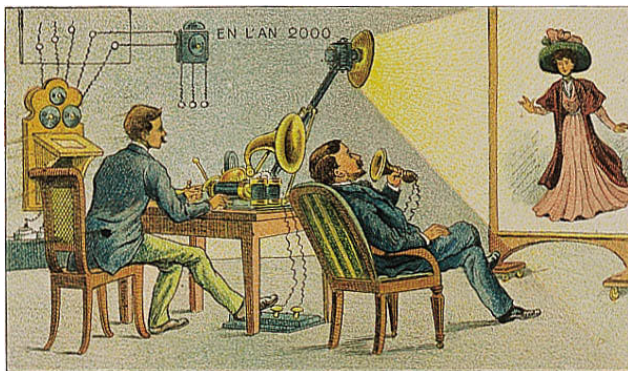
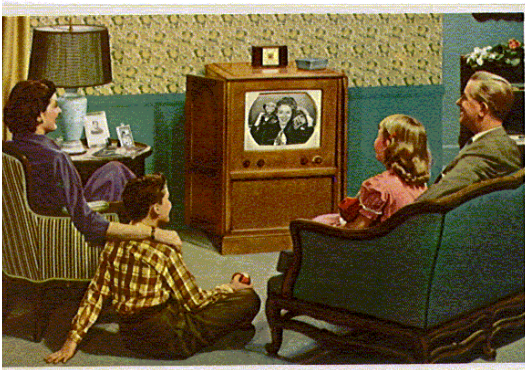


Sensing Engagement

Helping Performers to Evaluate their Impact

Pablo Cesar: p.s.cesar@cwi.nl



ABOUT ME AND MY JOB

CWI: Centrum Wiskunde & Informatica

- National Research Institute for Mathematics and Computer Science (founded in 1946)
- Staff: 55 permanent, 40 postdocs, 70 PhDs
- CWI registered the '.nl' domain (1986)
- 1st connection between Europe and the Internet (17 November 1988)
- Topics examples:
 - Holland's first computer
 - Height/Strength dykes
 - Algol-68, Python and SMIL



DIS@CWI



DIS@CWI: research areas

- Social IoT and Smart Textiles
- QoE
- VR and Immersive Media
- Experience-Aware Networking
- Connected Shared Experiences
- Multi-Screen Media Consumption



CWI

Centrum Wiskunde & Informatica



DIS@CWI

Creative Industries



BYBORRE®



waag society

www.news.cn



www.xinhuanet.com



Disney Research

CWI

Centrum Wiskunde & Informatica

Network Operators



Telefonica



Others



Alcatel-Lucent



Microsoft

PHILIPS



21ST CENTURY CLASSROOM

The 21st Century Classroom

21st Century Skills are a combination of cognitive processes and the technologies that enable individuals to leverage these processes for the greatest impact. The 21st Century classroom is one that is student-centered, project based and focused on creating life-long learners.

Research & Information Fluency	Problem Solving & Critical Thinking	Collaboration & Communication	Creativity & Innovation
Teacher: <ul style="list-style-type: none"> provides opportunities for students to develop and demonstrate essential skills. Students: <ul style="list-style-type: none"> select appropriate digital tools to assemble, evaluate, and utilize information and resources. apply research and information resources. use information and resources to accomplish real-world tasks. 	Teacher: <ul style="list-style-type: none"> provides opportunities for students to develop and demonstrate essential skills. Students: <ul style="list-style-type: none"> select multiple resources to plan, design, and execute real-world problems. use technology to collaborate and solve authentic problems. develop open-ended questions using higher order thinking skills 	Teacher: <ul style="list-style-type: none"> creates structure and provides opportunities for student collaboration and communication. Students: <ul style="list-style-type: none"> Initiate communication in real and virtual time. collaborate and communicate with learners of diverse cultural backgrounds. form collaborative teams to solve real-world problems and create original works. 	Teacher: <ul style="list-style-type: none"> provides opportunities for students to develop and demonstrate essential skills. Students: <ul style="list-style-type: none"> apply critical thinking, research methods, and communication tools to create original work. collaborate effectively with an audience beyond the classroom to create original work.

<https://drzreflects.blogspot.com/2015/08/the-anatomy-of-21st-century-classroom.html>

21st Century Classroom

- Material and assignments
 - Empowering students
 - Video annotation
- Remote Learning and Collaboration
 - Breaking distance
 - Remote delivery: e.g., MOCC or Skype
 - Communication between students
- Feedback and Grading
 - New metrics and ways of evaluating
 - Intelligence: Avatars as teachers
 - Gathering data: sensors

21st Century Classroom

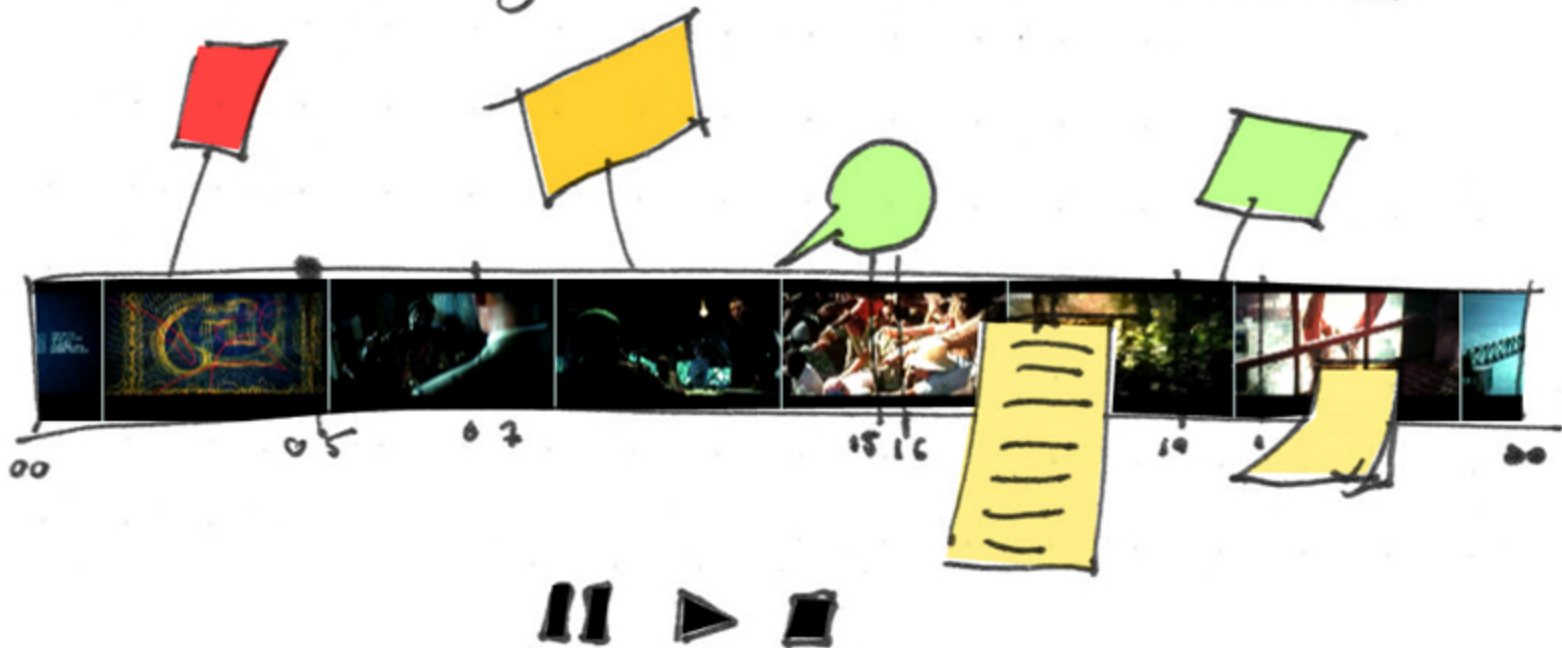
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Empowering students



Empowering students

Pick the right location in the content



Empowering students



21st Century Classroom

- Material and assignments
 - Empowering students
 - Video annotation
- Remote Learning and Collaboration
 - **Breaking distance**
 - Remote delivery: e.g., MOCC or Skype
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Breaking distance

Stage 2A - Start Game

A-card
B-card
C-card
Yes-card
No-card

Spaceship Energy
3000

A
Hans
Cost: 1500

B
Orlando
Cost: 2000


Pick Destination

Peter
Cost: 1000
Reward: 500 - 2000
Game: Pitch Matching


Reset Destination



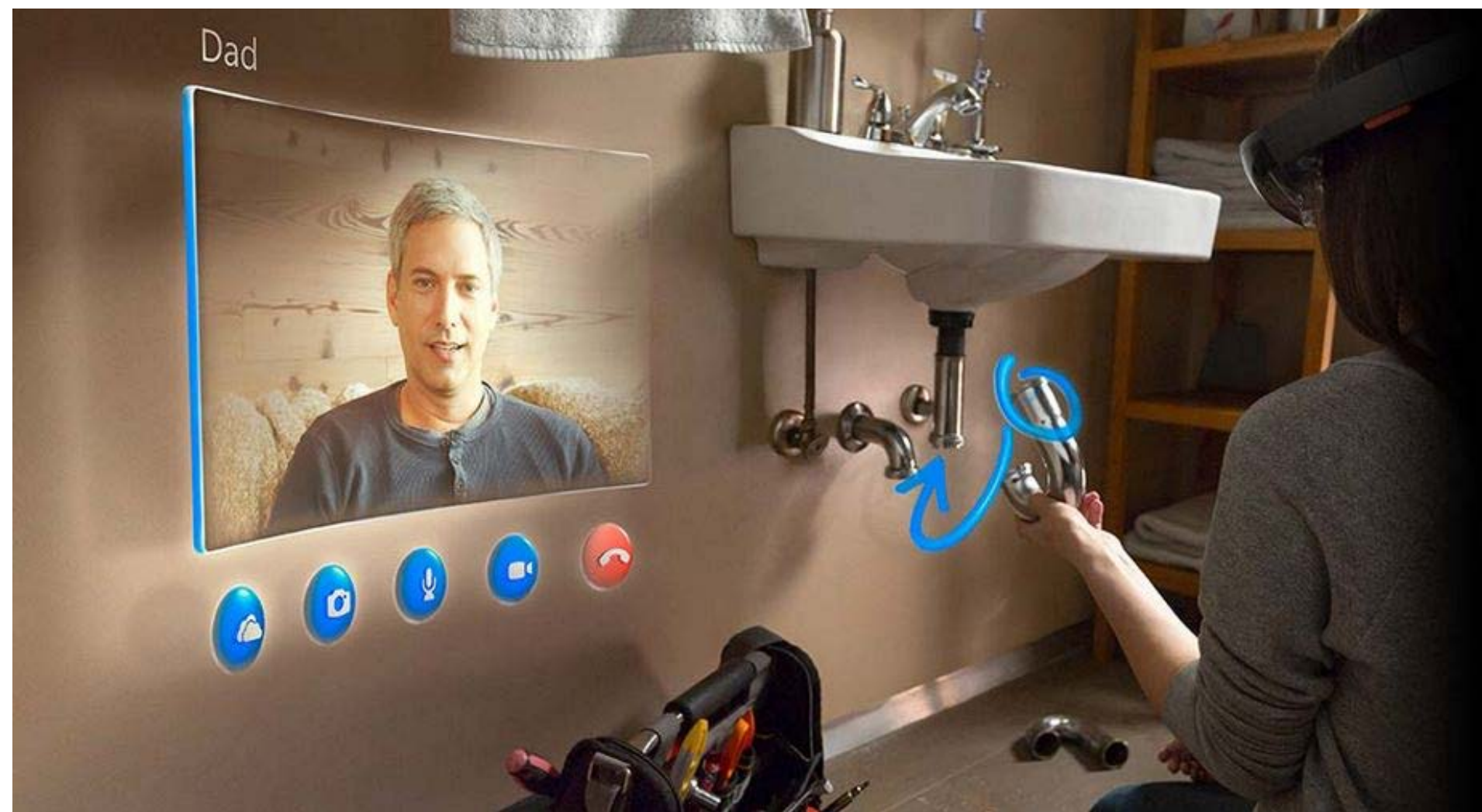
Breaking distance



Breaking distance



Breaking distance



21st Century Classroom

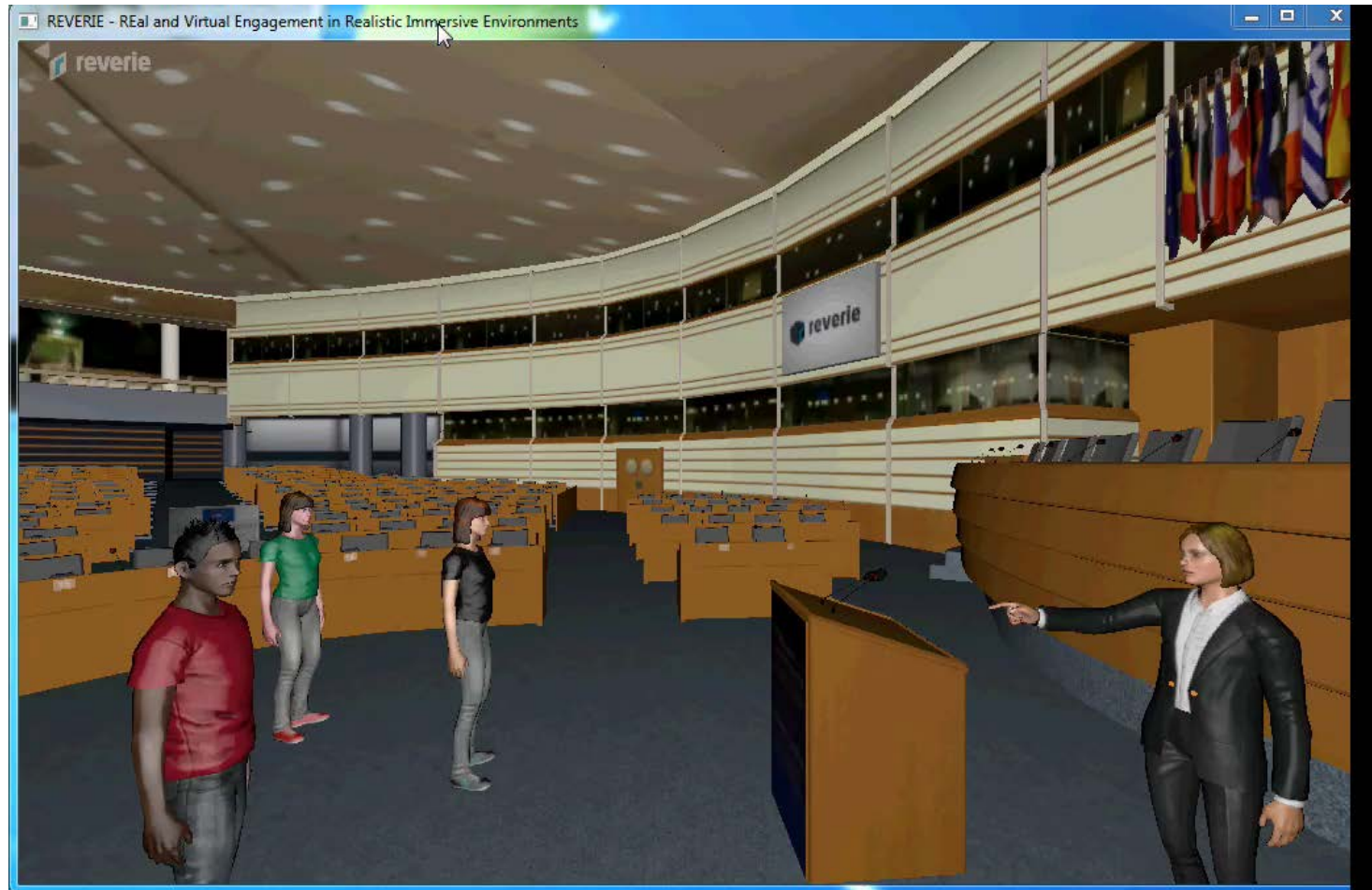
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Intelligence: Avatars as teachers

- Agents
 - React on user engagement: call for attention
 - Have a simple multimodal dialog: individual and group
 - Natural gaze behavior
- Avatars
 - Reflect engagement
 - Reflect camera view
 - Gestures (request to speak)
 - Puppeting (body, face)



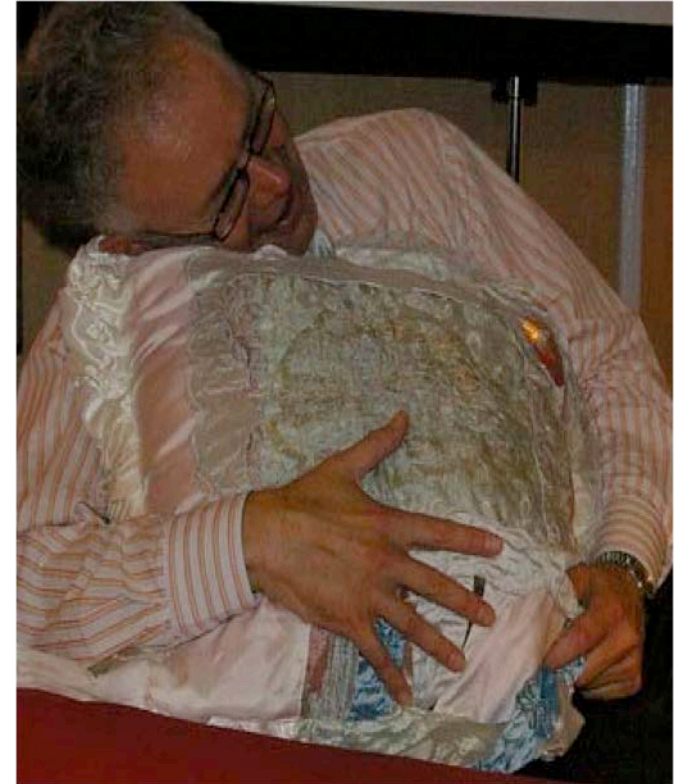
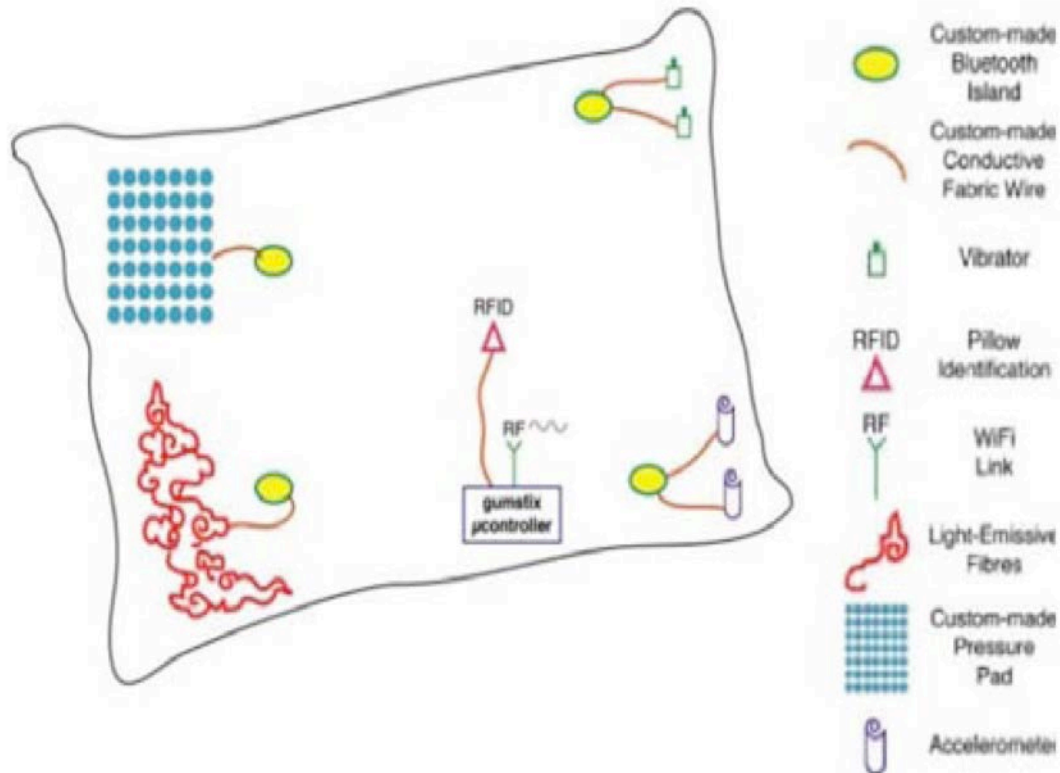
Intelligence: Avatars as teachers



21st Century Classroom

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 - Gathering data: sensors

Gathering data: sensors



Gathering data: sensors



SENSING ENGAGEMENT

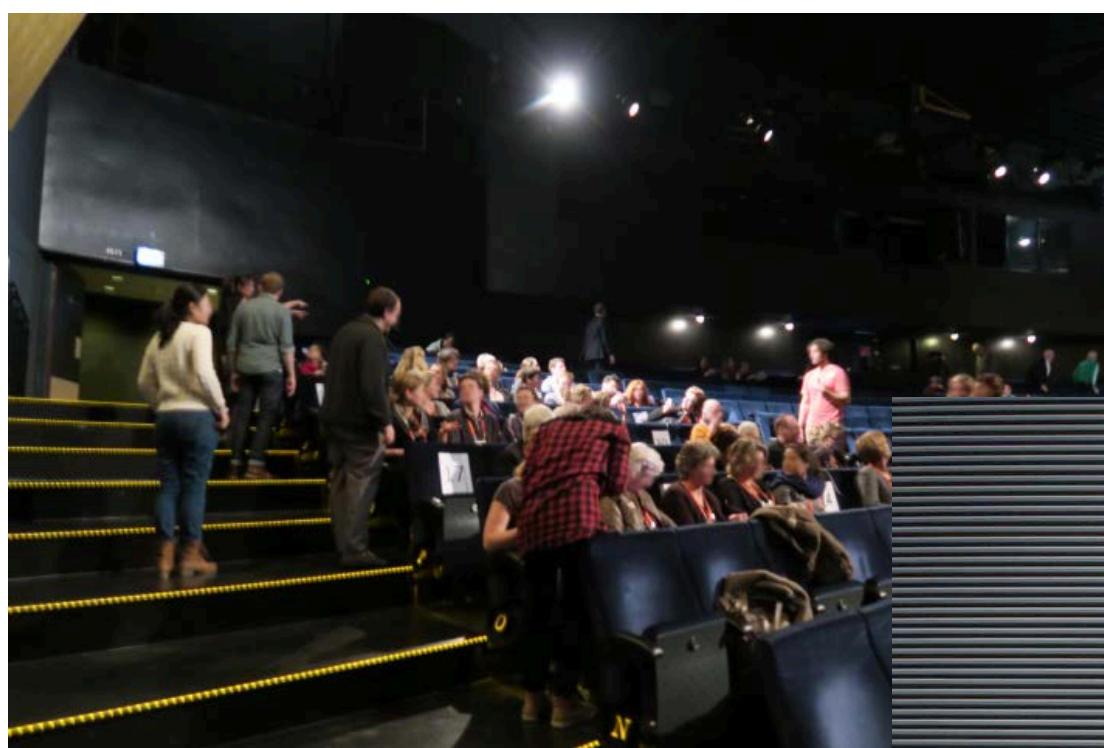
Objective: quantifying engagement



Objective: quantifying engagement

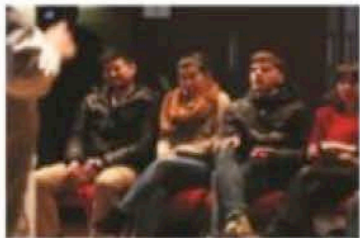


Methodology: research in the wild



Sensing: Devices

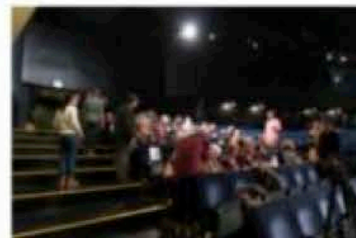
Method: Measure GSR data from 15 audience members while they watched a 28-minute pseudo play.



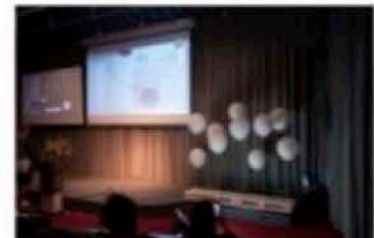
Method: Measure GSR data simultaneously from 12 live and 12 remote audience members. The show was streamed live to another location.



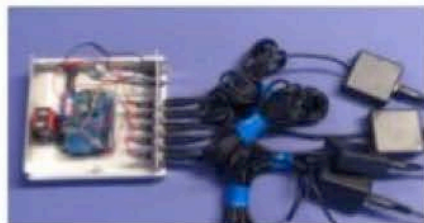
Method: Measure GSR data from 20 audience members while they watch a one hour commercial dance performance in an actual theater.



Method: Visualize measured GSR data on a digital display and use data to control heights of balloons.



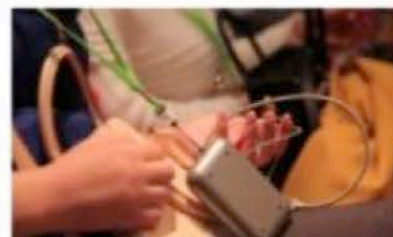
First generation of sensors: Consisting of one Arduino UNO board, one Xbee wireless module (for every five users), and noise filter.



Second generation of sensors: Consisting of one Jeenode board and one RFM12B radio module each.



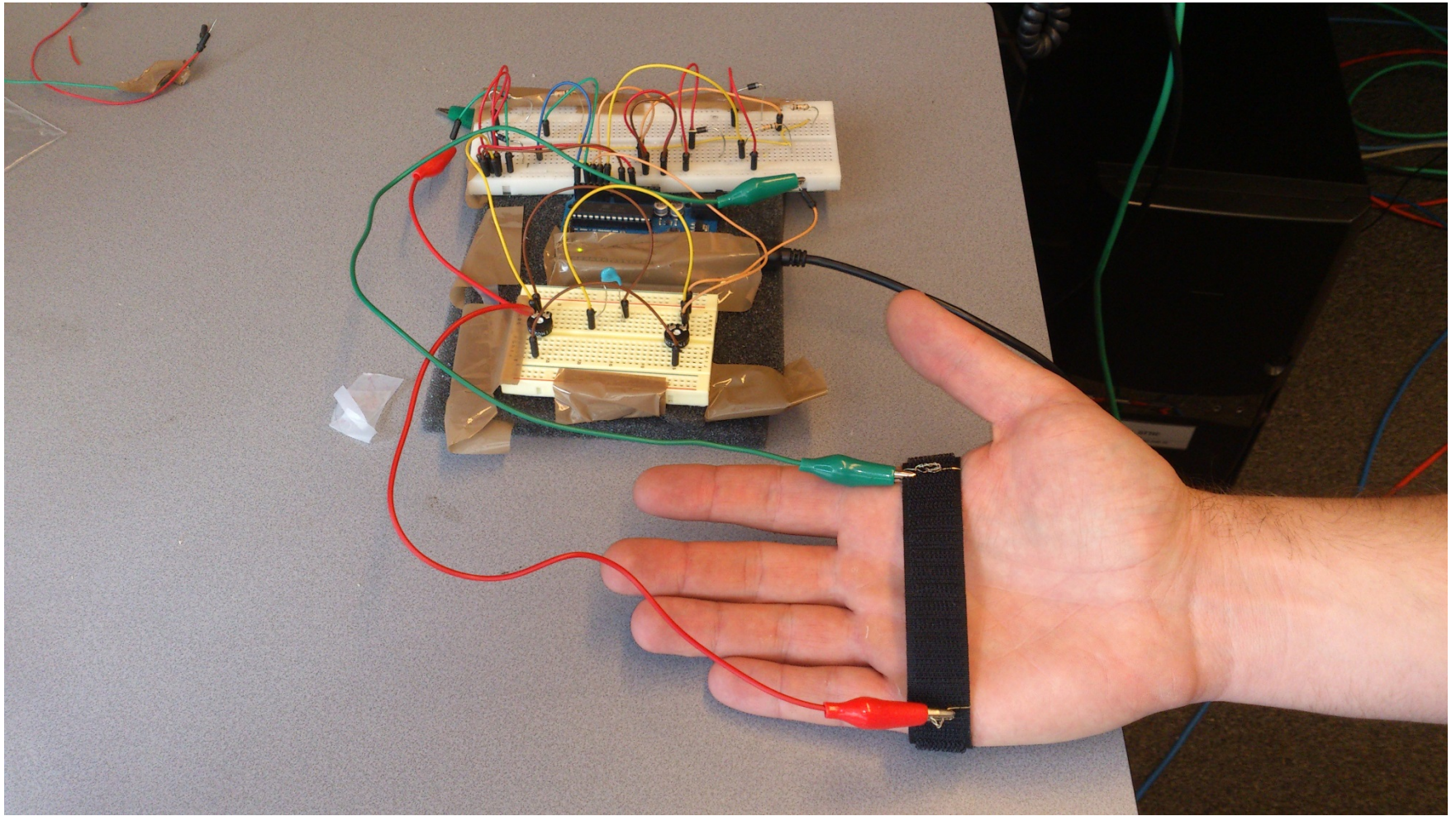
Third generation of sensors: Repackaged the hardware with a new version of software.



Visualization to indicate audience engagement

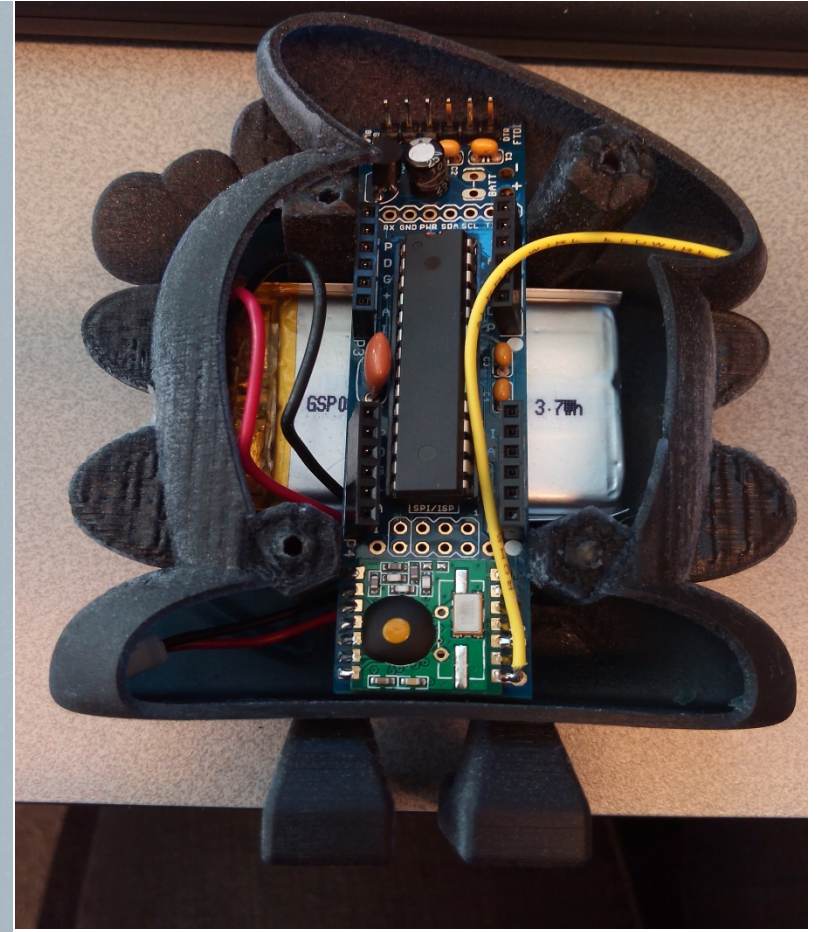


Sensing: Devices

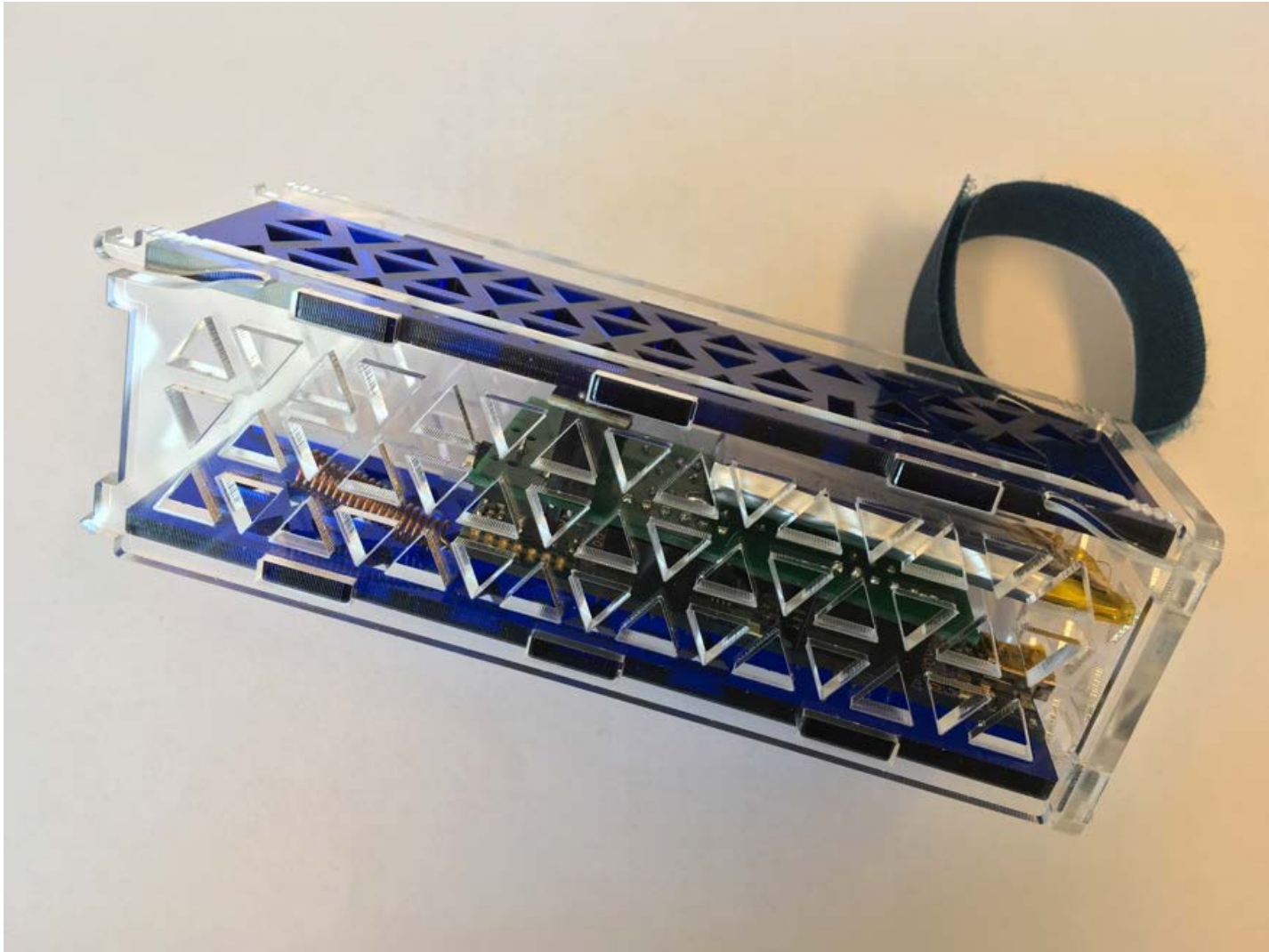




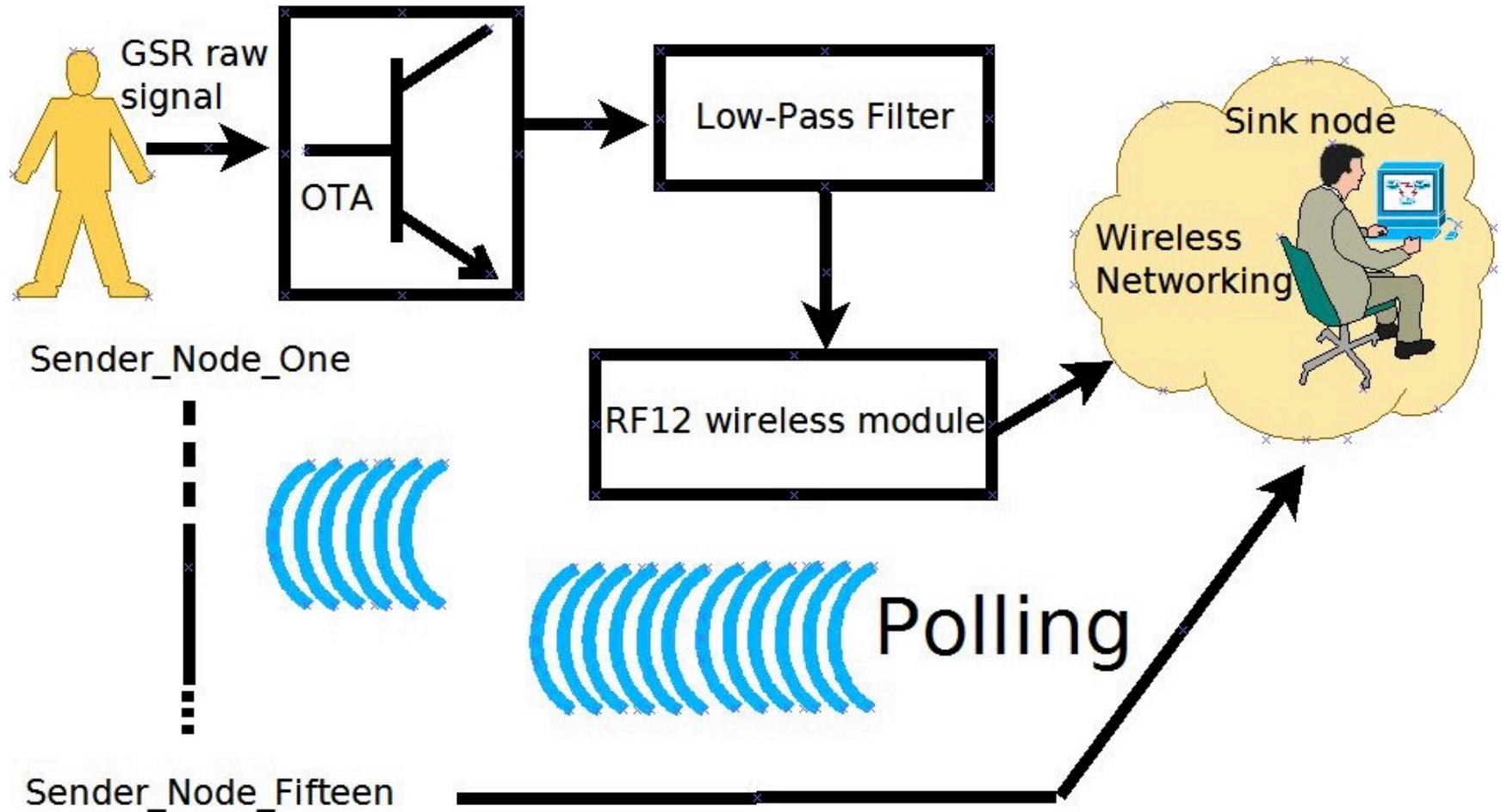
Sensing: Devices



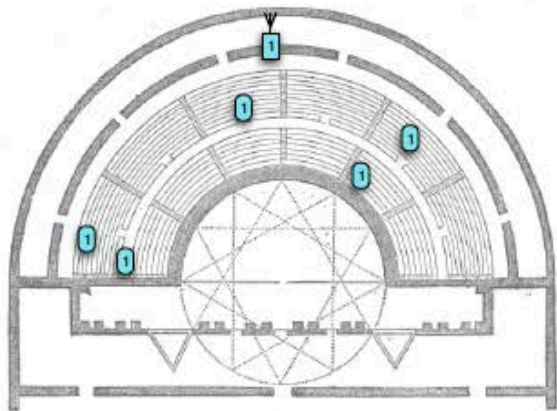
Sensing: Devices



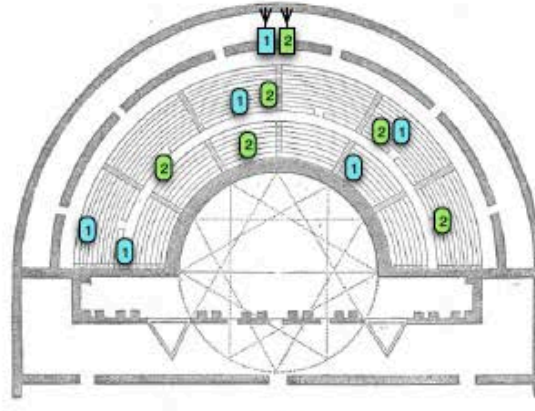
Sensing: Infrastructure



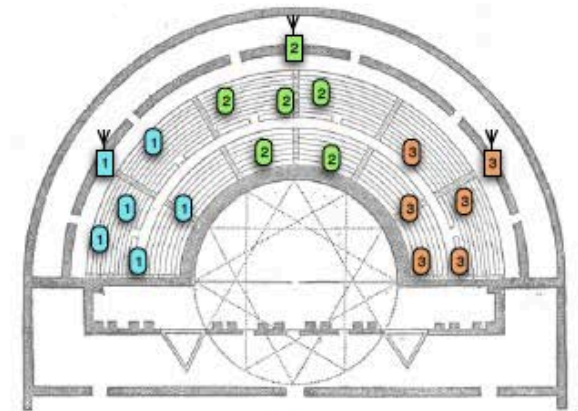
Sensing: Infrastructure



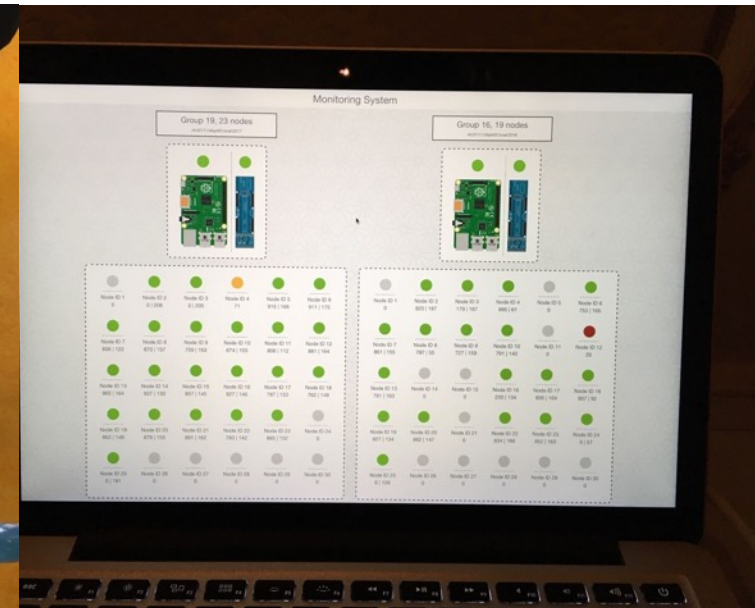
(a)



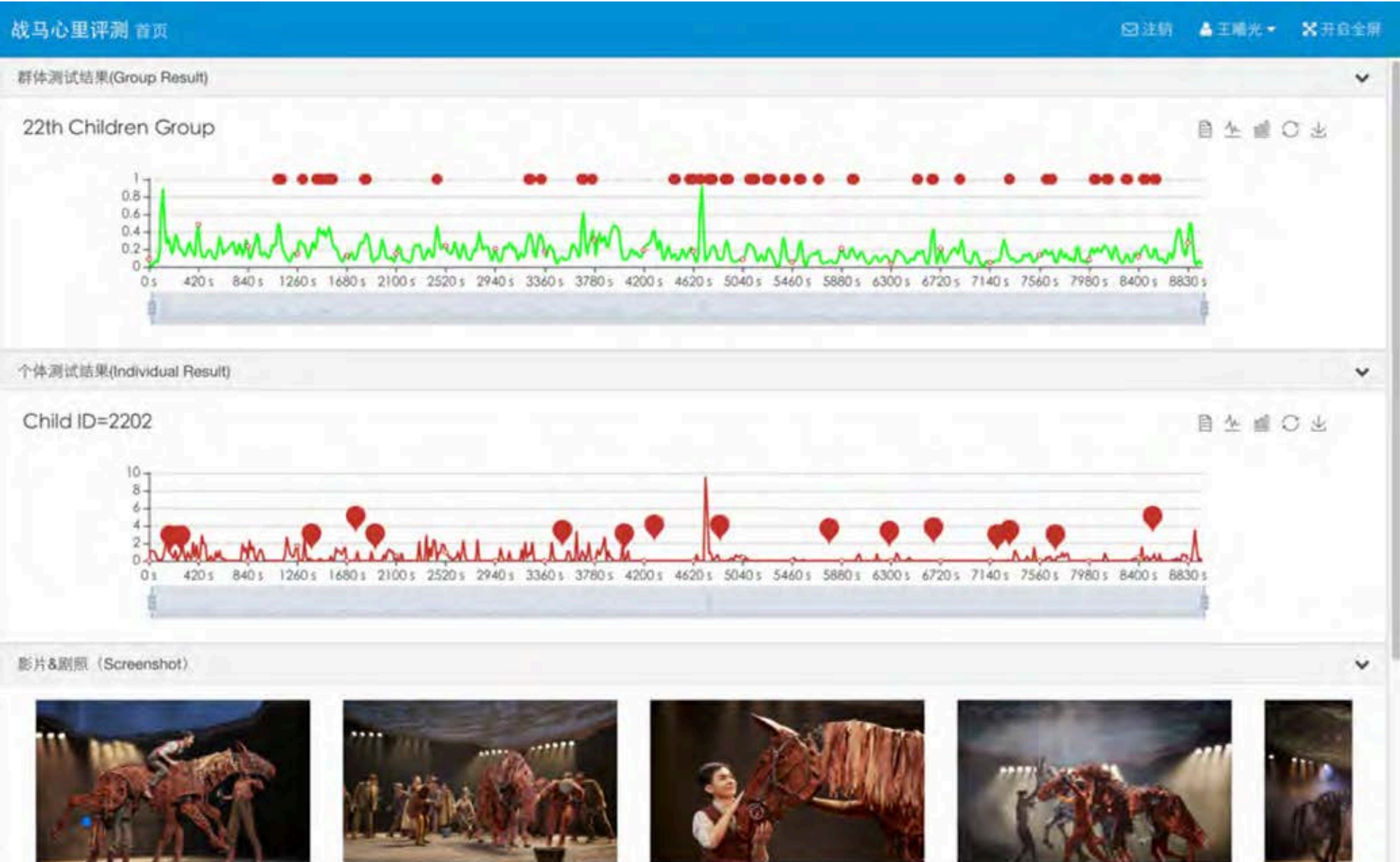
(b)



(c)



Sensing: Understanding



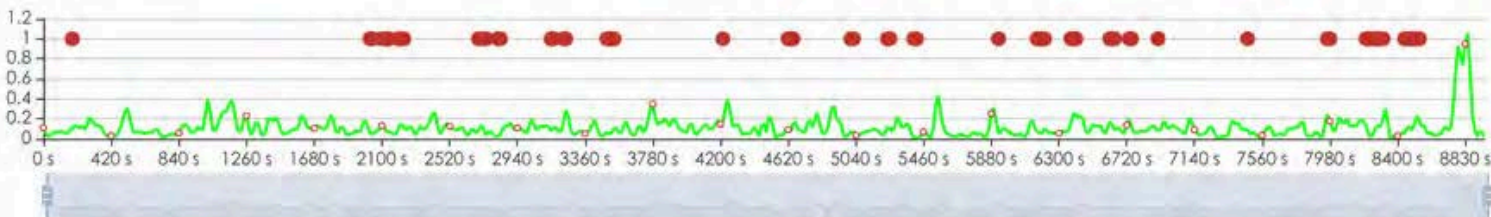
Sensing: Understanding

战马心里评测 首页

注册 王曦光 开启全屏

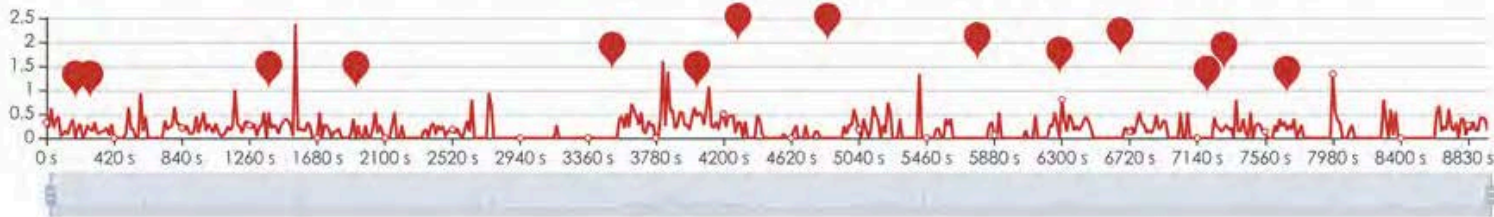
群体测试结果(Group Result)

22th Adult Group

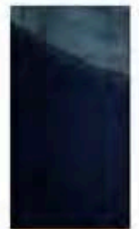
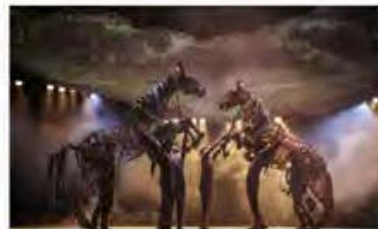
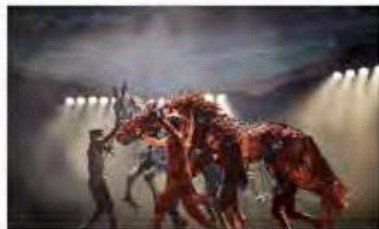
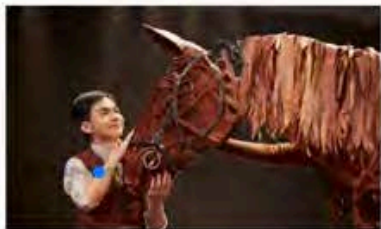


个体测试结果(Individual Result)

Adult ID=2206



影片&剧照 (Screenshot)



Sensing: Understanding

演艺非凡



75

1 李玟



70

2 张信哲



85

3 老狼



82

4 李克勤



5 徐佳莹



6 容祖儿



7 赵传



8 金志文



9 苏运莹



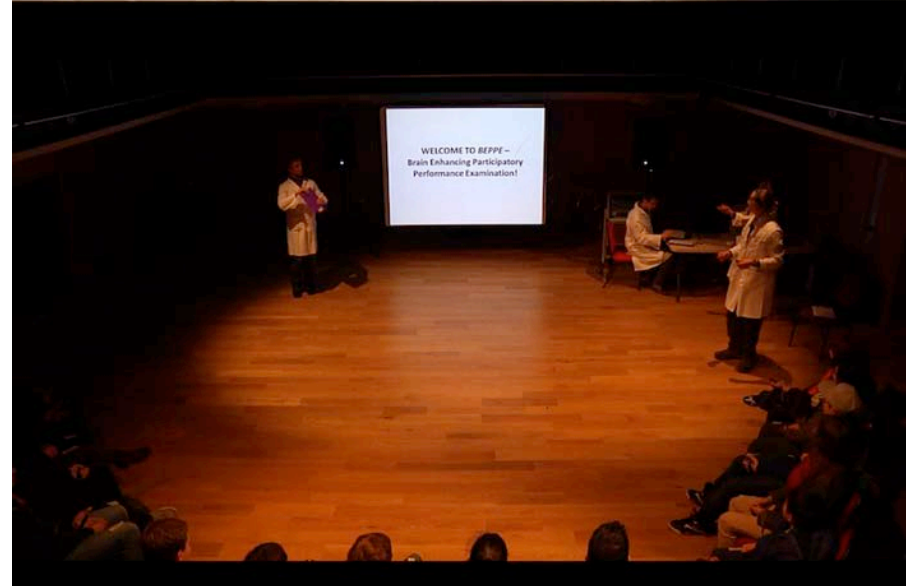
10 关喆

55%

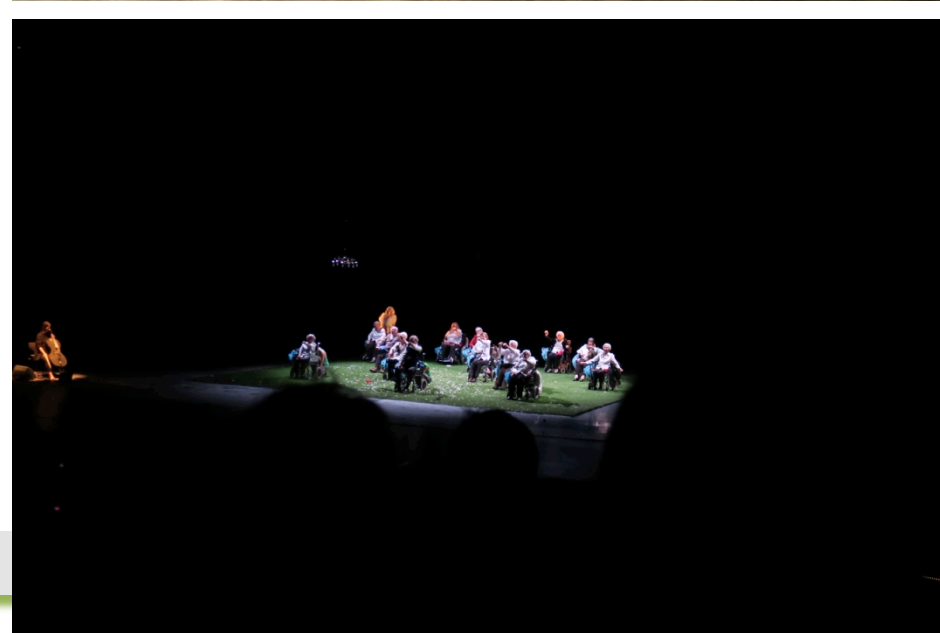
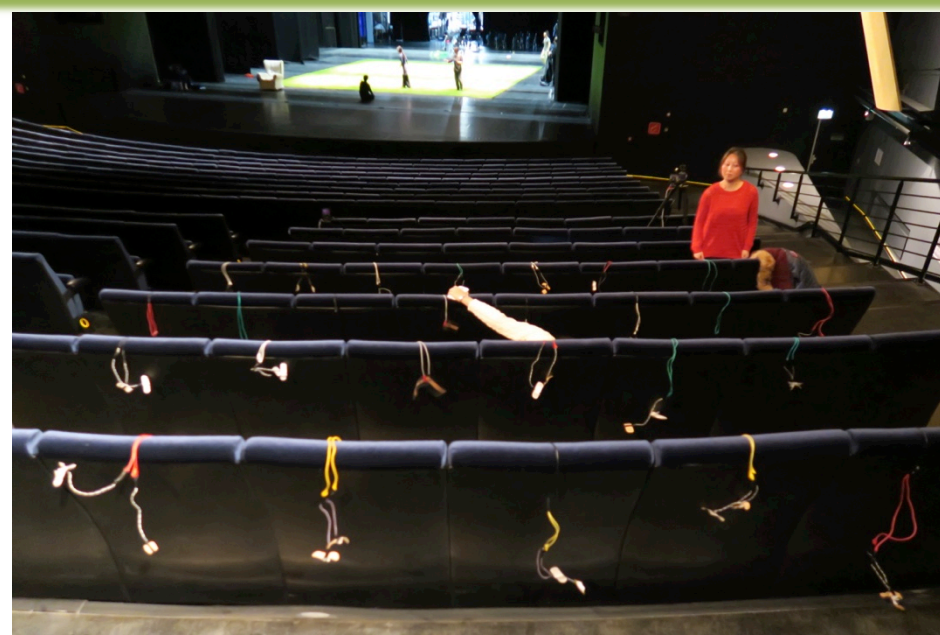
26%

19%

Sensing Examples: Student Theatre



Sensing Examples: Holland Dance

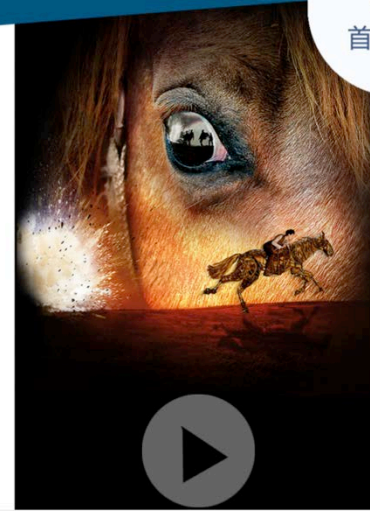


Sensing Examples: War Horse



STAR
首个项目

正开展的研究还包括：1) 生物传感+移动医疗的
传媒应用——循证医学与数据挖掘；2) 电子商
务领域的传媒情报分析；3) “蝙蝠侠”——新闻无
线服务与监控系统等杀手级应用



战马 WarHorse 袭心 ——国内首次剧场传感：

新华网携手国家话剧院开展国内首次观众
传感实验

被誉为英国“国宝级”的舞台剧《战马》已由中国国家话剧院与英国国家话
剧院联手制作出中文版。这部讲述一战中少年阿尔伯特寻找爱马“乔伊”的
舞台剧，相继在英国、美国、澳大利亚、德国、荷兰等地上演，连英国女
王伊丽莎白二世和首相卡梅伦都多次接见过“乔伊”。而11月中旬上海站的
演出，又成为它极为特别的一段征程。[阅读全文](#)

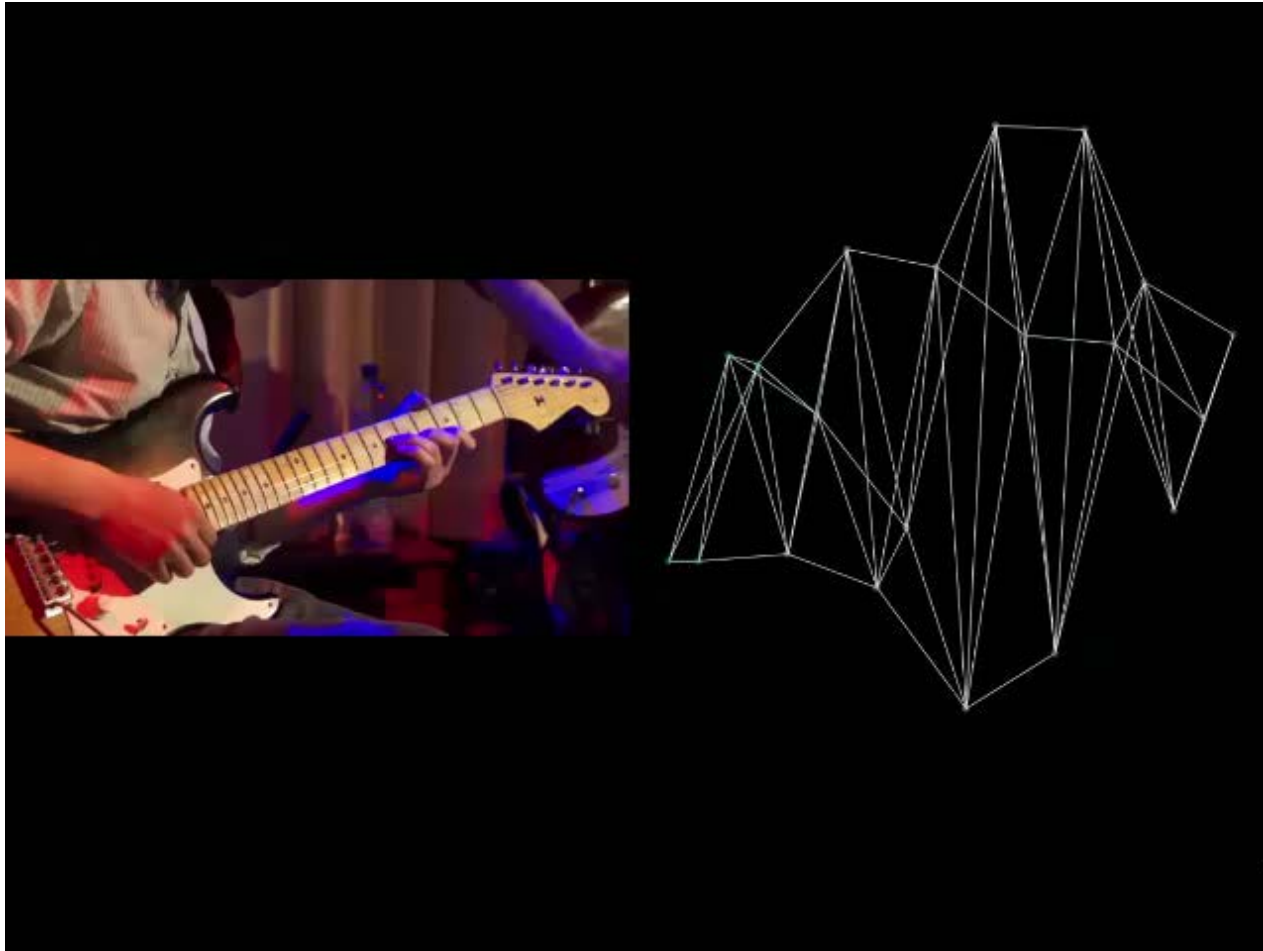
剧场传感实验引发各领域需求探索

这场科技与艺术“跨界”，研究团队“跨国”组合的实验吸引了来自各地各行
业的观众志愿者，没有参与测试的观众和敏锐的媒体人也纷纷提问，对生物
传感技术以及人工智能领域的最新发展与未来应用，表现出浓厚兴趣——

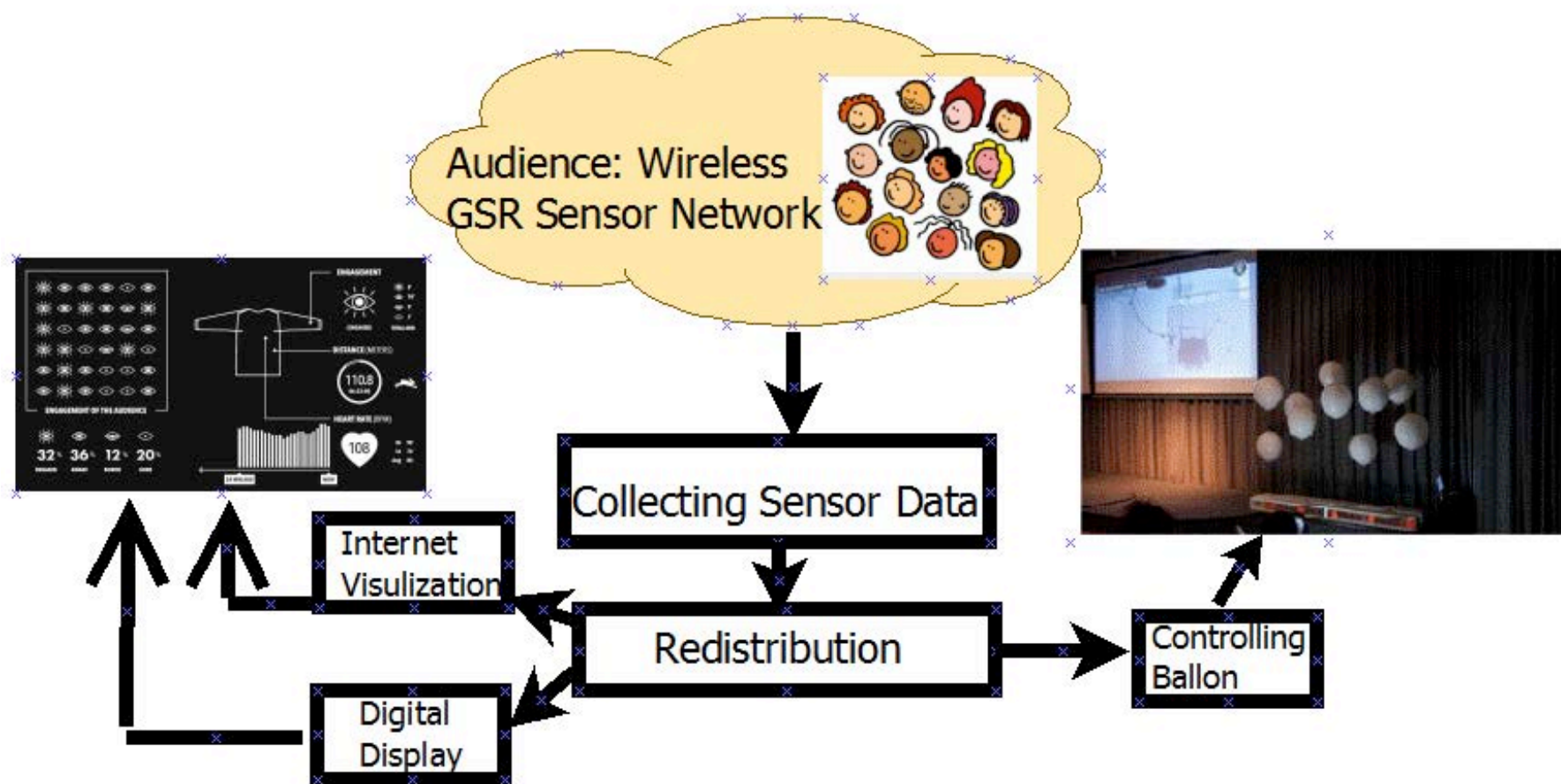
Sensing Examples: Jazz at Goethe



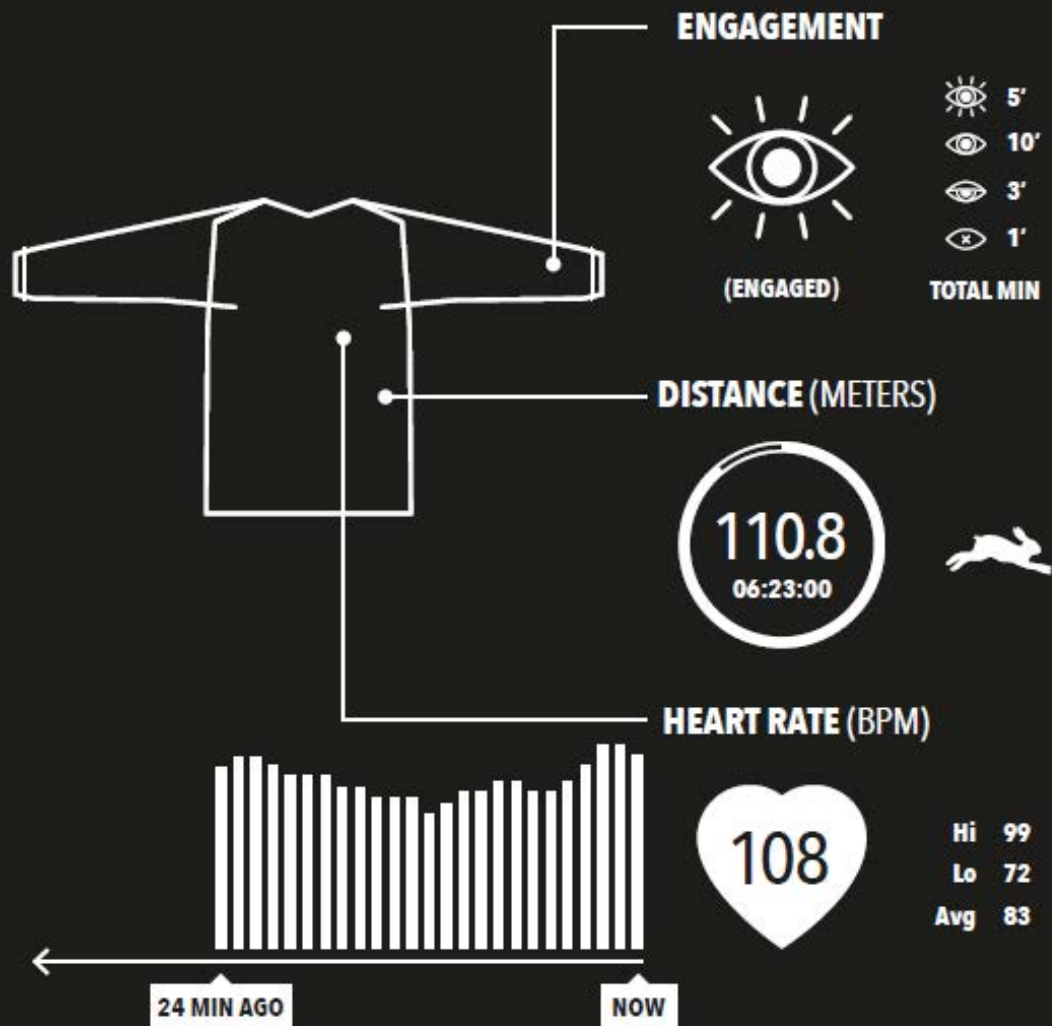
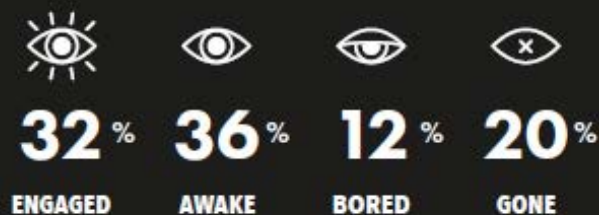
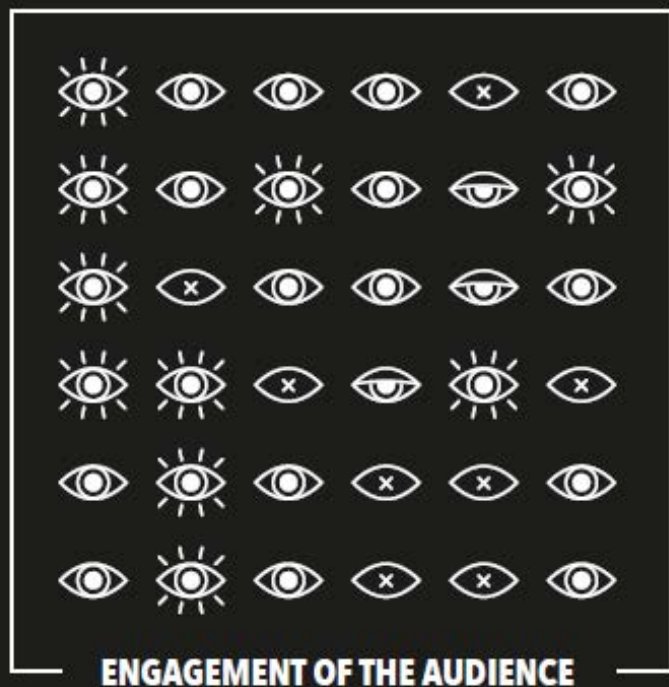
Sensing Examples: Jazz at Goethe



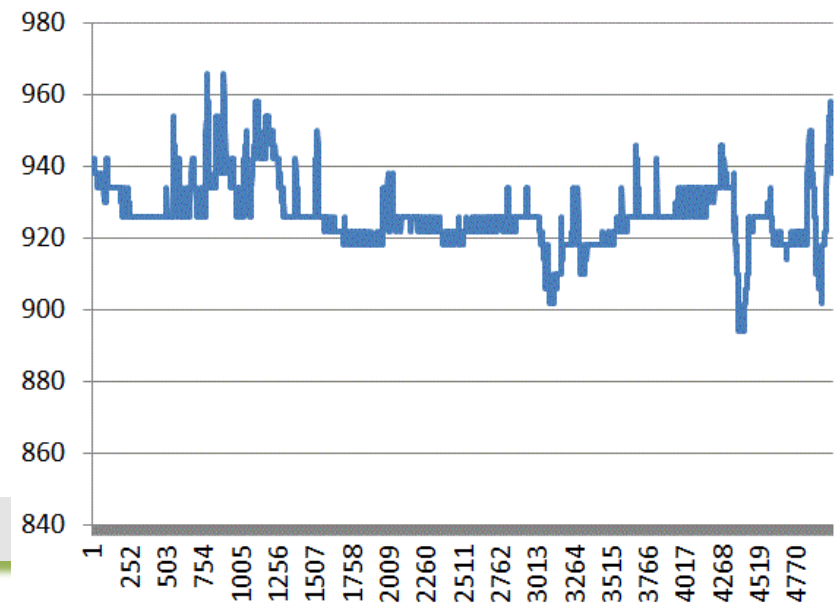
Sensing Examples: Lectures



Sensing Examples: Lectures



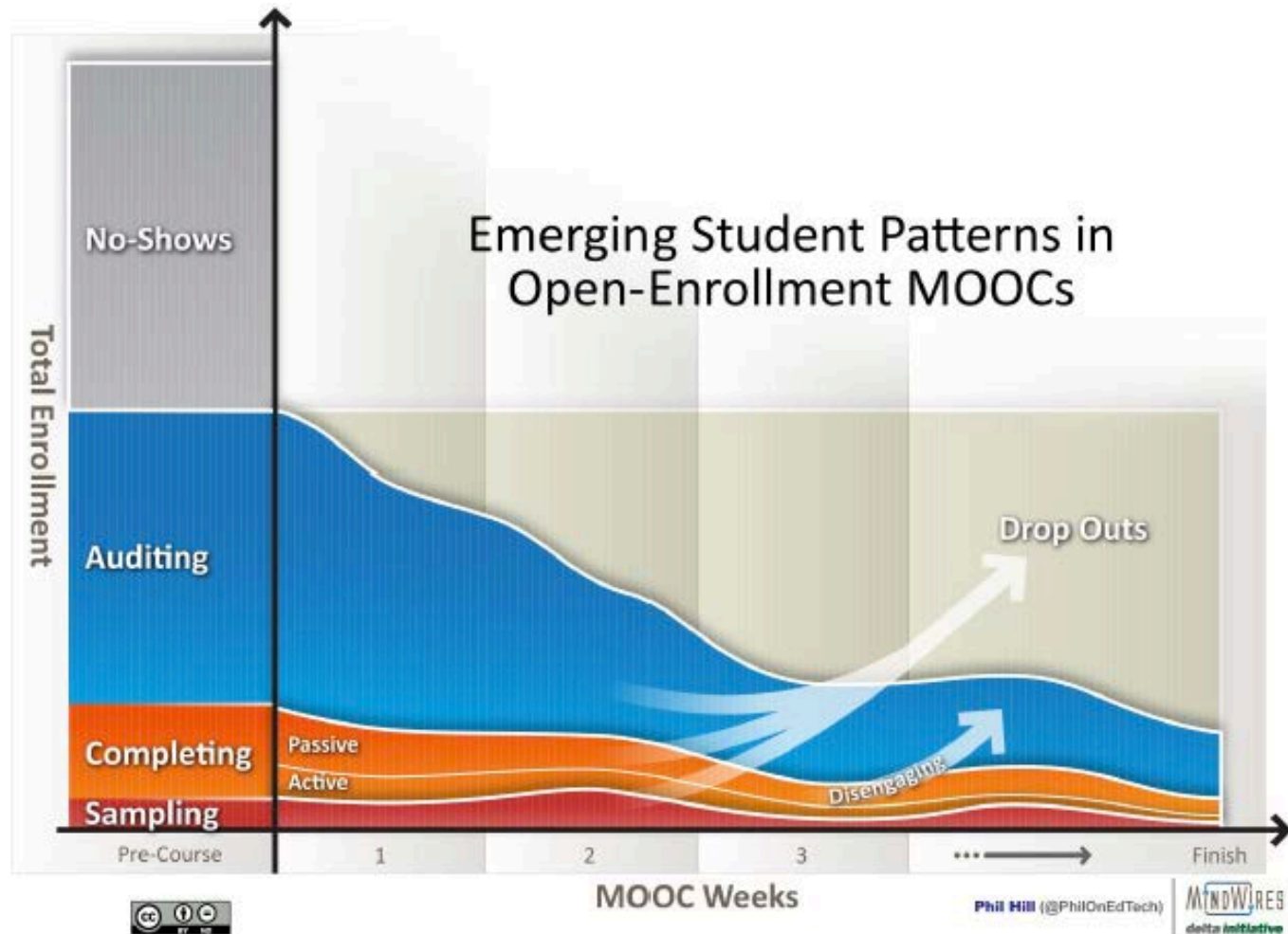
Sensing Examples: Lectures



21st Century Classroom

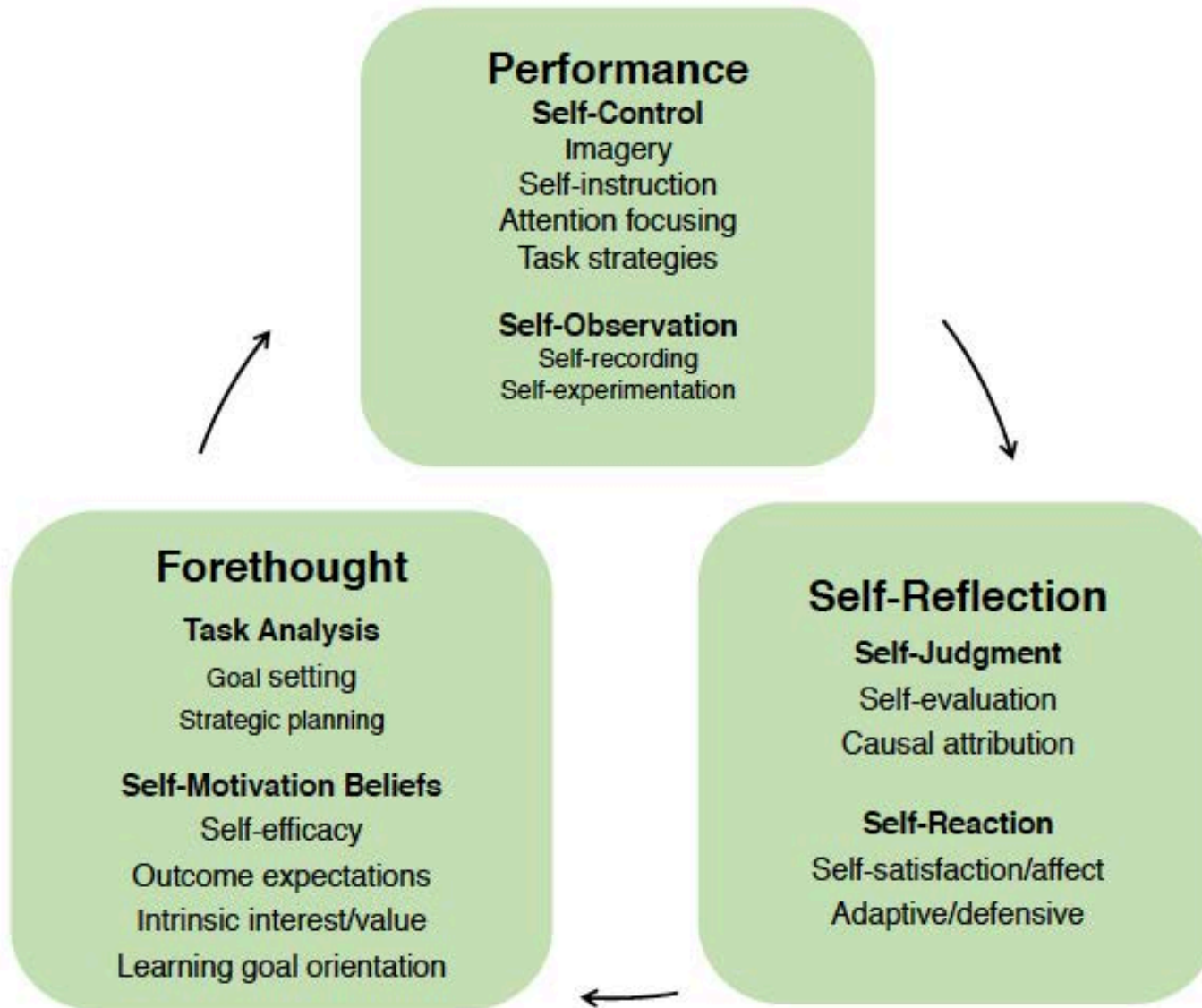
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Remote Learning and Metrics



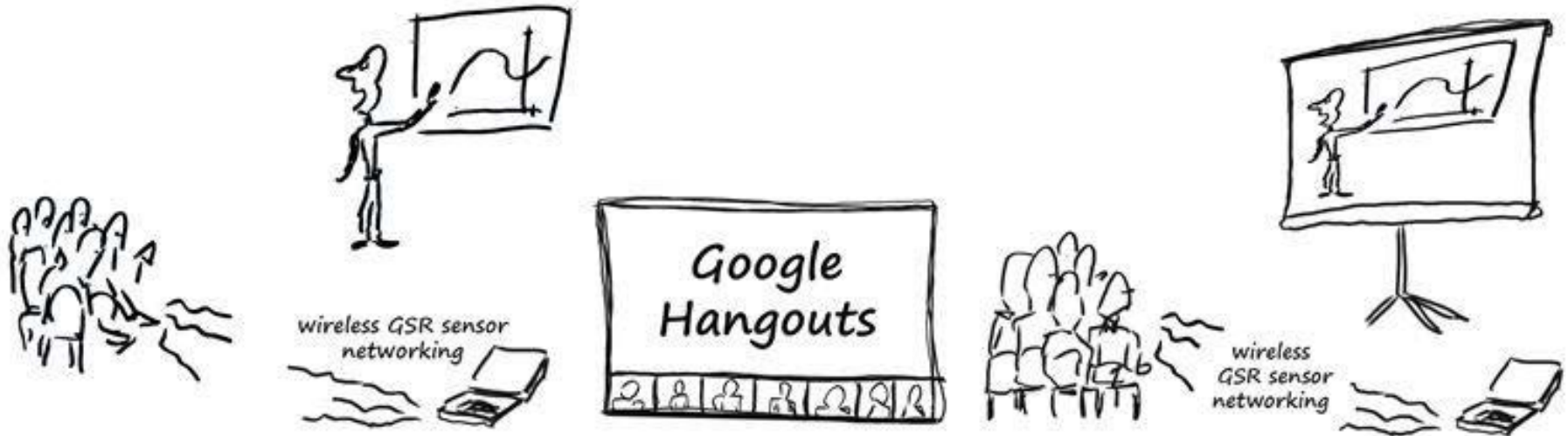
Graph from <http://mfeldstein.com/battle-for-open-mooc-completion-rates/>

Self Regulated Learning



SRL Model from Zimmerman
and Campillo (2003)

Remote Learning and Metrics





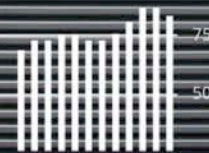
BORRE ENGAGEMENT



ACCELERATION ON AXIS



HEART RATE (BPM)



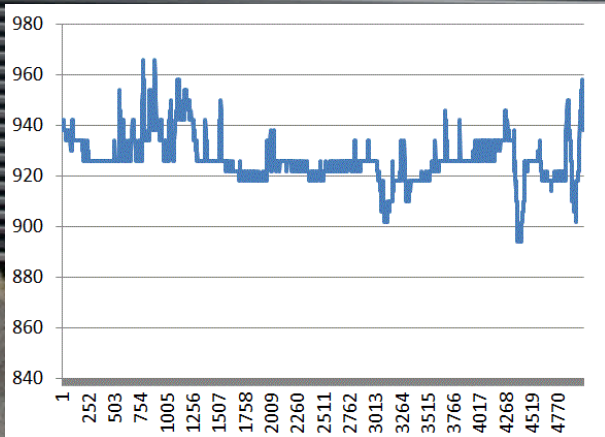
NOW



Hi: 108

Lo: 52

Avg: 70



Thanks!

@pablocesar2661

<http://www.dis.cwi.nl>

David A. Shamma

Demosthenis Katsouris

Amritpal Singh Gill

Chen Wang

...

(and so many more people)



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