



SEAMLESS LEARNING SPACES ...



Leiden•Delft•Erasmus
Centre for Education and Learning



Universiteit
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The Netherlands

TU Delft Delft University of Technology

Erasmus
University
Rotterdam
Erasmus



PROF. DR. MARCUS SPECHT
WELTEN INSTITUTE, OPEN UNIVERSITEIT



Welten Institute

Seamless Learning
decomposed into

a) Learning In Context

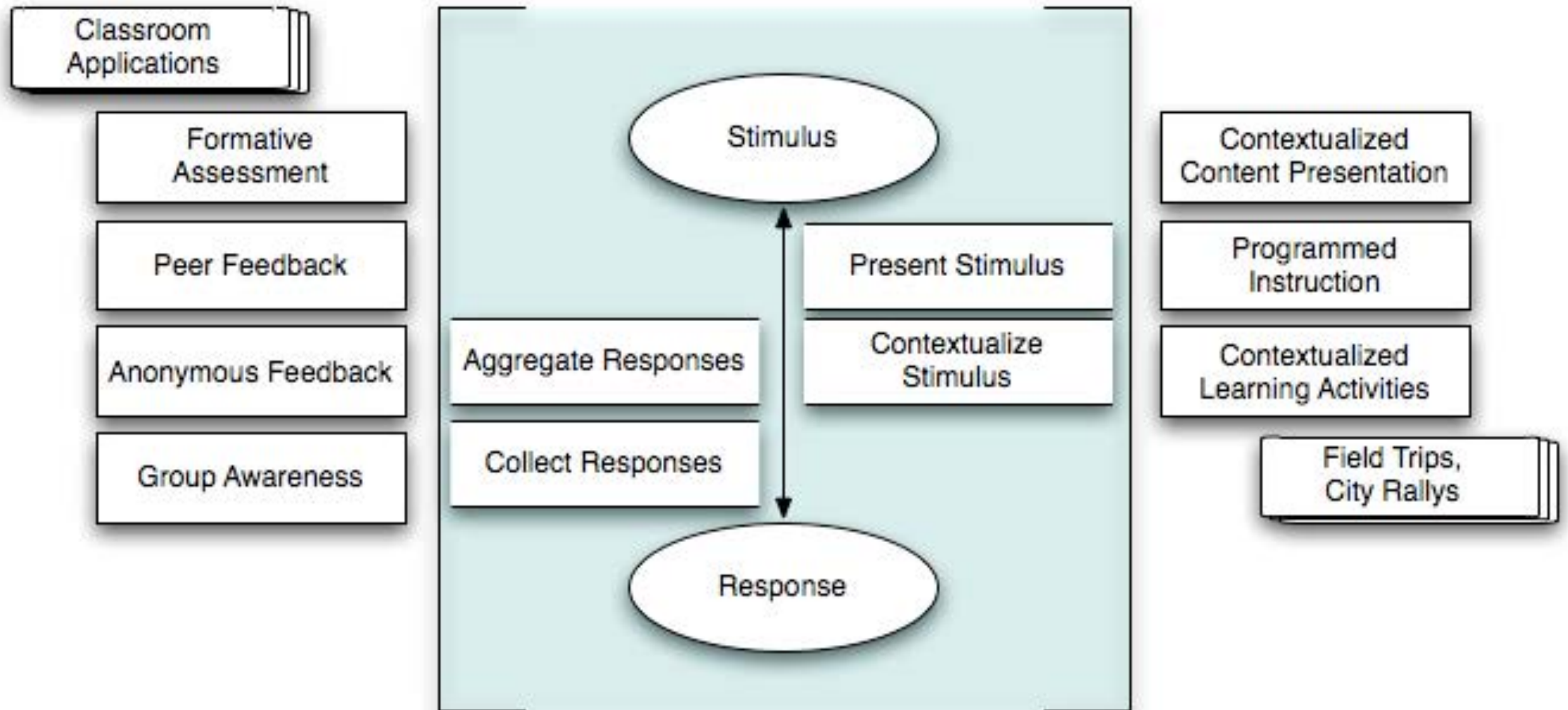
b) Learning Across Context

Perspectives: Mobile Technologies for Learning (Nesta Futurelab 2004)

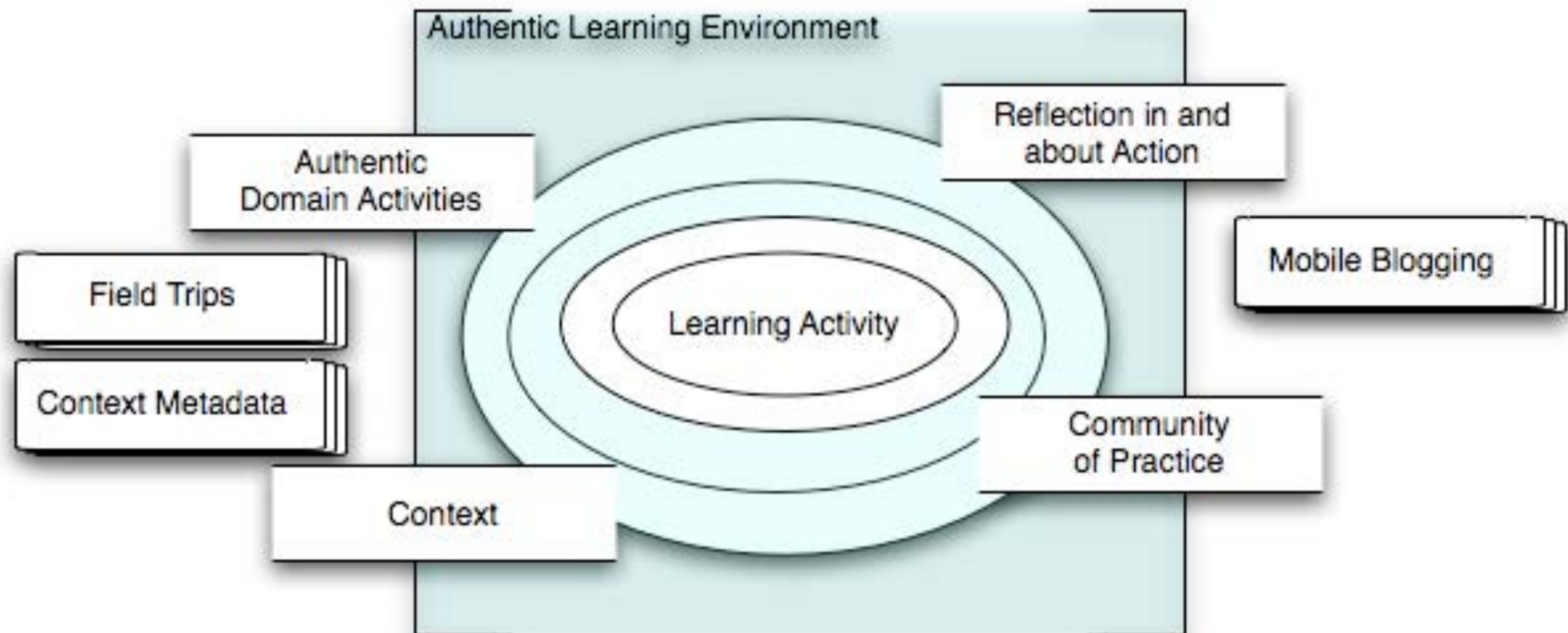
Theme	Key Theorists	Activities
Behaviourist learning	Skinner, Pavlov	• drill and feedback • classroom response systems
Constructivist learning	Piaget, Bruner, Papert	• participatory simulations
Situated learning	Lave, Brown	• problem and case-based learning • context awareness
Collaborative learning	Vygotsky	• mobile computer-supported collaborative learning (MCSCL)
Informal and lifelong learning	Eraut	• supporting intentional and accidental learning episodes
Learning and teaching support	n/a	• personal organisation • support for administrative duties (eg attendance)

Table 1: An activity-based categorisation of mobile technologies and learning

Behaviourist Learning



Situated Learning



HIPPIE – a museum guide

Useful use of multimedia: graphical support

HIPPIE
[Content](#)
[Map](#)
[Tour](#)
[Search](#)
[Profile](#)

Amor und Merkur in Galerie-Saal in Schloss Födinghoven



Amors Körper weist eine Bogenspannung auf. Arm und Körper selbst sind als Pfeil und Bogen gestaltet. Somit ist er vollkommen identifiziert mit dem bewegenden, hinweisenden Prinzip.

Arrow and bow



Time: 9 (64) sec.
Title: 2 (6)

[Abstract](#)
[Style](#)

[Artist](#)
[Composition](#)

[Dateline](#)
→ [Form](#)

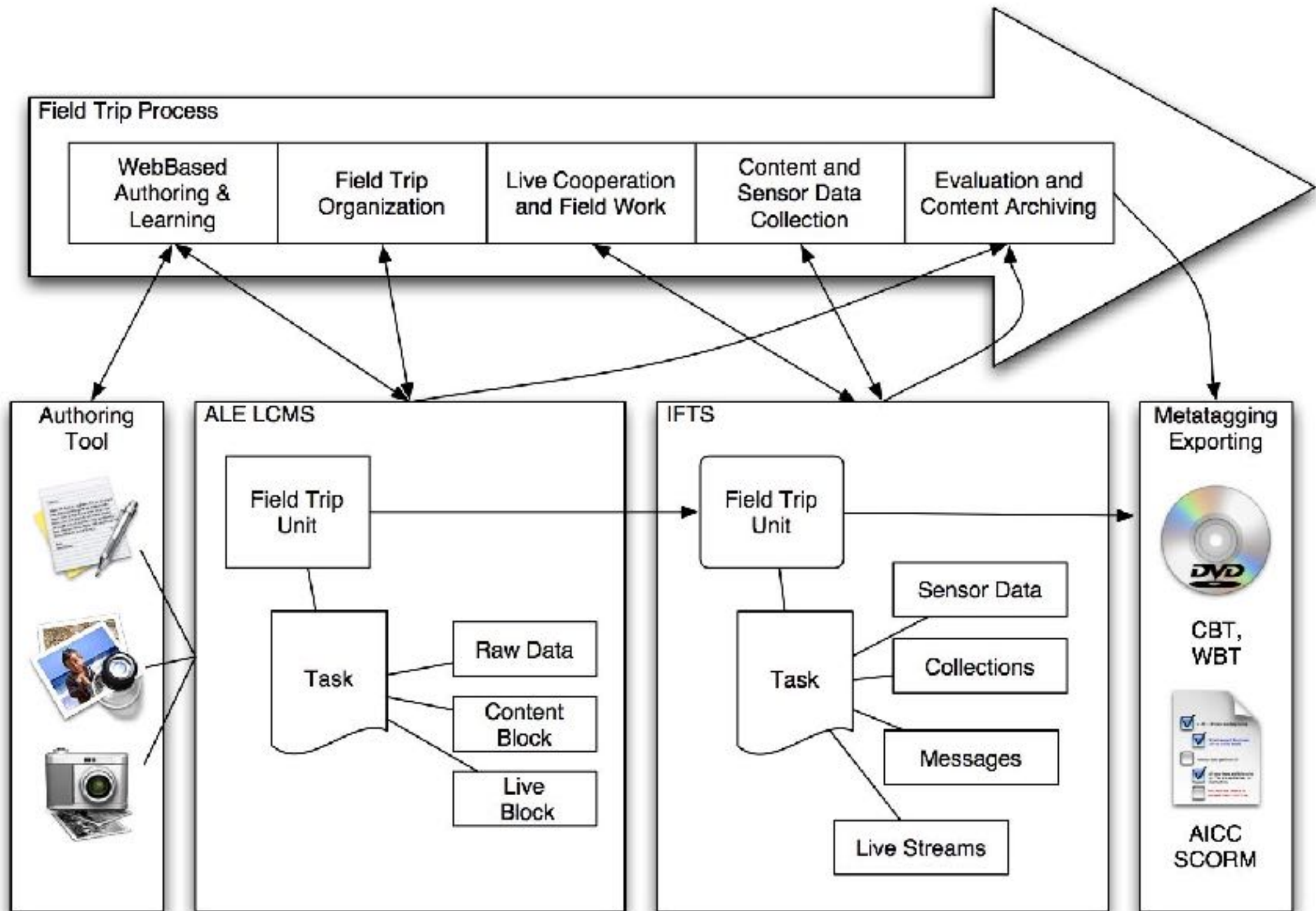
[Motive](#)
[Color](#)

[Genre](#)
[Note](#)

[Material](#)
[View](#)

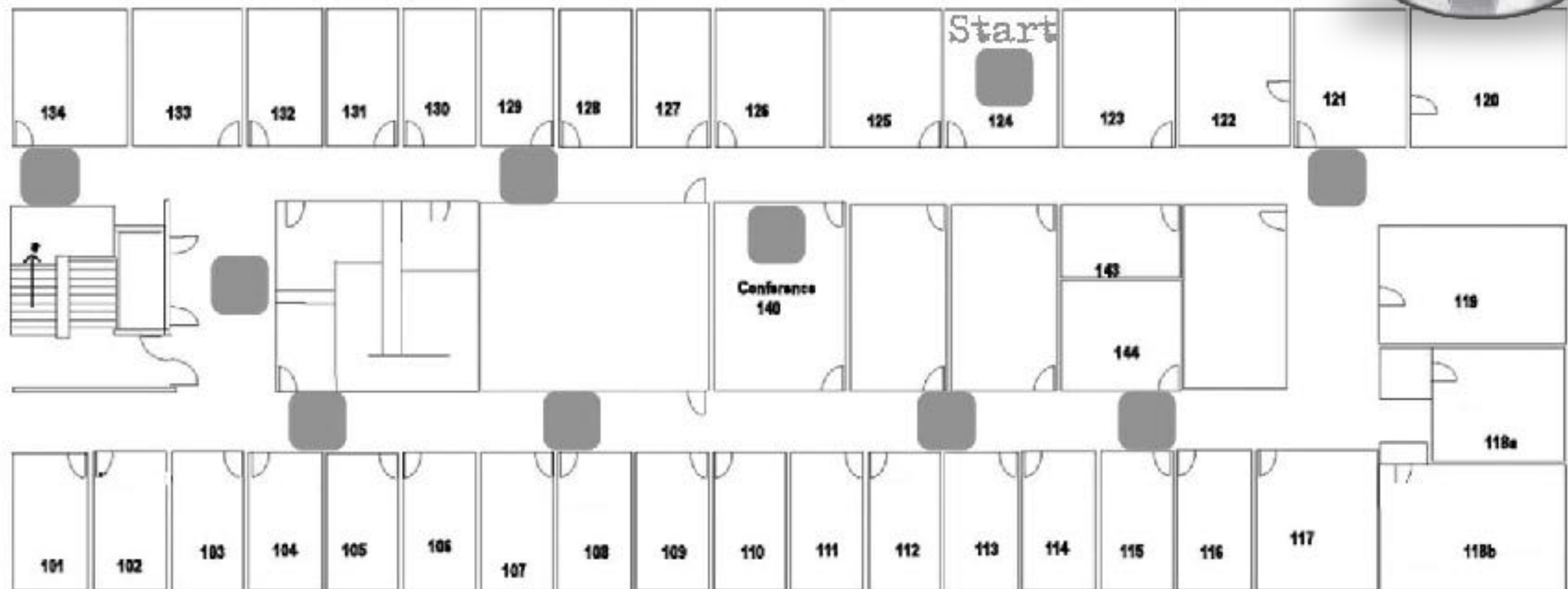
[Technique](#)
[Way to ...](#)

RAFT: Field Trips

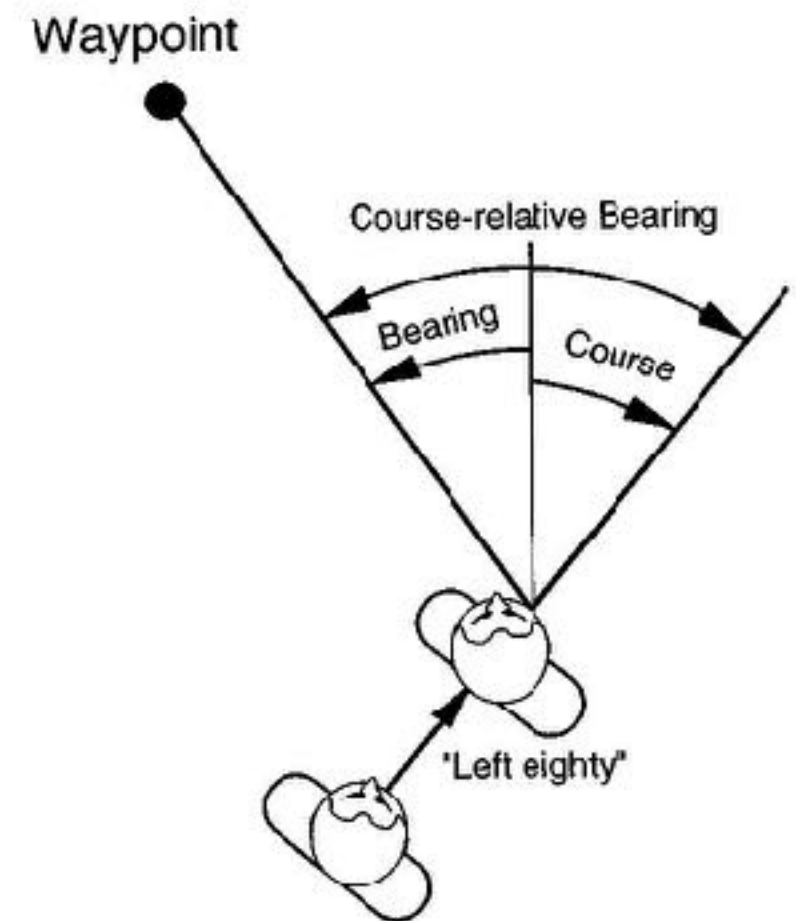


Locatory: Mobile Gaming

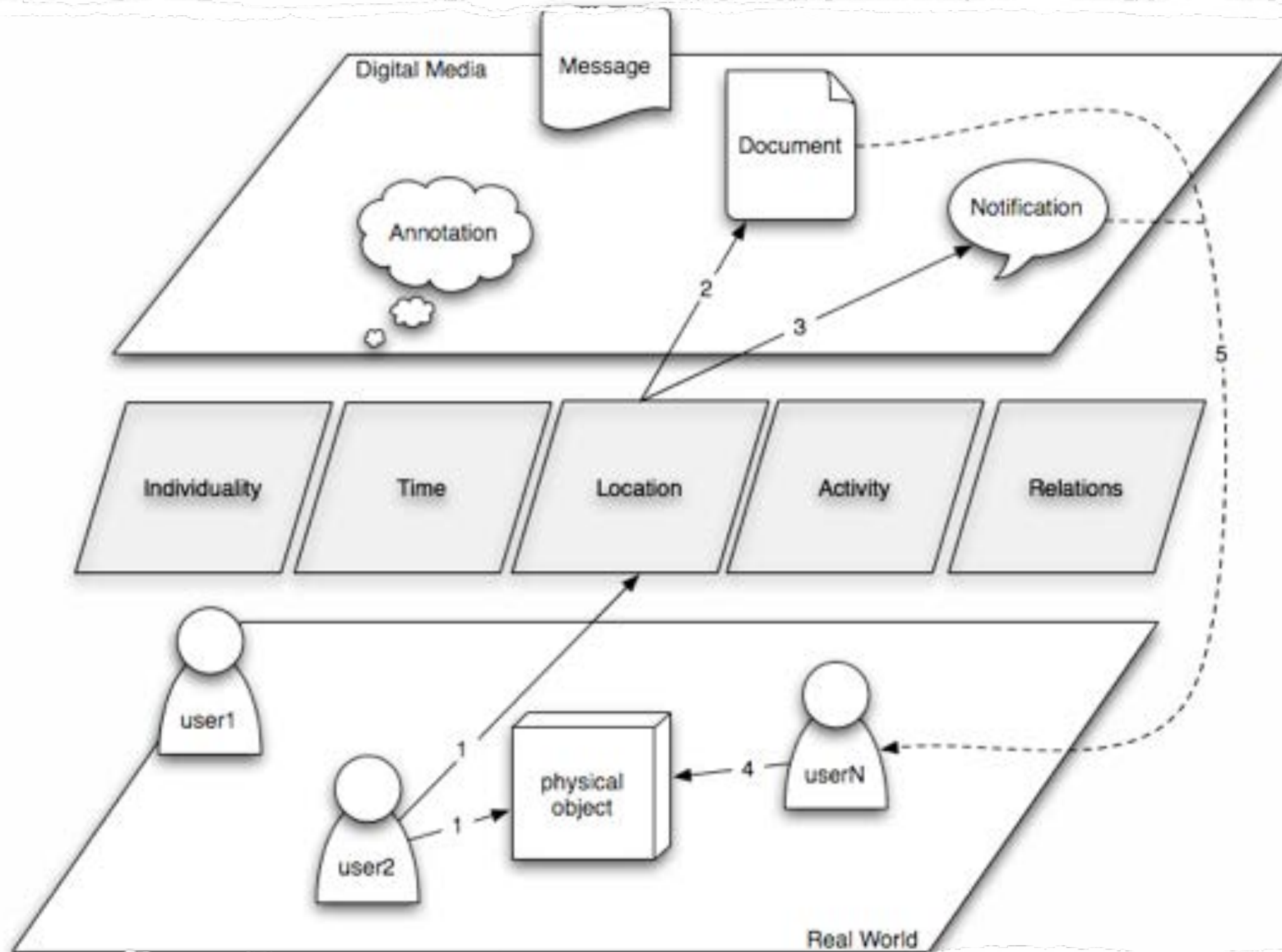
Locatory-Cards



Melodious Walkabout: Auditory Displays

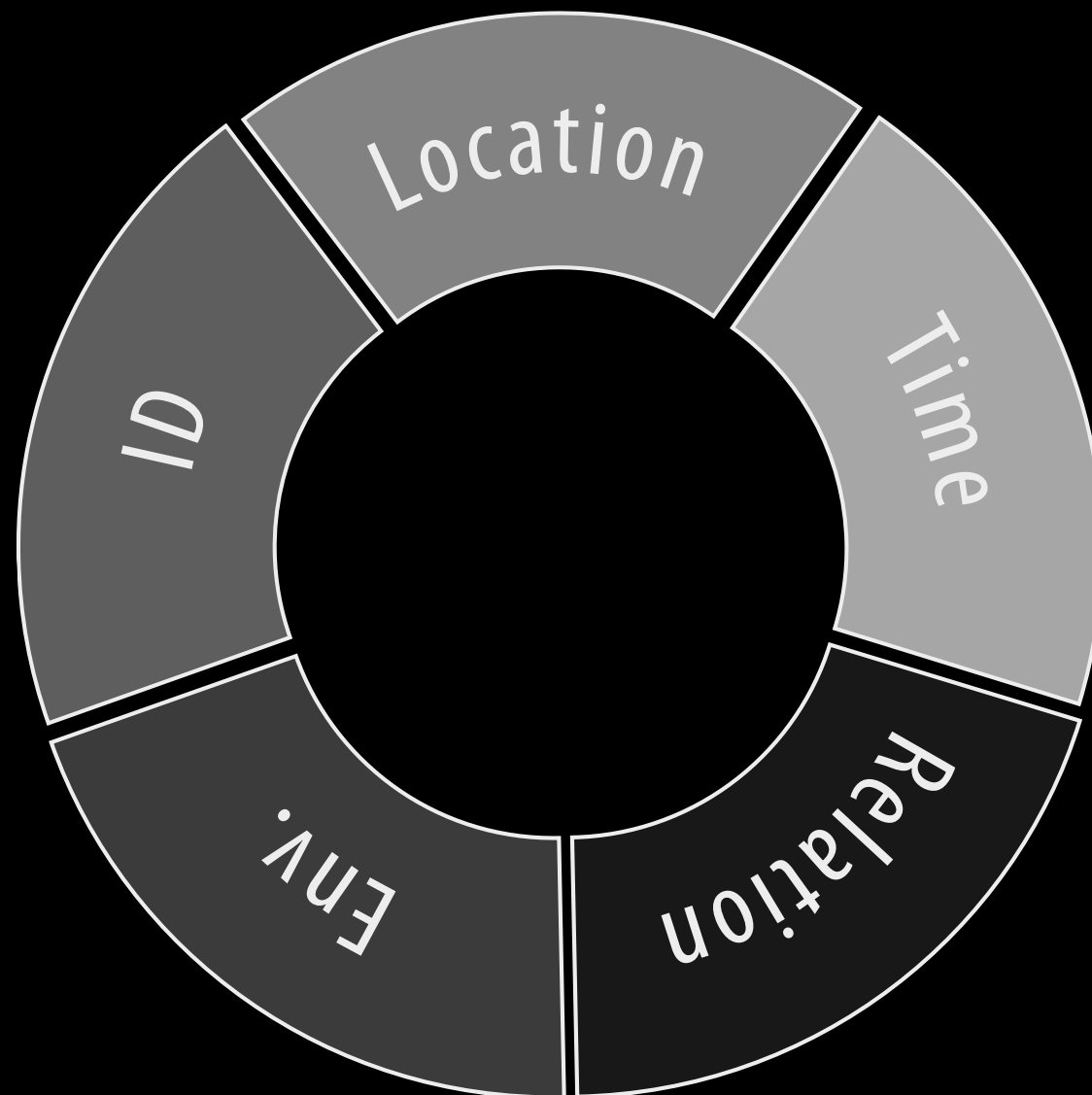


concept

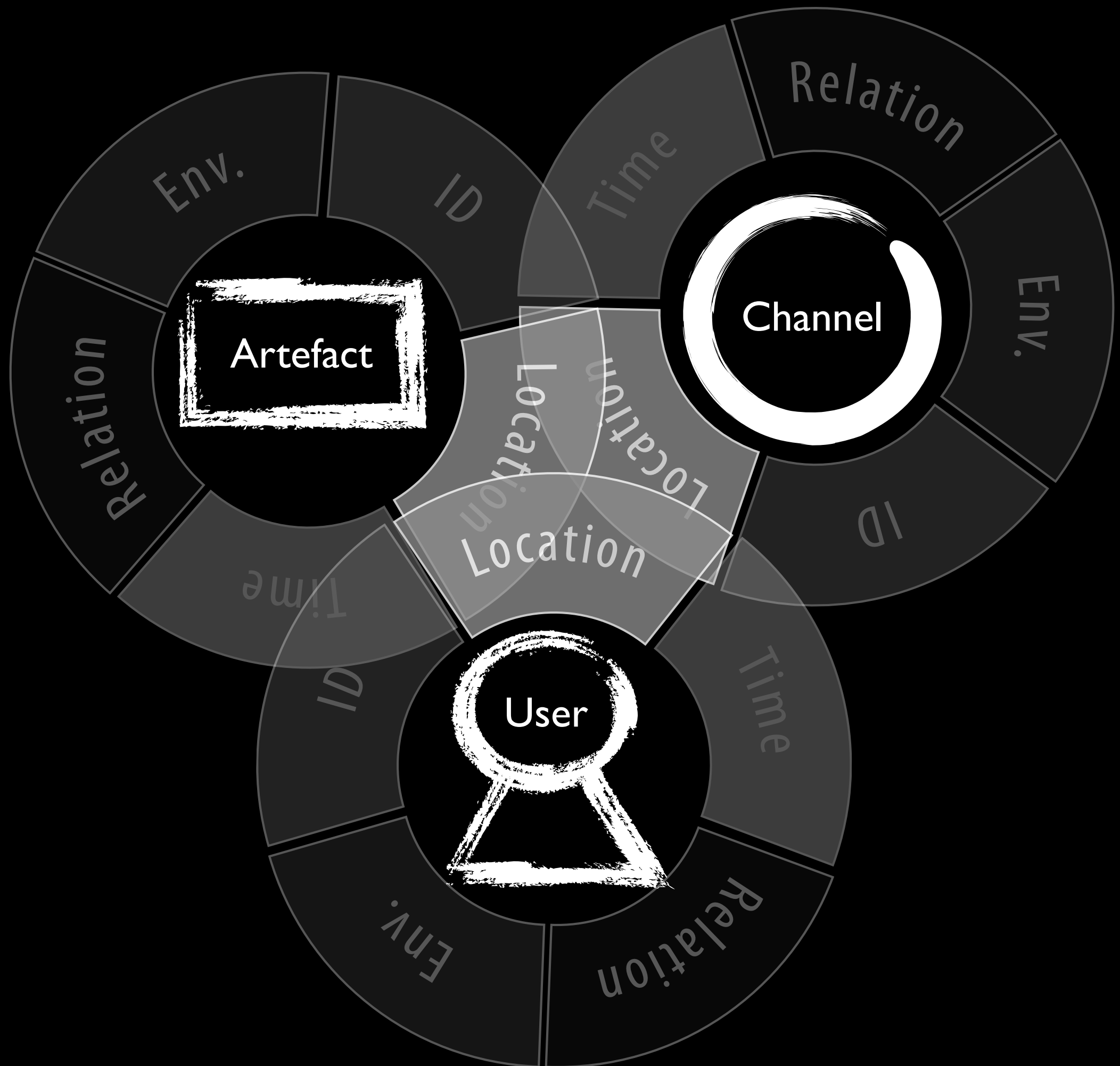


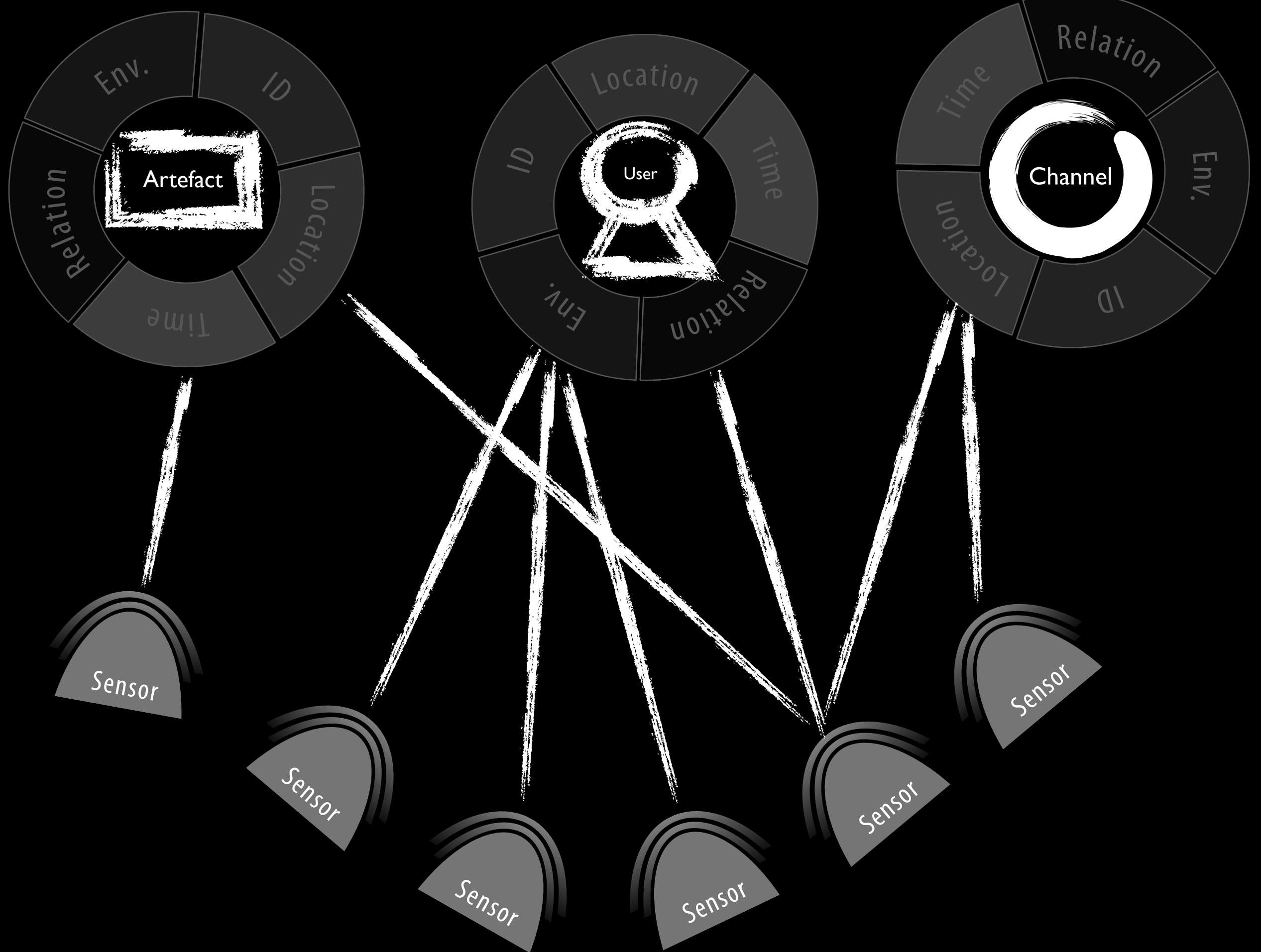


Ambient Information Channels



Context Dimensions



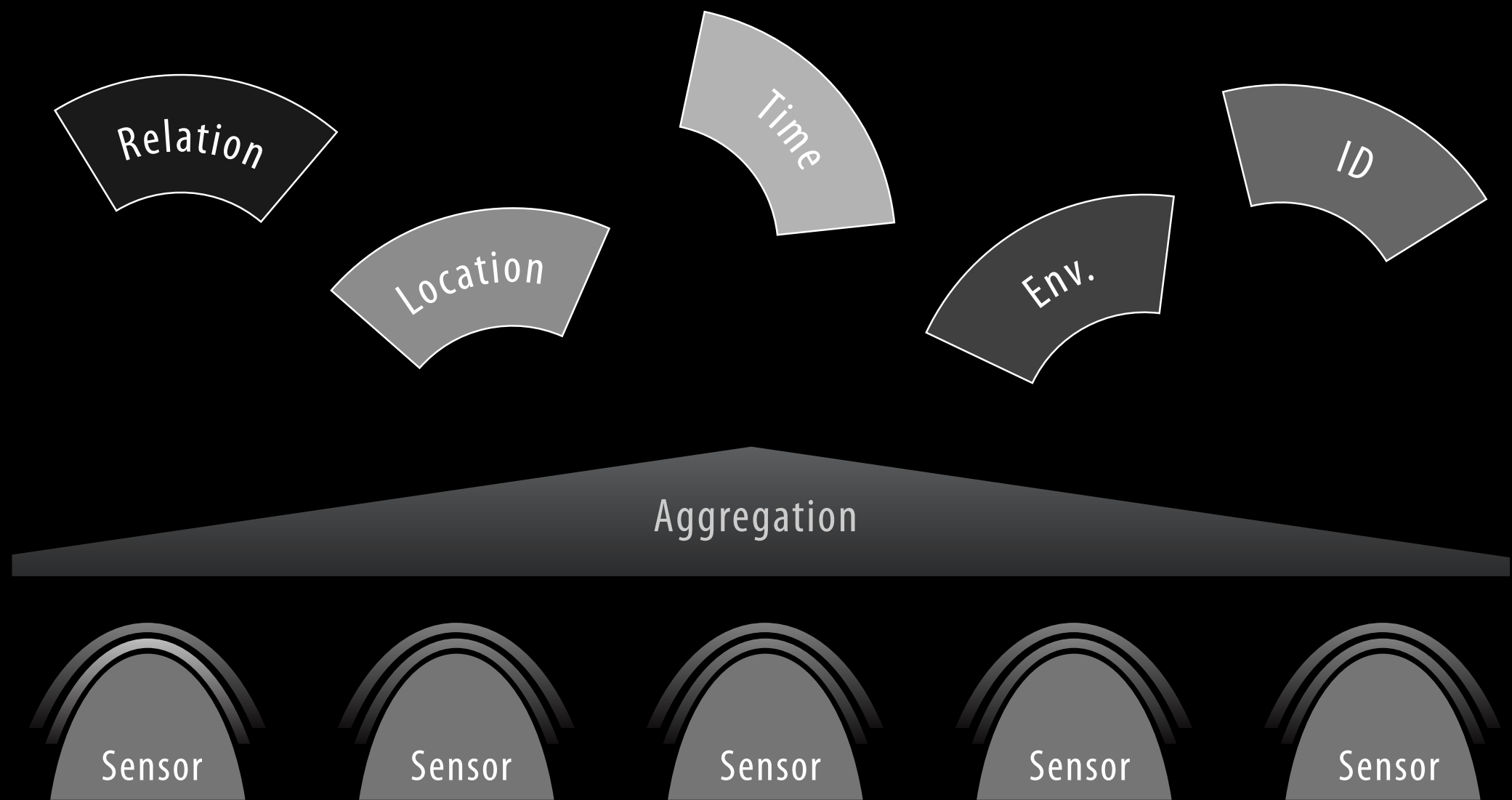


SENSOR-BASED LEARNING SUPPORT

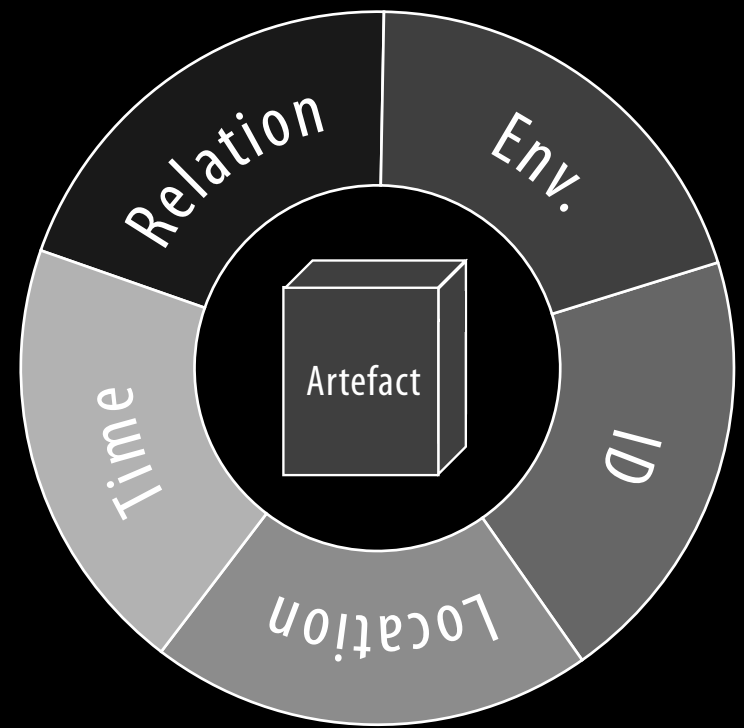
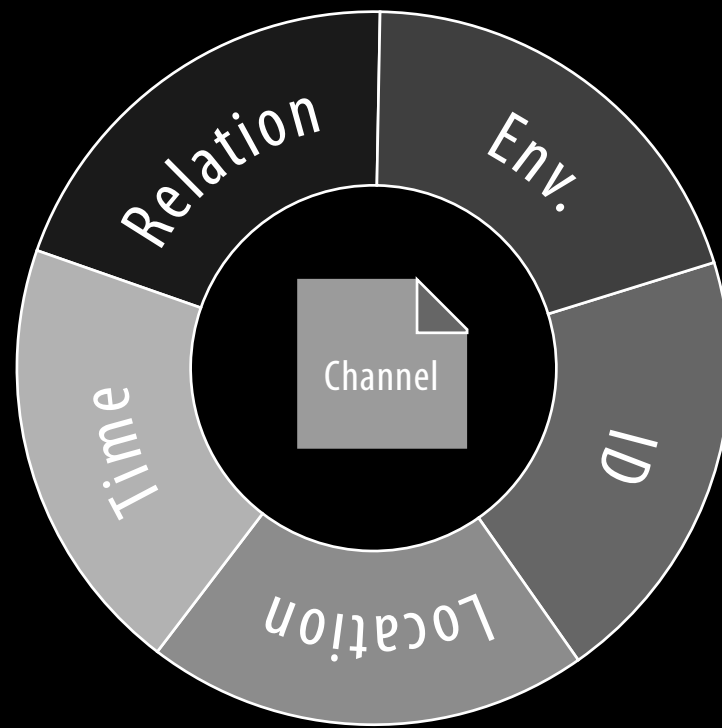
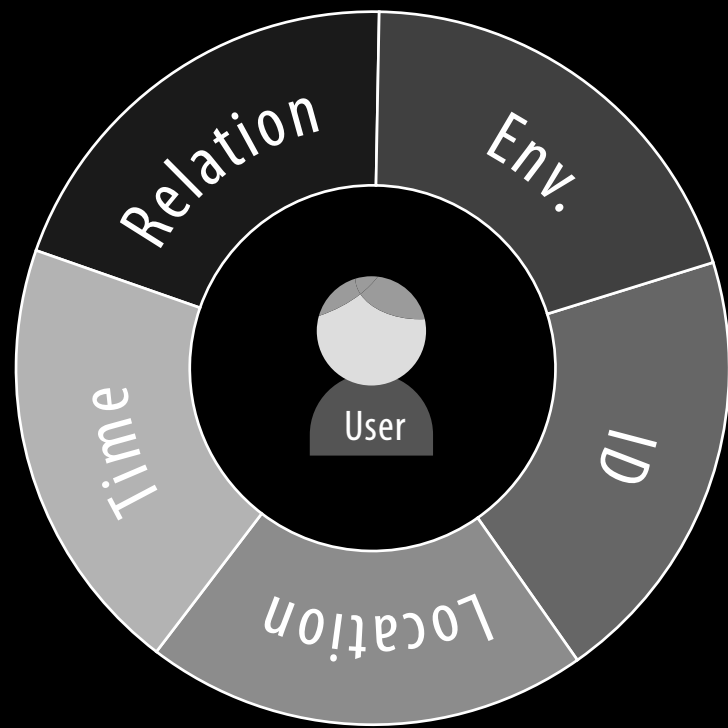
Table 4. Support for the aspects of formative assessment.

Aspects of Formative Assessment	Number of Prototypes	Strategies Used	Example of Sensors Used
Knowledge of subject matter	12	Presenting sensor data about the learner's performance	Accelerometers, Cameras, Gyroscopes, Software sensors
Knowledge of criteria and standards	15	Presenting sensor data about the learner's performance. Presenting sensor data about the learner's physiological state	Accelerometers, Cameras, EEG, Heart-rate monitors, Galvanic skin response sensor, Gyroscopes, Software sensors
Attitudes toward teaching	2	Informing the tutor about the emotional state of the learner while performing learning tasks	Camera, Galvanic skin conductance, pressure mouse, accelerometers
Skills in setting	8	Setting assessments according to learner's location. Setting assessments according to learner's physiological state	GPS, EEG, Heart-rate monitors, NFC, RFID, Software Sensors
Evaluative skills	4	Evaluating answers of learners	GPS, NFC, RFID, Software Sensors
Sharing learning expectations	0	-	-
Self-Assessment	6	Presenting an overview of the learner's performance	Accelerometers, GPS, Software sensors

SCHNEIDER, J., BÖRNER, D., VAN ROSMALEN, P., & SPECHT, M. (2015). AUGMENTING THE SENSES: A REVIEW ON SENSOR-BASED LEARNING SUPPORT. SENSORS, 15(2), 4097–4133. DOI:10.3390/S150204097

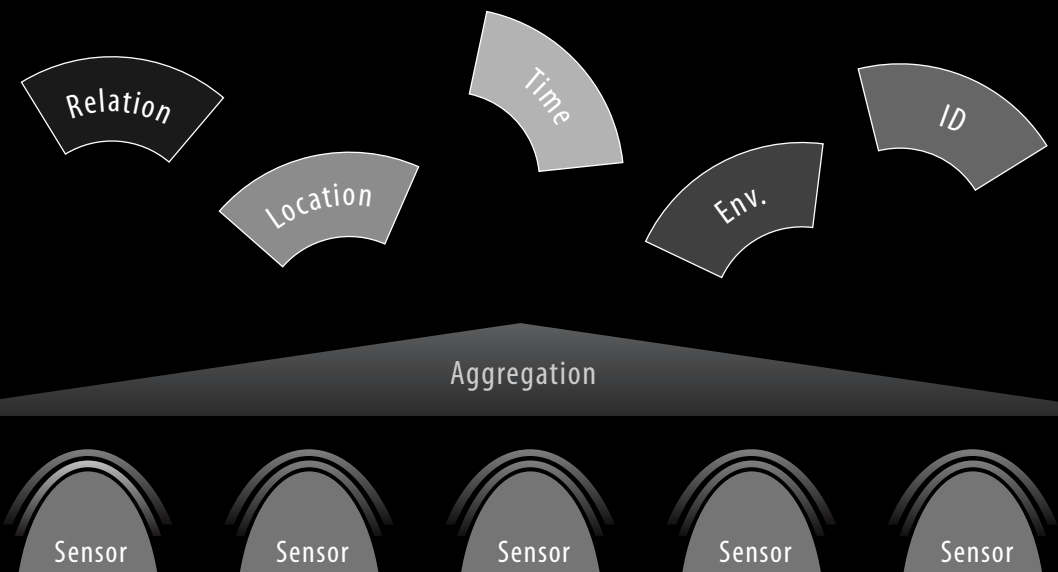


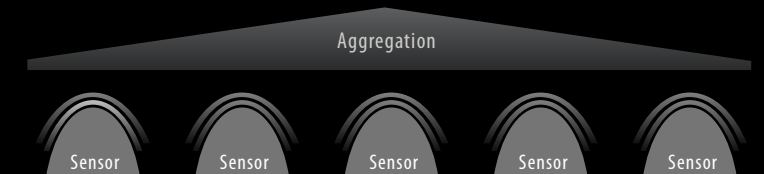
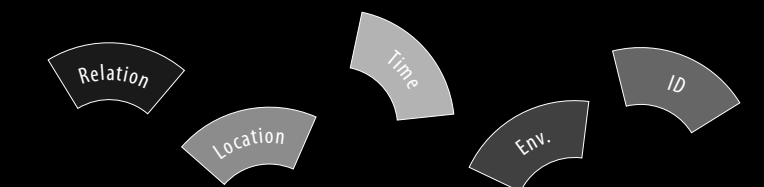
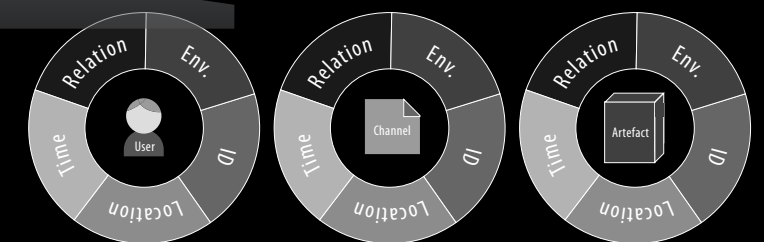
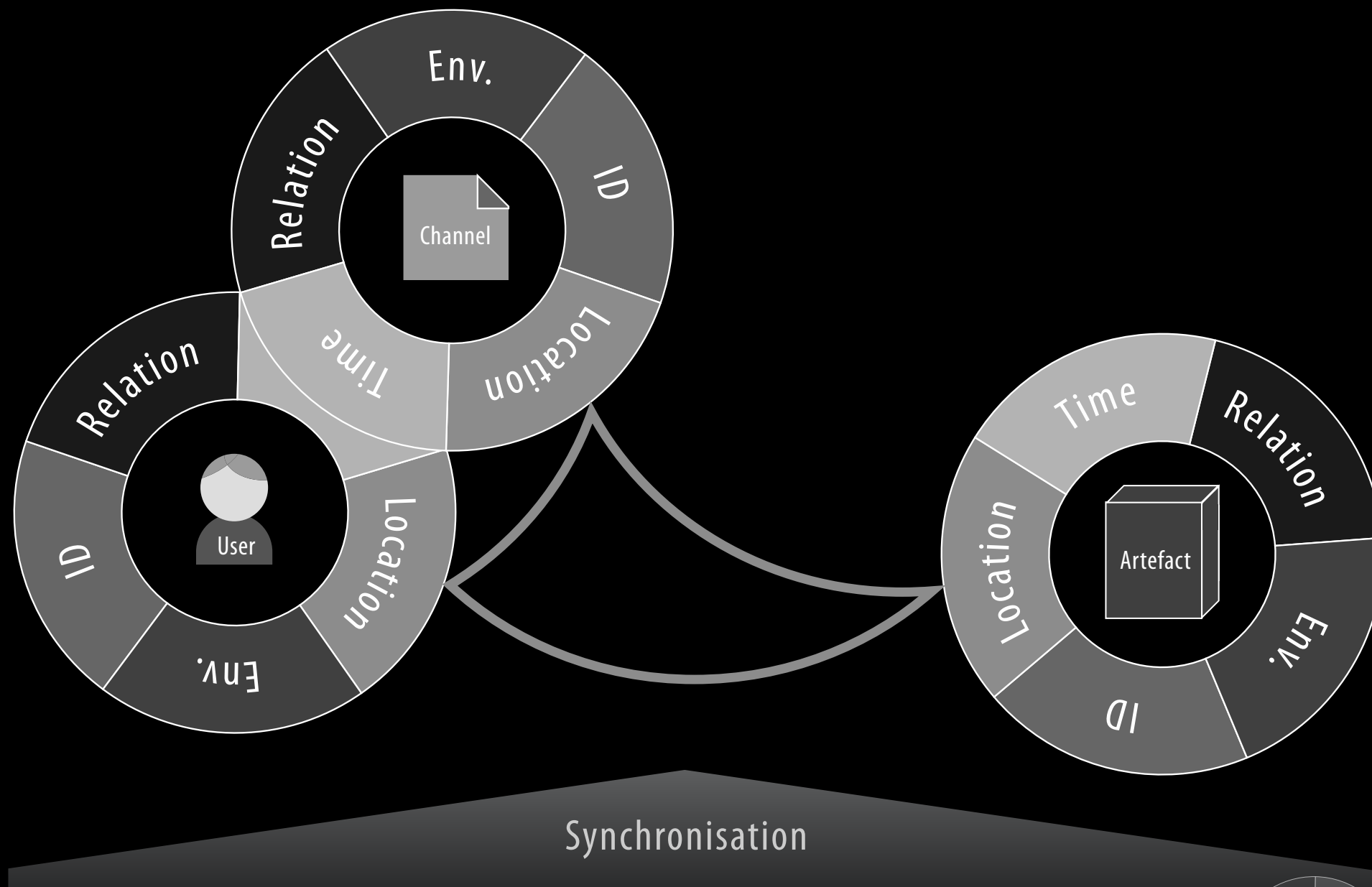
AICHE Processes



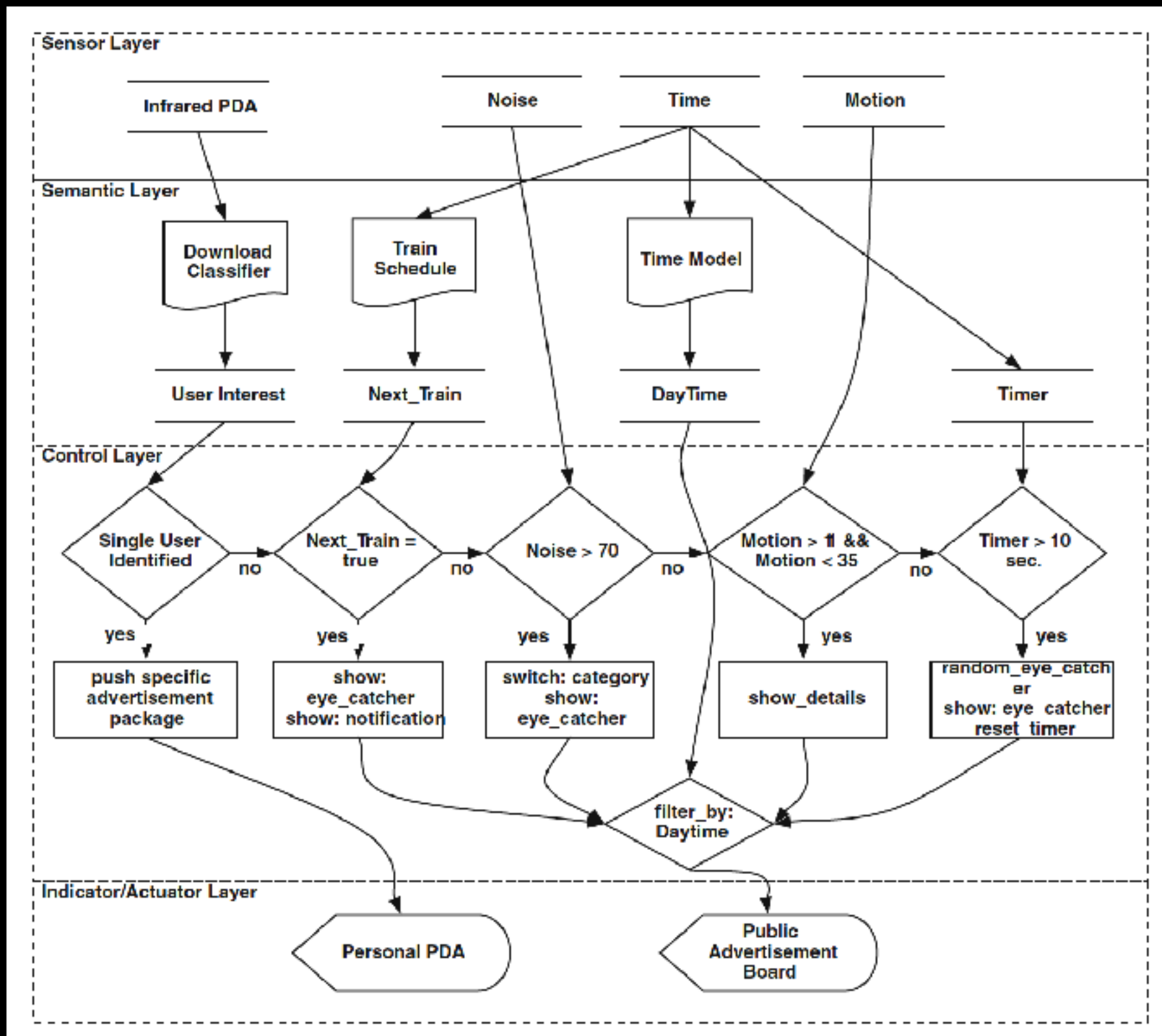
Enrichment

AICHE Processes

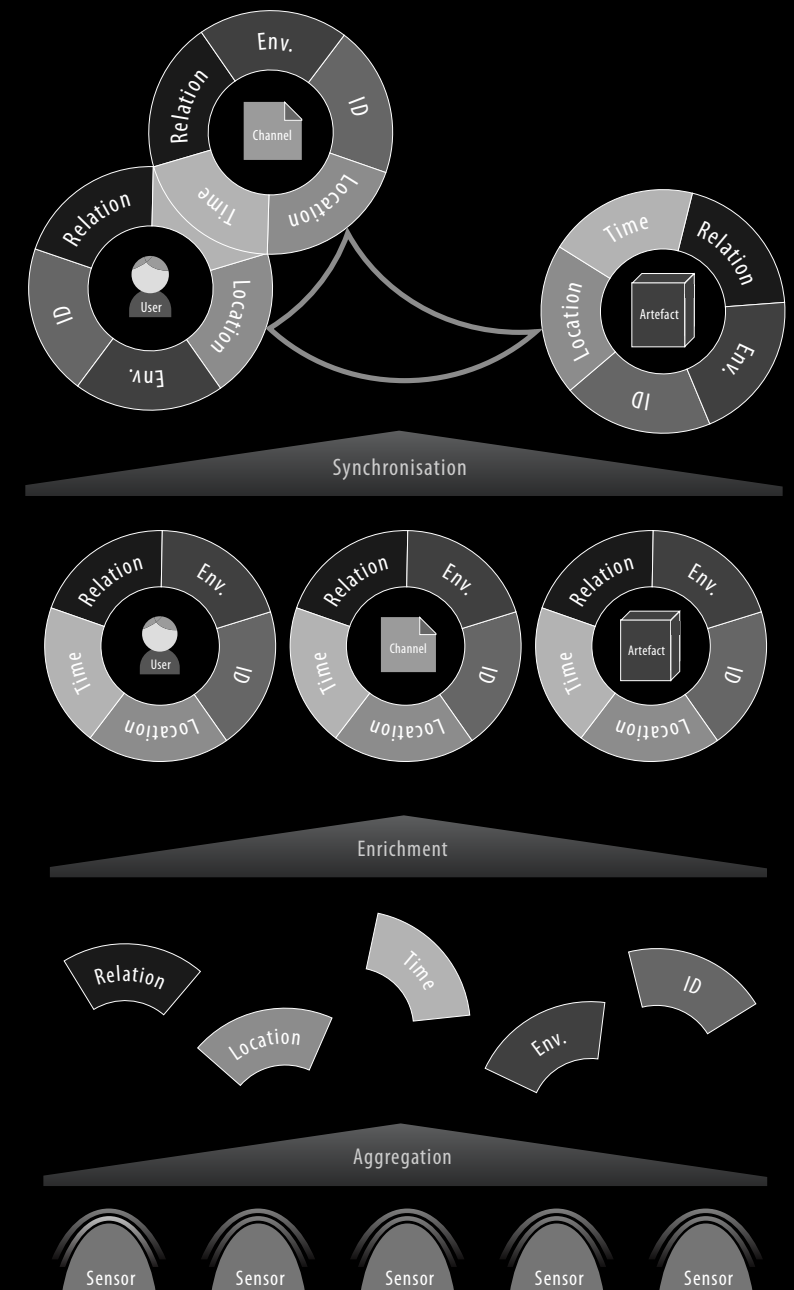
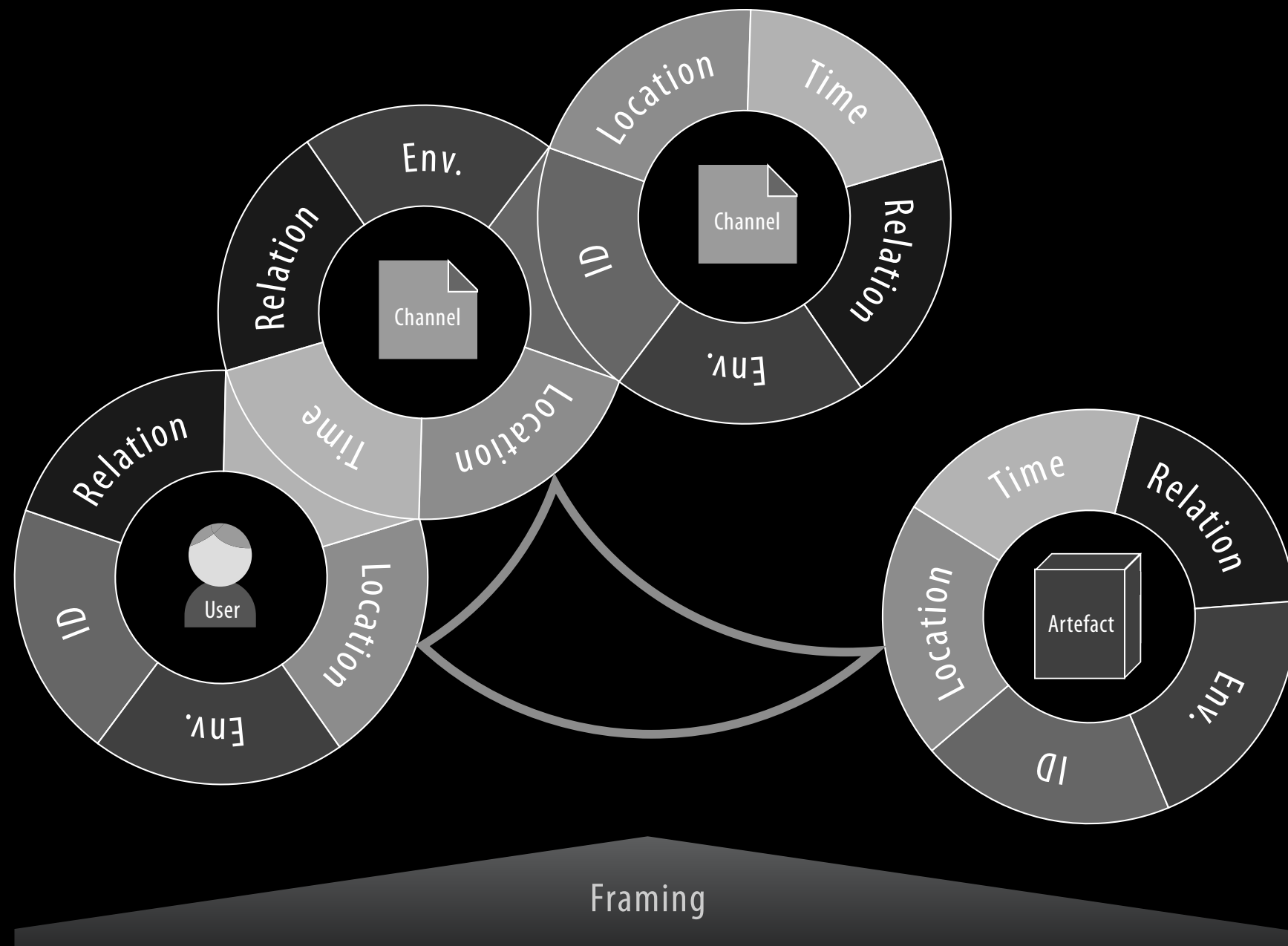




AICHE Processes

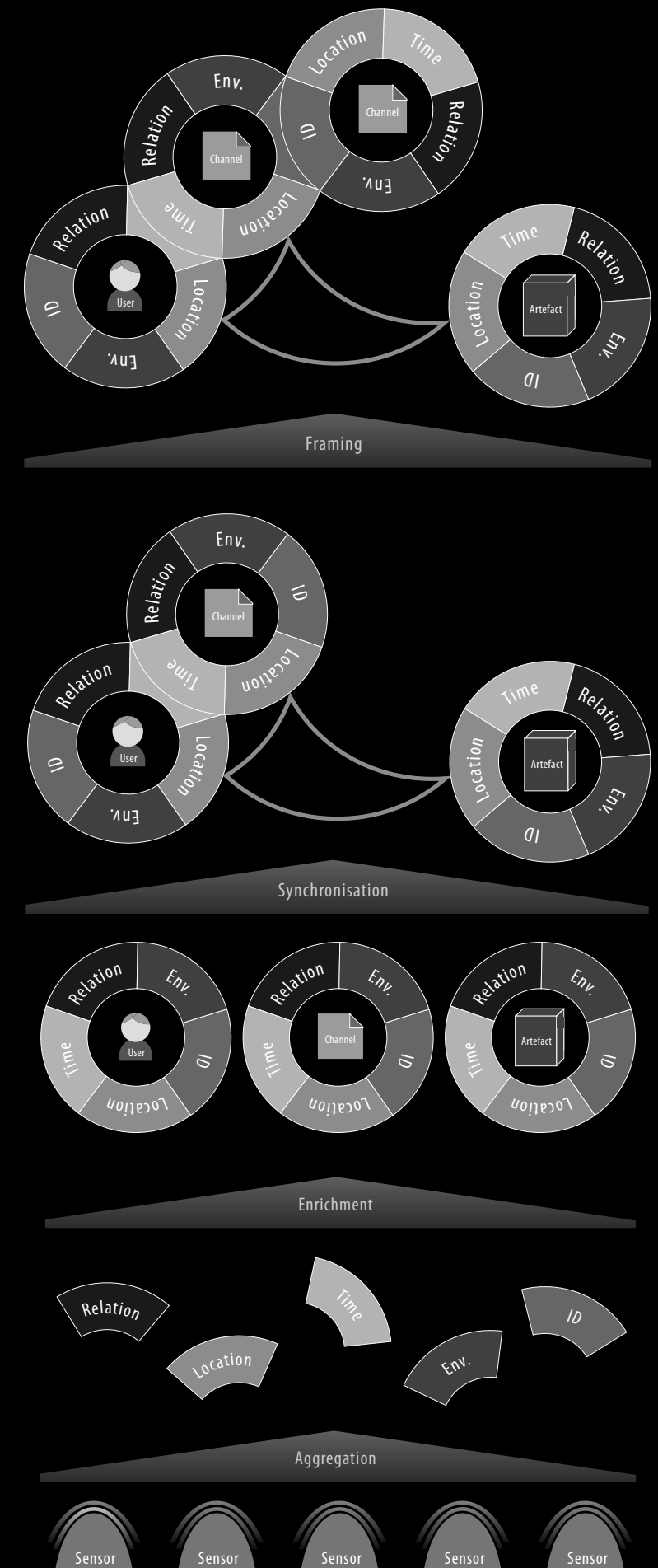


Zimmermann, A., Specht, M., & Lorenz, A. (2005). Personalization and Context Management. *User Modeling and User-Adapted Interaction*, 15(3-4), 275–302. doi:10.1007/s11257-005-1092-2



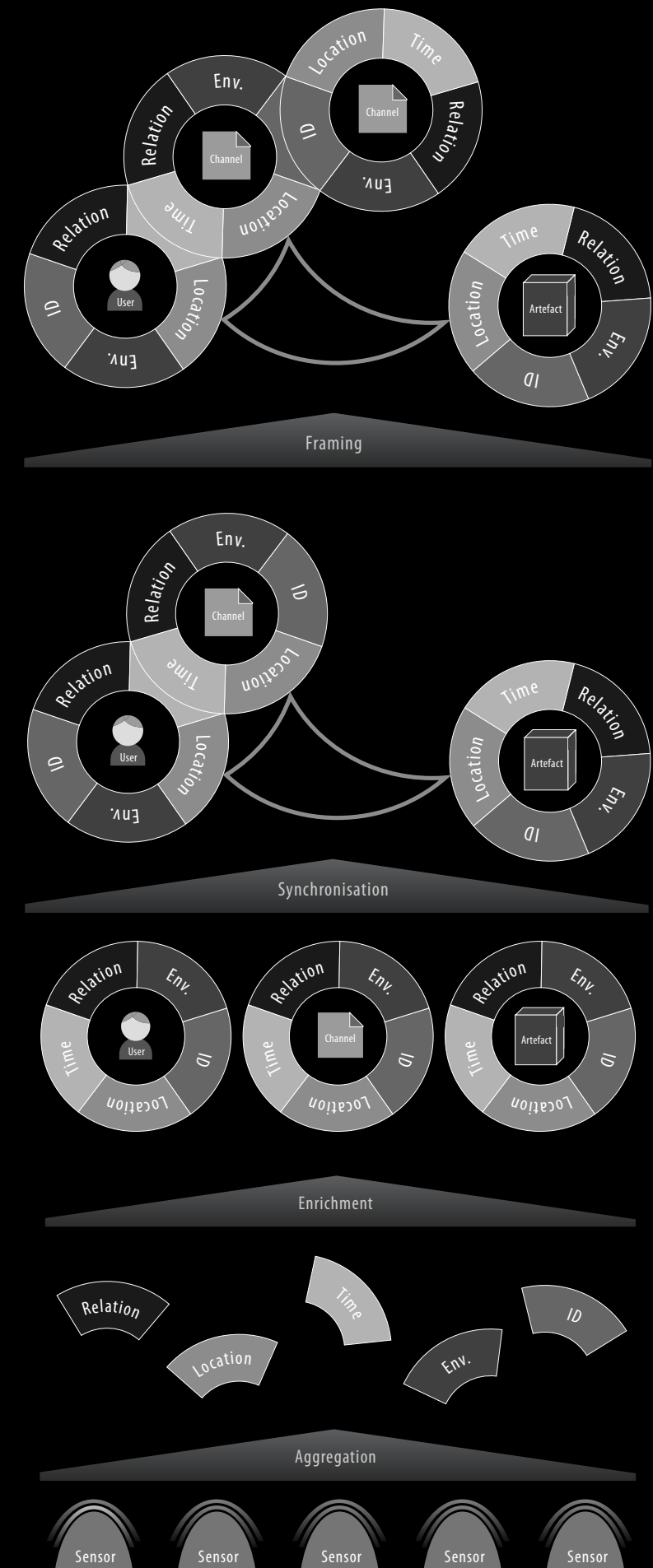
AICHE Processes

AICHE Processes



AICHE used for

- system analysis
- innovation and engineering
- instructional design





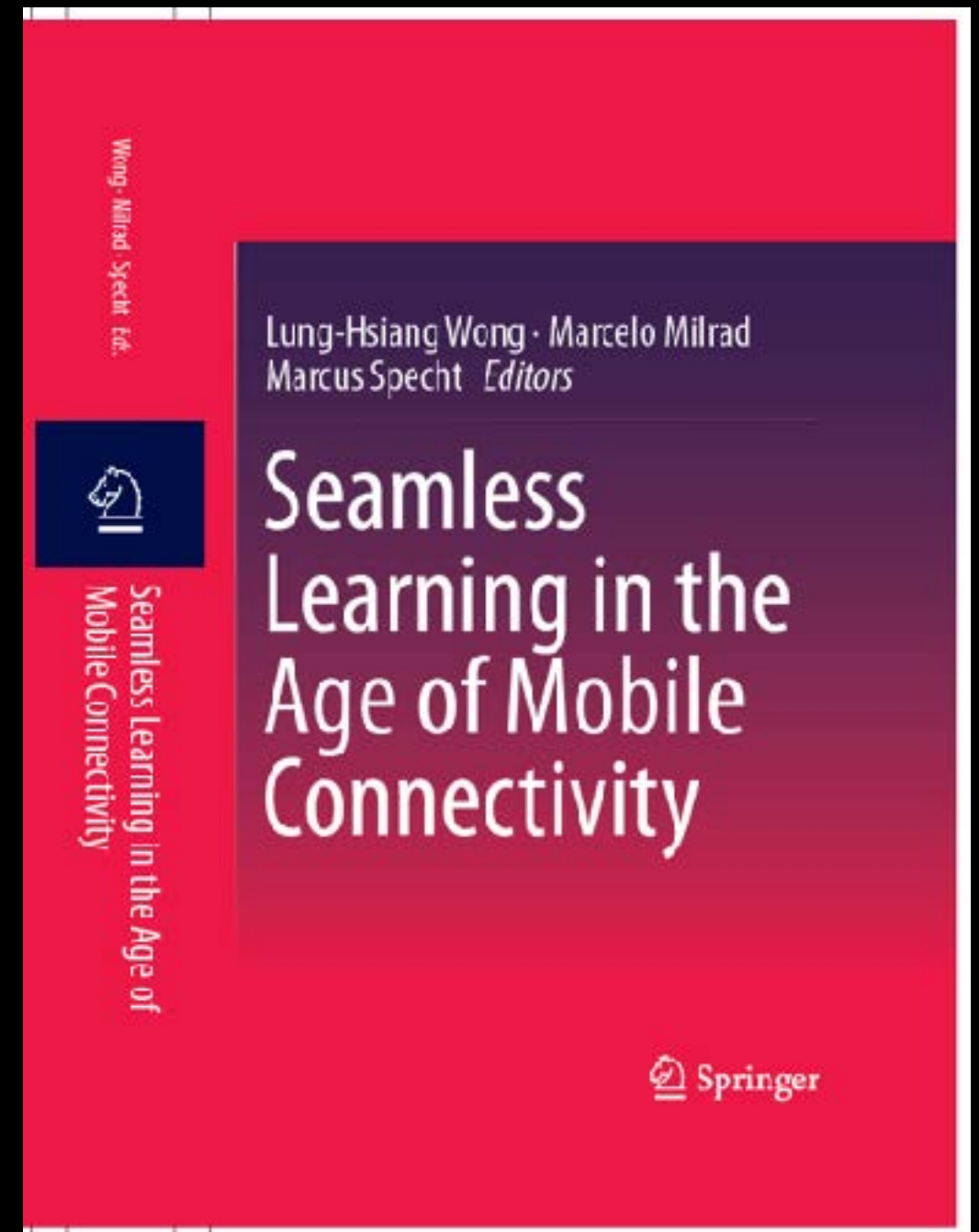
Contextualised TV



Enhancing Learning Across Context and Linking Settings

HOW TO DESIGN SEAMLESS LEARNING SUPPORT

- Formal and informal learning;
- Personalized and social learning;
- Across time; locations, social contexts
- Combined use of multiple device types;
- Physical and digital worlds
- Multiple learning tasks knowledge synthesis



task driven design

Participants

	Name	Role
	Mo	Scout
	Marcus	Data Gatherer
	Lucia	Annotator
	Nick	Researcher
	Milos	Analyst
	Alex	Reporter

Communication

from	subject	time
Lucia	A new task for you!	11:35
Nick	Can you please...	11:27
Marcus	Question concerning task 1	11:22
Mo	Hello	11:21
Roderick	What shall we do next?	11:17

New message Reply

Mo	Hello	11:21
Hi, here you are some more flower pictures. Just tell me if you need more or different ones...		
		
		

Task Overview

Task	Subtasks	Status	Participants	Repository
Flower Task	• Collect pictures of at least 10 different flowers you can find on the meadows.	finished	 Mo (Scout)  Marcus (Data Gatherer)  Lucia (Annotator)	      
	• Find out at which places they preferably grow and check if that matches your findings.	ongoing	 Nick (Researcher)  Milos (Analyst)	  
	• Ask the expert which of the flowers is the rarest and which he likes best.	pending	 Alex (Reporter)  Sian (Comm. Manager)	
	Add Subtask	Change	Add / Remove	
Tree Task	• Collect pictures of at least 10 different flowers you can find on the meadows.	ongoing	 Mo (Scout)  Marcus (Data Gatherer)  Lucia (Annotator)	      
	• Find out at which places they preferably grow and check if that matches your findings.	ongoing	 Nick (Researcher)  Milos (Analyst)	  

Navigation



Comments

Here are a lot of different flower different flowers and old trees.

TASKS IN
FIELD-TRIPS

Open Universiteit
www.ou.nl



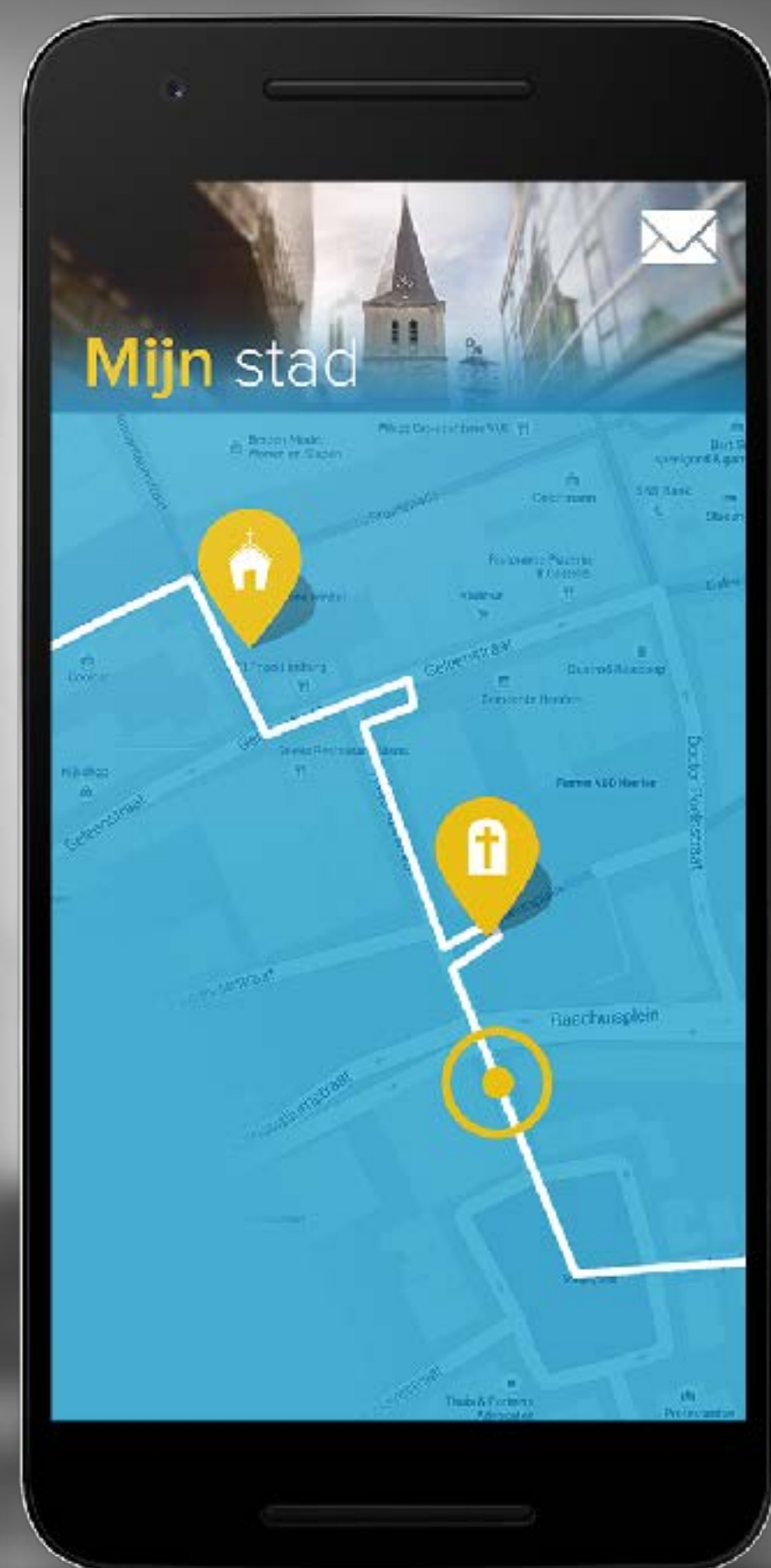
Florence

Excursie Cultuurwetenschappen

Location based

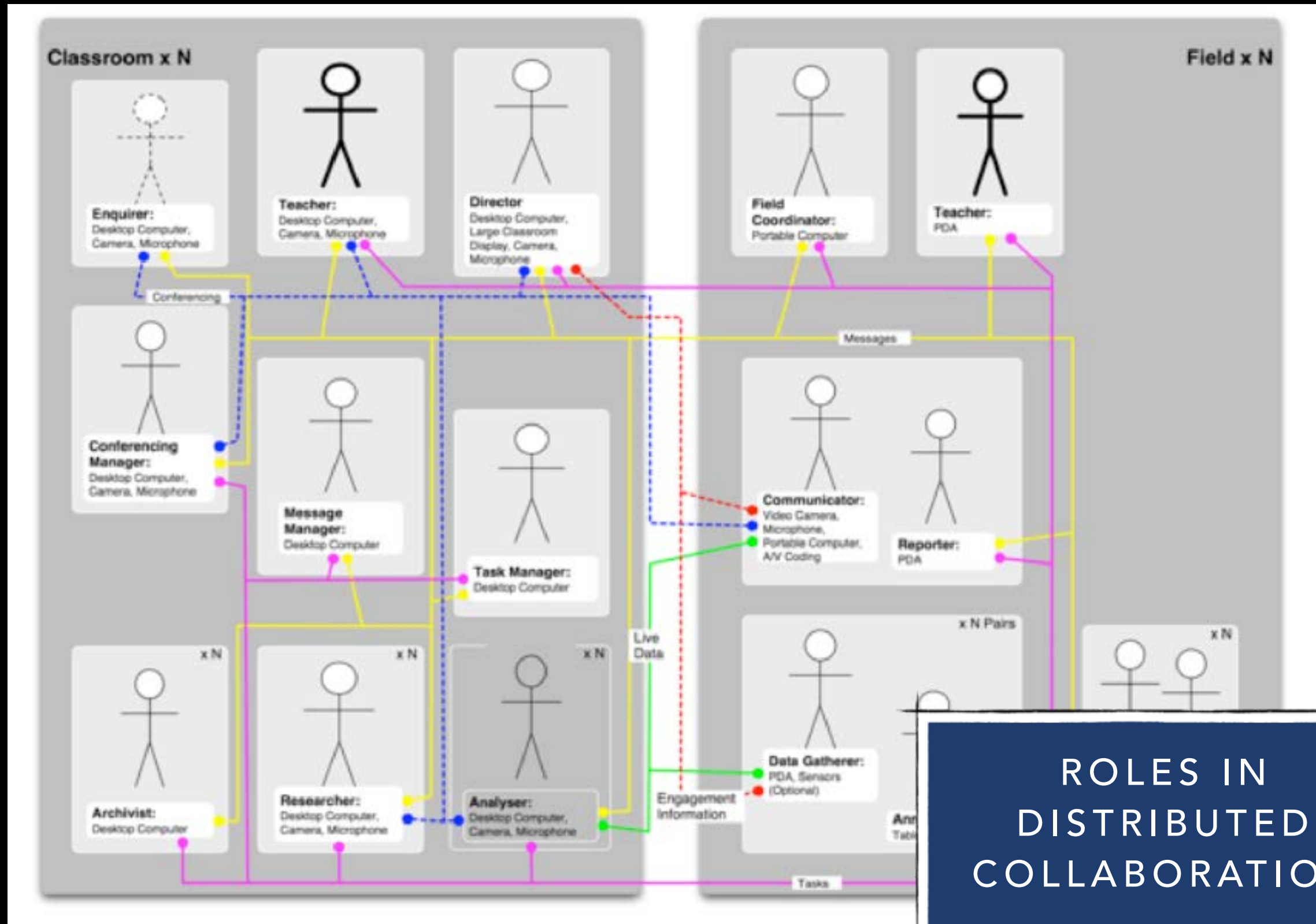
Time independent





role driven design

DISTRIBUTED COLLABORATION



weSPOT inquiry

SettingsLog out

HomeInquiresMembersActivityHelp

Search

inquiries > Healthy food open inquiry

Healthy food open inquiry

More info

Problem / topic

Plan the method

Collect the data

Analyse the data

Discuss the findings

Communicate the results

I wonder ...

0 vote

0 Answer

Amount of calories
Is there a correlation between the time at which a meal is taken and the amount of calories that is consumed.
By Stefaan Ternier 58 days ago

Pre-knowledge resources

What types of research questions are there?

By Fleur Prins 55 days ago Comments: 24

Do this

ShareEmailPrint

Healthy food open inquiry

Open membership

Badges

Domain Structure

Inquiry activity

Inquiry help

Learning Analytics Dashboard

Quizzes

weSPOT Inquiry Tool

Stefaan Ternier, Welten Institute - 6 november 2014

Onderwijs

Geïnstalleerd

Deze app is compatibel met een aantal van uw apparaten.

★★★★☆ (4)

g+1 +3 onder wie Bernardo

weSPOT inquiry

HomeInquiresMembersActivityHelp

General Inquiry at home in
Healthy food open inquiry
Heraklion Test Group Bulgaria
Life on Earth

Alexander Mikroyannidis
Angel Suarez Fernandez
Fleur Prins
John Hendriks

Star rating none - 5

Name	Prob. u	Oper. u	Dat. Col. u	Dat. Ana. u	Inter. u	Comm. u
Alexander M (Healthy food open)						
Angel Suare (Healthy food open)						
Fleur Prins (Healthy food open)						

PROCESS AND ROLES IN INQUIRY-BASED LEARNING

Menu

New inquiry

Open inquiries

Batteries discovery26368

Connect college inquiry7765

Demo inquiry for review8104

Microclimates151

Login

Login with Google

Login with Facebook

Menu

New inquiry

Open inquiries

Batteries discovery26368

Connect college inquiry7765

Demo inquiry for review8104

Microclimates151

Login

Login with Google

Login with Facebook

weSPOT

My Inquiries6

My media

Profile

Badges

Friends

Menu

New inquiry

Open inquiries

Batteries discovery

Connect college

Demo inquiry for

Microclimates

Stefaan Test

test stefaan

OPENSOURCE FRAMEWORK FOR MIXED REALITY GAMES

ARLEARN



process driven
design



ARLearn

A technical framework for creating mobile serious games



Play anywhere

Follow the scenario

Patient

Emergency at the office



Make the call



Feedback



Question



Wilkommen

game driven design



Single
player
(1 role)



Multiplayer
(x roles)



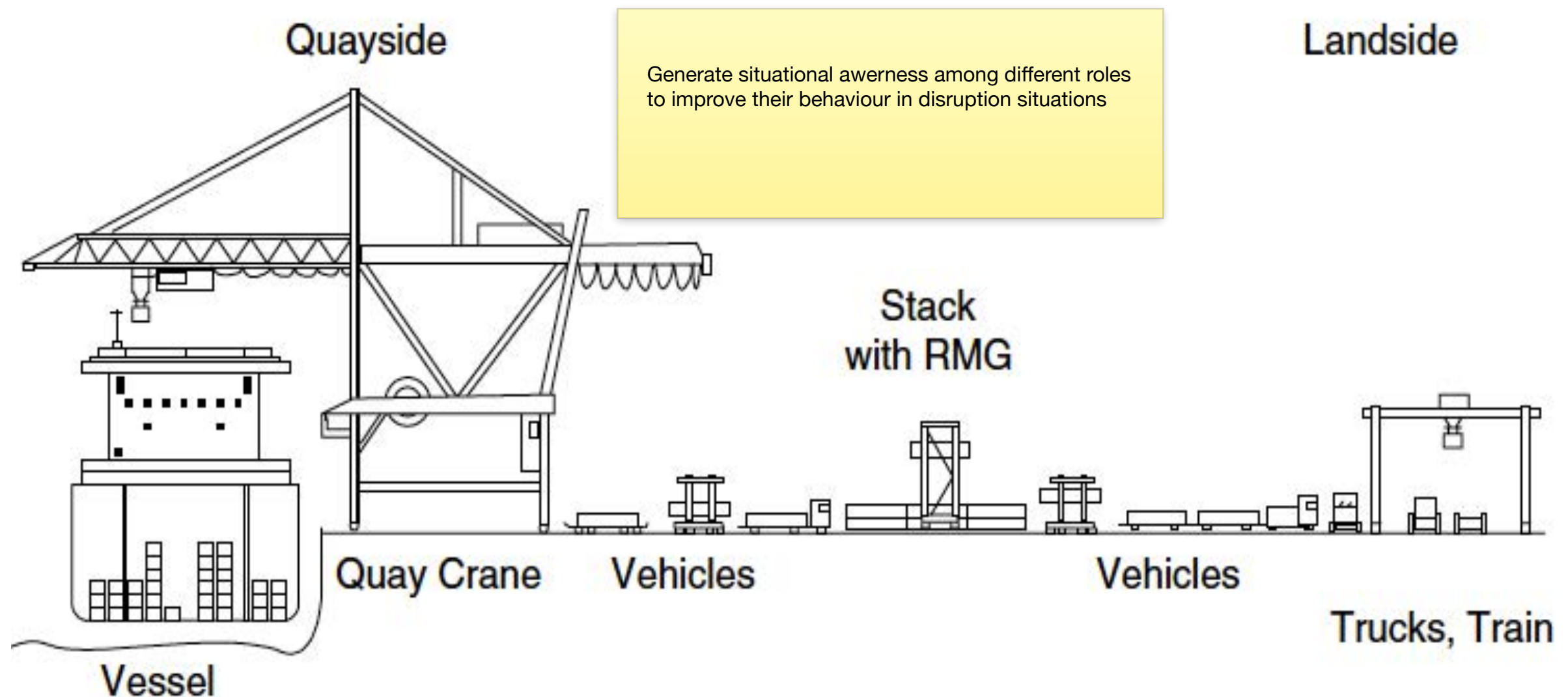
Hostage Simulation

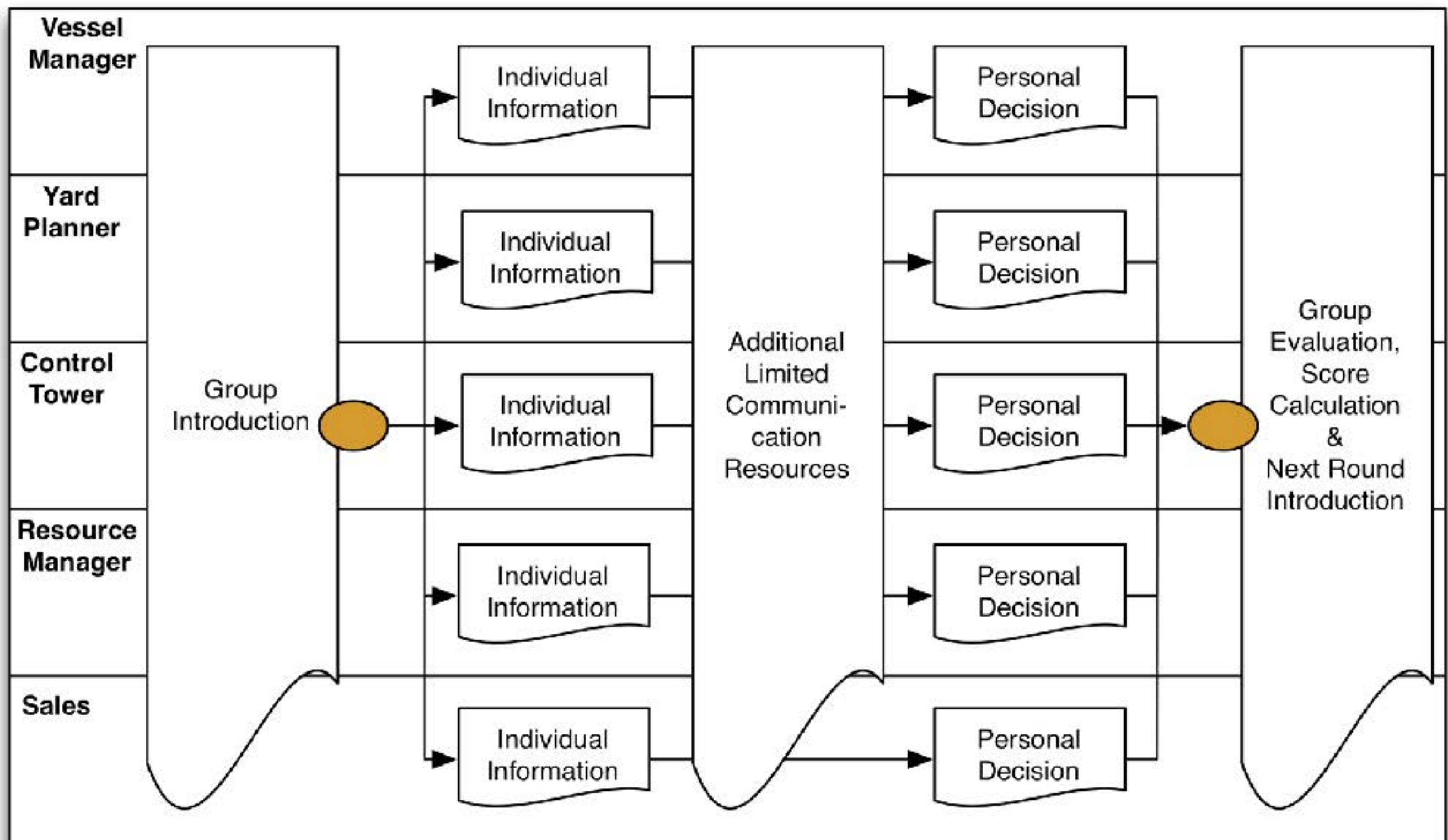
Real World Training for critical situations

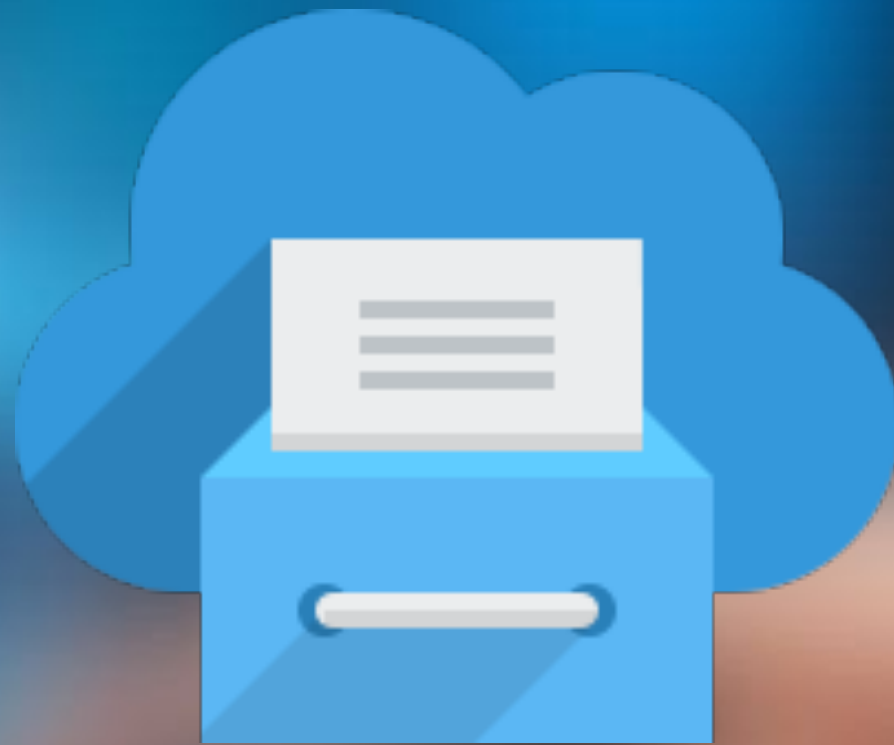


SALOMO

Decision training for exception handling in logistics







Portfolio driven design
and data collection



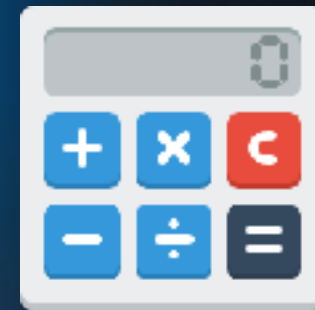
Video



Photo



Audio



Numeric



Questions



Text



Scan Data collection



Enhancing Learning in Context

DESIGN NEW FEEDBACK LOOPS FOR ...

BEHAVIOUR CHANGE ...

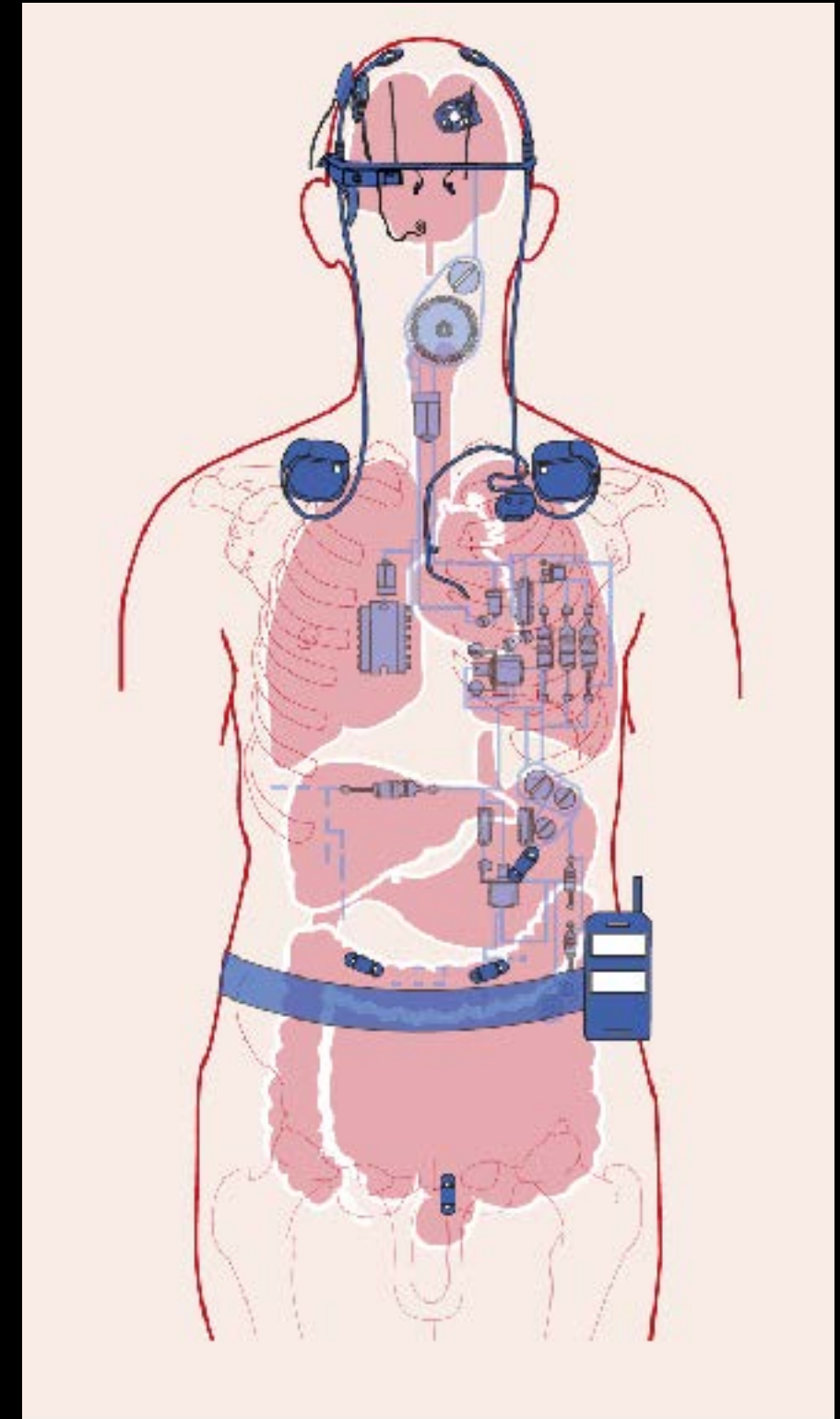


Goetz, T. (2011). Harnessing the Power of Feedback Loops | Magazine. *wired.com*. Retrieved August 22, 2011, from http://www.wired.com/magazine/2011/06/ff_feedbackloop/5/

INTIMATE TECHNOLOGY

- Technology integration into our daily live
- on personal, environmental and infrastructural level

<http://www.rathenau.nl/en/publications/publication/intimate-technology-the-battle-for-our-body-and-behaviour.html>



#4

ENHANCING LEARNING?



Project weSPOT: Personal Context Notifications



a

Figure 8.2. Student reflective practice. a. What were your main learning channels today? b. What were your main learning channels today? c. How was your learning day? Rate it from 1 to 5.

context notification and
experience sampling

Information

Action

Challenge

Welcome

Second Floor

142 occupants

7,764

Growth: 10.1%

26%

PERFORMANCE NOW



Flags

Single

QR code

Scan

Experience

Single

Statement

Audio

[Action] QR code

Great you found the Mindergie flags. The first thing you have to do here is to find the small QR code attached to the 'Athabasca' flag pole.

When you found it, simply press the scan icon below and use your camera to scan the code.



image #

1

3

12

21

last



Presentation Trainer

Best Demo Award - Ectel 2015
Best Demo Award - ACM Multimodal Interaction 2015





Contents lists available at ScienceDirect

Computers & Education

journal homepage: www.elsevier.com/locate/compedu



Time will tell: The role of mobile learning analytics in self-regulated learning

Bernardo Tabuenca^{a, *}, Marco Kalz^a, Hendrik Drachsler^b, Marcus Specht^c

LEARNING ANALYTICS ...

[HTTPS://WWW.YOUTUBE.COM/WATCH?V=RL-JAII4IN8](https://www.youtube.com/watch?v=RL-JAII4IN8)

LearningPulse

Data sources



Biofeedback data

Heart-rate, steps, distance, calories



RescueTime

Activity data

Software use tracking



Weather data

Outdoor weather condition



Skin
conductance



WEKIT



Myndplay Brainwave / EEG

Hololens Augmented
Reality Display

Heart Rate Variability

Alex Poster Sensor

Arm Movement Sensor

Heart Rate Variability

WEKIT



Transfer Mechanism	Attribute	Requirements for recording	Requirements for enacting
Augmented paths	Augmenting virtual information atop the physical world in a way which allows the trainee to guide his motion with precision	- Tracking of expert's hand motion - Motion sensors - Depth camera	- Visualizing guidance paths using AR - Provide haptic or visual feedback - Comparison to expert data by capturing apprentice movement with sensor
Augmented Mirror	Augmented display where the apprentice can track his/her body similar to dance rooms	- Record and track body postures - Posture sensor such as kinect	- Large display where the apprentice can see himself/herself - Posture tracker to provide visual feedback
Highlight Object of Interest	Highlight physical objects in the focus area indicating to the trainee that the expert found that object of interest	- Eye Tracker - Video recording - Record Gaze behaviour of the expert	- Eye Tracker for Formative feedback - AR display to highlight the image
Directed focus	visual aids for objects outside the visual area	- Eye Tracker - Video recording - Record Gaze behaviour of the expert - Record the procedure	- Eye Tracker for Formative feedback - AR display display - Visual Indicator

#be aware, real life
learning is multi-level and
complex ...

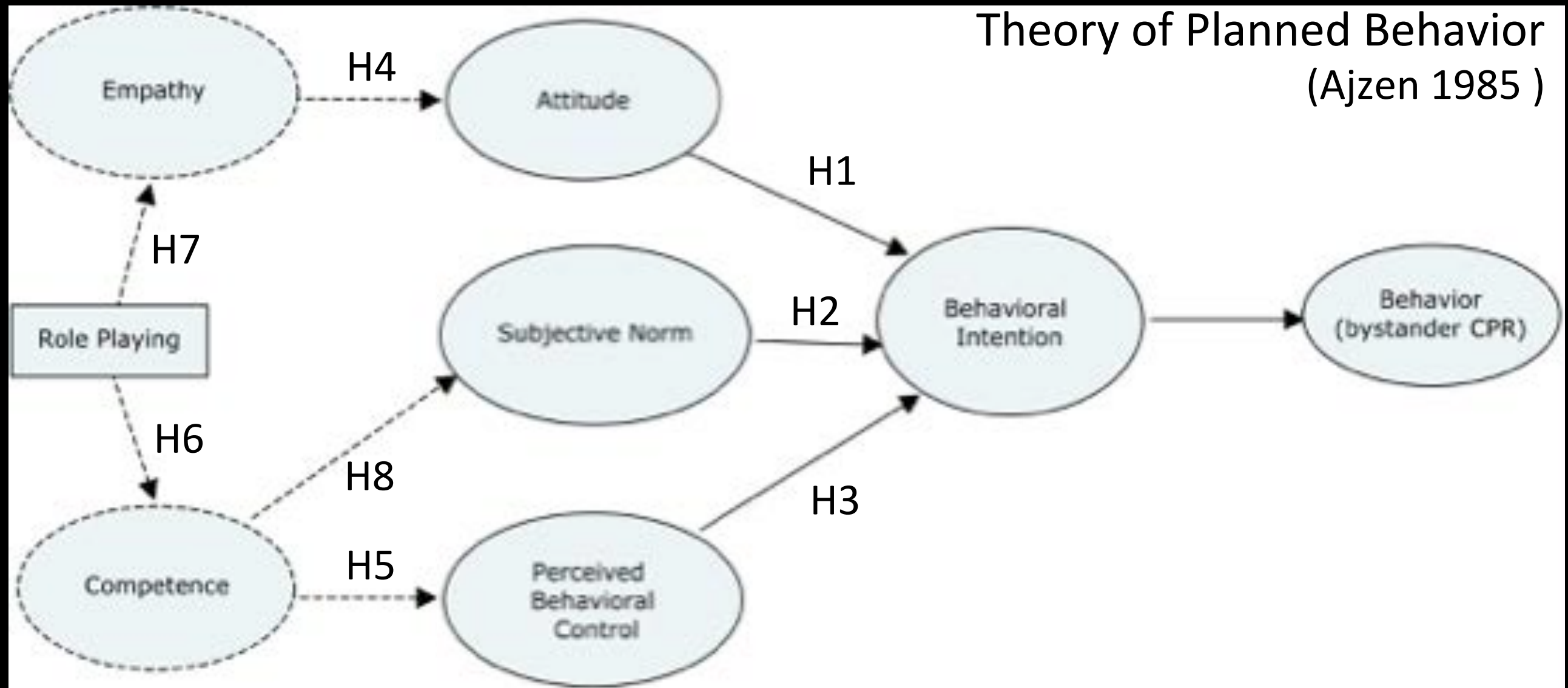
DO ITERATIONS OF PROTOTYPES ...

DESIGN-BASED RESEARCH



HIDDEN VARIABLES CAN BE MORE IMPORTANT ...

TEL IN MULTI-VARIATE CONTEXT



Summary

- Learning in Context, enhance feedback and reflection support sensor technology and embedded displays ...
- Learning Across Context connect driven by design tasks, roles, process models, portfolio ...
- Think about your pedagogical model and your foreseen primary and secondary effects ...



THANK YOU !

Leiden•Delft•Erasmus
Centre for Education and Learning



Universiteit
Leiden
The Netherlands

 **TU Delft**
Delft University of
Technology

Erasmus
University
Rotterdam


PROF. DR. MARCUS SPECHT: AKA MARCUSPECHT

