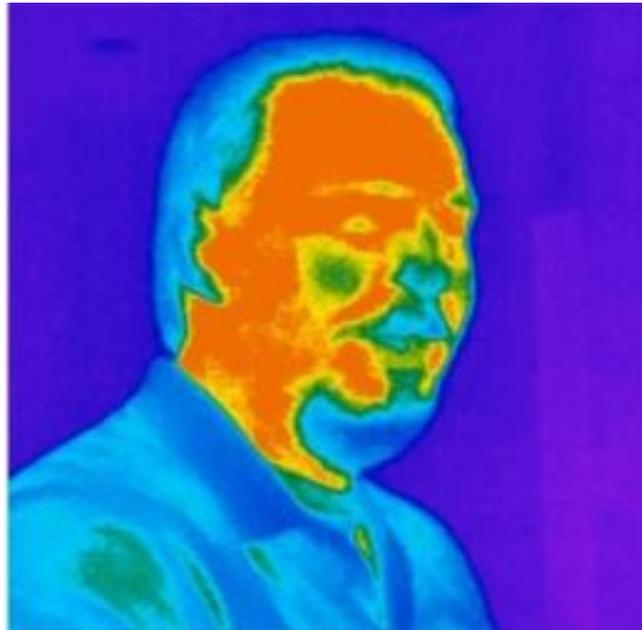
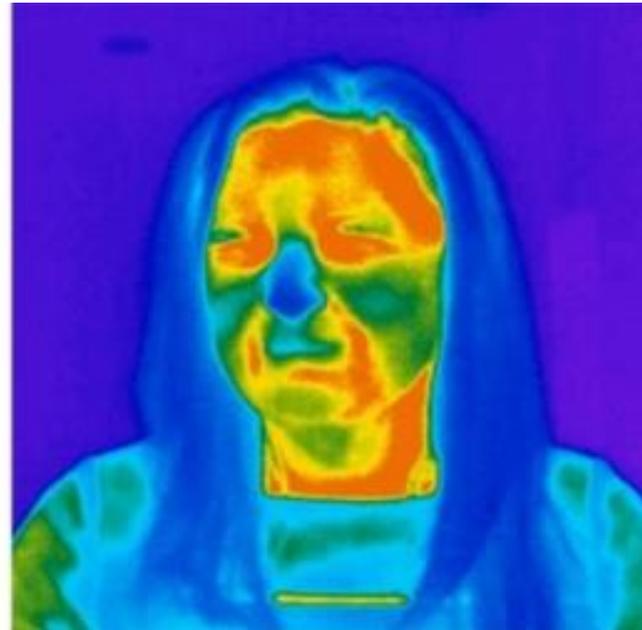


Exploring Biometric Insights in Business Research

Frederik Beuk, Ph.D. / The University of Akron
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Prof. David Payne
Director of Sales Center



Dr. Vanja Djuric



Dr. Frederik Beuk
Research director

Background

- The **Sales Biometrics Laboratory** was founded in August 2021 as part of the Fisher Institute for Professional Selling at the University of Akron.
 - Fisher Institute is one of the oldest and largest sales centers in the US.
 - Roughly 5,300 square feet, including 9 fully equipped multi-camera observation rooms.
 - First dedicated biometrics lab in the US with a focus on sales and negotiations research.
 - Dr. Frederik Beuk serves as the founding research director.

The
University
of Akron





Type of research questions typically answered with Biometric approaches

- **Consumer behavior** – responses to advertising, product design or **store layout**
- **Brand perception** – emotional attachment to different brands
- **User experience** – How people interact with a product, website, or service
- **Customer satisfaction** – engagement with the service or product
- **Employee engagement** – Focus of our lab as we research and train salespeople



Current capabilities

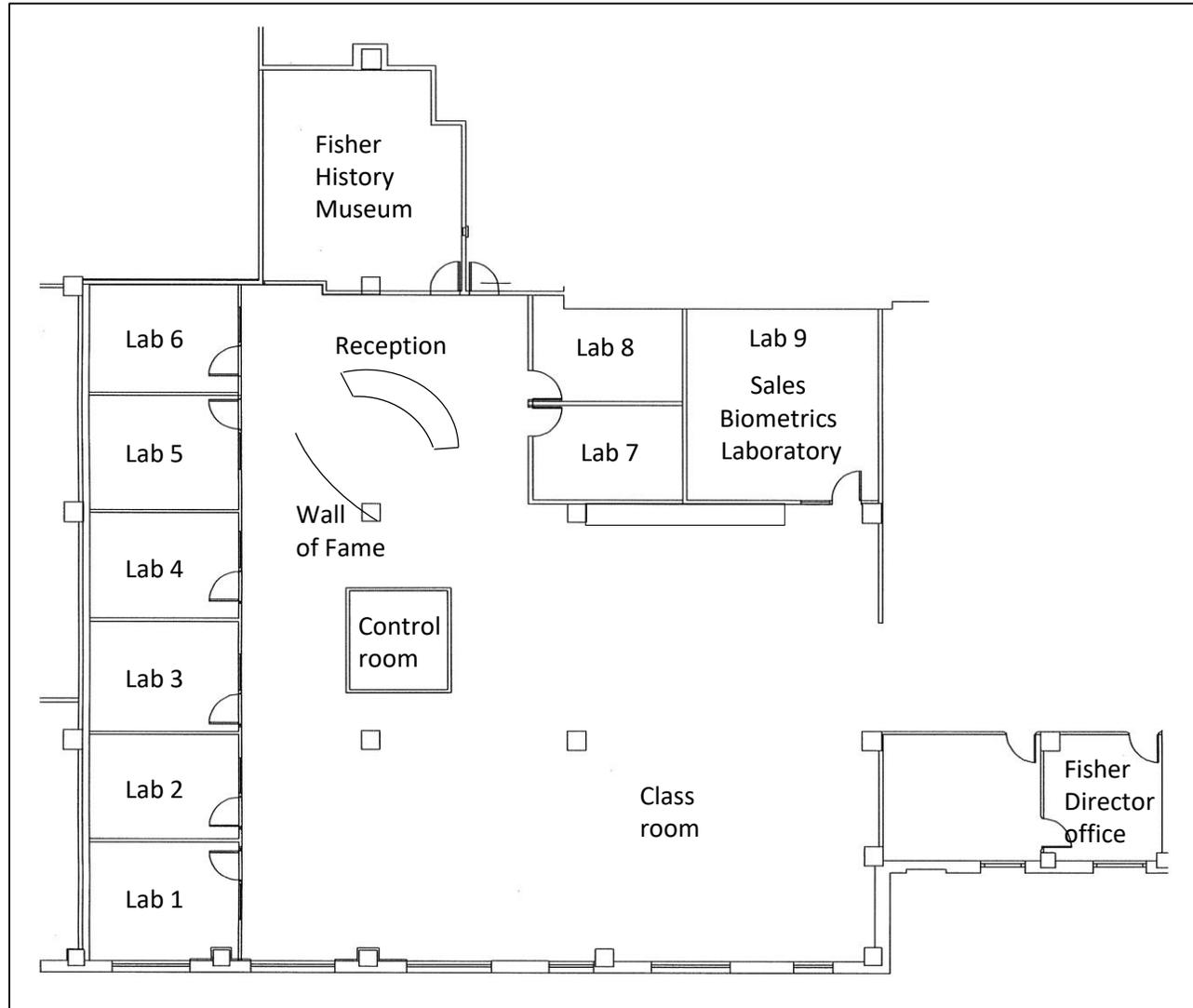
Primarily based on the iMotions platform, together with our custom (sales) video platform

1. Eye tracking (fixed station)
2. Galvanic Skin Response (Shimmer 3+)
3. Facial expression coding (AFFDEX v2)
4. Heart rate (Empatica E4)
5. Skin temperature (Empatica E4)
6. Infrared camera (of face)
7. Video recording (dual cameras)
8. Audio transcription (sentiment analysis)

 **IMOTIONS**[®]

 **interact**[™]
solution

Layout of the Fisher Sales Center at UAkron



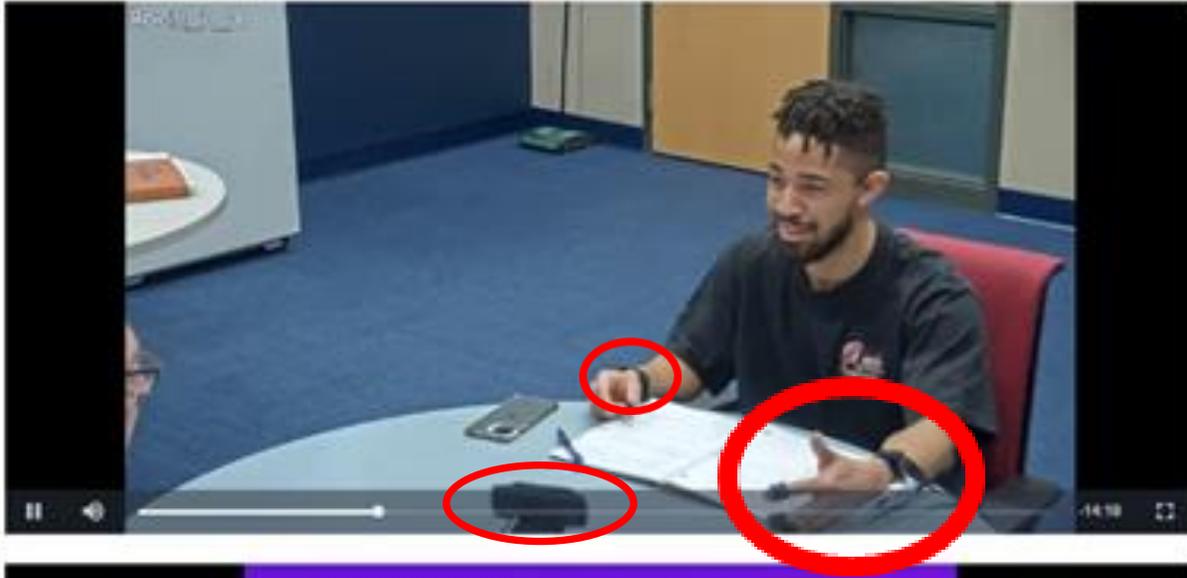
- 5,300 square feet (490 m²)
- 9 dual camera video labs, including
- Sales Biometrics Laboratory
- Full size classroom and meeting space (60 seat capacity, 200 standing)

A blue pen with a silver tip is positioned diagonally on the left side of the slide, resting on a document that features a blue bar chart. The background of the slide is white with a large, light blue circular graphic on the left side.

Challenges with biometric research

- Resource intensive
 - Collecting even simple data typically takes 10 to 30 minutes per subject
 - Recruiting of participants
 - Result in small sample sizes
- Mostly focus on within subject designs
 - Variability in baseline
- In dyadic settings (e.g., negotiations, sales interactions) there is a constant tradeoff between realism (external validity) and
 - Keeping the stimuli constant
 - Measurement artifacts (especially GSR, infrared)

Minimally restrictive sensors



NOTES ANNOTATIONS

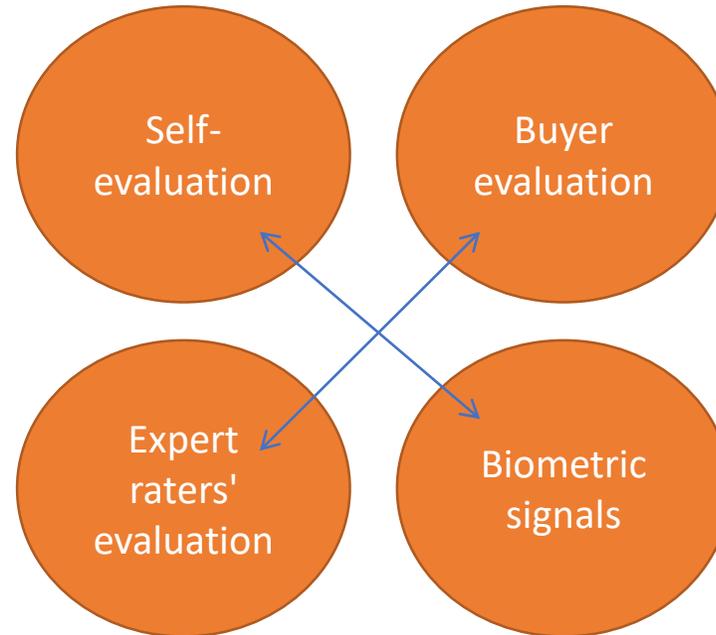
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DRAWING ANNOTATIONS

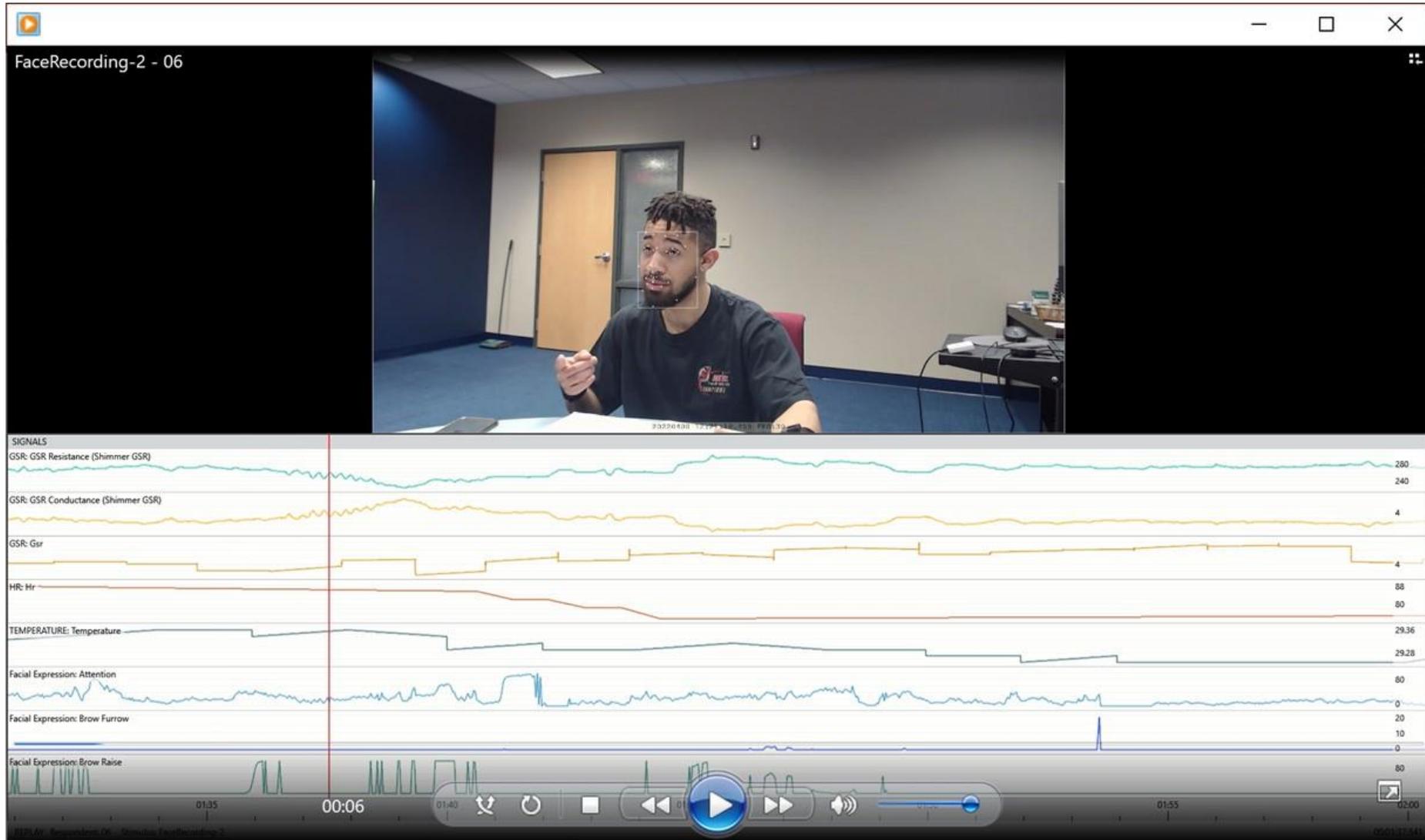
AUDIO ANNOTATIONS

Some of our recent projects

- We mostly deploy multi-method approaches, supplementing survey research with biometric insights, text analysis and external raters.
- Current project we look at **objection handling during sales calls**



Facial recognition during objection handling





Eye tracking during simulated retail environment (within & between design)



Now, imagine that you have been working very hard recently. After a long day, you feel very exhausted. You have difficulty concentrating and are very irritable. You are entering a fashion retail store hoping that the shopping may help you get a break from your routine. Watch this video and please provide your responses based on your experiences from watching it. Please click the next button to continue.

Next →



Recent improvements

- Developing new methods and custom software to isolate and track facial temperature changes



2:37 min



6:50 min

Thermal Face Detection

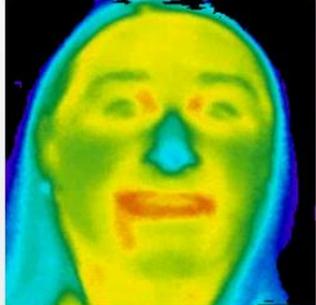
Select Video File

Start Process Stop

Input Video



Output Image



Start temperature [°F] 98.0

Measured temperature [°F] 101.8

Detected face size [px] 229 * 229

Video time stamp 0:0:6

Process parameters

Detection method Haar Cascade

Min. / Max. face length [px] 138 319

Upper temperature [°F] 107

Middle temperature [°F] 90

Lower temperature [°F] 70

Remove background

Threshold background 0.20

Remove color range

Lower Color [R,G,B] 0 0 150

Upper Color [R,G,B] 255 180 255

Color map ISO-Rainbow-WH

0%

Limitations not always clear

- AFFDEX 2.0 (released in 2022) down samples images to 96 x 96 pixels before analyzing for **facial expression** coding.
- This new algorithm often picks up on clearly displayed emotions, but human coders not seldomly disagree with what the facial expression likely represents. Subtleties are missed.
- Improvements now rapidly focusing on non-Caucasian subjects.

1920 x 1080

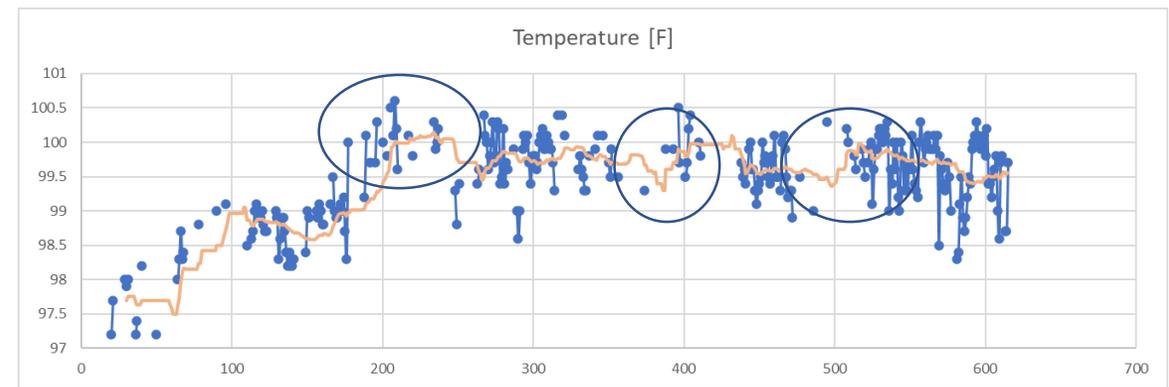
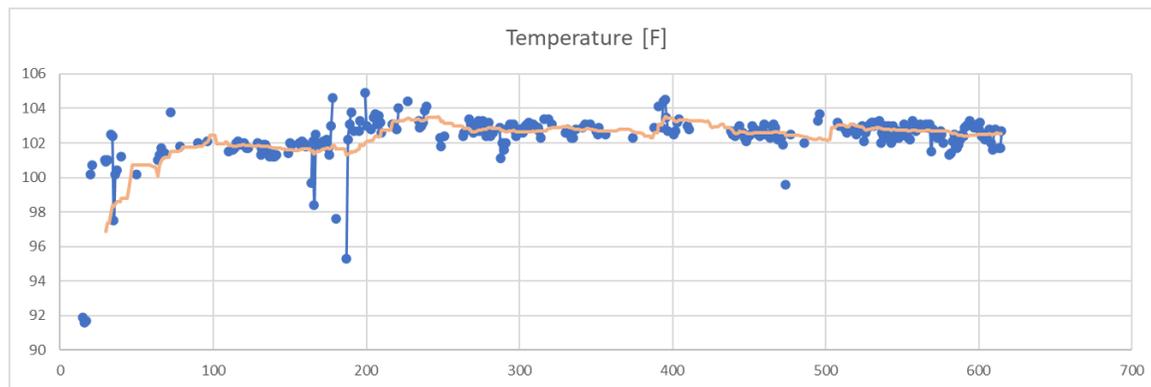


96 x 96



Limitations not always clear

- The infrared camera we are using is sensitive to “angle of measurement”
- OpenCV platform has several standard facial detection algorithms with different success rates.
- Very sensitive to temperature changes (0.5 degrees Fahrenheit / 0.3 Celsius), but absolute readings can be off by 5 degrees F (2.8 Celsius).



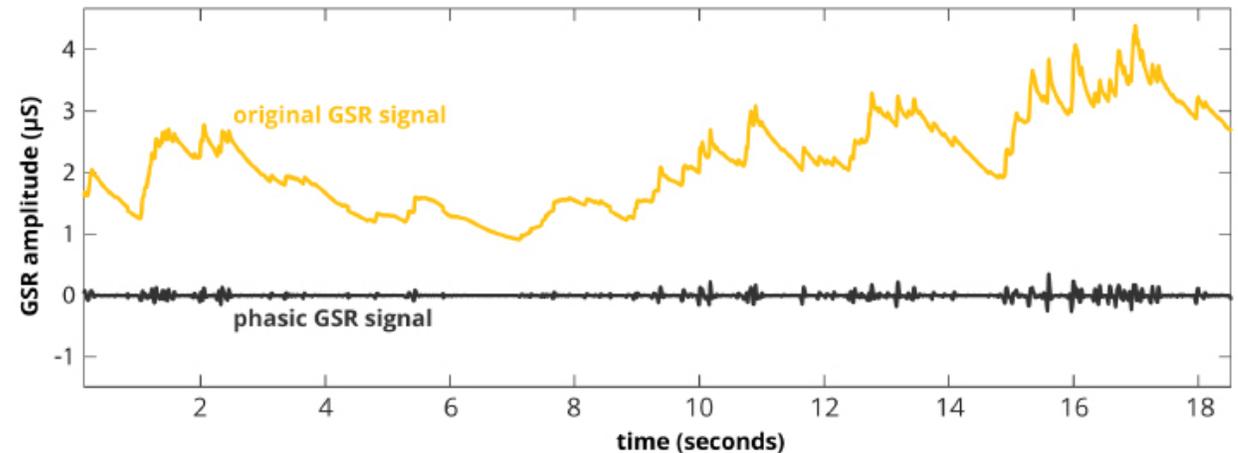
Temperature

- Needs to be calibrated with medical grade thermometers
- Not always linear relationship
- Impact of forehead perspiration on Infrared camera creates curve-linear effects (inverted U)



Limitations not always clear

- Individual differences in respondents impact the signal.
 - Electrodermal **labiles** – higher rate of non-specific skin conductance responses. Slow to respond to emotional stimuli. Superior performance in sustaining attention (good at high stress jobs)
 - Electrodermal **stables** – lower non-specific skin conductance responses. Superior performance in short-term memory and attentional focus where distractions need to be blocked out



Common (prescription) drug use can impact readings

Large number of drug classes impact several physiological responses

- Beta blockers (heart rate & heart rate variability)
- Anti-depressants / anti-anxiety medication (GSR)
- Cannabis (GSR)
- Caffeine (GSR, heart rate, temperature)

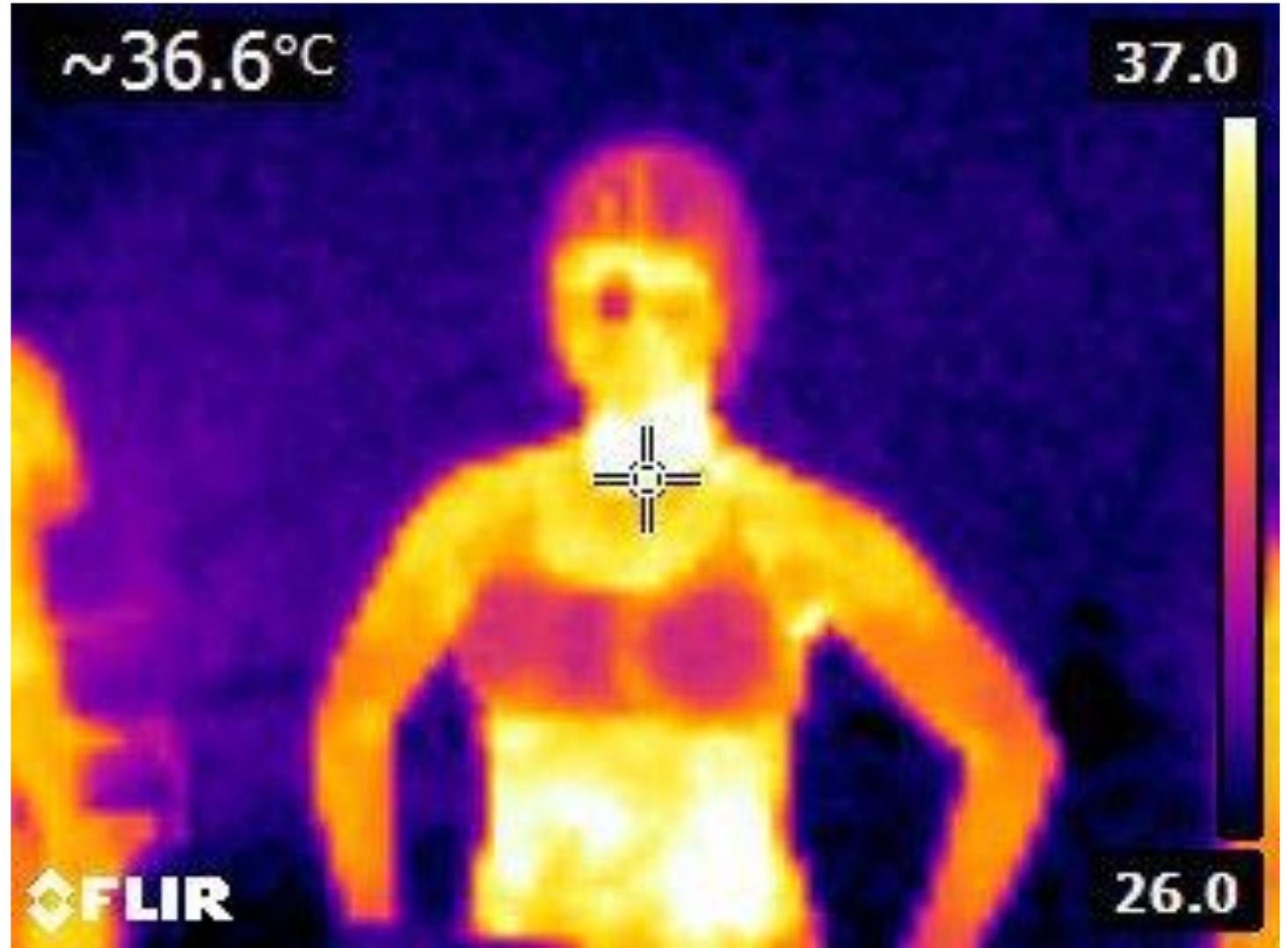


Ethical challenges

- Want to know about drug use while maintaining respondent privacy
- Our Internal Review Board (IRB) at Akron is very understanding of this challenge. Allows us to ask:
 - *To be part of the biometrics portion of the study, you cannot recently have consumed **caffeine** or **cannabis**, nor can you currently be on any **medications for anxiety, depression**, or use **beta-blockers** such as metoprolol. Do you foresee that you will consume any caffeine 3 hours prior to the scheduled biometrics session, or cannabis within 12 hours of that session, or are you currently using any of the prescription medication classes listed above?*

Ethical challenges

- Infrared camera can create perception that it reveals more than people want to share
- Solution: we don't start the camera until respondent is seated



Other concerns

- Data security – some platforms cloud process data
- Consent – we have long history of video recording subjects, and our IRB treats it similarly
- Applying/connecting of sensors invades personal space
- Good cleaning protocols
 - Physical space
 - Data cleaning



Getting started with your own lab

- Price of a lot of sensors and software has come down a lot.
- iMotions charges 13k per license and 1.3k renewal fee per year.
- Sensors range from couple of hundred (GSR), a couple of thousand (Empatica E4 Heart rate), to several thousand (Infrared Camera).
- Business models of sensor platforms (iMotions, Empatica, Biopac) appear to be changing to subscription based.
- We integrated the biometrics lab with our pre-existing sales observation labs.



Future expansion

- Eye tracking glasses
- EKG sensor bank
- Virtual Reality headsets





Questions & Next steps

We are very open to collaboration.

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