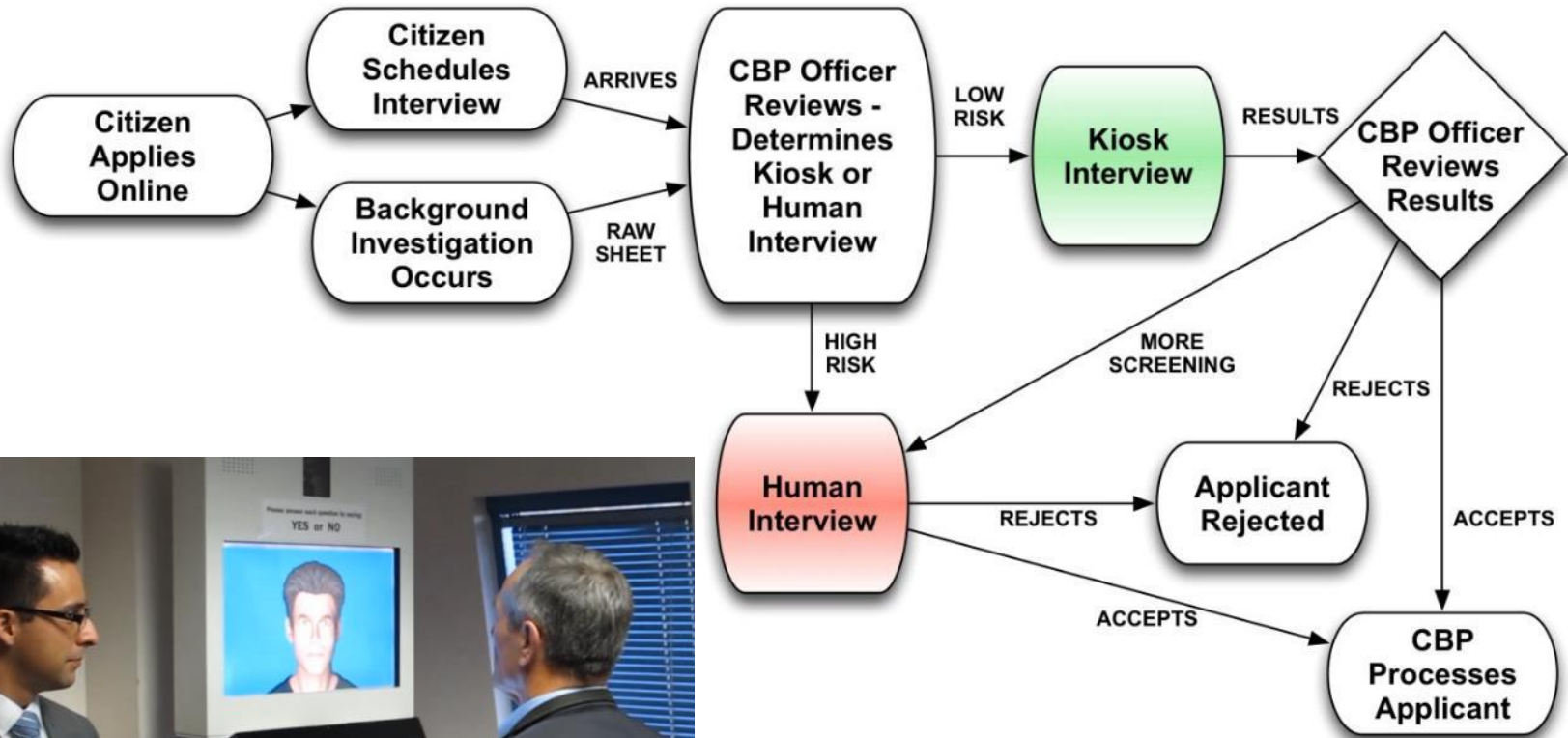- **Interface for border guard operation and support by AVATAR**

2012

Trusted Traveler Application Process
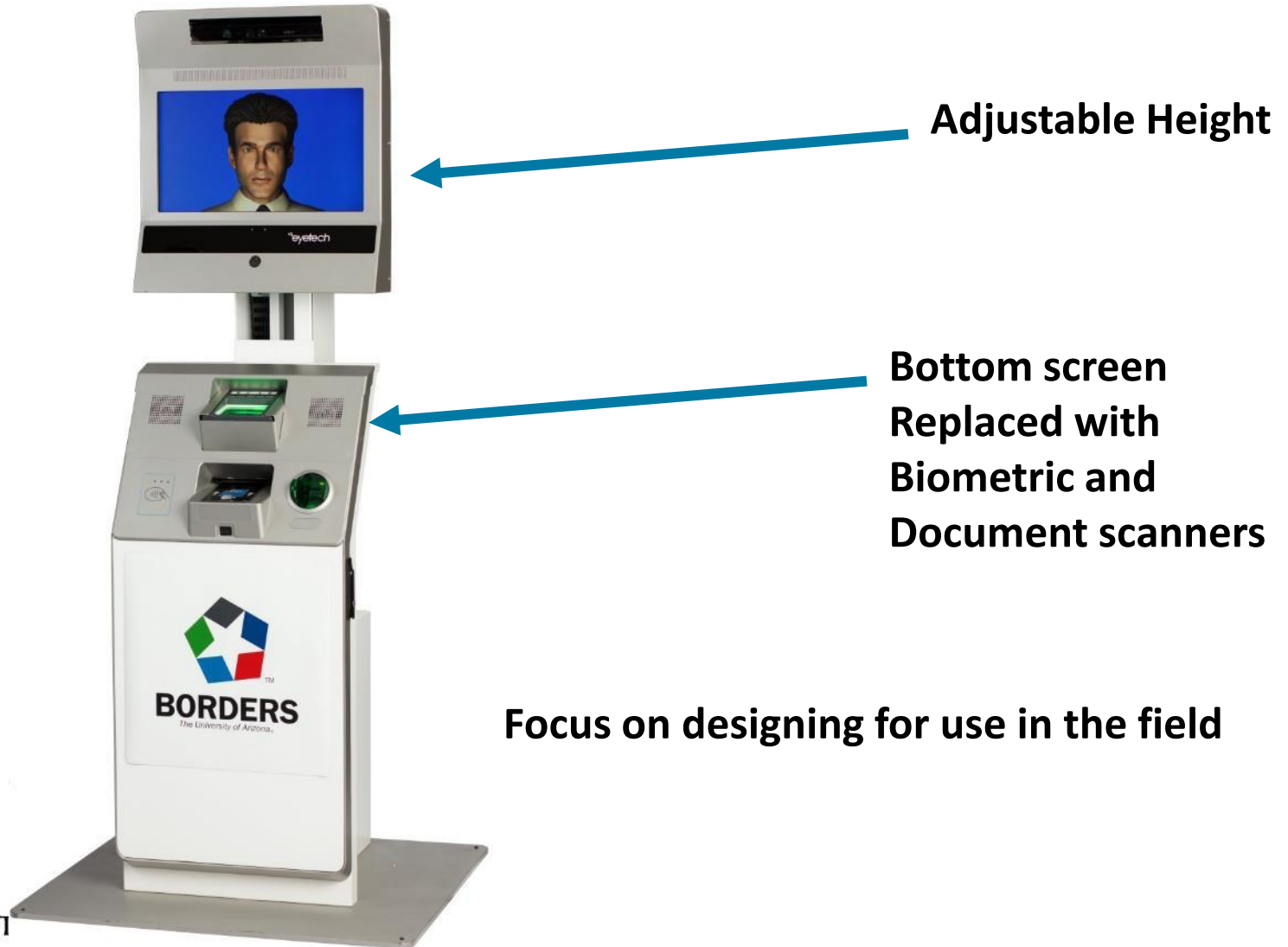
SENTRI Trusted Traveler Pilot Tests

- **Trusted Traveler provides expedited entrance for pre-approved, low-risk travelers to the U.S.**
- **Conducted at DeConcini Port of Entry, Nogales Arizona in 2012**
- **Problem:**
  - **Applications are increasing**
  - **Staffing levels stable**
  - **Result: long wait times for processing**
- **Solution:**
  - **AVATAR interview to expedite wait time, assess credibility and provide real-time feedback to CBP officers**
- **258 interviews conducted**
  - **172 American citizens**
  - **60 Mexican citizens**
  - **26 Other/unknown**

2013

Partnered with NCR and Developed Generation 4 Prototype

Adjustable Height

Bottom screen Replaced with Biometric and Document scanners

Focus on designing for use in the field

# 2013 AVATAR at Bucharest Airport Romanian Passport Control

- **Based on three years of exercises, research, and development**
- **Interviewed arriving passengers**
  - **Romanians**
  - **EU citizens**
  - **3rd country nationals**
- **Questions and language based on passport scan**
- **Decision support for Border Guards**
  - **Passenger responses**
  - **Behavioral analysis**
  - **Biometric match scores**
  - **Risk assessment**

Overview of Exercise

- **Passenger arriving on international flights volunteered to be screened by AVATAR**
  - **Passengers scanned their passport**
  - **Based on visa status the appropriate interview was conducted in Romanian**
  - **During interview message a behaviors were measured**
  - **After the interview border guards reviewed results**

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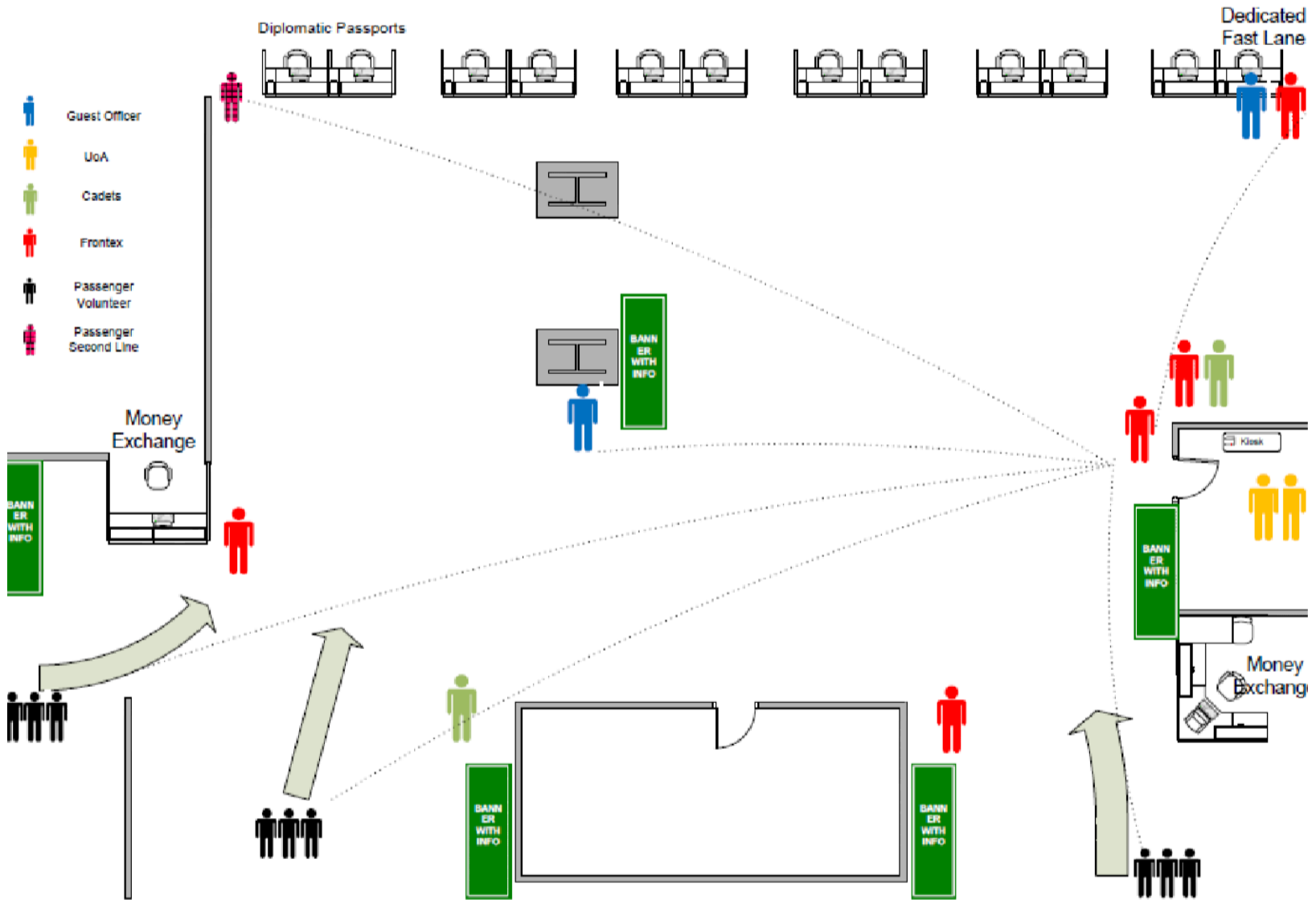
Passenger Feedback
Bucharest Airport

- **After the AVATAR interview, passengers completed a survey on their experience**
    - **90% liked the AVATAR**
    - **75% they would use the AVATAR in the future**
    - **96% found the AVATAR easy to use**
    - **85% said the AVATAR might make it easier to get through passport control**

2015 - present

TSA and CBP Airport Screening Test

- **Conducted a field test at TSA Transportation Systems Integration Facility (TSIF)**
  - **June 3-12, 2015**
- **Mock screening environment with passengers (N=210) packing bags and entering screening process**
  - **Multiple AVATARs supporting officers**

42

Canadian Border Service Agency

- **Conducted field experiment on March 2016 in Ottawa**
- **AVATAR conducted 70 customs interviews to passengers arriving on an international flight**
- **Some passengers attempted to smuggle drugs and hide their true identity**
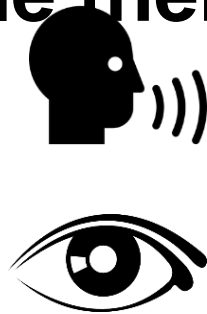
CURRENT AND FUTURE PROJECTS

Navy Cyber Security Project

- **Actionable Intelligence-Oriented Cyber Threat Modeling**
  - **Started Aug 2017**
  - **Funded for 3 years at $310K**
- **Applying threat model to develop automated system for identifying, patching, and sharing cyber threats and vulnerabilities**
  - **Applications on sea battle groups and land bases**

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Singapore Government

- **Woodlands Checkpoint**
  - **Border of Malaysia and Singapore**
    - **180,000 Travelers a day**
- **$4.8m project to develop customized AVATAR kiosks for pedestrian and bus passenger crossing**
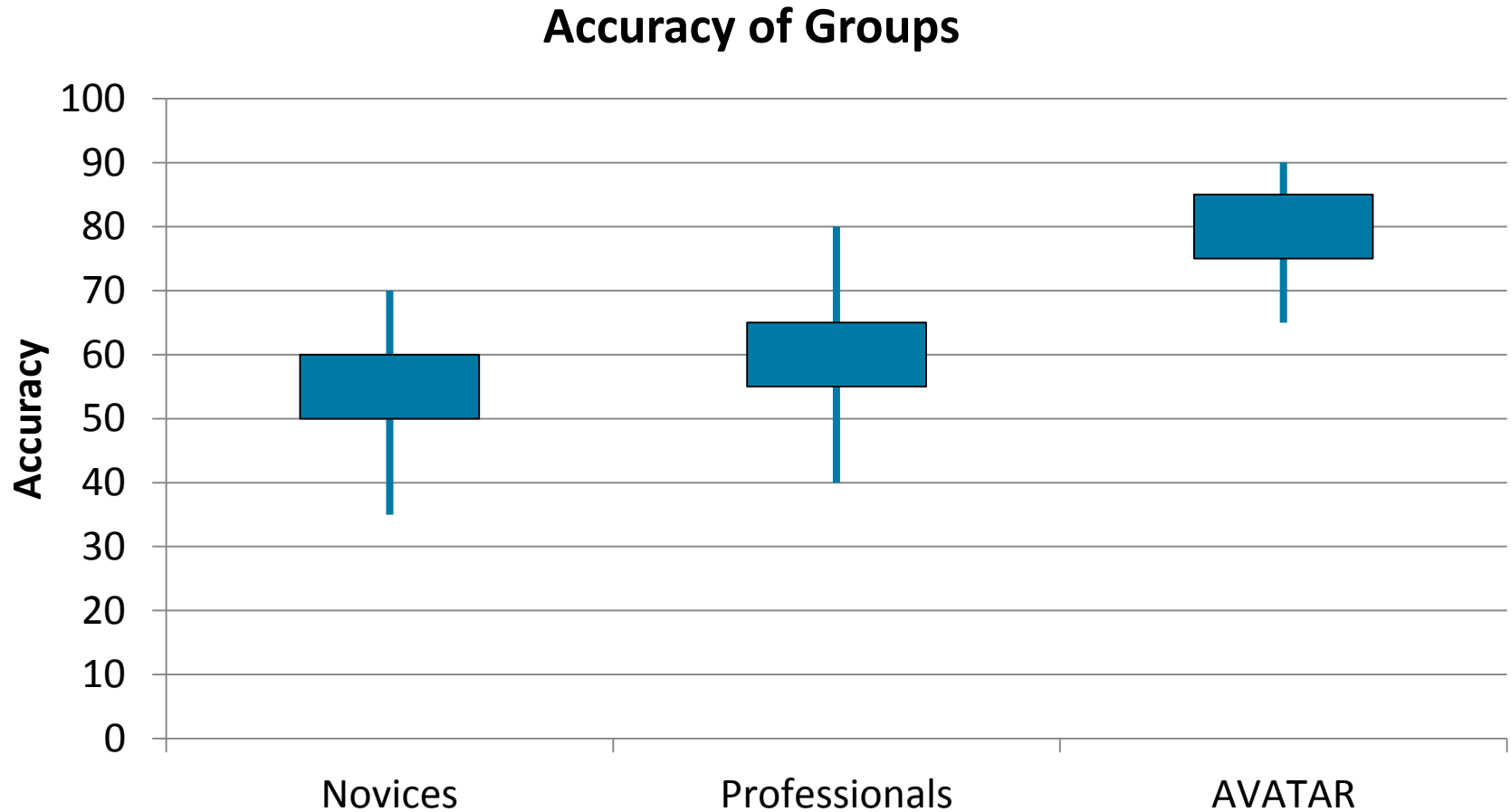- **Project estimated start Jan 2018**

American Airlines

- **Customized AVATAR kiosks for interviewing AA passengers departing on international flight**
  - **Subject to increased DHS security regulations**
- **Pilot study targeted for London Heathrow airport Terminal 3**

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Summary of Experiments and Pilot Tests

Accuracy of Groups

Future Technology Applications

Employment screening (interviews & resumes)

Property protection

Building security

Border protection

Transportation screening

Event security screening (Super Bowl, World Series)

Fraud detection

Medical triage

Questions?