

Ambient Learning Displays - Distributed Mixed Reality Information Mash-ups to support Ubiquitous Learning

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Ambient Learning Displays

Distributed Mixed Reality Information Mash-ups to
support Ubiquitous Learning

Dirk Börner

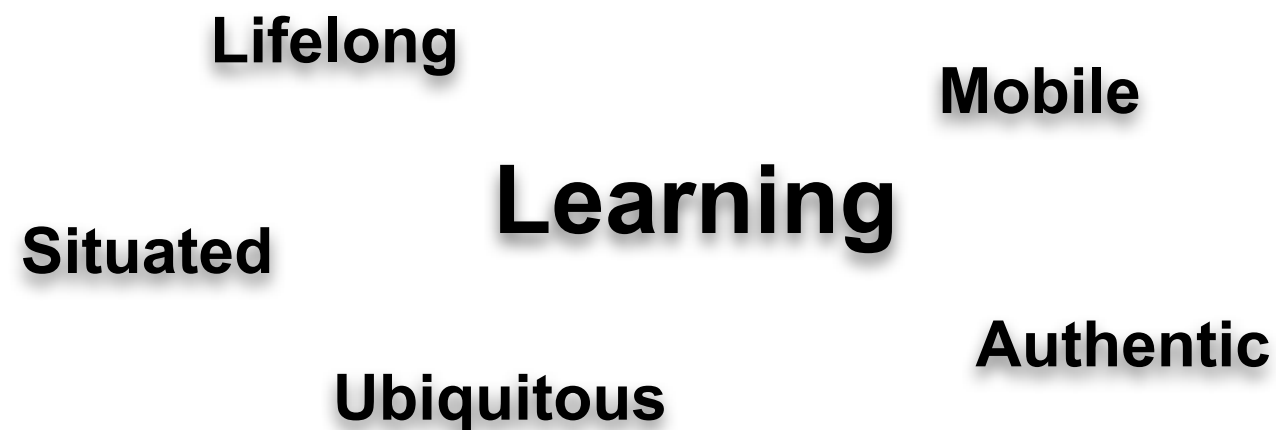
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Centre for Learning Sciences and Technologies
celstec.org



Promotor: **Prof. Dr. Marcus Specht**
Supervisor: **Dr. Marco Kalz**

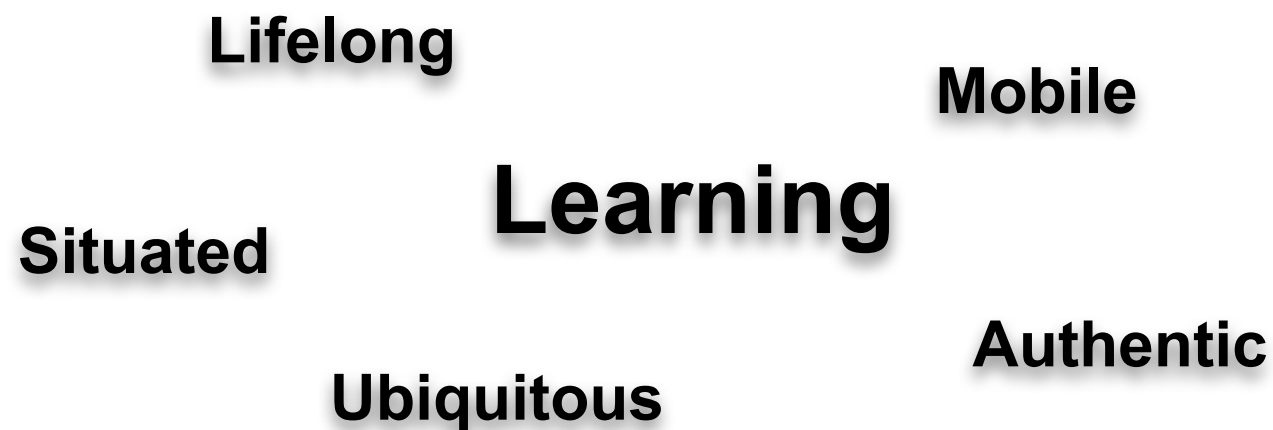
Background

- Mobile Technologies + Ubiquitous Connectivity + Pervasive Functionality are changing the conditions for lifelong and non-formal learning
- Rethinking the relationship of environment, technology, and learning to build a bridge between different contexts and situations learners are operating in



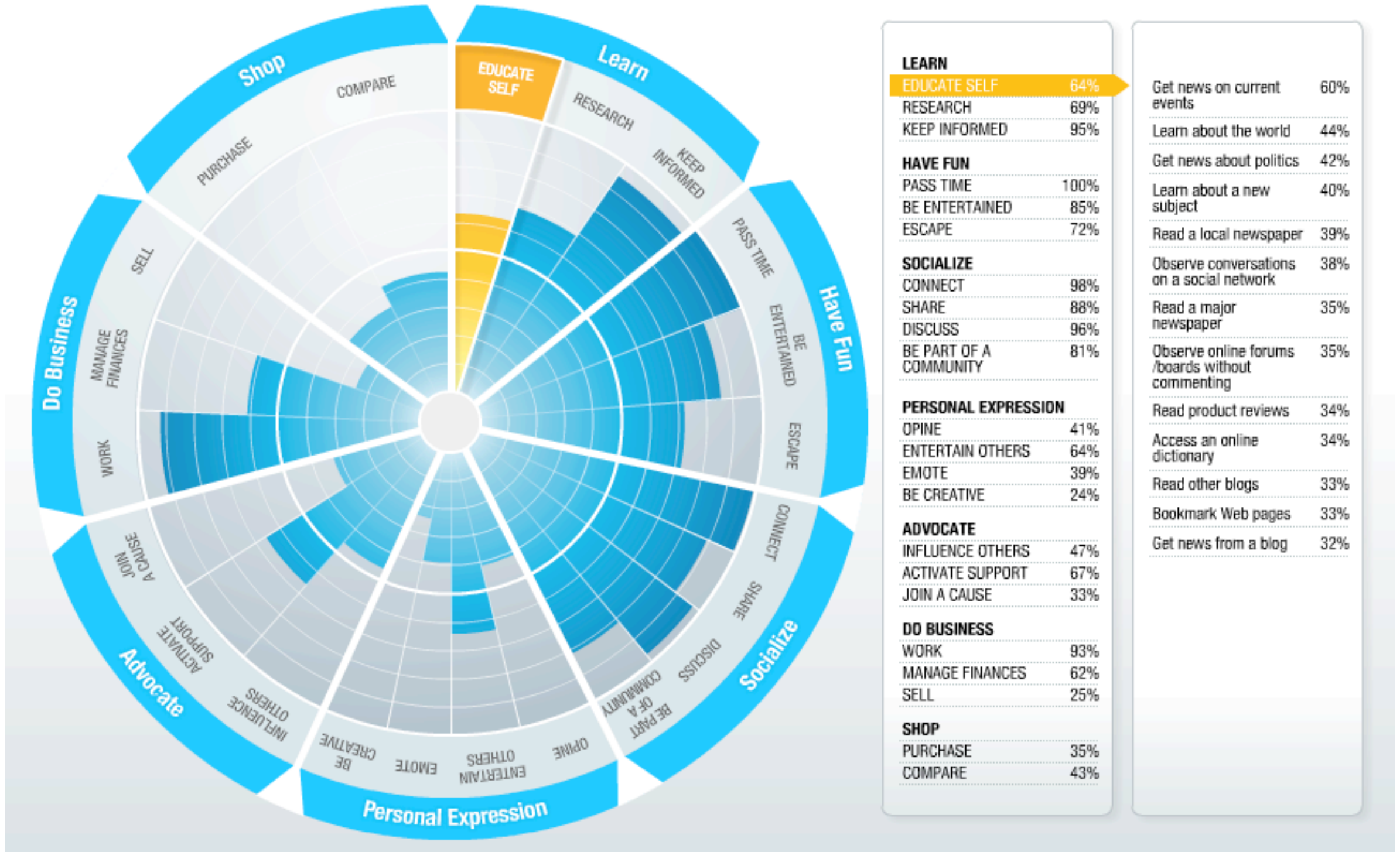
Background

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- ➡ Interdisciplinary approach to explore the potentials of mobile and pervasive technologies to support ubiquitous learning in authentic situations

Background



Research Focus

Ubiquitous Learning

**Learning
Environments**



Mobile Technologies
Pervasive Functionality

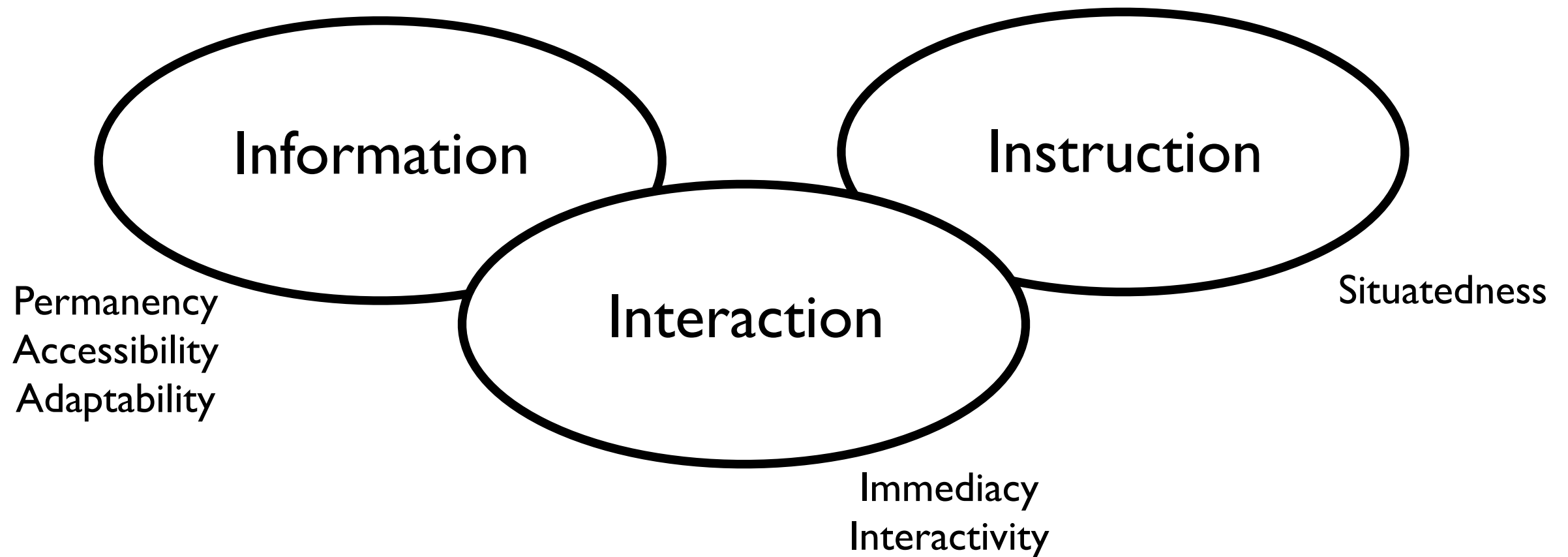


**Ubiquitous
Learning
Environments**

Permanency
Accessibility
Adaptability
Situatingness
Immediacy
Interactivity

Research Focus

Ubiquitous Learning



Research Focus

Information, Interaction, Instruction

Production

Enrichment

Context

Information

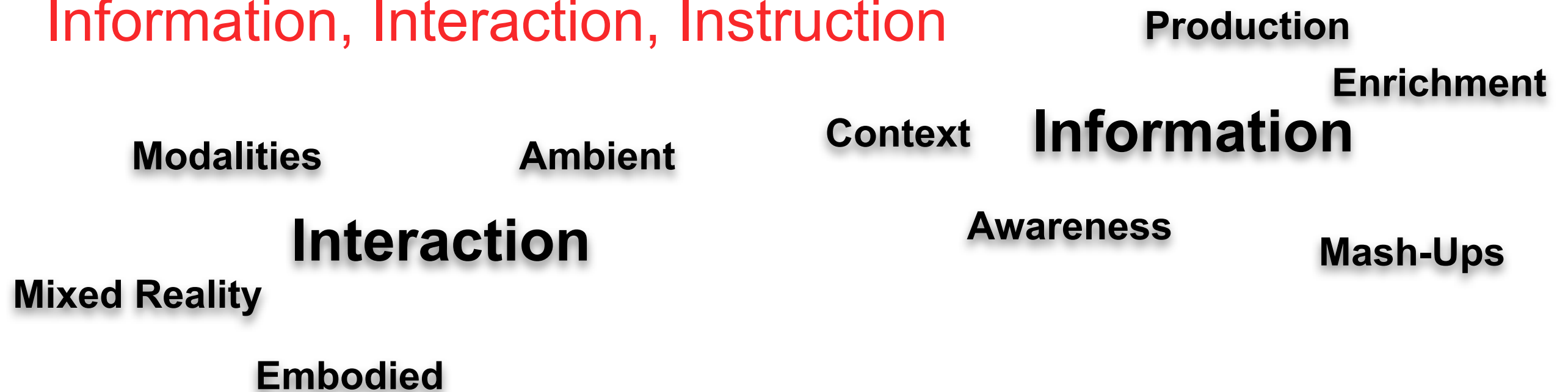
Awareness

Mash-Ups

- Support and assist learners to enable them to navigate more efficiently through information and find the right information in any given situation

Research Focus

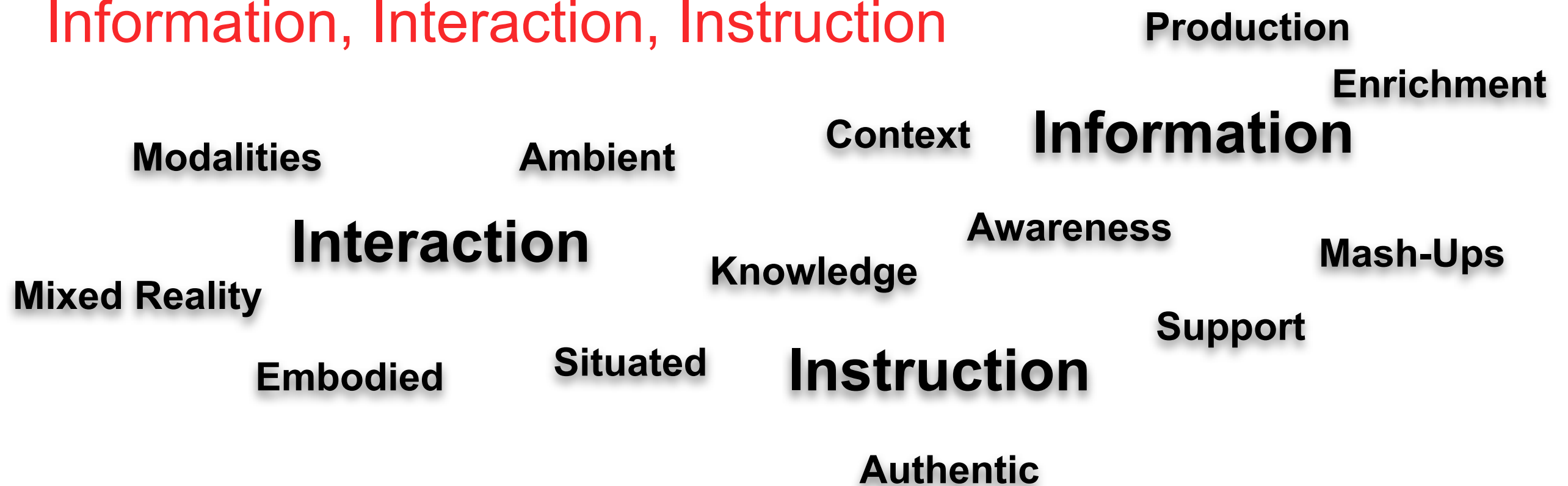
Information, Interaction, Instruction



- Support and assist learners to enable them to navigate more efficiently through information and find the right information in any given situation
- Move the information off the screen into the physical environment and make use of the entire physical environment as an interface

Research Focus

Information, Interaction, Instruction



- Support and assist learners to enable them to navigate more efficiently through information and find the right information in any given situation
- Move the information off the screen into the physical environment and make use of the entire physical environment as an interface
- Support the learning process in the physical environment where it is happening and enable learners to construct knowledge as a personal, social, and environmental process

Research Questions

Problem: Ubiquitous learning is **not supported in its situatedness**, authentic context, and social dependencies. Although ubiquitous learning environments offer a variety of display and interaction modalities learners are confronted with **missing awareness indicators** reflecting the available learning support in their current environment.

Research Questions

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Which types of digital content can support learning in ubiquitous learning environments? How can these content be condensed to create meaningful mash-ups?

Which sensors, displays, and artefacts can be used and how must they be aggregated, filtered, and implemented in ubiquitous learning environments?

Which methods of interaction and information presentation can be used to create awareness in ubiquitous learning environments?

How are the awareness methods assimilated and perceived in ubiquitous learning environments and what are the implications for the design?

Does the utilization of contextualized digital content support and enhance the learning experience in ubiquitous learning environments and what are the effects?

Research Questions

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Which information is relevant for learners in authentic learning situations within ubiquitous learning environments and how can this information be obtained and aggregated?

How can ambient interaction modalities improve the availability and accessibility of this information within ubiquitous learning environments?

Is the improved availability and accessibility of relevant information an effective support in authentic learning situations?

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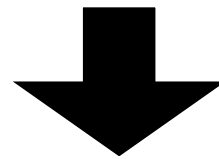
➡ **What are the learning effects of ambient information presentation in a situated learning context within ubiquitous learning environments?**

How can ambient interaction modalities improve the availability and accessibility of this information within ubiquitous learning environments?

Is the improved availability and accessibility of relevant information an effective support in authentic learning situations?

Research Objectives

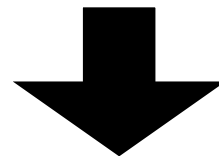
*Support learners in authentic learning situations within ubiquitous learning environments: **establish the awareness for information** relevant for situated learning, **examine the personal, social, and environmental sense-making process** facilitated through ambient information presentation, **evaluate the situated learning support** in authentic learning situations on its effectiveness for learning, especially to solve problems in context.*



Ambient Learning Displays

Research Objectives

*Support learners in authentic learning situations within ubiquitous learning environments: **establish the awareness for information** relevant for situated learning, **examine the personal, social, and environmental sense-making process** facilitated through ambient information presentation, **evaluate the situated learning support** in authentic learning situations on its effectiveness for learning, especially to solve problems in context.*



Ambient Learning Displays

Define functional requirements** for a ubiquitous learning support framework: **give suggestions and provide guidelines** for the design and implementation of future **ambient systems and applications for learning.

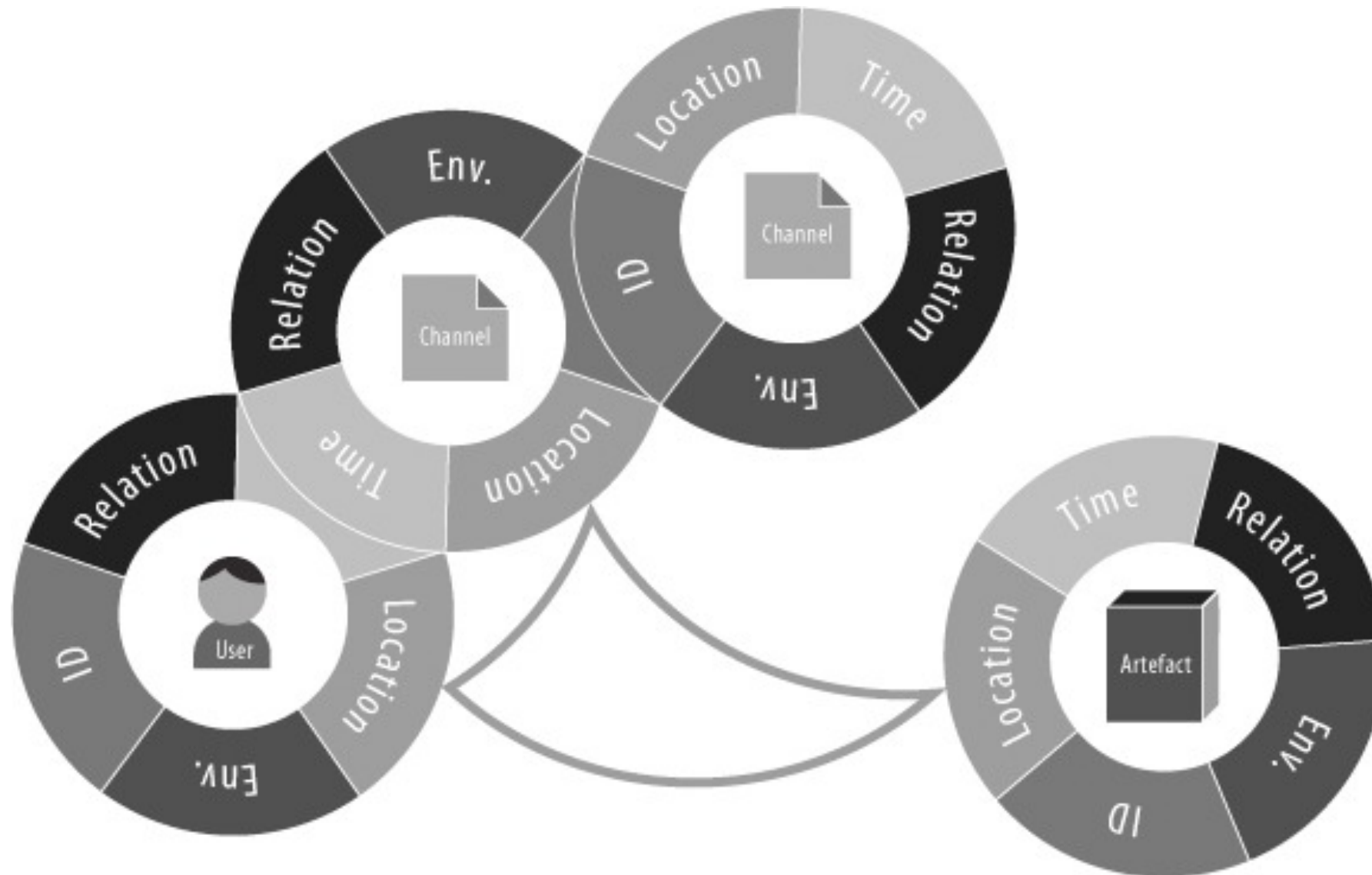
Conceptual Framework

Types of Awareness for Ubiquitous Learning

[Ogata, 2009]

Awareness	Example
Social	Who can help to solve the problem? How can I interact with the peer(s)?
Task	Which task can I do? How much time is required?
Concept	What kind of concepts is necessary to complete the task? Do I need to revise any of my current ideas in light of this new information?
Workspace	What are they doing? What have they already done?
Knowledge	Who is using, changing, or discussing the same knowledge? What knowledge did they use, change, or discuss?
Context	What objects are available around them? Where are they?

Conceptual Framework

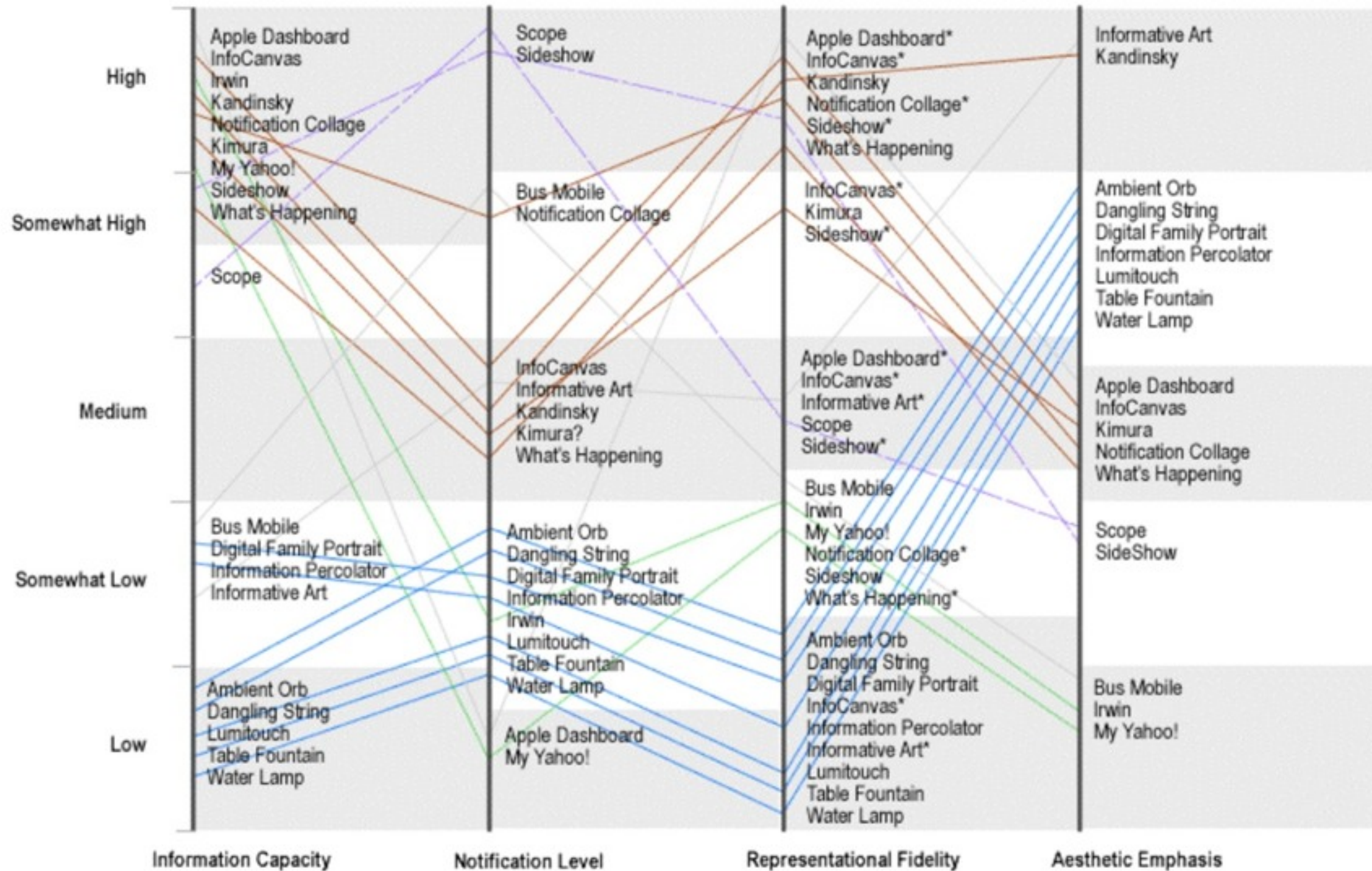


Ambient Information Channels (AICHE)

[Specht, 2009]

Conceptual Framework

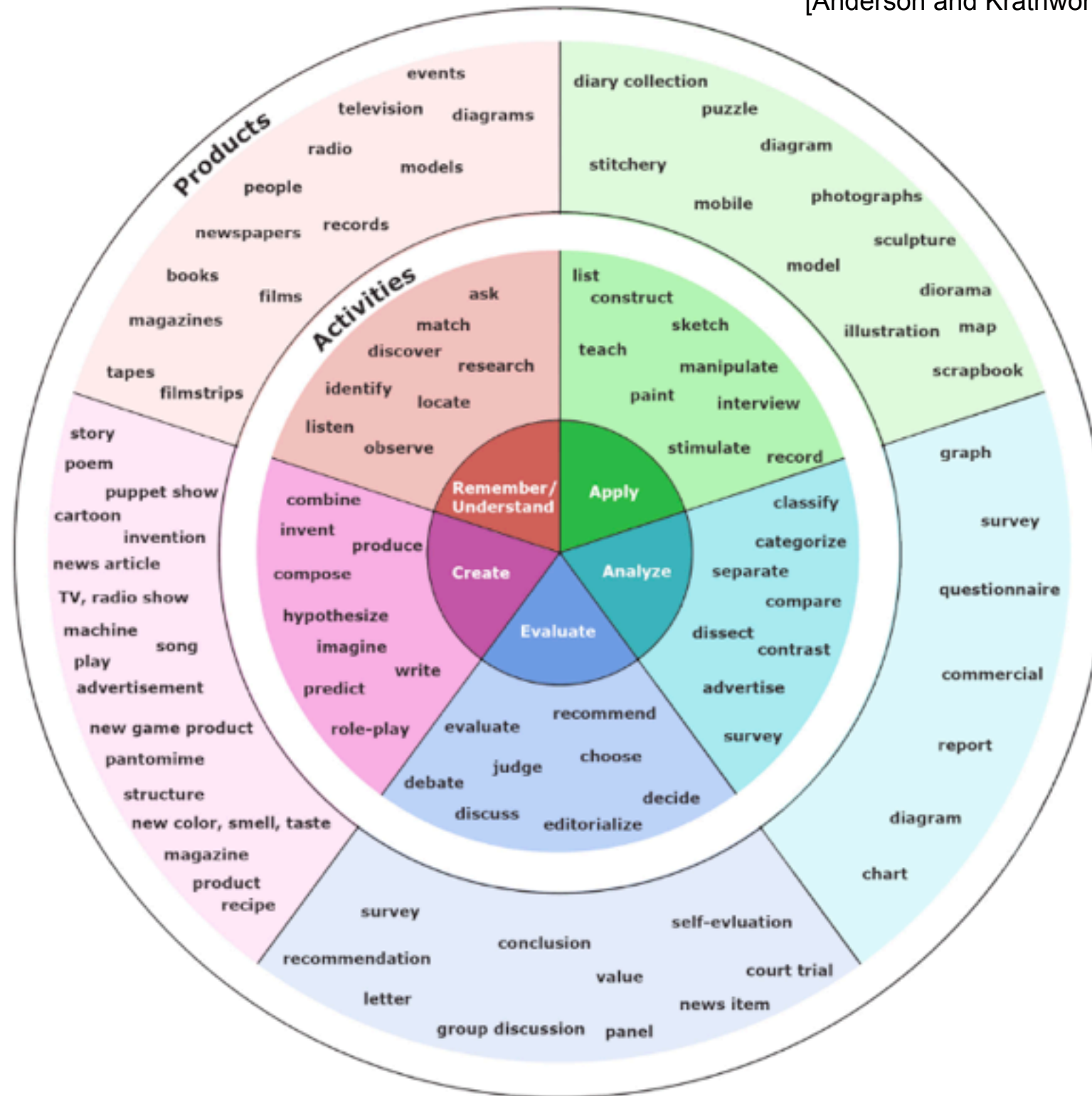
Design Dimensions of Ambient Systems [Pousman and Stasko, 2006]



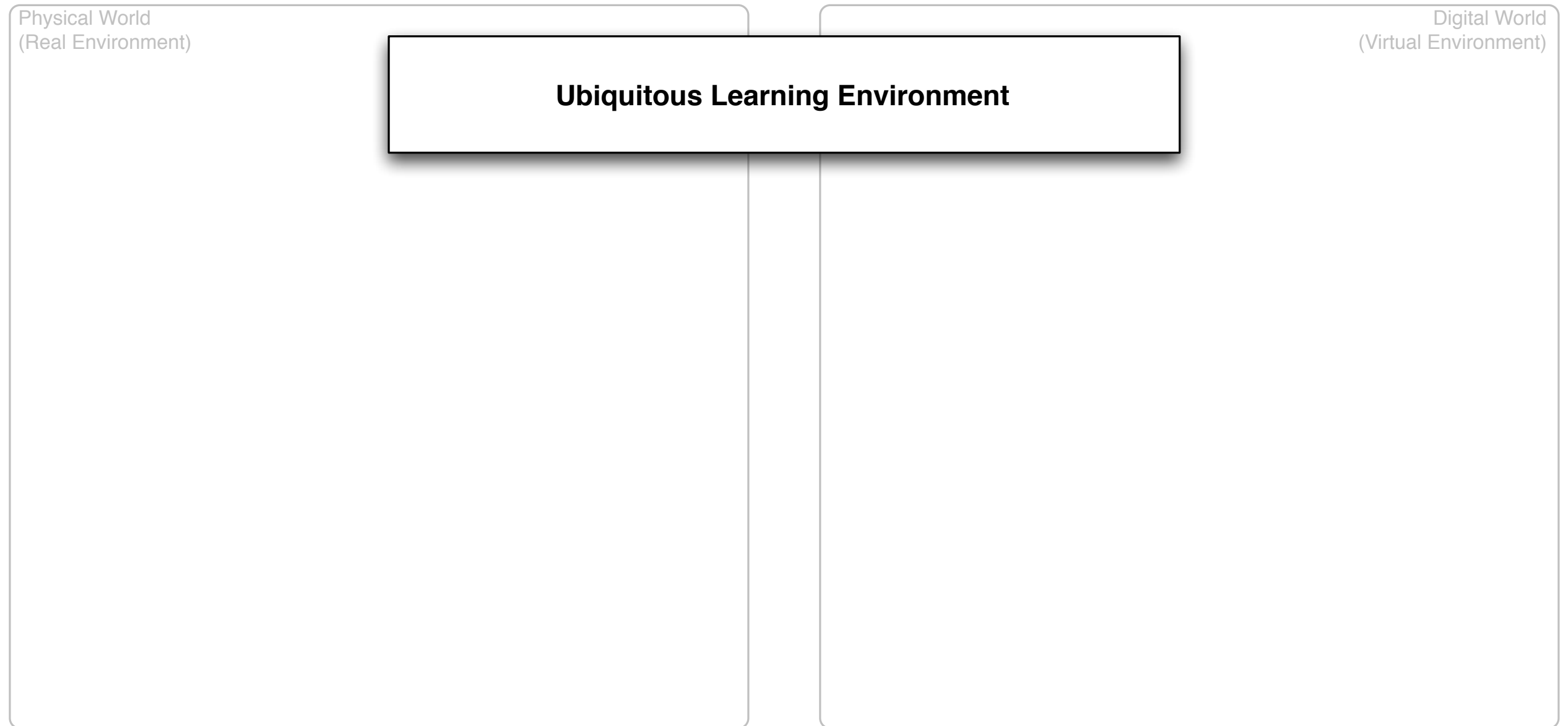
Conceptual Framework

Revised Taxonomy of Educational Objectives

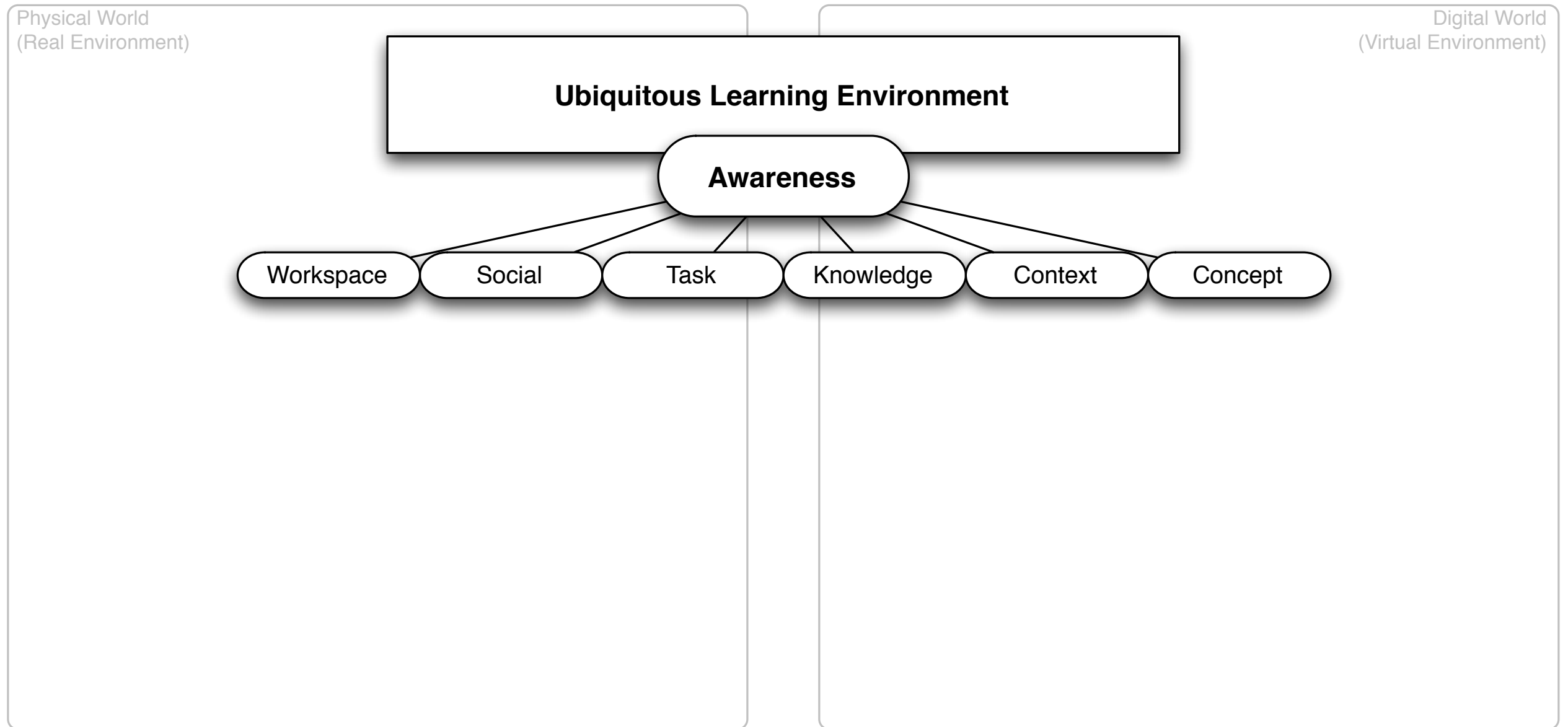
[Anderson and Krathwohl et al., 2001]



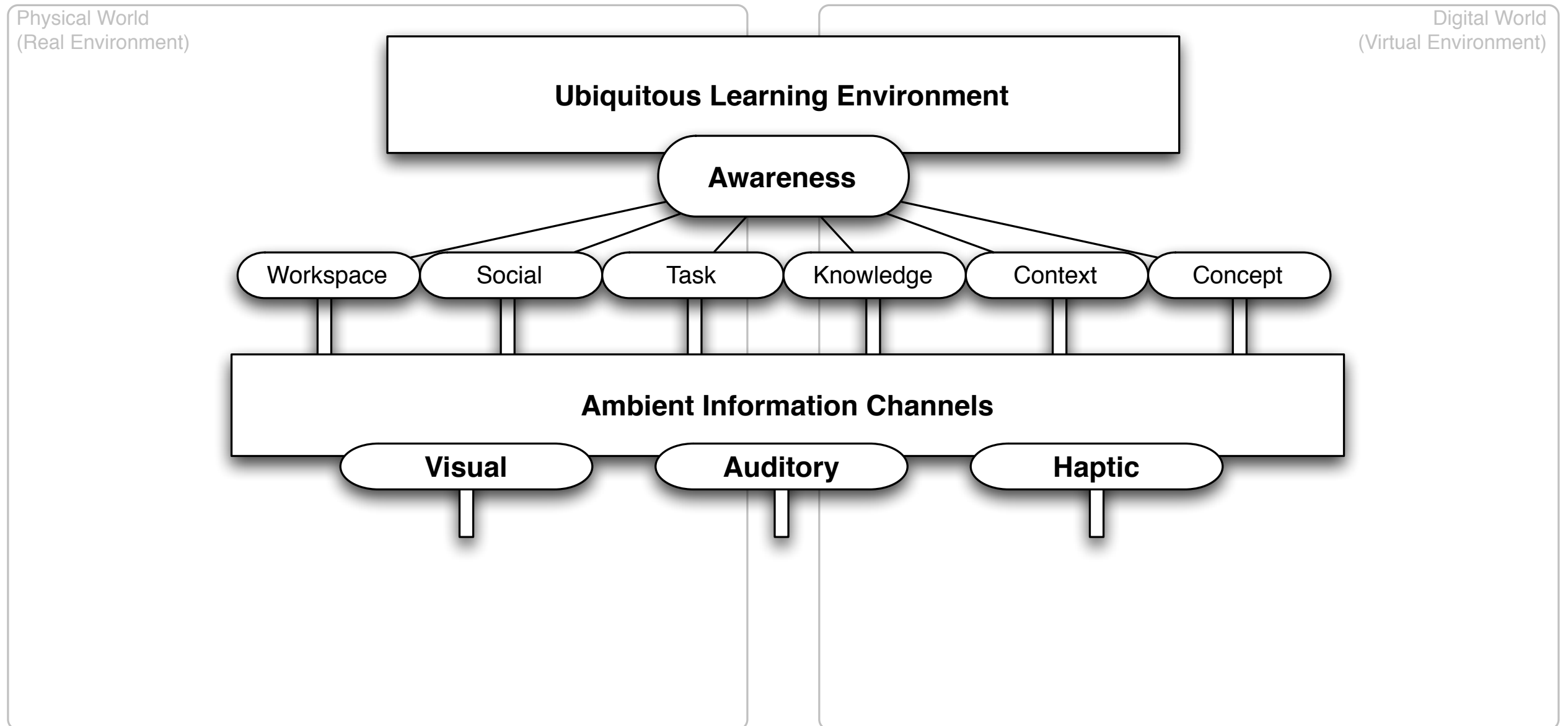
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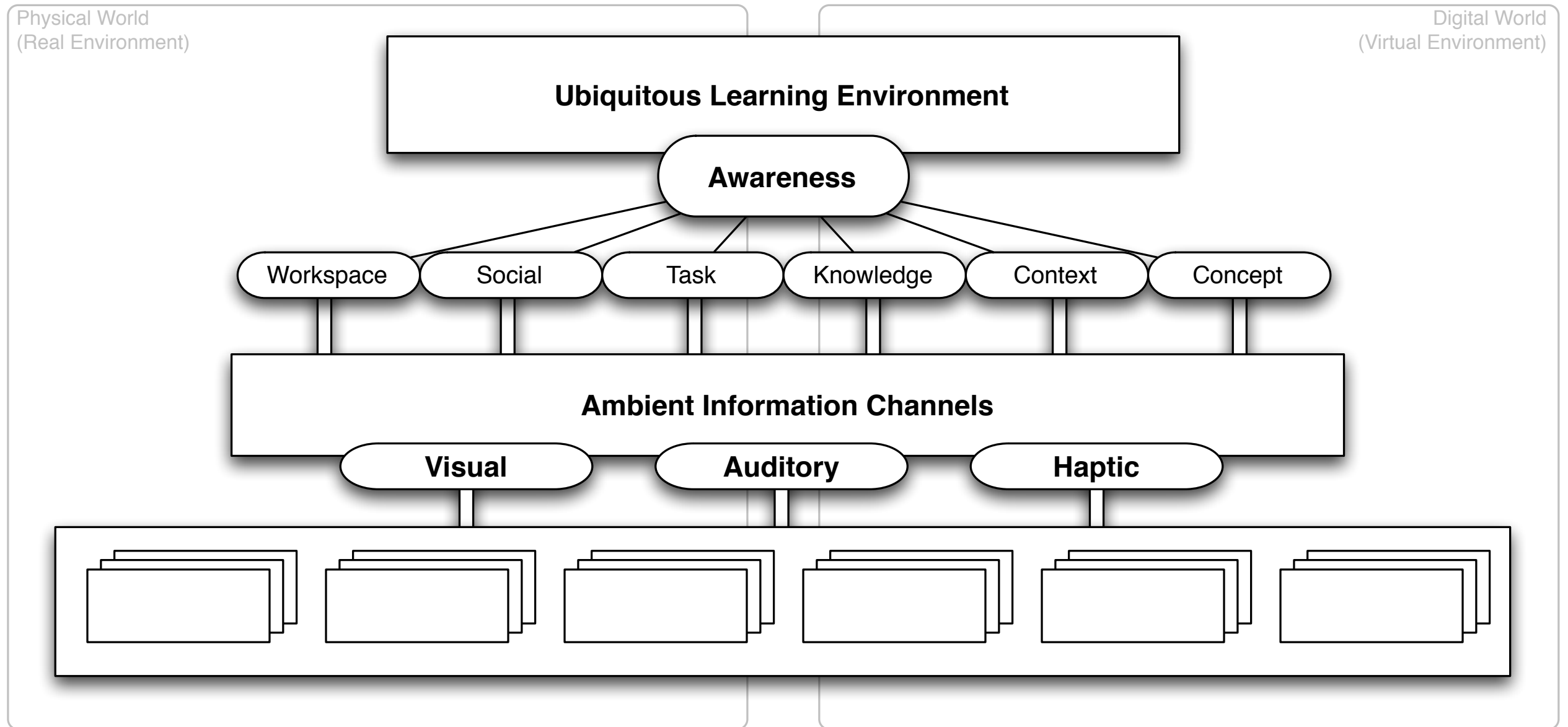
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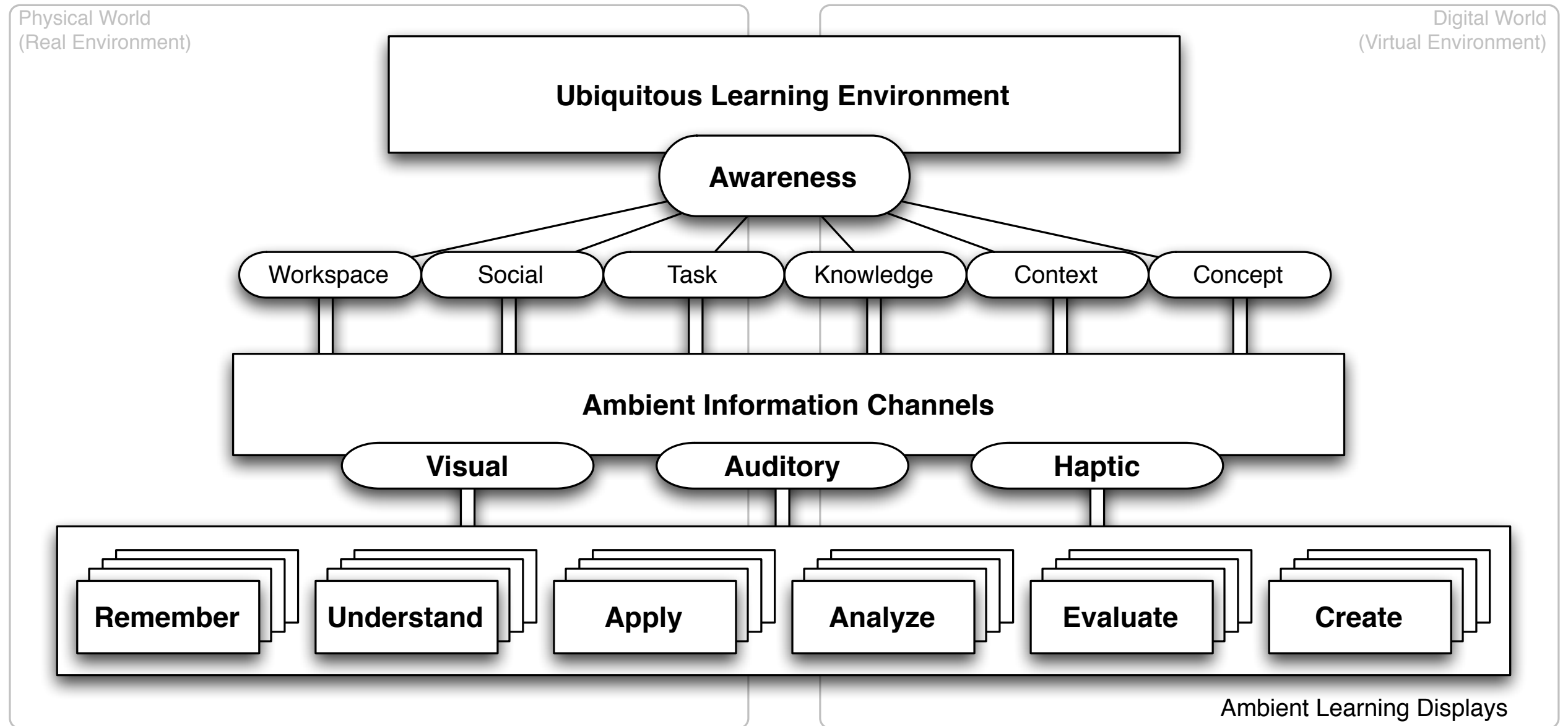
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Conceptual Framework

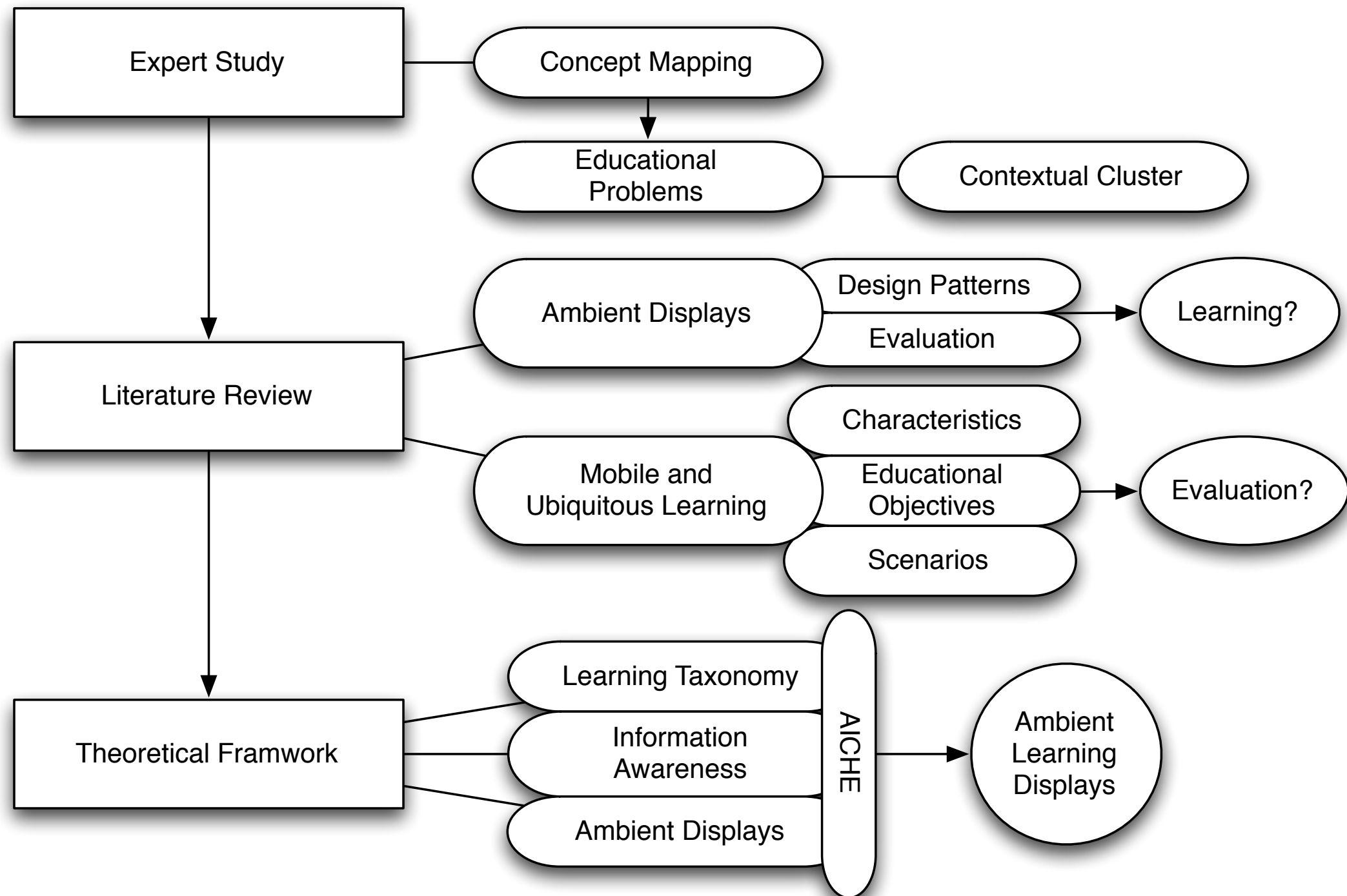


Conceptual Framework



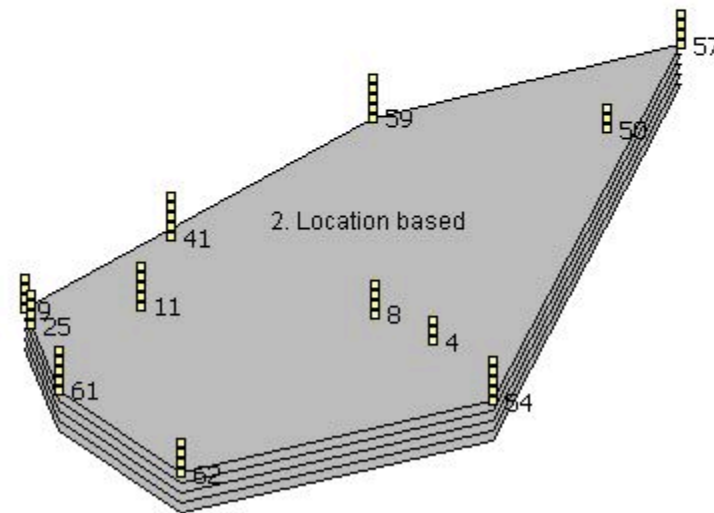
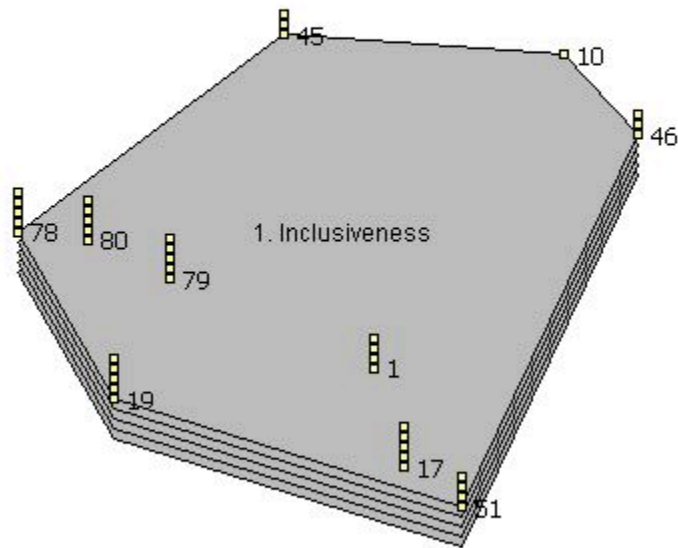
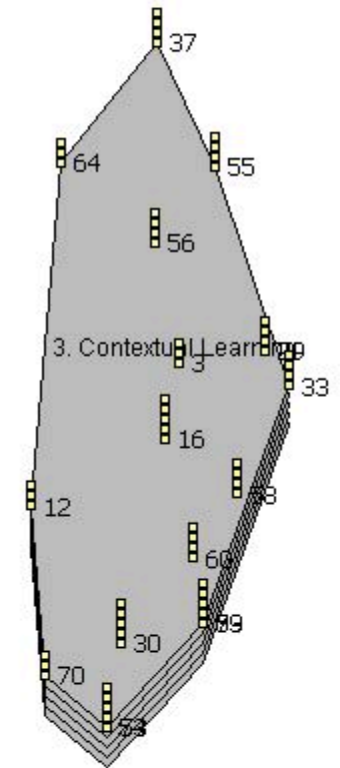
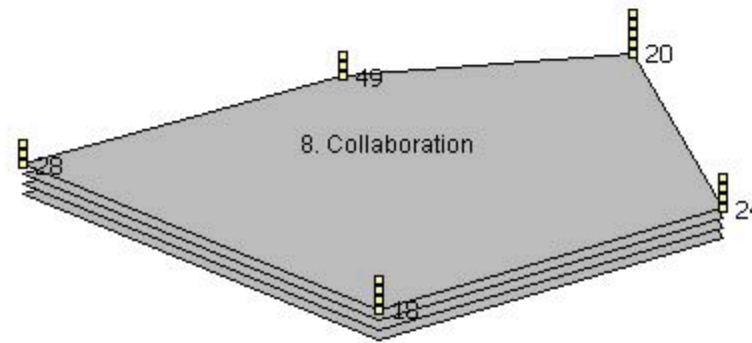
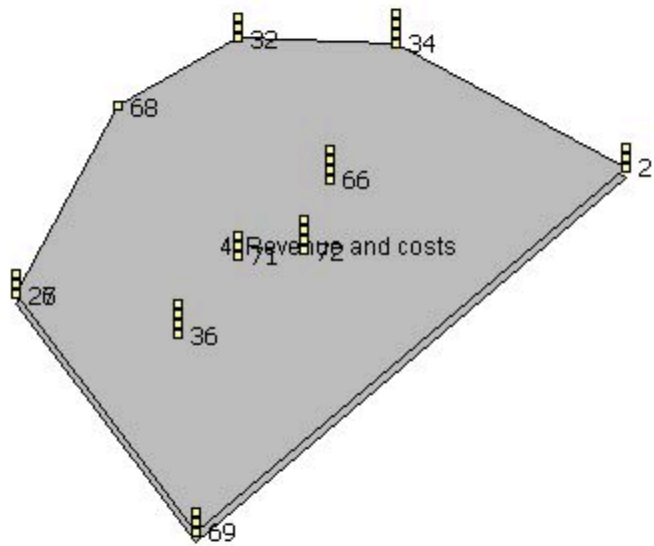
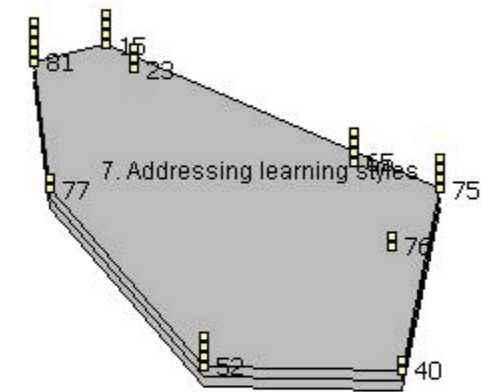
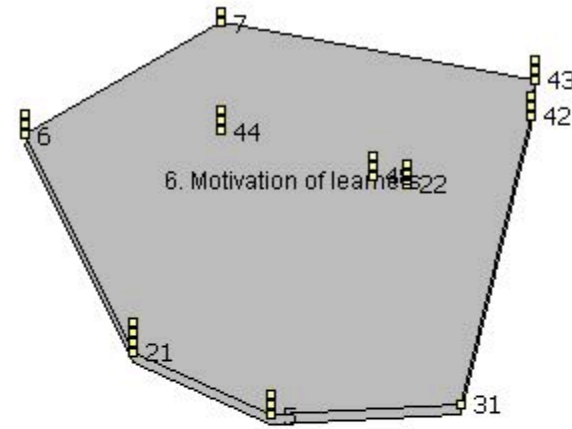
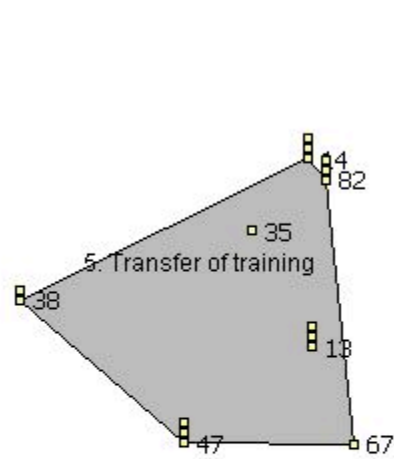
Research Design

Literature Review



Research Design

1 2 3 4 5 6 7 8



Research Design

Methodology

Information Capacity	Representational Fidelity	Aesthetic Emphasis	Notification Level
high	indexical	high	demand attention
somewhat high	iconic	somewhat high	interrupt
medium	iconic (methaphors)	medium	make aware
somewhat low	symbolic	somewhat low	change blind
low	symbolic (abstract)	low	(ignore) user pull

Ambient Design Dimensions

Remember Understand

Cognitive Process Dimension



Research Design

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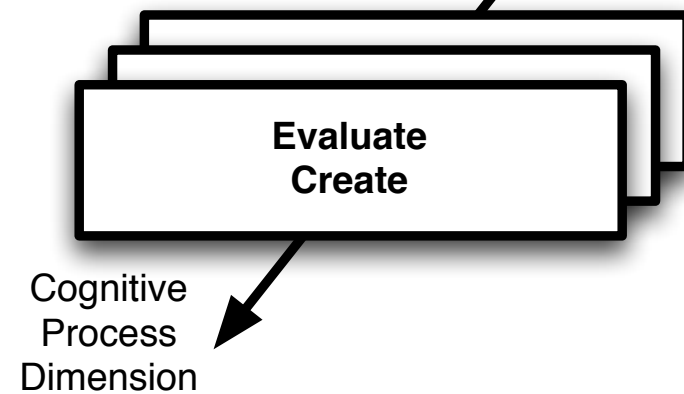
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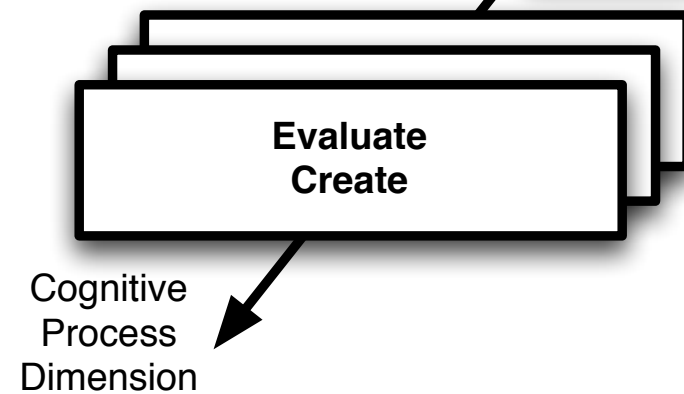


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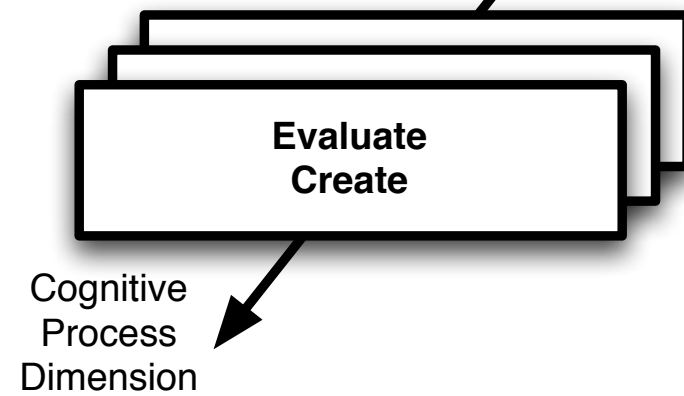


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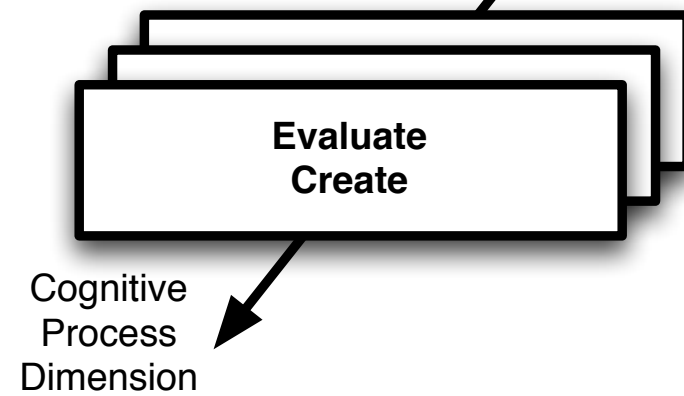
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Research Design

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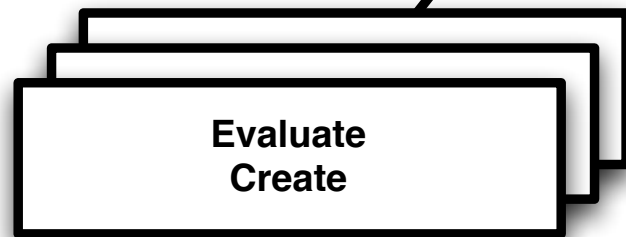
Research Design

Methodology

Dashboard
Audio Signal
Messenger

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Ambient Design Dimensions



Cognitive Process Dimension

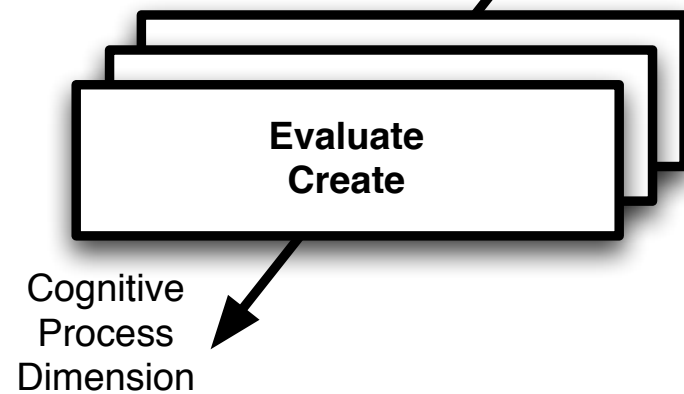
Research Design

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Ambient Design Dimensions



➡ Which domain?

Mathematics
Ecological Facts
Social Game

➡ Evaluation technique?

Experience
Sampling Method

Thank you!

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celstec.org



OpenUniversiteitNederland

MACE

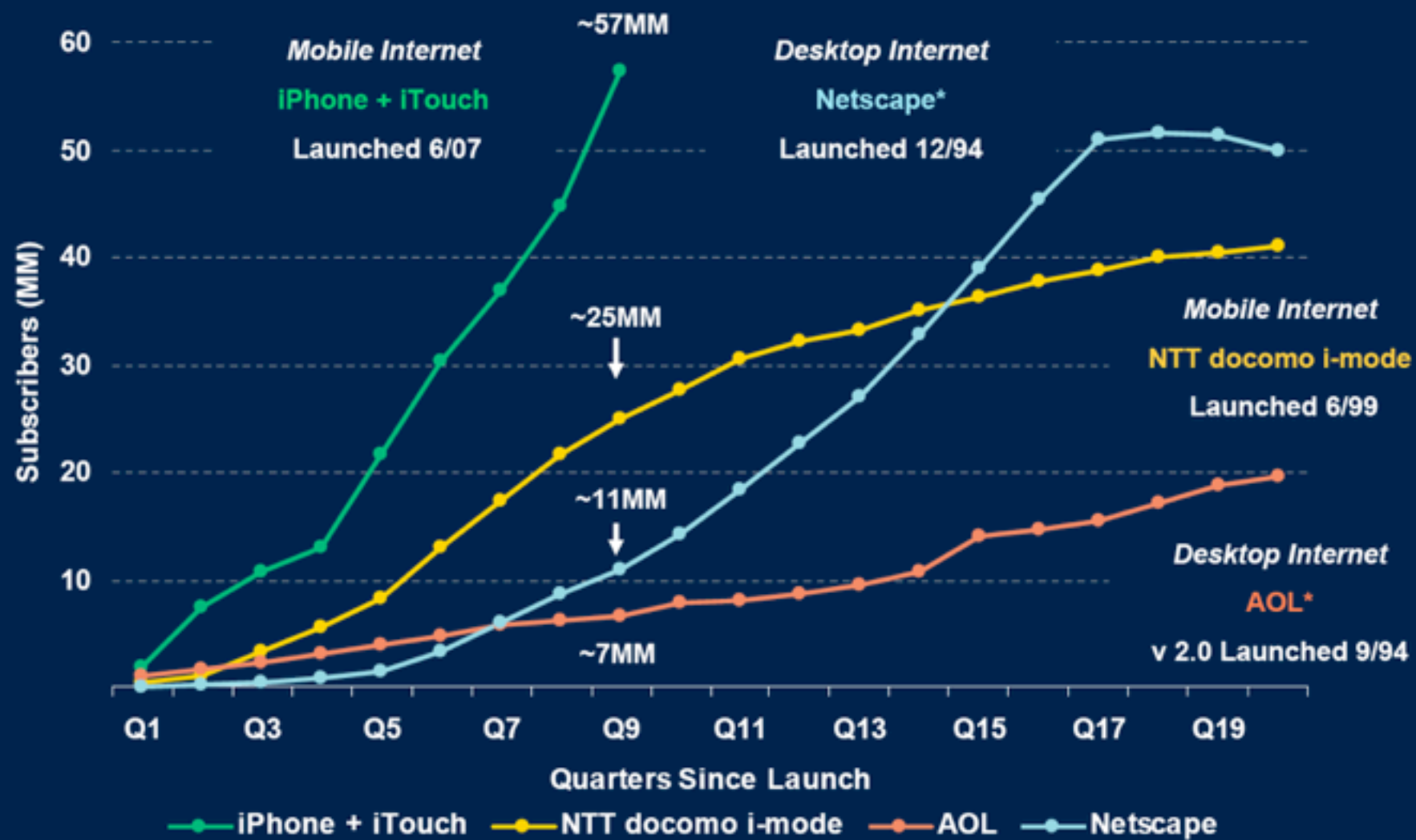
Metadata for
Architectural Contents
in Europe



Background

Mobile Internet Outpaces Desktop Internet Adoption iPhone + iTouch Users = 8x AOL Users 8 Quarters After Launch

iPhone + iTouch vs. NTT docomo i-mode vs. Netscape vs. AOL Users
First 20 Quarters Since Launch

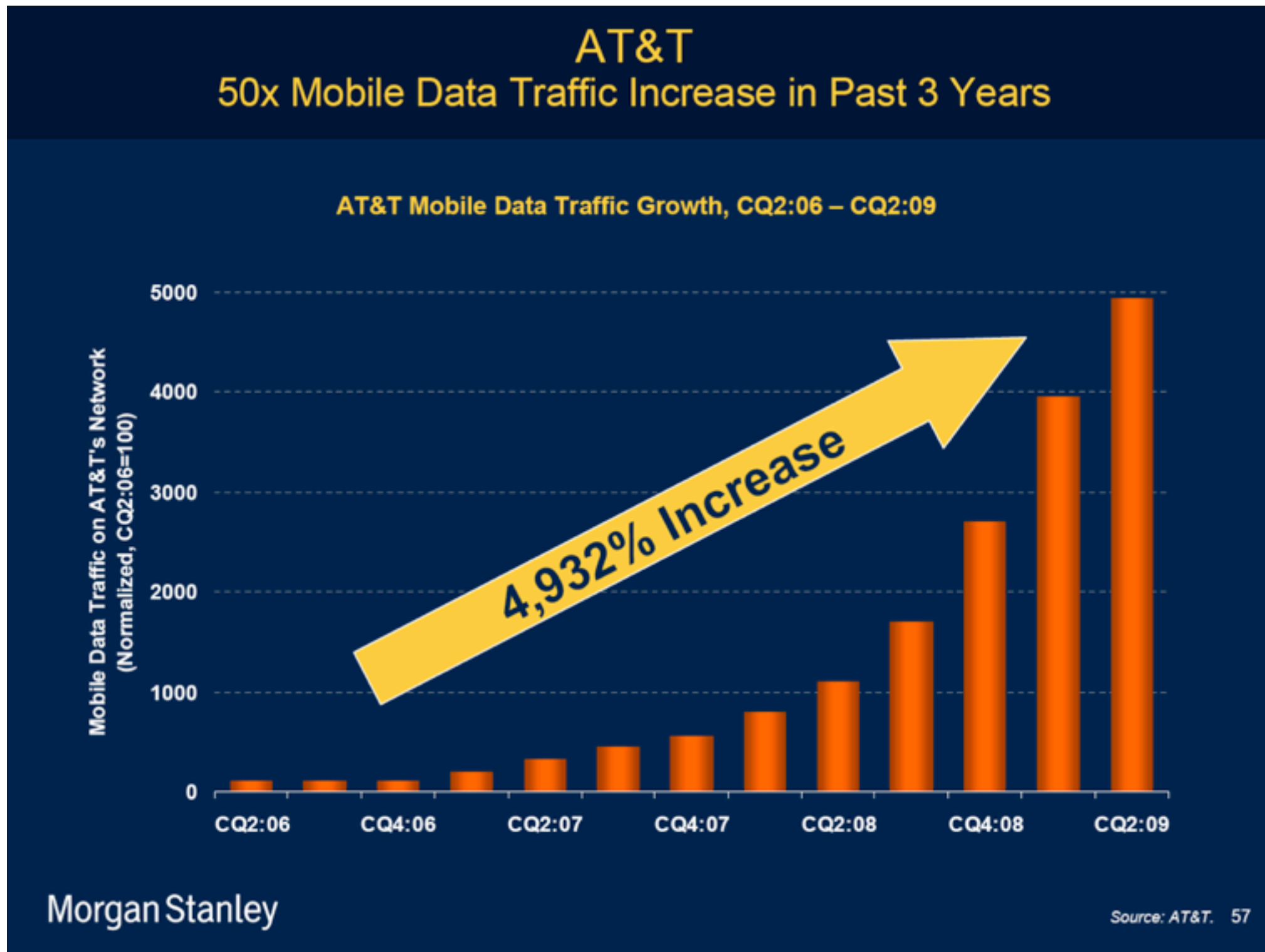


Morgan Stanley

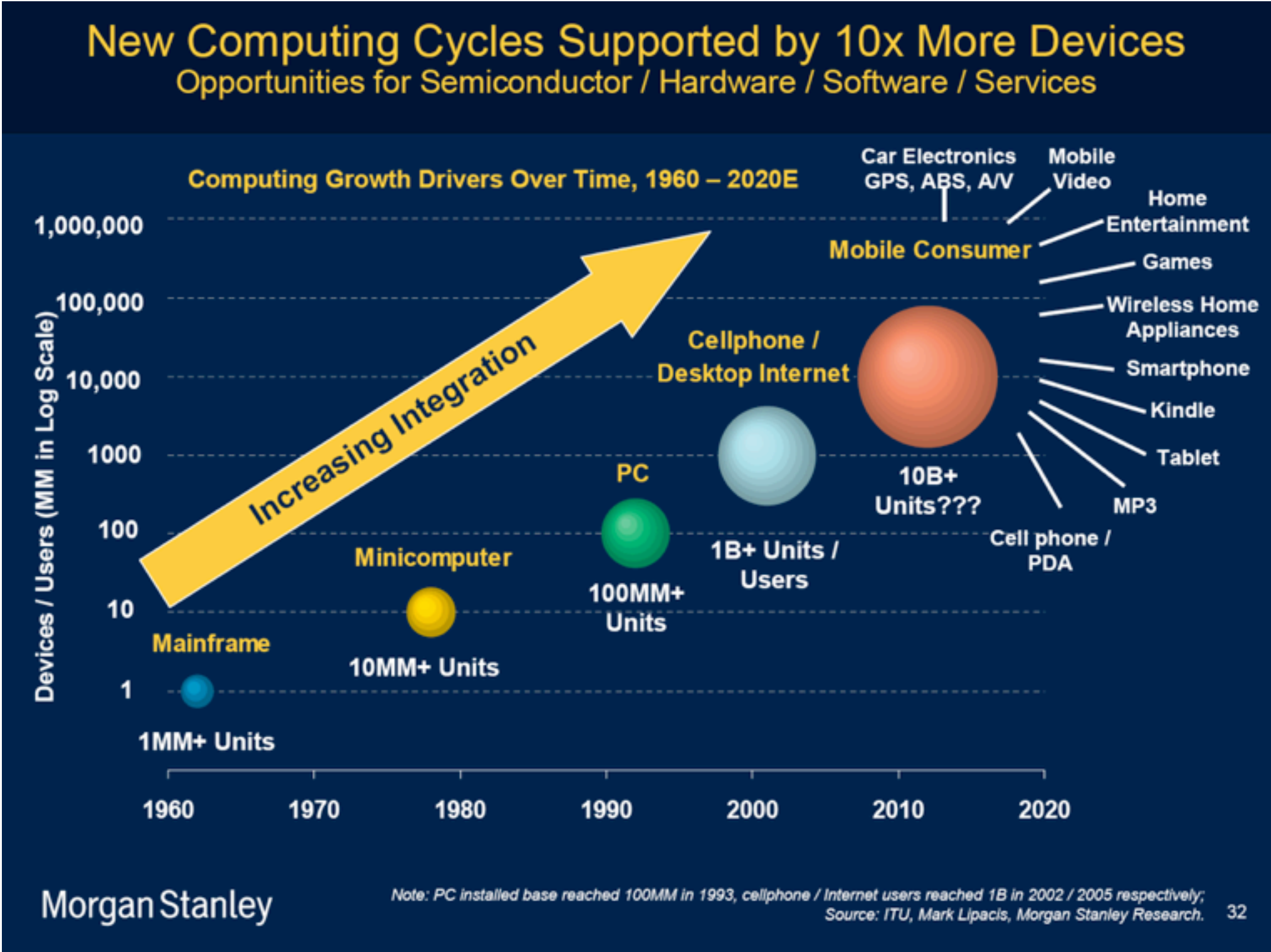
Note: *AOL subscribers data not available before CQ3:94; Netscape users limited to US only.
Source: Company Reports, Morgan Stanley Research.

33

Background



Background



[http://www.morganstanley.com/institutional/techresearch/mobile_internet_report122009.html]