DETECTION AND ANALYSIS OF SMOKING EVENTS WITH WRIST WORN SENSORS

ARTEM DEMENTYEV
Big goal - find effective way to help people quit smoking using technology

Accurate detection of smoking event with wrist worn sensors: is there a measurable emotional component, to facilitate detection?
RELATED WORK

**A Feasibility Study of Wrist-Worn Accelerometer Based Detection of Smoking Habits**

Phillipp M. Scholl and Kristof van Laerhoven
Embedded Sensing Systems, ESS
Technische Universität Darmstadt
Email: scholl.kristof@ess.tu-darmstadt.de

**Monitoring of Cigarette Smoking Using Wearable Sensors and Support Vector Machines**

Paulo Lopez-Meyer, Member, IEEE, Stephen Tiffany, Yogendra Patil, and Edward Sazonov*, Senior Member, IEEE

**Cardiovascular Variables, Skin Conductance and Time Estimation: Changes after the Administration of Small Doses of Nicotine**

C. Agué
Medical Research, Sandoz Ltd., Basle, Switzerland
Artem Dementyev - Affective Computing (MIT)

Received July 20, 1973; Final Version March 13, 1974
Hypothesis: Smoking or anticipation of smoking causes arousal
N = 13 (Males: 10, Females: 3)
Age: 22-44
10 everyday smokers, 3 occasional smokers
1 was excluded

10 subjects were studied at physician’s office in Maryland
  - Before or after their doctor’s appointment.

3 subjects in Cambridge
EXPERIMENTAL SETUP

Get consent

Place sensor on dominant arm

Tell to press button right before and after smoking

Wait for 5 minutes

Go outside to smoke

Wait 5 minutes

Remove sensors

Interview

Tell to press button right before and after smoking

Wait for 5 minutes

Remove sensors

Interview

Tell to press button right before and after smoking

Wait for 5 minutes

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Tell to press button right before and after smoking

Wait for 5 minutes

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Interview
SENSORS

- Q – sensors on the wrist
  - Skin conductance
  - Acceleration
  - Temperature
- Experimented with dust sensors
  - Not used in experiments – too large
Mean:
- Five minutes before smoking
- During smoking
- Five minutes after smoking
- Ignore ‘zero’ skin conductance readings.
Mean: before, during and after smoking

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Arousal increased during smoking: 3 subjects
Decreased: 6
About the same: 3
Two sample T-test

- P value is above 5%: no statistical significance
- P < 0.0001 in the previous study (Ague, 1974)

Ague, 1974
REGULAR OR OCCASIONAL SMOKERS

Occasional

Subject 5

Regular

Subject 8

Subject 12
TEMPERATURE AND ACCELERATION
WEARABLE DUST SENSORS

[Image of wearable dust sensor]

[Graph showing dust readings over time with labels for blowing smoke into sensor, not smoking, and smoking]
Decrease in arousal is most common, but not statistically significant

No clear trends: different responses in different people
- Increased arousal
- Decreased arousal
- Same level

Response is most apparent in occasional smokers
Not by itself, but can provide insights, especially in occasional smokers

- Sensors need to be tailored to the person
- Sensor fusion is needed to detect smoking
LIMITATIONS

- Only one smoking even for each subject.
  - Not sure if responses are reproducible

- Data quality: skin conductance sensors were often out of range

- Experiments are not in laboratory conditions.

- No thorough interviews.
People are generally willing to participate.
- Only one subject out of 14 declined to participate.
- Recruited almost 3x more subjects than expected.

Often subjects forget to follow directions. Need safeguards.
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