

# Sensor-based Learning Support

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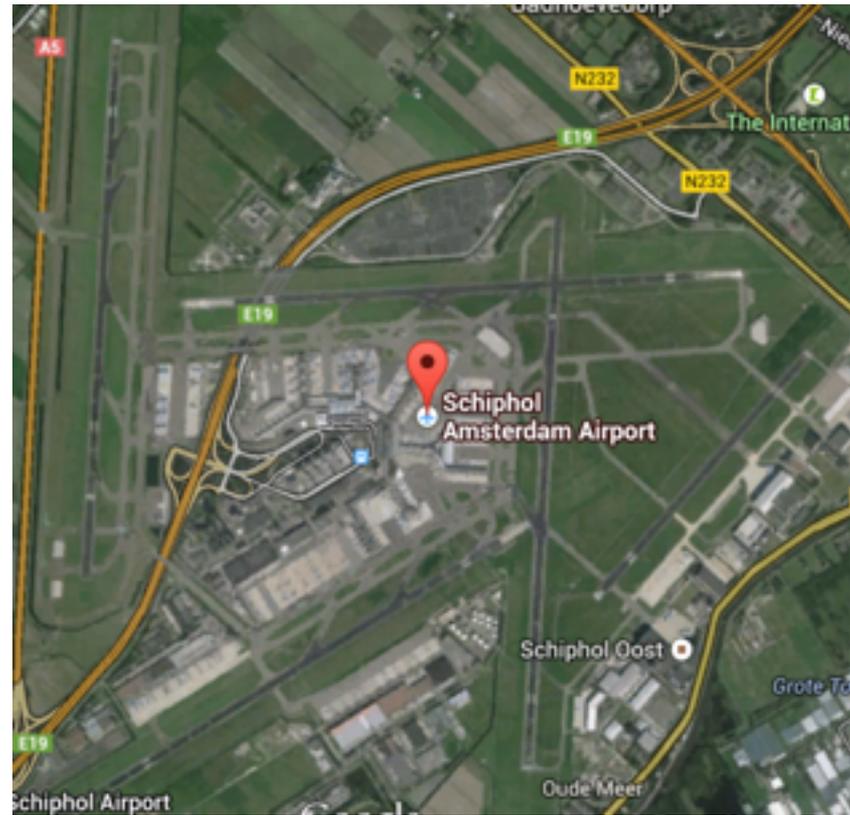
## Sensor-based Learning Support.

- What is a Sensor?
- In a very general “sense”, sensors are components that measure certain values and properties:
- For example:
  - Movement
  - Temperature
  - Distance
  - sound
  - Light



## Sensor-based Learning Support

- What type of sensors will you use?



## Why Sensors and Learning?

- Sensors can be used to unobtrusively take measurements.
- This gives us hints that they can be used as assessment tools.
- If we can connect them to software programs, we could automatically analyse these sensor data, and give feedback.
- An educational challenge nowadays that has a lot to do with assessment and feedback is the implementation of formative assessment.
- Formative assessment deals with presenting learners with information that allows them to improve their performance (Geyde, 2010)
- But it is hardly implemented because the work overload that requires from teachers (Berlanga, van Rosmalen, Boshuizen, and Sloep, 2012)



## Literature Review and Research gaps

- Sensors have been used to give support in the cognitive, psychomotor and affective domain of learning.
- Sensors have been used to give feedback.
- Sensors have also been used in other tasks that might facilitate the implementation of formative assessment such as presenting opportunities for self-assessment, retrieving useful data allowing experts to assess a specific situation, etc.
- Studies exploring the learning impact of the feedback given by these tools have not been found.
- Studies exploring the learning impact of different feedback representations such as timing, complexity, amount, channel , etc. were not found.
- Only few studies empirically revealed the added value of using sensors for learning.



## Research Questions

- What are the implications to design, evaluate and implement sensor-based systems that support the implementation of formative assessment?
  - Can we use sensor information to correctly assess learners?
  - Can we use Sensor information to correctly diagnose the expertise level of learners?
  - What are the implications for developing sensor-systems able to provide learners with the kind of feedback that has a positive effect on their learning?
  - What are the implications for developing sensor systems able to guide learners throughout their learning process?



## Metalogue Project and Presentation Trainer

- Working for the Metalogue project whose goal is to produce a multimodal dialogue system, designed to train users to become better at dialog situations, such as selling, debating, etc.
- We are mostly involved with the instructional design for the Metalogue project.
- To explore how to automatically give instruction and feedback to learners training to improve their dialog skills, we decided to start with something simpler such as a monologue, where only one person has to speak.
- For that we designed the Presentation Trainer, a tool designed to help you train your nonverbal public speaking skills for presentations.
- The tool that will help me with in the exploration between sensors and learning support.



## First studies: Defining Rules

- Objective:
  - Come with a valid set of rules for assessment and teaching for the Presentation Trainer.
- Description:
  - We plan to do a Group Concept Mapping study, recruiting experts in the field of public speaking and lecturing.
  - We want to find important rules for presentations regarding:
    - Body Posture
    - Body Movements
    - Speaking Cadence
    - Voice Volume
- Participants: 10-15

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## First studies: Assessing

- Objective:
  - Explore whether a sensor system can be used to correctly assess learners.
- Description:
  - Use the Presentation Trainer to assess some presentations. Record these presentations and let experts assess the presentations, using a program where they can click when there was a problem with the body posture, voice volume, etc.
  - Compare the assessment of the Presentation Trainer with the assessment of the expert.



## First studies: Assessing

- Participants: Same Experts and 5 presenters.
- Measurement instrument:
  - Presentation Trainer Assessment
  - Experts Assessment
- Comparison variables:
  - Differences and similarities between both assessments.



## First studies: Diagnosing

- Objective:
  - Explore whether sensor data could be used to diagnose the level of expertise in public speaking and classroom management.
- Description:
  - A study to compare the body movements and voice aspects between expert teachers (in which expert means being good in classroom management) and novice teachers (who are not very confident about their classroom management). We will use the Presentation Trainer to log the presentations, and later we will analyse the logged data.
  - (We might also add a function to the Presentation Trainer where according to the presentation rules that we already implemented, it can try to predict whether the participant was an expert or not. )



## First studies: Diagnosing

- Participants: ~30
- Comparison variables:
  - Differences in Body Posture
  - Body Movements
  - Voice Volume
  - Speaking Cadence
- Measurement instruments:
  - Presentation Trainer



## Second Studies: Feedback

- Objective:
  - Explore the learning impact of immediate feedback, delayed feedback and no feedback in training nonverbal public speaking skills.
- Description:
  - A study to compare delayed feedback with immediate feedback, and no feedback using the presentation trainer. The experiment will have 3 groups of participants. All of them will go through a training procedure, and then will do a “real” presentation. The difference is that the first group will receive immediate feedback while training, the second group delayed feedback and the final group no feedback.



## Second Studies: Feedback

- Participants: +- 45
- Comparison variables:
  - Cognitive load
  - Differences in nonverbal communication
  - User preferences
  - User confidence
- Measurement instruments:
  - CL questionnaire
  - Questionnaire about how confident they feel to do a presentation after the training
  - Presentation Trainer



## Second Studies: Training

- Objective:
  - Explore the implications and added value of having a system guiding learners through their learning process by giving feedback, instruction while performing learning exercises.
- Description:
  - A study to measure the effect of doing exercises with a tutor guiding and giving feedback to the participants through them, in comparison with a group that does the exercises just in front of a mirror without guidance and a control group that does not do the exercises.



## Second Studies: Training

- Participants: +- 30
- Comparison variables:
  - Gain/change in 'body expertise'
  - Gain/ change in 'voice expertise'
- Measurement instruments:
  - Presentation trainer
  - CL questionnaire
  - SUS questionnaire



## Third Studies: Generalising

- Objectives:
  - Explore whether the findings of the previous studies can be translated to other domains
- Description:
  - Use the knowledge gained from the previous studies to create an interface that teaches you how to get in rapport with other people, by matching the body posture, speaking cadence, voice volume, movements, breath rhythm, etc. Probably we can try it with two persons or one person and an avatar.



## Third Studies: Generalising

- Comparison variables:
  - Cognitive load
  - Differences in Mirroring and matching
  - User preferences
  - User confidence
- Measurement instruments:
  - Rapport trainer

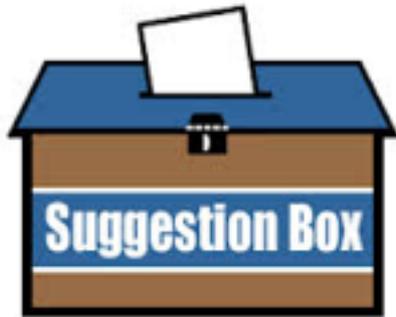


## Formative Studies

- Objective:
  - Investigate the implications for developing sensor-based tools designed to effectively provide learners feedback and instruction.
- Description:
  - Set of iterative studies, exploring the usability of different interfaces. Comparing variables such as the amount of feedback, feedback channels, feedback representations, etc.
- Measurement instruments:
  - Eye tracker
  - Presentation trainer
  - Bio sensors
  - SUS questionnaire
  - Videos



## Questions, Comments, Suggestions...



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