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Trust, Confidence, Familiarity
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Building and Losing Trust in Ambient Intelligent Software Applications

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SoSe 2018

Contextualized Computing and Ambient Intelligent Systems

medieninformatik
IMAI – Institut für Mathematik und Angewandte Informatik

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Assignment 3.6: Davies & Gellersen; Hansen, Bardram & Soegaard

Required Reading

- Required reading for week 6
  - Davies, N., & Gellersen, H. W. (2002). “Beyond prototypes: Challenges in deploying ubiquitous systems.” IEEE Pervasive computing, 1(1), 26-35.
  - Hansen, T. R., Bardram, J. E., & Soegaard, M. (2006). “Moving out of the lab: Deploying pervasive technologies in a hospital.” IEEE Pervasive Computing, 5(3), 24-31.
- The text will be discussed in the tutorial 04.06.2018

- Course readings can be downloaded in the learnweb
- Every text has a wiki-page in the learnweb
  - Use it to describe the text
  - Use it to link the text to the course
- Results of the discussion may also be written up

Assignment 4.1: Abowd, Mynatt & Rodden

Required Reading

- Required reading for week 7
  - Abowd, Gregory D., Elizabeth D. Mynatt, and Tom Rodden. “The human experience” IEEE pervasive computing 1.1 (2002): 48-57.
- The text will be discussed in the tutorial 11.06.2018

- Course readings can be downloaded in the learnweb
- Every text has a wiki-page in the learnweb
  - Use it to describe the text
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- Results of the discussion may also be written up

Assignment 4.2: De Ruyter & Aarts

Required Reading

- Required reading for week 8
  - De Ruyter, Boris, and Emile Aarts. “Experience research: a methodology for developing human-centered interfaces.” In Handbook of ambient intelligence and smart environments, pp. 1039-1067. Springer, Boston, MA, 2010.
- The text will be discussed in the tutorial 18.06.2018

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Assignment 4.3: Course Context

Group Work

- Form groups of 3-6
- What are the most important features of the three steps?
  - context studies
  - lab studies
  - field studies
- What are the different results you would expect?
- Name things that would be difficult to evaluation for one or more steps, but which you should be able to evaluate in others
- Present your idea in the course/learnweb

Assignment 4.4: Palmer & Popat, Cheok et al., Lantz

Required Reading

- Required reading for week 9
  - Palmer, Scott, and Sita Popat. “Dancing in the Streets: The sensuous manifold as a concept for designing experience.” International Journal of Performance Arts and Digital Media 2, no. 3 (2007): 297-314.
  - Cheok, Adrian David, Kok Hwee Goh, Wei Liu, Farzam Farbiz, Siew Wan Fong, Sze Lee Teo, Yu Li, and Xubo Yang. “Human Pacman: a mobile, wide-area entertainment system based on physical, social, and ubiquitous computing.” Personal and ubiquitous computing 8, no. 2 (2004): 71-81.
  - Lantz, Frank: PacManhattan. In: Montola, M., Stenros, J., & Waern, A. (2009). Pervasive games: theory and design. CRC Press.
- The text will be discussed in the tutorial 25.06.2018

Video 4.1: Dancing in the Streets

☞ Dancing in the Streets, York 2005 (1:25)

Assignment 4.4: Further Examples

Recommended Reading

- Recommended reading for week 9
  - Montola & Stenros: Killer: The Game of Assassination
  - Stenros & Montola: Momentum
  - Stenros & Montola: Epidemic Menace
  - Ballagas & Walz: REXplorer
  - (All in: Montola, M., Stenros, J., & Waern, A. (2009). Pervasive games: theory and design. CRC Press.)
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Assignment 4.5: Dourish & Bell

Required Reading

- Required reading for week 10
  - Dourish, P., & Bell, G. (2014). “Resistance is futile”: reading science fiction alongside ubiquitous computing. Personal and Ubiquitous Computing, 18(4), 769-778.
- The text will be discussed in the tutorial 02.07.2018

- Course readings can be downloaded in the learnweb
- Every text has a wiki-page in the learnweb
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Artificial Intelligence

Artificial Intelligence

- Concepts that need some elaboration:
  - What is trust?
  - What are intelligent software applications?
  - What are ambient systems?

Artificial Intelligence

- Concepts that need some elaboration:
  - What is trust?
  - What are intelligent software applications?
  - What are ambient systems?
- Intelligent software applications are systems that realize artificial intelligence in software:

What is Artifical Intelligence (AI)?

"It is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable." (McCarthy, 2007)

- This preliminary definition poses new questions, the most importantly the question of what intelligence is.

Intelligence

- No universally accepted answer, but few would argue that intelligence is a capacity displayed by humans.

What is Intelligence?

"Intelligence is a very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience. It is not merely book learning, a narrow academic skill, or test-taking smarts. Rather, it reflects a broader and deeper capability for comprehending our surroundings – 'catching on,' 'making sense' of things, or 'figuring out' what to do." (Gottfredson, 1997)

- What are examples of software systems realizing intelligent behaviour?

Intelligent Software Applications

- Examples for intelligent applications:
  - **Recommender** systems, involving abstraction and often learning.
  - **Configuration** systems, being able to plan new products.
  - **Diagnostic** systems, exhibiting reasoning capabilities.
  - **Spam filters**, which often have to learn from experience.
- Usually involves delegation of responsibilities.

Intelligent Software Applications

- Examples for intelligent applications:
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- Usually involves delegation of responsibilities.

Example

"How do I know that this product recommendation is relevant?"
"I don't trust automatic bayesian spam filtering!"

Ambient Intelligent Systems

Definition

At the core of an ambient intelligent system lies the ability to **appreciate the system's environment**, be **aware of persons** in this environment, and **respond intelligently to their needs** (Ducatel et al. (2001), *ISTAG Scenarios for AmI in 2010*).

- **Perception:** The initial act of perceiving the world that the system inhabits
- **Context Awareness:** Being aware of the environment and reasoning about ongoing situations
- **Context Sensitivity:** Exhibit appropriate behaviour in ongoing situations
- **Action:** Changing the environment according to context

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Trust

What is Trust?

Example

"Trust is not a new research topic in computer science, spanning areas as diverse as security and access control in computer networks, reliability in distributed systems, game theory and agent systems, and policies for decision making under uncertainty. The concept of trust in these different communities varies in how it is represented, computed, and used." (Artz and Gil, 2007)

- Trust can be something to be avoided (in security).
- Can be a desirable feature (electronic voting).
- Can be computationally modeled (multi agent systems).
- Can be understood as a mental attitude cognitive agents have towards each other (Falcone and Castelfranchi, 2001).
- It can focus on **different aspects** in cognitive agents.

Aspects of Trust

Let us look at different aspects of trust

- Accordance with Mental Models
- Relying on past performance
- Providing explanations for (changed) behavior

☞ xkcd 364: responsible behavior

Mental Models

Example

"This trust comes from an ability to predict the system's behavior through observation. To predict and explain the behavior of a system, people construct mental models that may be more or less complete and accurate. Therefore, designers must create intelligent applications that enable the formation of mental models that are predictable enough to merit their trust." (Tullio et al., 2007)

- The authors strengthen the role of mental models.
- They also highlight the fact that the user should be able to explain and predict the system's behaviour.

Change Over Time, Explanation

Example

"Results [...] indicate that trust is an important factor in understanding automation reliance decisions. Participants initially considered the automated decision aid trustworthy and reliable. After observing the automated aid make errors, participants distrusted even reliable aids, unless an explanation was provided regarding why the aid might err. Knowing why the aid might err increased trust in the decision aid and increased automation reliance, even when the trust was unwarranted." (Dzindolet et al., 2003)

- The author point out that initial positive trust can decrease and increase based on performance.
- They indicate that explanations can help building trust.
- Trusted systems are less disused or misused.

Experience

Example

"[...] it can be shown that positive experiences can be identified that (usually) have an increasing or at least nondecreasing effect on trust, and negative experiences that have a decreasing or at least non-increasing effect. Here it appears easier to destroy trust than to build trust: the designed negative experiences show a stronger negative effect on trust than the positive effect shown by the designed positive experiences." (Jonker et al., 2004)

- The role of experience with a system is highlighted.
- Flexibility over time is discussed, as are countermeasures.

Trust: Typology

- McKnight and Chervany (2001) develop a typology of trust based on literature survey and identify core characteristics: benevolence, integrity, competence, and predictability.
  - "**Benevolence** means caring and being motivated to act in one's interest rather than acting opportunistically.
  - **Integrity** means making good faith agreements, telling the truth, and fulfilling promises.
  - **Competence** means having the ability or power to do for one what one needs done.
  - **Predictability** means trustee actions (good or bad) that are consistent enough to be forecasted in a given situation."
- They also organise trust by conceptual type, "such as attitude, intention, belief, expectancy, behavior, disposition, and institutional/structural."

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- They also organise trust by conceptual type, "such as attitude, intention, belief, expectancy, behavior, disposition, and institutional/structural."
- There seem to be huge disagreement about what trust is!

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Overview

Problems with the Definitions

- Partly problems between disciplines are to blame:

Example

"A disciplinary lens sheds significant light on a topic like trust, but can also blind the researcher to possibilities outside the paradigm the discipline pursues. Based on the differences among their definitions of trust, it appears that psychologists analyzed the personality side, sociologists interviewed the social structural side, and economists calculated the rational choice [...]. Few researchers [...] have developed trust typologies that define a set of trust constructs, and fewer still [...] have tried to reconcile interdisciplinary sets of constructs. More typically, trust typologies have stubbornly retained an intra-disciplinary flavor." McKnight and Chervany (2001)

Problems with the Definitions

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- But there might also be an **epistemic problem**.

Danger vs. Risk

- Let's step back a bit and look at some basic properties, as defined by sociologist Niklas Luhmann.
- He looks at the risk or dangers (of not reaching a goal) involved when taking certain decisions:

Definition

"[...] uncertainty exists in relation to future loss. There are then two possibilities. The potential loss is either regarded as a consequence of the decision, that is to say, it is attributed to the decision. We then speak of **risk** [Risiko] – to be more exact of the risk of decision. Or the possible loss is considered to have been caused externally, that is to say, it is attributed to the environment. In this case we speak of **danger** [Gefahr]." (Luhmann, 1993)

Choice and Alternatives

Definition

"…an attribution can be made to a decision only if a choice between alternatives is conceivable and appears to be reasonable, regardless of whether the decision maker has, in any individual instance, perceived the risk and the alternative, or whether he has overlooked them." (Luhmann, 1993)

- Luhmann thinks it is essential for regarding something as a risk that there are alternatives to be considered, whether considered in practice or not.
- If a user chooses to use a system, he deliberately takes the risk of failure.
  - Using the system is the result of an (potential) *analysis*.
- If he is bound to use it, he has the object of danger.
  - Using the system is grounded in *habit*.

Familiarity and Trust

- Luhmann (1979) distinguishes several types of trust relations.
- First of all, he distinguishes between familiarity [Vertrautheit] and trust [Vertrauen]:

Definition

"*Familiarity* reduces complexity by an orientation towards the past. Things that we see as familiar, because 'it has always been like that', are accepted – we do engage in relations with those – and things that we see as unfamiliar are rejected – we do not engage in relations with those." Pieters (2008)

- For example, especially elderly people often refuse to use ATM's, precisely because they are not used to them.
- Trust, on the contrary, has an orientation towards the future: it involves expectations. We trust in something because we expect something.

Trust and Confidence

- Luhmann (1988) also distinguishes trust [Vertrauen] and confidence [Zutrauen].
- Both involve expectations with respect to future events.

Definition

"According to Luhmann, trust is always based on assessment of risks, and a decision whether or not to accept those. Confidence differs from trust in the sense that it does not presuppose a situation of risk. Confidence, instead, neglects the possibility of disappointment, not only because this case is rare, but also because there is not really a choice. This is a situation of danger, not risk." Pieters (2008)

- Only when we chose to use a system, we talk about trust.

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Examples

Familiarity

We can use this distinction to clear the muddy waters around different definitions of trust prevailing in the computer science literature:

Example

"[Trust is] a subjective expectation an agent has about another's future behavior based on the history of their encounters." (Mui et al., 2002)

- We can classify this as being *familiar* with a system.

Confidence

Example

"[Trust is] the firm belief in the competence of an entity to act dependably, securely, and reliably within a specified context." (Grandison and Sloman, 2000)

- We can classify this as having *confidence* in a system.

Trust

Example

"Trust of a party A to a party B for a service X is the measurable belief of A in that B behaves dependably for a specified period within a specified context (in relation to service X)." (Olmedilla et al., 2005)

- We can classify this as having *trust* towards a system.

Trust

Example

"Trust of a party A to a party B for a service X is the measurable belief of A in that B behaves dependably for a specified period within a specified context (in relation to service X)." (Olmedilla et al., 2005)

- We can classify this as having *trust* towards a system.
- In the following, we will look at two aspects that can increase or decrease trust or confidence into the systems:
  - The aspect of explanations, and
  - the aspect of contextuality.

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Overview

Why bother to explain?

- Important vehicle to convey information between communicating people in everyday human to human interaction.
- Enhance the knowledge of the participants in such a way that they accept certain statements and gain a better understanding of the actions of the other persons involved and their motivations.
- They understand more, allowing them to make better informed decisions themselves.
- Explanations are the most common method used by humans to support their decision making (Schank, 1986).

Use of Explanations

- If we cannot follow a conversation,
  - we ask our conversation partner about concepts that we did not understand,
  - we request justifications for some fact or we ask for the cause of an event,
  - we want to know about functions of concepts,
  - we want to know about purposes of concepts, and
  - we ask questions about his or her behaviour and how he or she reached a conclusion.

Explanations in Intelligent Systems

System Centric View

Explanation as **part of the reasoning process** itself.

- **Example:** a knowledge intensive case-based reasoning system can use its domain knowledge to explain the absence or variation of feature values.

User Centric View

Giving explanations of the found solution, its application, or the reasoning process **to the user**.

- **Example:** in an engine failure diagnosis system, the user gets an explanation on why a particular case was matched.

Explanations for {Trust|Confidence}

- Systems being able to explain their behaviour and reasoning increase the user's perception of the system's *competence* and *integrity*.
- This in turns support building up trust and confidence (McKnight and Chervany, 2001).
- Looking for a model describing the relation between explanation and {trust|confidence} as well as possible points of failure.
- Taking a actor network perspective: looking at the translation and delegations processes involving system and user as actors.

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Black Boxing

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Black Boxes

Pieters (2011) introduces the concept of black boxing with regard to explanations:

- In different IT settings, the black box character of systems lacking explanations is often mentioned.
- This concept can mean very different things.
- In the common sense meaning, a black box is something that outputs something based on certain inputs, but that we do not know the inner workings of.
- In a more philosophical sense, a black box is something that has been “blackboxed”; a theory or technology of which the supporting network of actants has become invisible. (Latour, 1999)

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Explanation Programs

- Latour associates the process of blackboxing with three other phenomena: translation, composition and delegation.
  - **Composition** means that actants in a network form a composite actant to which actions can be attributed.
  - **Translation** denotes that the “action program”, the intentions and possibilities for action, change when actants join forces. A man plus a gun has different action possibilities than a man or a gun alone.
  - **Delegation** is the the process in which parts of an action program are delegated to different actants. The responsibility of delivering hotel keys at the reception can be delegated to large pieces of metal.
  - We “translate” these concepts to explanation and trust.
- Actants have an explanation program: when they are asked to explain something about a theory or system, they have certain intentions and possibilities for explaining in a certain way.

Explanation for {Trust|Confidence}

- Explanation may serve different purposes.
- It can either aim at acquiring confidence or at acquiring trust.
- *Explanation-for-trust* is contrasted with *explanation-for-confidence*

Definition

Explanation-for-trust is explanation of how a system works: the black box of the system is opened. *Explanation-for-confidence* is explanation that makes the user feel comfortable in using the system: the black box is not opened.

Black Boxes and Trust

- A black box cannot acquire trust, but only confidence.
- Black boxes can explain things to their environment, but only as an *explanation-for-confidence*.
- Black boxes can be opened when trust is required instead of confidence; this opening produces an *explanation-for-trust* of how the system or network does what it is supposed to do.
- It reveals part of the inner workings, thereby reveals part of the risks, and thereby trades confidence for (possible) trust.
- If the explanation program of the network around a technology is strong enough, the black box of the inner mechanisms of the technology itself may not need to be opened.

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Possibility of Failure

Failure to Create Trust

- A bad explanation-for-trust may fail to create trust.
- Too little detail does not *explain-for-**trust**:* it fails to open the black box, by only providing superficial reasons.
  - For example, the spam filter is explained to be working within acceptable limits because it has been tested.
  - Such explanations may contribute to confidence, but fail when trust is required, because the black box is not being opened.
- Too much detail, on the contrary, does not ***explain**-for-trust*.
  - It fails to make the system comprehensible, because the user is not capable of processing the information at this level of detail.

Failure to Create Confidence

- A too detailed explanation may fail to reach its goal, because it does not *explain-for-**confidence***.
  - It aims for trust instead of confidence, by opening the black box of the system.
  - For example, a system may provide a complete reasoning trace when only some indications are required by the user in order to provide her with confidence.
  - In that case, it may even decrease confidence.
- On the other hand, too little detail will not ***explain**-for-confidence*.
  - “Because I said so” might help to deal with unruly kids, but is not likely to increase their confidence.

Levels of Detail

We can map levels of detail to different results of explanations:

level of detail	result
too low	explanation fails
low	explanation-for-confidence, justification
high	explanation-for-trust, transparency
too high	explanation fails

Please note that level of detail is a simplification ignoring the qualitative aspects (what kind of explanations are needed to open the black box, and are they different from those not opening it?).

Outlook

- If intelligent systems can reach a level of explanation that creates as much confidence in these systems as we have in people, they may become increasingly blackboxed phenomena in our society.
- We know more about how they work than we know about how people work, because we designed intelligent systems ourselves.
- Even so, the **need** for knowing precisely how they work may become less pronounced.
- In a complex society, there is still a need for experts who trust the systems because they know about their inner working.

Challenges for Ambient Systems

- An ambient systems that works in accordance with the mental model of the user can probably remain blackboxed
  - No surprises
  - High weaviness
- If something goes wrong, i.e. not according to user expectations, the system will fall out of ambience
  - System becomes visible again as a technological system
- Unboxing is required, at lest to a degree
  - Problem: How, if there are no explicit system outputs available?
  - Do we always need a “Herczeg-display” or “Herczeg-voice”?

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Contextualisation for {Trust|Confidence}

- Contextually adequate behaviour increases the user's perception of the system's *competence* and *predictability*.
- This in turns supports building up trust and confidence (McKnight and Chervany, 2001).
- Looking for a model describing contextually adequate behaviour and possible points of failure.
- Taking a semiotic perspective: looking at the meaning making processes involving system and user as actors.

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Semiotics

- Semiotics is the science of signs or the study of sign systems (Fawcett, 1992).
- Semiotics, or semeion, was originally peculiar to medicine, referring to inference on the basis of some outward manifestation of state (or sign) (Eco, 1984).
- We can think of semiotics as a perspective, as a means of looking at anything from the point of view of how it generates meaning (Halliday, 1992).
- Semiotics deals with understanding sense making processes and sense making systems.
  - Interaction is a process of exchanging and interpreting signs, symbols referring to and standing for something else.
  - The users of a computer system see their interaction with the system against this background.

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Systemic-Functional Theory of Language

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Systemic Functional Theory of Language

- Systemic Functional Linguistics (SFL) is a *social semiotic theory* that sets out from the assumption that humans are social beings that are inclined to interact (Halliday, 1978).
- In addition, Halliday states that human communication is inherently multimodal.
- Halliday combines the strengths of the approaches of Saussure (1966), Peirce (1904) and Voloshinov (1973) (Cassens and Wegener, 2008).
  - Saussure: the tradition of relational thinking
  - Pierce: the understanding of meaning across modalities
  - Voloshinov: the insistence that the sign is social

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SFL: Stratification

- **Stratification:** A stratified model of language systems including:
  - Sound Systems – phonetics, phonology, gesture, pixels etc.
  - Lexicogrammar – lexis/grammar; or wording and structure
  - Semantics – the meaning system
  - Context – culture and situation; elements of the social structure as they pertain to meaning

Example

- Context: the situation we are in is a lecture
- Semantics: a lecturer standing in front of students and talking constitutes knowledge transfer
- Lexicogrammar: from the worked examples down to the sentences used
- Sound Systems: the phonemes said and gestures used

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SFL: Register

- **Register:** Dialectic relation of system and instance
  - System – at the level of context the culture
  - Instance – at the level of context the situation that we are in
  - Register – dialectic relation
    - Abstraction of instances which typically share a similar structure
    - Concretisation of parts of the system

Example

- System: the computational or linguistic system
- Instance: the concrete situation
- Register: the instantiation/generalization that allows the system to work in different concrete situations
  - This is a relation, not an entity

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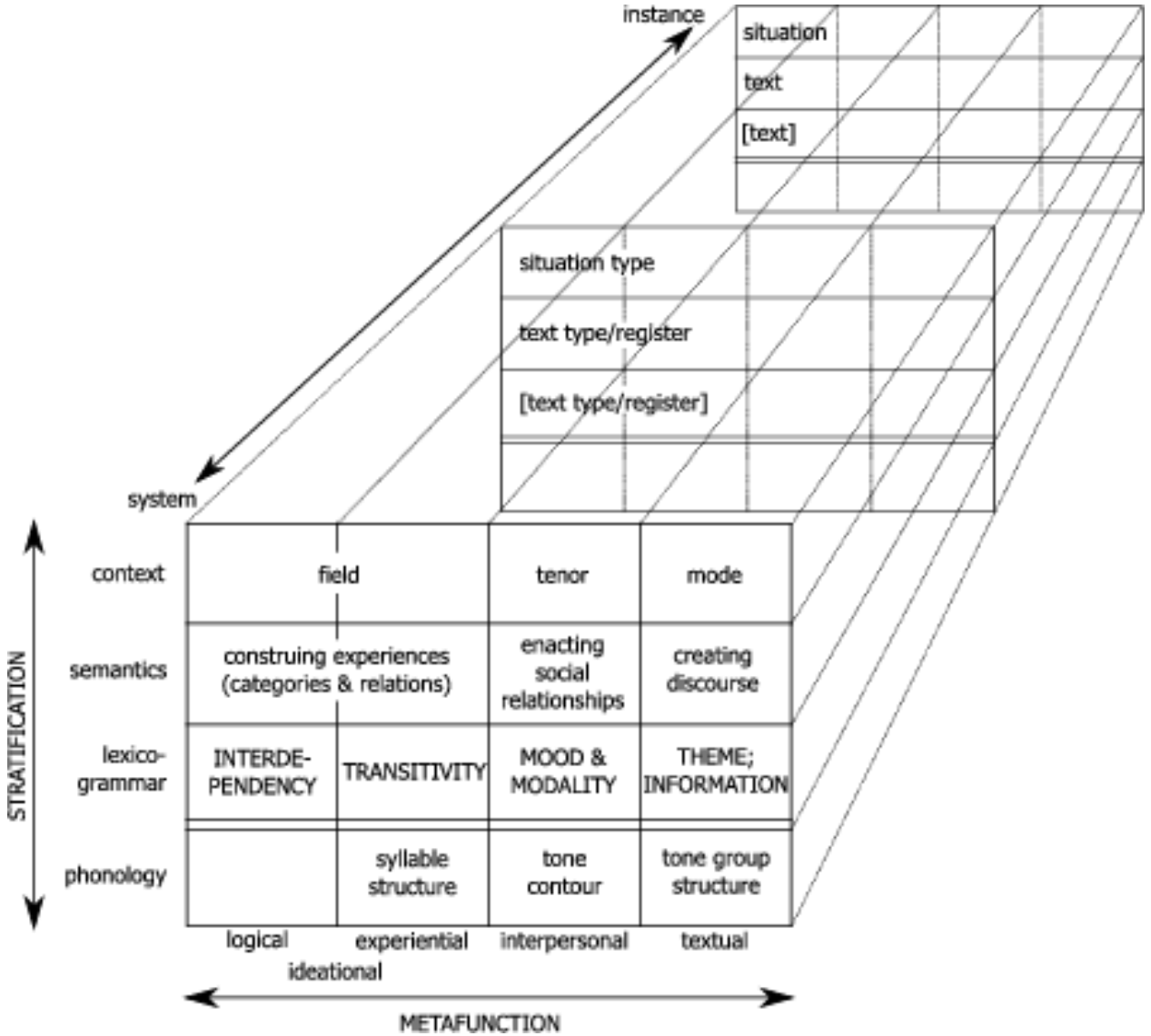
SFL: Metafunction

- **Metafunction:** What function do representations have:
  - Ideational – structure, relation of linguistic elements
    - Logical
    - Experiential
  - Interpersonal – relation of actors
  - Textual – content of discourse
- Together, these concepts span a space of exploration and description

Example

- Ideational – using the field of discourse
  - what is it about?
- Interpersonal – using the tenor of discourse
  - how do the actants interact?
- Textual – using the mode of discourse
  - what is being said and how?

Dimensions of Language



The dimensions of language – Halliday and Matthiessen (2004)

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Language as …

- Halliday uses a tripartite representation of language, which has language as system, language as behaviour and language as knowledge.
  - Language as system encapsulates the abstract structure of language, regularised (though changeable) patternings.
  - Language as behaviour looks at the activity of language.
  - Language as knowledge looks at the way in which we know language.
- But we do not do these things independently; we do not know language as a set of abstract rules.
- When we try to build a device, it is behaviour and knowledge that we face, yet it is the seemingly inaccessible system that we need to encode.

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SFL in Context

Field

Definition

"The FIELD OF DISCOURSE refers to what is happening, to the nature of the social action that is taking place: what is it that the participants are engaged in, in which the language figures as some essential component?" (Halliday and Hasan, 1985)

- We are talking about **ideational** aspects.
  - What is the domain? What are the long term or short term goals? The experiential domain?
  - What is the structure, what are the networks of interaction?

Tenor

Definition

"The TENOR OF DISCOURSE refers to who is taking part, to the nature of the participants, their status and roles: What kinds of role relationship obtain among the participants [...], both the types of speech role that they are taking on in the dialogue and the whole cluster of socially significant relationships in which they are involved?" (Halliday and Hasan, 1985)

- We are talking about **interpersonal** aspects.
  - What is the power structure between actors involved?
  - What is the agentive role?
  - What is the competence of the actors?

Mode

Definition

"The Mode of Discourse refers to what part the language is playing, what is it that the participants are expecting to do for them in that situation: the symbolic organisation of the text, the status that it has, and its function in the context . . . and also the rhetorical mode, what is being achieved by the text in terms of such categories as persuasive, expository, didactic, and the like." (Halliday and Hasan, 1985)

- We are talking about **textual** aspects.
  - What medium is used?
  - What is the type of interaction (dialogic, monologic)?
  - What is the rhetorical thrust?

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Context and Explanations

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Failure to Create {Trust|Confidence}

- The different actors being aligned in their perception of context will usually have an increasing or at least non-decreasing effect on trust and confidence.
- The different actors being misaligned in their perception of context will usually have an decreasing or at least non-increasing effect on trust and confidence.

Example

If the intelligent system misjudges the competence of the human user (misalignment in the TENOR), it might adjust the rhetorical thrust (leading to a misaligned MODE) and for example deliver an explanation-for-trust instead of an explanation-for-confidence, thereby risking to decrease confidence.

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Challenges for Ambient Systems

Depending on the type of system, Field, Tenor and Mode may not be easy to define

- **Field**
  - Smart Meeting rooms have, given “normal” usage, a restricted set of activities to support
  - Smart Homes may need to support a wide variety of activities
- **Tenor**
  - Ambient Systems in closed settings (universities, companies) have to deal with a limited amount of different users
  - Public systems can make very little assumptions about their users (walk up and use)
- **Mode**
  - Available modes of discourse are themselves restrained by context (no Klingon opera aria in a lecture)
  - Modality/Mediality/Codality might be limited, and therewith the expressiveness

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Abstract Concepts

Abstract Concepts

Definition

Abstract concepts: concepts which have no grounding in the material setting of the activity

- **Value:** abstraction, or the ability to create a more general category from a set of specifics, by whatever principle, is one of the most useful mental tools that humans possess.
- **Challenge:** to function intelligently in context artifacts must be able to recognise and understand abstract concepts and respond appropriately but the meaning of such concepts is not grounded in the material setting.

Example

Example

Emergency in the hospital domain has meanings that are distinct from meanings in other domains. These might be:

- Hospital specific meanings (cultural specific)
- Activity specific meanings (situation specific)

- **Concrete:** Having a direct material referent of place, using the specific deictic (e.g. ‘the emergency department’) and having the potential to be used as a circumstance location spatial (e.g. ‘in the emergency department’).
- **Abstract:** Having no clear referent in the material setting but referring rather to a state, using the no specific deictic (e.g. ‘an emergency’) and having the potential to take the specific deictic in past tense (e.g. ‘the emergency’) (e.g. ‘the emergency this morning’).

Emergency

Definition

Emergency: a complex set of actions and relations that constitute an interruption to the normal flow of a social process.

- **Culture based:** deriving from the function of the broader hospital culture, or,
- **Context based:** deriving from variation within the structure of the social process itself.

Application: Culture-Based

Example

Culture based emergency (e.g. the doctor is called away from the ward round because of pressures from the wider hospital).

- **Response from artifact:** provide new information
- **Why:** a culture based emergency constitutes a change in context because the field (topic), tenor (relations) and possibly the mode (interactional features) have changed; this means that new information will be needed by the doctor.

Application: Context-Based

Example

Context based emergency (e.g. the doctor is required to resusitate a patient during ward round)

- **Response from artifact:** be quiet and await query – alternant modes may be needed
- **Why:** a context based emergency is a sequence shift and not a new context. There are only minor changes to the field, if any. This situation requires material action from the doctor but the device needs to be ready for queries.

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Semiotic Profile

- If the system acts contextually appropriate, user confidence in the system can be increased
  - If the user understands why, it can also increase trust
- How can we model such abstract concepts?
  - Not having a material grounding does not mean that there are no observable features
  - In particular, contextual appropriate behaviour follows certain “scripts”
  - Diversion from these scripts can be a sign for a change in context that is due to abstract concepts
- Here: Semiotic profiles and Generic Structure Potential
- We can try to model abstract concepts as unexpected context shifts

Scripts

Example

"When you go to buy something in a convenience store you can be reasonably certain of what's going to happen in that situation. First, you'll walk in and you might say 'hello'. Then you'll ask for some batteries and then pay. We can guess this sequence due to our previous experience with these kinds of situations and the fact that they are nearly always the same. Some parts may change (you might not say hello) but you always have to pay." (David Didau)

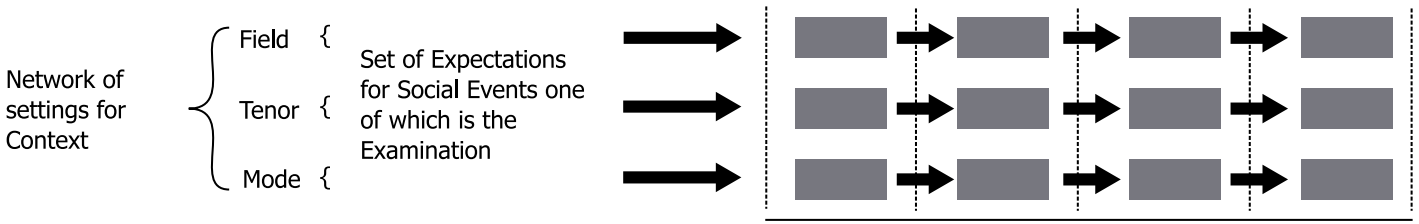
Related (but not identical) concepts:

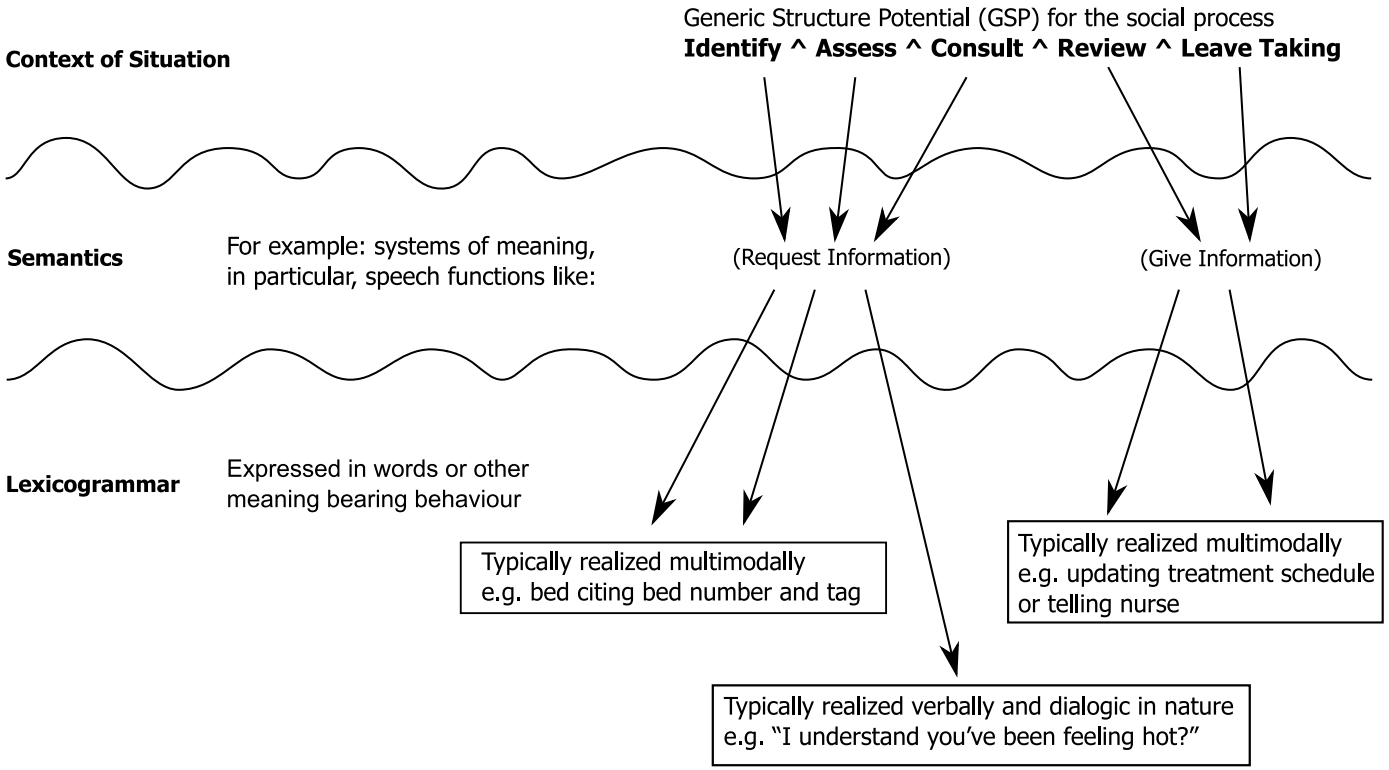
- Scripts (Silvan Tomkins, Roger Schank, Robert Abelson)
- Generative grammar (Noam Chomsky)
- Frame (Marvin Minsky)

Generic Structure Potential

- Within certain recurring sets of texts then, coherence of structure is formed through obligatory and optional elements, the totality of which forms the Generic Structure Potential (GSP) for that set (Halliday and Hasan, 1985)
- In other words, there are certain obligatory elements that characterize the genre and other optional ones that add elaboration but are not necessary
- There is thus a *structure* to social interactions
- We can call it *potential* because it has a predictive quality that allows us to navigate these social situations almost unconsciously

Semiotic Profile





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Challenges for Ambient Systems

- Structural view:
  - Conceptual descriptions of context parameters such as the notion of tenor, field and mode can help model parameters of concept important for the activities to be supported
  - Conceptual models have to be transformed into computational models and filled with experiential data
    - to sense shifts in tenor, field or mode
    - to act appropriately with regard to tenor, field or mode
- Procedural view:
  - Descriptions of unfolding activities like Generic Structure Potential can help model activities to be supported
  - Conceptual models have to be transformed into computational models and filled with experiential data
    - to “go along” with a possible instantiation
    - to detect deviations that could indicate context changes

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Tutorial 2

Descriptive Framework Version 4

Contextualisation

- Contextual Parameter
  - Environment – things, services, people
  - Personal – mental & physical information about user
  - Social – roles & relations
  - Task – what is the user doing
  - Spatio-Temporal – when & where are we
  - Other
- Process of Contextualisation
  - Awareness – what aspects are taken into account?
  - Sensitivity – what aspects are changed?

Descriptive Framework Version 4

Intelligence

- System Intelligence
  - Personalized – tailored to individual needs
  - Adaptive – changing in response to user needs
  - Anticipatory – can act on its own on user's behalf
- Social Intelligence
  - Socialized – compliant to social conventions
  - Empathic – take user's inner states into account
  - Conscious – introspection, has inner state

Descriptive Framework Version 4

Ambience

- Perception
  - Mediality – media types
  - Codality – semantic representation
  - Modality – human senses
- Reasoning
  - *Context Awareness*
  - *Context Sensitivity*
  - Other
- Action
  - Mediality – media types
  - Codality – semantic representation
  - Modality – human senses

Descriptive Framework Version 4

Interaction

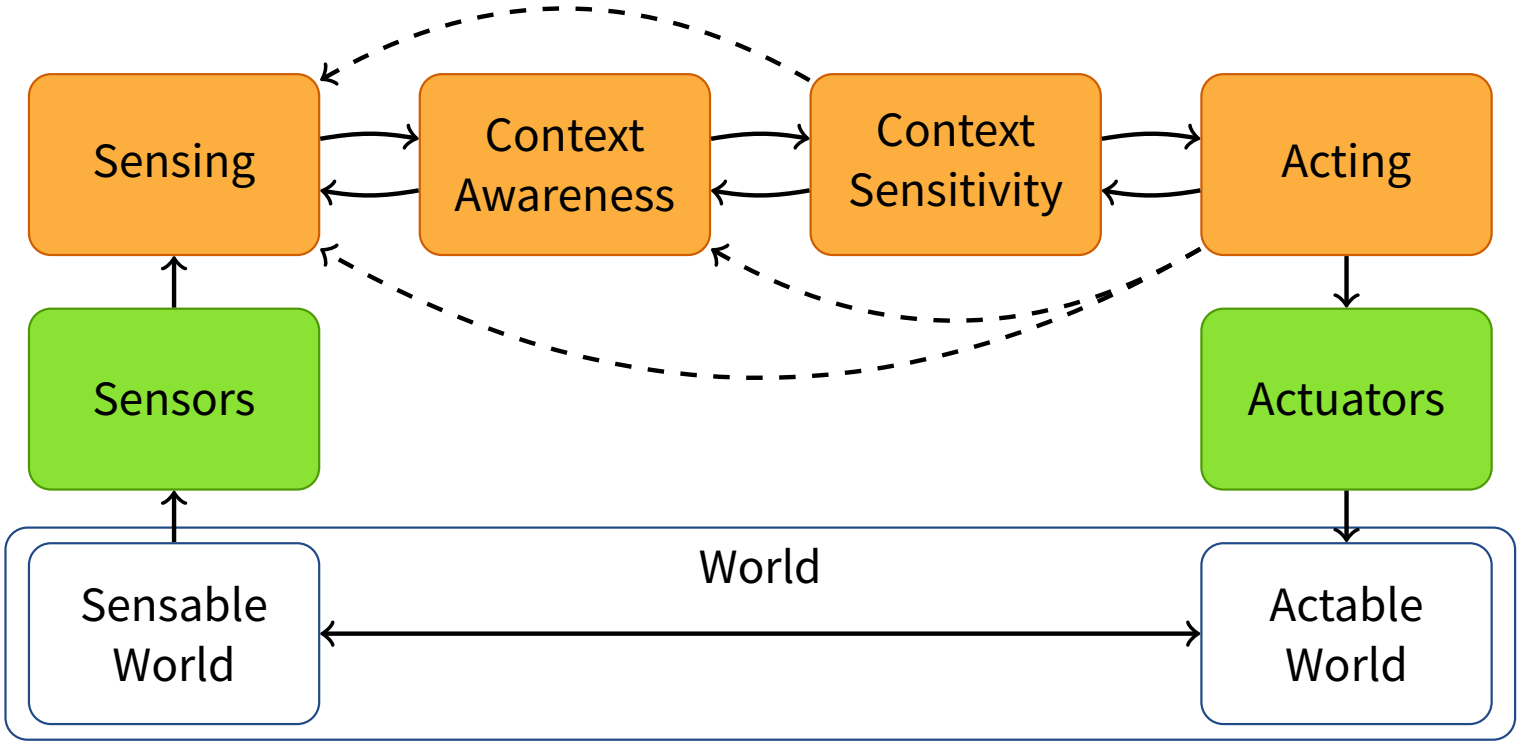
- Implicit vs. Explicit
  - Implicit input – through behaviour not primarily aimed at interacting with the computerised system (walking through a door, using a whiteboard…)
  - Explicit input – primarily aimed at interacting with the computerised system (voice or gesture commands…)
  - Explicit output – designed to get the users' attention (voice output…)
  - Implicit output – change of material setting where the users' attention is not the primary goal (opening doors…)
- Emotion
  - Does the system sense emotions?
  - Does the system show emotions?

Descriptive Framework Version 4

Embeddedness

- Weaviness
  - Is the system woven into the background?
  - Is the interaction naturally/culturally sound?
- Enhancement
  - Does the system enhance or replace current solutions?
    - Current “technical” solutions – using (computerized) artefacts
    - Current “non-technical” solutions – not using (computerized) artefacts
- Social Interaction
  - Does the system enable/enhance social interaction amongst humans?
  - Is the system targetting at supporting individual users?

Architecture Version 1



General, simplified architecture

Assignment 4.6: Course Context

Group Work

- Form groups of 3-6
- Position the required reading within the course context
  - Course roadmap given
    - Which categories to use?
    - Granularity
  - Show links
    - Between texts
    - Between lectures
    - Between texts and lectures
  - Find a ways to show those links
    - Iconic
    - Hypermedia
- Present your idea in the course/learnweb

Assignment 4.6: Roadmap

Group Work

Definitions & Theory

- Context, Ambient Intelligence

Descriptive Framework & Examples

- Facets, Architectures, Examples

Implementation & Evaluation

- Challenges, Prototyping, Deployment, Evaluation

Human & Computer

- Interaction, Privacy, Emotion
- *Trust*
  - *Explanations, Context*

Computing & Culture

- Arts & Games

Specific Issues

- Uncertainty, Privacy-respecting technologies

Assignment 4.6: Required Reading I

- Required reading for week 1
  - Weiser, M. (1991). *The computer for the 21st century*. Scientific American, pages 94–104.
- Required reading for week 2
  - Aarts, E., R. Harwig, and M. Schuurmans. 2001. Ambient Intelligence. In *The Invisible Future: The Seamless Integration of Technology into Everyday Life*, ed. P. J. Denning, pp 235-250. New York: McGraw-Hill Companies.
- Required reading for week 3
  - Dourish, Paul, and Ken Anderson. *Collective information practice: exploring privacy and security as social and cultural phenomena*. Human-computer interaction 21.3 (2006): 319-342.
- Required reading for week 4
  - Dourish, Paul. “What we talk about when we talk about context.” Personal and ubiquitous computing 8, no. 1 (2004): 19-30.

Assignment 4.6: Required Reading II

- Required reading for week 5
  - Tom Geller: “How Do You Feel? Your Computer Knows.” Communications of the ACM Vol. 57(1), pp. 24-26. Jan. 2014
  - Rosalind W. Picard: “Affective Computing”. MIT Technical Reports – TR 321. Nov. 1995
- Required reading for week 6
  - Davies, N., & Gellersen, H. W. (2002). “Beyond prototypes: Challenges in deploying ubiquitous systems.” IEEE Pervasive computing, 1(1), 26-35.
  - Hansen, T. R., Bardram, J. E., & Soegaard, M. (2006). “Moving out of the lab: Deploying pervasive technologies in a hospital.” IEEE Pervasive Computing, 5(3), 24-31.
- Required reading for week 7
  - Abowd, Gregory D., Elizabeth D. Mynatt, and Tom Rodden. “The human experience” IEEE pervasive computing 1.1 (2002): 48-57.

Assignment 3.5: New Lab Room

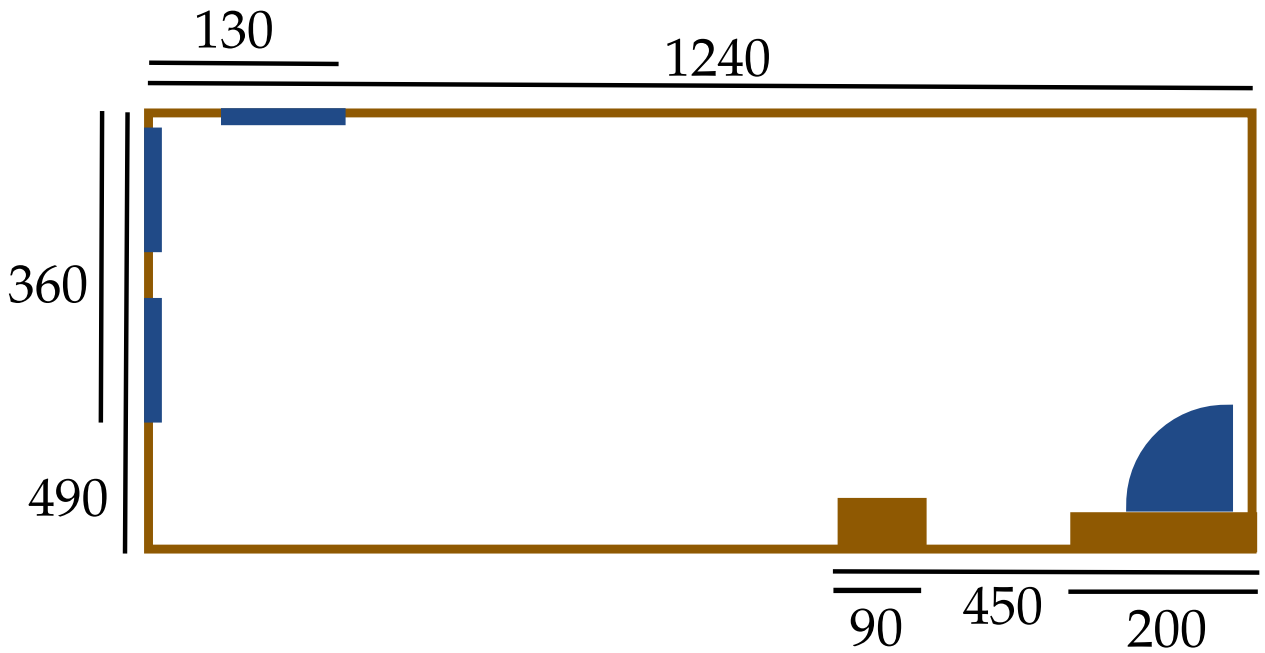
Group Work

- Form groups of 3-6
- Develop the outline of a project idea to change A120 into a room you would like to use:
  - Today, traditional computer lab
  - How to change it?
    - Interior decor
    - Furniture
    - Technology
  - Possible technologies:
    - Tab, Pads & Boards
    - Behavioural interfaces
    - Natural language processing
- Pitch your idea in the course

Assignment 3.5: Old Lab Room

Samelsonplatz, A 120

Assignment 3.5: Old Lab Room Measurements



- 15 computer workstations (9+6)
- 16 group work seats (8+8)

Video 3.1: Universität 2025

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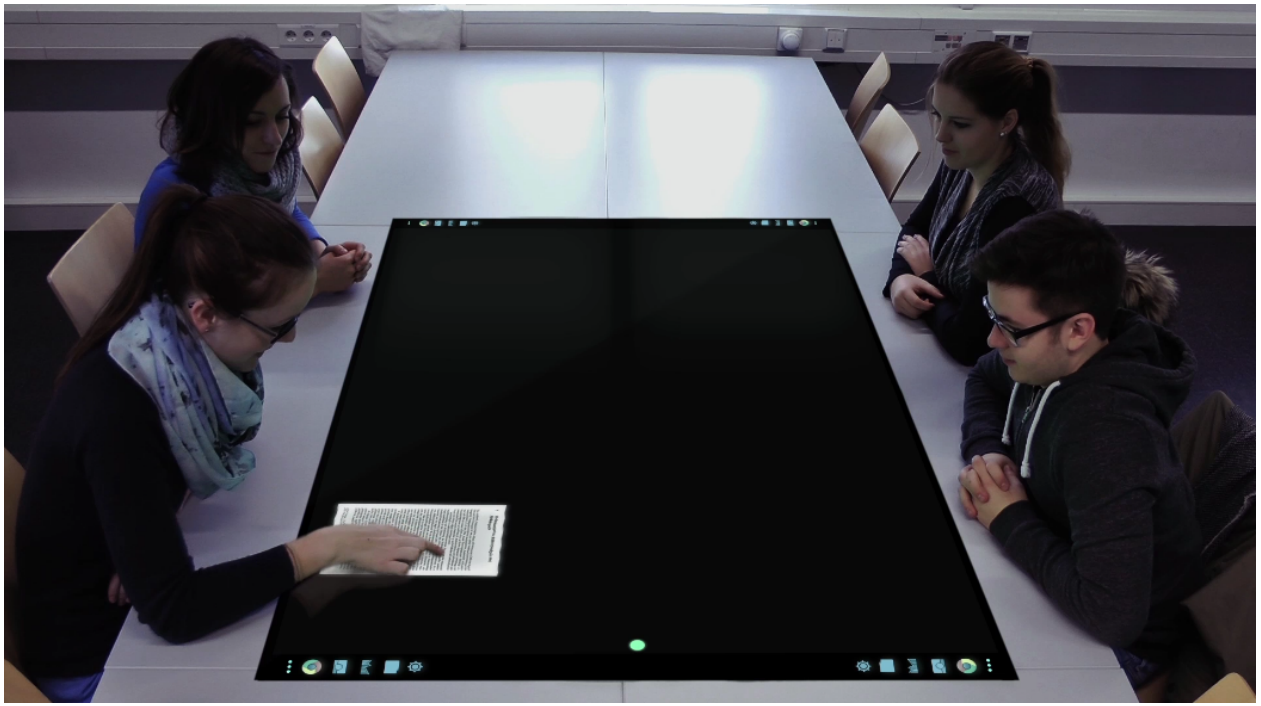

☞ Where VR in 2025 (6:45)

Assignment 3.8: Exam (Questions)

Discussion

- Design your own exam
  - What kind of exam would you expect for this kind of course?
- Design your own exam questions
  - If suitable they might get used in the exam
- Describe and discuss your questions in the learnweb forum

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Building and Losing Trust in Ambient Intelligent Software Applications

Jörg Cassens

SoSe 2018

Contextualized Computing and Ambient Intelligent Systems

medieninformatik
IMAI – Institut für Mathematik und Angewandte Informatik

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