Beyond current testing standards:
A framework for evaluating human-sensor interaction

International Biometric Performance Testing Conference 2010 | March 2-4, 2010

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Agenda

- Current Testing Standards and Norms
- The Missing Link?
  - What performance evaluations should also explain
  - Usability & Biometrics: Our systems should be usable?
  - The Human-Biometric Sensor Interaction (HBSI)
- HBSI Framework
- Applications & Uses
- Questions

Scope

From Mansfield & Grother's *The Wide World of Biometric Testing*

Have tests been driven by what can be done

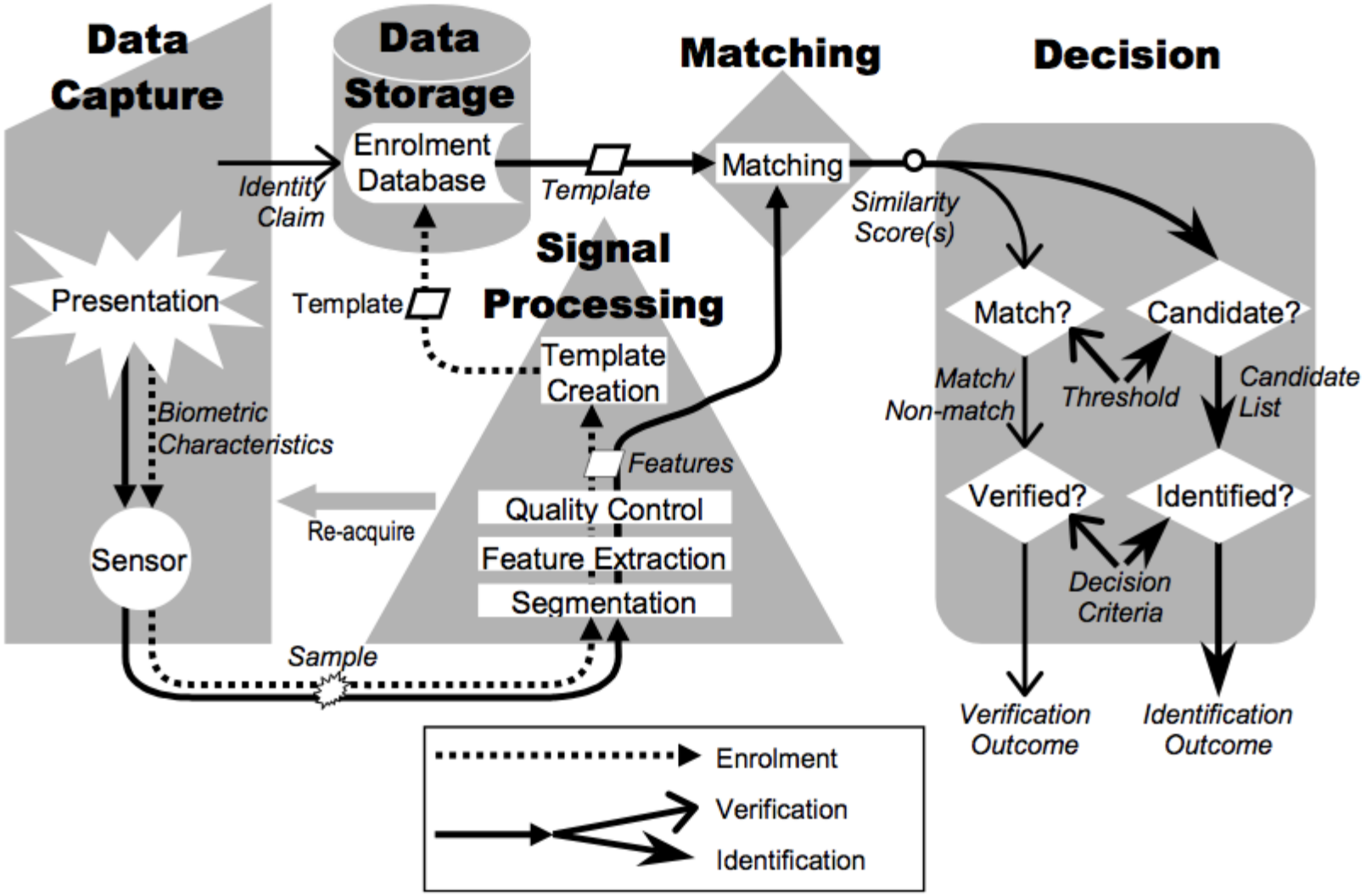
- Measure FRR after data collection

VS

What should be done

- Observe and count mispresentation effects

A General Biometric System Model (ISO/IEC 19795-1)



What do our testing standards say?

- Distinctions between technology and scenario evaluations according to ISO/IEC 19795-2:

Type of Test	Technology	Scenario
Objective of Test	Measure performance of algorithm(s) on a standardized corpus	Measure performance of end-to-end system in simulated application
Typical metrics	•Most error rates [FMR, FNMR, FTE, FTA] •Not end-to-end throughput •Good for large-scale identification system performance where difficult to assemble large test crew	•Predicted end-to-end throughput •FMR, FNMR, FTE, FTA, GFAR, GFRR

What do our testing standards say?

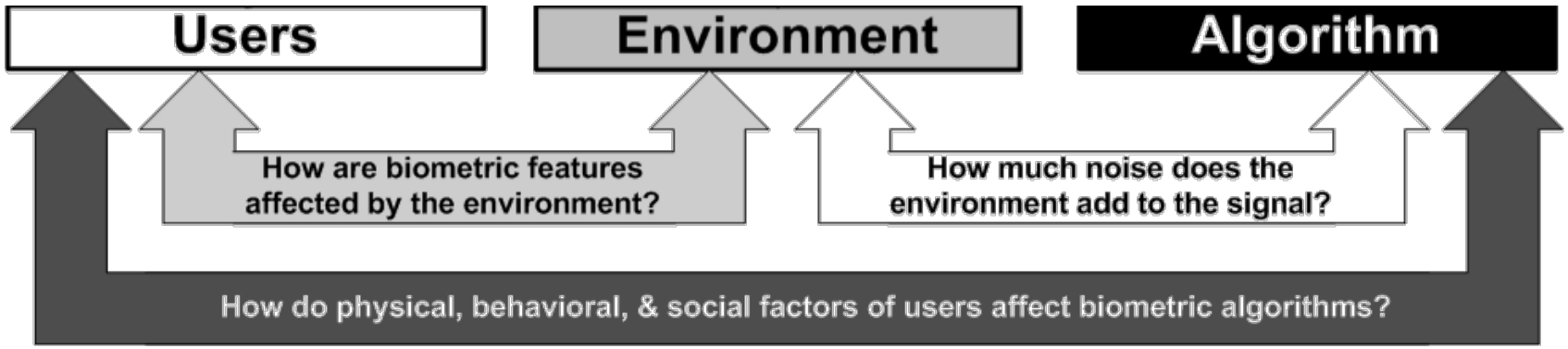
Table 6 - Registry of Biometric Performance Testing Methodology Standards

Domain of Applicability	Recommended Standard
Physical and logical access control tests	(1) ISO/IEC 19795-1:2005 (2) ISO/IEC 19795-2:2006
Testing of performance and interoperability of cross-supplier implementations generating and matching instances of standardized biometric data interchange data	(1) ISO/IEC 19795-1:2005 (2) ISO/IEC 19795-4:2008

- What about the:
  - Environment
    - ISO/IEC 1st WD 29197, Evaluation methodology for environmental influence in biometric systems
  - Human-Sensor Interaction
    - …

What Performance Evaluations Should Also Explain

- Is the algorithm the cause of matching errors?
- Is the application or environment the problem?
- Is the design of the sensor the problem?
- Are the users/agents causing the issue?
  - Can users/agents do what the system/sensor is asking for?
  - Do users/agents understand how to use the system/sensor?
  - Can users/agents produce repeatable images?



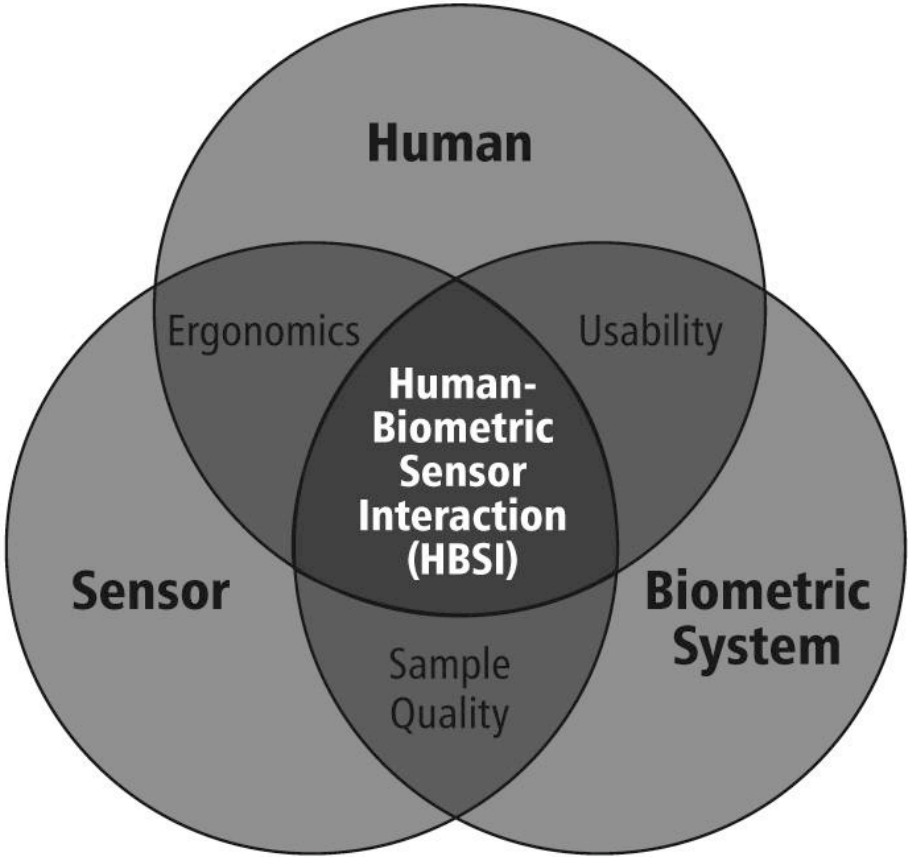
Usability & Biometrics "Usability"

- Usability
  - The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use (ISO 9241-11:1998, ISO/IEC 25062:2006)

- Failure to Acquire (FTA)
  - Traditional measure of "*usability*" in biometrics
  - Proportion of verification or identification attempts for which the system fails to capture or locate an image or signal of sufficient quality (ISO/IEC 19795-1)

The Human-Biometric Sensor Interaction (HBSI)

- Derived from multiple research fields to better understand and evaluate overall **functionality** and **performance** of a biometric system

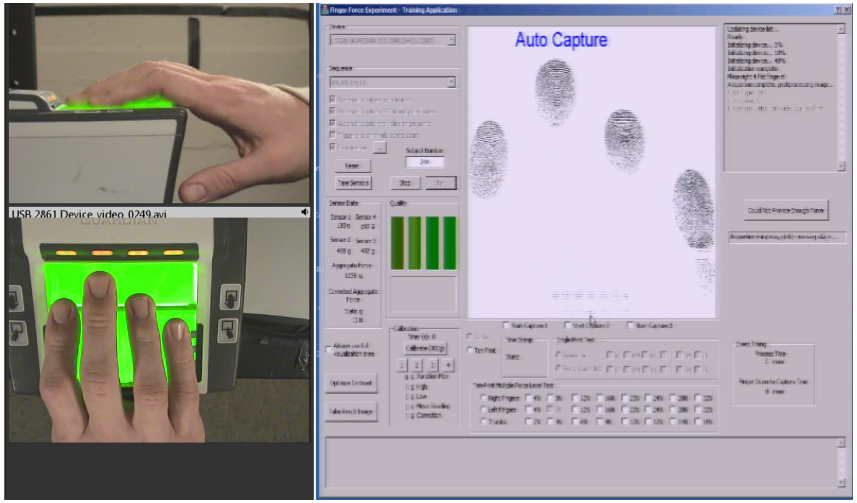


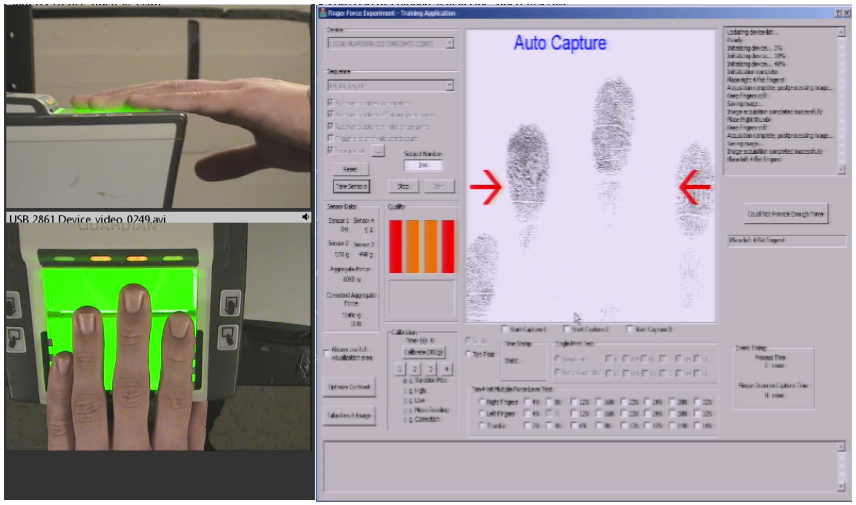
HBSI Framework for Biometric Interactions

- Objective
  - Classify every human-sensor interaction "***event***" with the resulting biometric system "***reaction***"
    - Event + Reaction = *HBSI episode*
- Purpose
  - Understand and classify all interactions / movements / behaviors that occur with a biometric device to improve performance, quality, and usability
- Examines a biometric system from 2 perspectives:
  - User
  - Biometric System

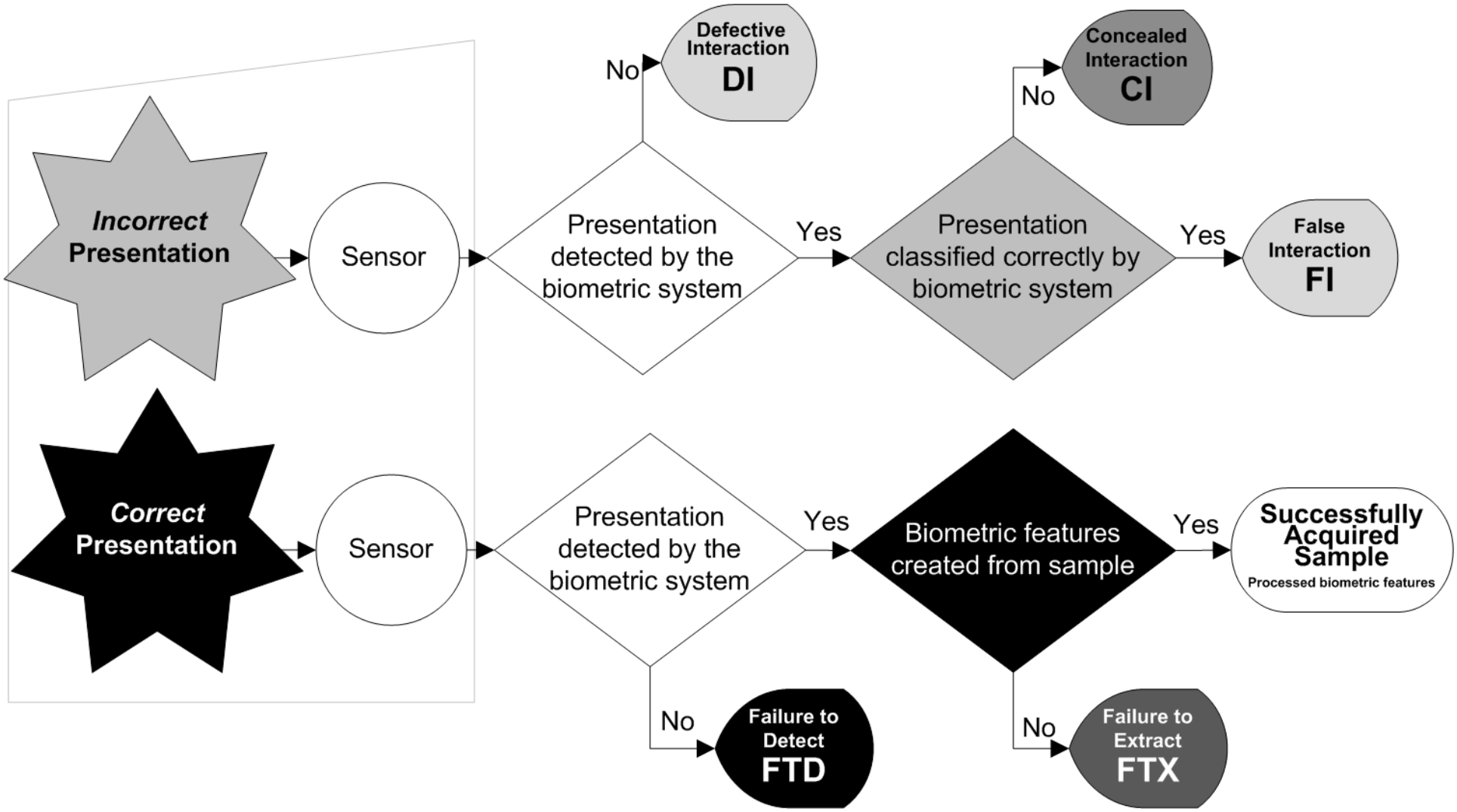
HBSI Episodes

Event Reaction



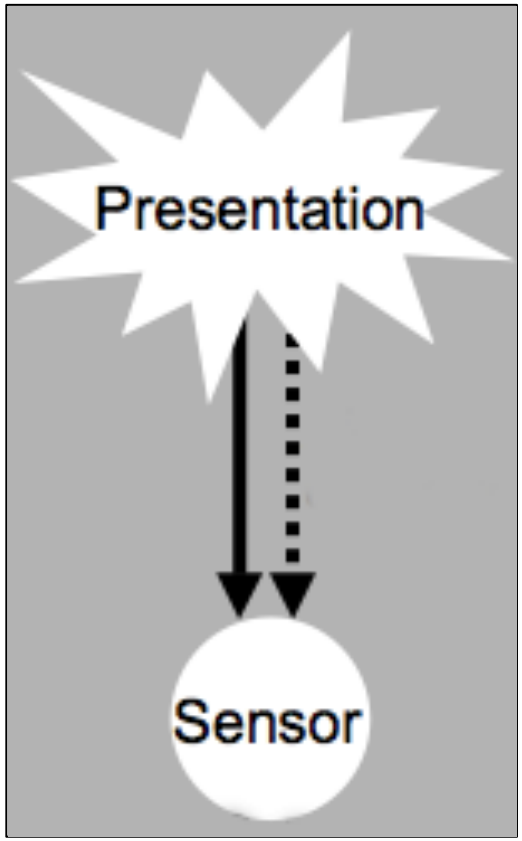


HBSI Framework for Biometric Interactions



Technology Evaluations & Offline Analysis

- How do we analyze:
  - Previously collected data
  - Black-box systems
- Can we calculate:
  - FTE
  - FTA
  - …
- Modifications
  - Failure to Extract (FTX)
    - Capable of handling black-box systems
  - Non-Biometrically Captured Data (NBC)
    - Analyzing data not originally collected for biometric systems.



Application & Use of the HBSI Framework

- Government & Integrators
  - System development
  - Field Readiness
  - Training
- Vendors
  - Alpha & Beta Testing

Future Work

- Evaluate more modalities with the framework
  - physical-interactive
  - image-based
  - behavioral
- Refinement of the metrics
- T&E Standard Methodology?

HBSI Publications

Available on: http://www.bspalabs.org/publications

S. Elliott and E. Kukula, "A definitional framework for the human biometric sensor interaction model," in *Proc. SPIE Symposium on Defense, Security, Sensing: Biometric Technology Human Identification VII Conf.,* Orlando, FL, April 5-9, 2010.

E. Kukula, M. Sutton, and S. Elliott, "The Human-Biometric Sensor Interaction Evaluation Method: Biometric Performance and Usability Measurements," *IEEE Transactions on Instrumentation and Measurement, vol. 59 , no. 4,* Apr 2010. doi: 10.1109/TIM.2009.2037878. p. 784-791

E. Kukula, "Design and evaluation of the human-biometric sensor interaction method," Ph.D. dissertation, Purdue Univ., West Lafayette, IN, 2008.

Thank you for your attention.
Questions?

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