

# Human Computer Interaction (HCI)

## Week 3: HCI Methodologies 2

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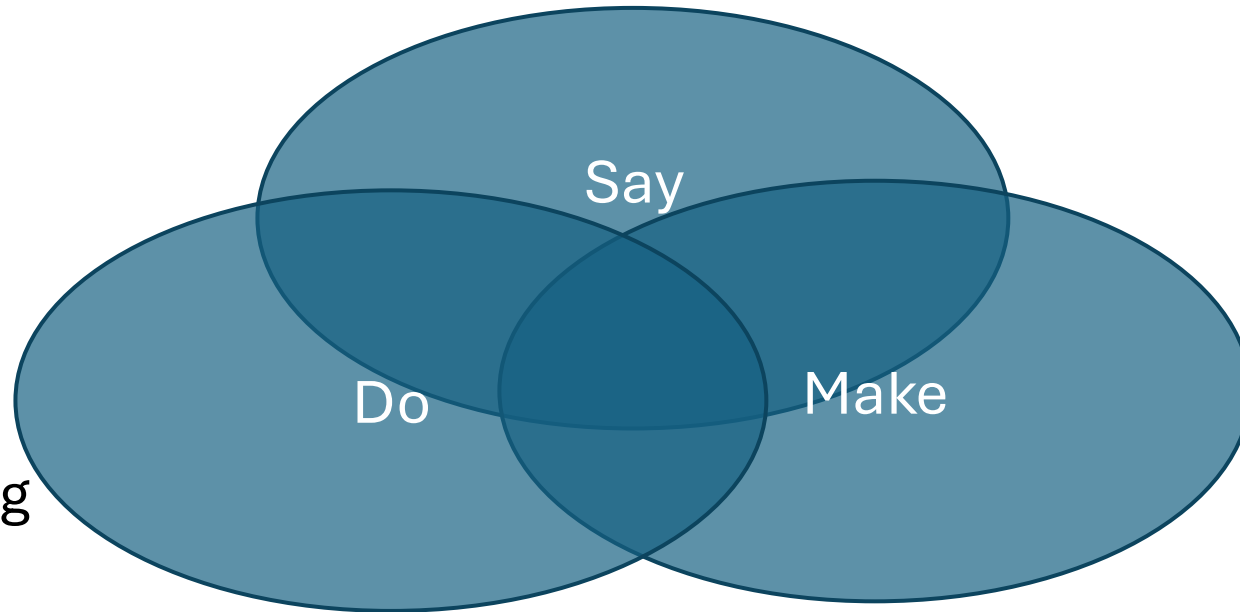
THE UNIVERSITY  
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# Week 3 Outline

- Brief re-cap
- “say” methods: questionnaires
- Study design by example
- Socio-technical systems and social factors

# Say, Do, Make Model

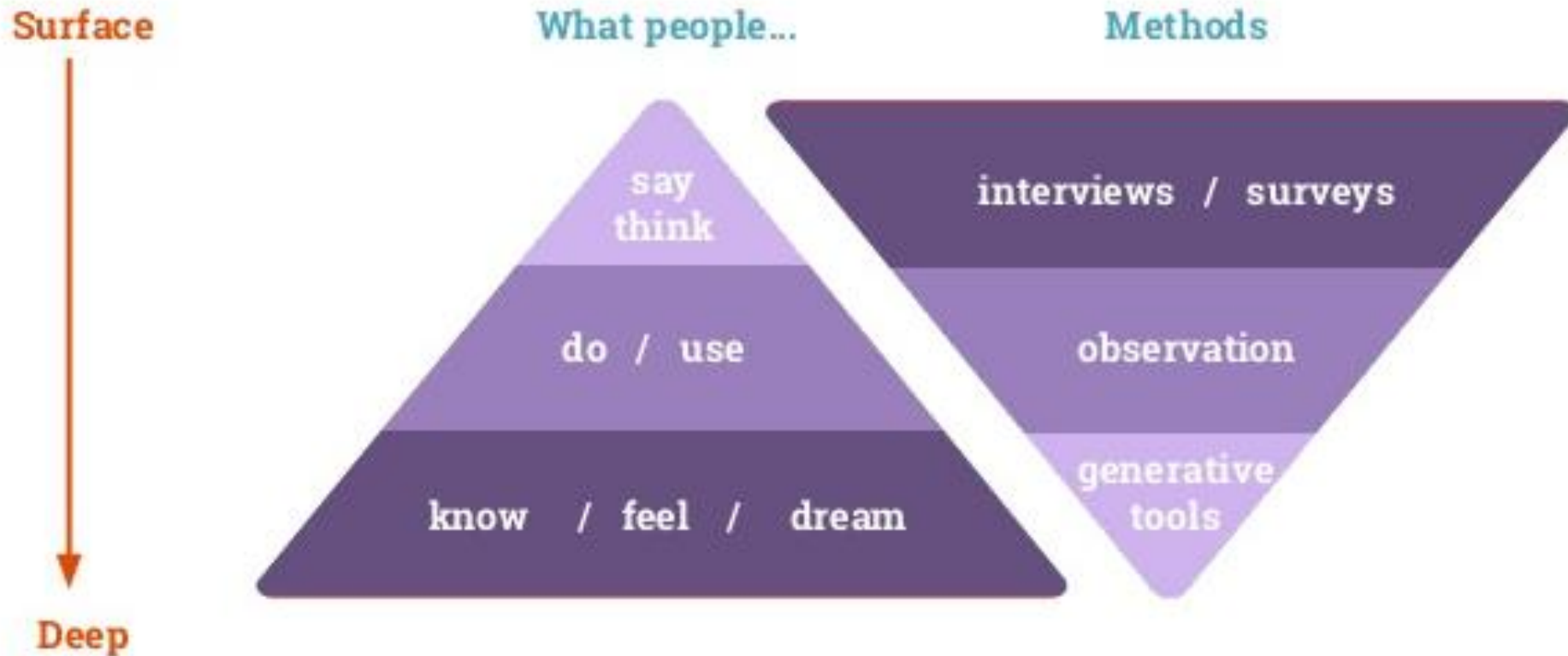
- Interviews
- Focus Groups
- Questionnaires/surveys



- Observation
- Diary
- Usability testing

- Collage
- Mapping
- Card sorting
- Photo elicitation
- Probes

# Why Use (Different) Methods?



By Liz Sanders [link](http://www.maketools.com/articles-papers/FromUsercenteredtoParticipatory_Sanders_%2002.pdf)

- Aim for a deep understanding of experiences by combining different methods (triangulation)

[http://www.maketools.com/articles-papers/FromUsercenteredtoParticipatory\\_Sanders\\_%2002.pdf](http://www.maketools.com/articles-papers/FromUsercenteredtoParticipatory_Sanders_%2002.pdf)

“say” methods - questionnaires

# questionnaires

- Online forms or on-paper
- Questions should be directly related to the questions you are exploring
- Question types
  - Open-ended questions
  - Single- and multiple-choice questions
  - Matching/ranking
  - Rating scales (e.g., Likert Scales or Semantic Scales)
  - e.g., Likert Scales or Semantic Scales; Typically, on a 5 to 7 point scale

# system usability scale

- Post-test assessment of usability
- 10 questions addressing usability and learnability of a system

1. I think that I would like to use this system frequently.

|                       |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. Strongly Disagree  | 2.                    | 3.                    | 4.                    | 5. Strongly Agree     |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

2. I found the system unnecessarily complex.

|                       |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. Strongly Disagree  | 2.                    | 3.                    | 4.                    | 5. Strongly Agree     |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

3. I thought the system was easy to use.

|                       |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. Strongly Disagree  | 2.                    | 3.                    | 4.                    | 5. Strongly Agree     |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

4. I think that I would need the support of a technical person to be able to use this system.

# other established usability scales

- Single Ease Question (SEQ)

- Post-task

Overall, this task was?

|                       |                       |                       |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. Very Difficult     | 2.                    | 3.                    | 4.                    | 5.                    | 6.                    | 7. Very Easy          |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

- NASA TLX (Task Load Index)

- 6 questions

- Unlabelled 21-point scale

Mental Demand      How mentally demanding was the task?

|                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
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| Very Low                 |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          | Very High                |

Physical Demand      How physically demanding was the task?

|                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
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| Very Low                 |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          | Very High                |

# established usability scales

- pros
  - Extremely established and widely used
  - Experimentally valid and reliable
  - Large amounts of industry data available to help benchmark scores (especially for SUS)
- cons (limitations)
  - Participants may have a wildly different sense of the meaning of the scales (what does a “5” out of “7” mean?)
  - Require large participant samples to be meaningful
  - Metrics do not tell you the story behind participants’ rating or what the strengths or weaknesses of the system are
  - A combination of satisfaction, performance/observation, and in-depth qualitative feedback can provide a clearer story

# Frequent focus of studies in HCI

## Usability & user experience

### Usability

- Effective to use
- Efficient to use
- Safe to use
- Have good utility
- Easy to learn
- Easy to remember how to use



### User Experience

- The way people feel about technology
- Their satisfaction when using, holding it, etc...
- Satisfying
- Enjoyable
- Helpful
- ...

# Beyond usability & user experience ...

- Measuring usability
  - Quantitatively (e.g., through time and error rate)
- Measuring user experience
  - Quantitatively (e.g., through Likert scales in questionnaires)
  - Qualitatively through open-ended questionnaires or interview
- Important: capture not only “what is done” but also “how it is done” in order to get the big picture – the “why?”
  - E.g., knowing that System A is faster than System B, does not tell you how people actually use System A vs. System B in the real world.
  - Importance of “do” methods such as observations
- Knowing that a system does not really work, does not provide human-centred ideas for improvements
  - E.g., knowing that people avoid using a system does not tell you how to improve the situation
  - Importance of “make” methods that to get a more in-depth understanding of people’s perspectives, values, etc...

study design by example

# study design includes

- Study context
  - A laboratory where people are invited to interact with a selected piece of technology
  - A real-world setting that includes people interacting with the technology as they normally do
- Study setup
  - Instructions given to participants (or not)
  - Tasks
  - Things & aspects that are being studied
  - Technical setup (e.g., the specific technology used for the study)
- Methods of data collection
  - “do”, “say”, “make” methods

# how to decide on the study design

- The design of your study is determined by the goals of your study
- What are you trying to explore as part of your study?
- What type(s) of question(s) are you trying to explore?
  - Targeted questions
    - “Is System A faster than System B for solving a specific problem?”
  - Open-ended questions
    - “How do people approach problem solving using System A”?
    - “How do people experience System X while driving?”
- What quality criteria are you looking for in your results?
  - High generalizability or high ecological validity (realism)

# controlled studies

- Researcher tries to control all aspects of the study as much as possible to reduce factors that could influence the results
  - Targeted research questions & hypotheses
  - Control of study context and setup
    - Clear definition of dependent and independent variables
    - Clearly defined instructions and tasks given to participants
- Can lead toward more generalizable results

# Study variables

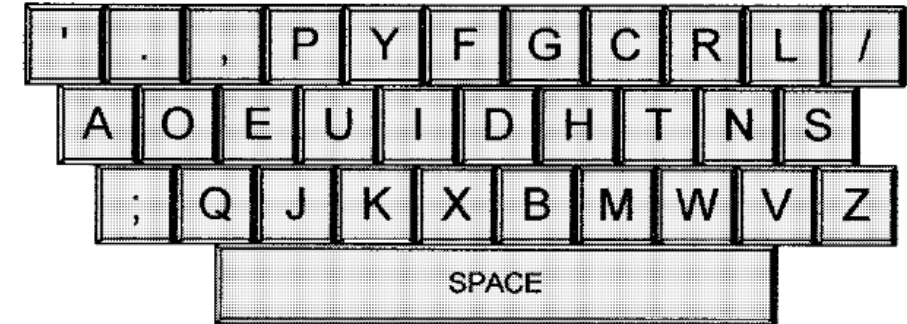
- Independent variables
  - Directly manipulated by the researcher (e.g., the type of interface shown to participants)
  - Pre-existing characteristics of participants (e.g., age, level of education, ...)
  - Study environment (e.g., lighting condition, computer type, ...)
- Dependent variables
  - Outcome variable that is manipulated by the study
  - The variable being tested
  - Examples: task performance, usability ratings, described satisfaction, answers to questions
- Fixed Aspect
  - Aspects of the study that are the same for all participants
  - Examples: survey structure, computer setup, wording of questions, task order

# Example: Comparison of text entry techniques

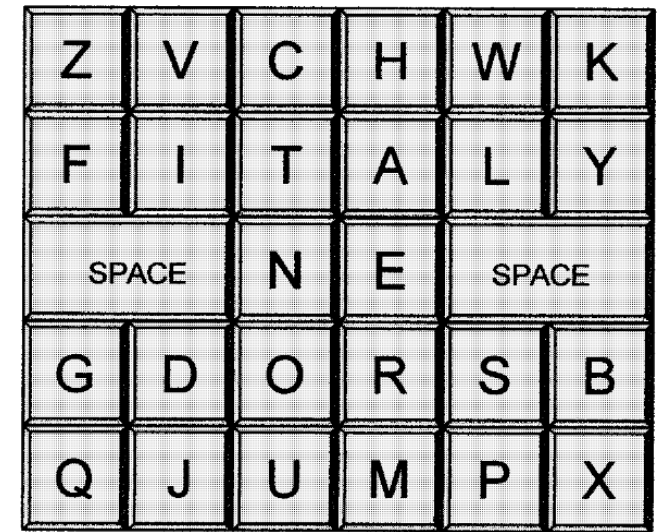
## Controlled study

- Research question:
  - Which soft keyboard is quicker for text entry?
- Goal:
  - Make text entry on soft keyboards more efficient
- Study design
  - Within subjects: participants use both keyboards
  - Independent variables: type of keyboard layout
  - Dependent variables: Typing speed & error rate

→ Do method only



Dvorak layout



Fitaly layout

# Semi-controlled study

- Some but not all aspects are controlled
- Research questions/goals are more open
- Independent and dependent variables may be less defined (or not defined at all)

# Example: Observations around novel technology

## Semi-controlled study

- Research question:
  - How do small group collaborate on tabletop displays using dynamic interface elements?
- Goal:
  - Understand collaborative dynamics around tabletop displays and how to support these.
- Study design
  - No independent or dependent variables but focus on qualitative observationsx
  - Open-ended storytelling task
  - Video recording & interviews
- Why this method?
  - Be able to observe how collaboration unfolds in open-ended tasks

→ Combination of “Do” and “Say” methods



<http://www.utahinrichs.de/Projects/InterfaceCurrents>

# Example: Focus group

## Semi-controlled study

- Research question:
  - How can we make visitors and cohabitants aware of smart speaker without overstepping social boundaries?
- Goal:
  - Gain a better understanding of how smart speakers should be introduced (by whom, how and when)
- Study design
  - Share scenarios with participants
  - Let them sketch/act out (on paper) how they would introduce the smart speaker
  - Discuss their outcomes and what influenced these
- Why this method?
  - Get participants imagine and discuss different scenarios

→ Combination of “Make” and “Say” methods



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# Example: Testing of a museum exhibit prototype

## Semi-controlled study

- Research question:
  - How do potential museum visitors (families) interact with a novel museum exhibit?
- Goal:
  - Improve the design and usability of the exhibit
- Study design
  - Invite families to interact to freely interact with the exhibit in a lab environment
  - Interview them for feedback
- Why this method?
  - Prototype testing easier than full museum install

→ Combination of “Do” and “Say” methods



Hornecker and E.Nicols. Towards the Wild: Evaluating museum installations in semi-realistic situations. *Re-thinking Technology in Museums 2011 Conference*. 2011.  
<http://www.ehornecker.de/Papers/HorneckerNicolFinal.pdf>

# context matters!

- It turns out that interactions at the museum were quite different!

E.Hornecker and E.Nicols. Towards the Wild: Evaluating museum installations in semi-realistic situations. *Re-thinking Technology in Museums 2011 Conference*. 2011.  
<http://www.ehornecker.de/Papers/HorneckerNicolFinal.pdf>



# other study types

- Online studies
- Field studies

# Online studies

- Survey
- Quantitative testing (efficiency & error rate)
- Comparative studies (A/B testing)
- Automatic logging of interactions
- Pros
  - Time efficient (for the researcher)
  - Large and/or diverse participant sample
- Cons
  - No follow-up questions possible (typically)
  - Uncontrolled environment (we don't know the conditions under which the tasks are accomplished)

# Example: data physicalization & sustainability

## Online studies

- Research question:
  - How do data physicalization designers and artist approach physicalization projects and reflect on sustainability?
- Goal:
  - Provide a comprehensive perspective on sustainability in Data Physicalization
- Study design:
  - Online survey targeting the community of data physicalization designers
  - Survey included questions regarding the disposal, reuse, and material selection as part of designers' physicalization practice
- Why this method?
  - Expand the pool of participants

Moras et al. From Exploration to End of Life: Unpacking Sustainability in Physicalization Practices. CHI'24 <https://arxiv.org/abs/2402.09860>

# Field studies



People's home



Health environments



Airport control room



Museum spaces

# field studies

- Possible methods
  - Observation
  - Think aloud
  - Focus groups
  - Interviews
- Comparative studies (A/B testing)
- Study is conducted in a real-world environment
- Participants are not provided tasks, but act and interact as they normally would
- Typically, participants are not recruited in advance
- Ethnographic approach

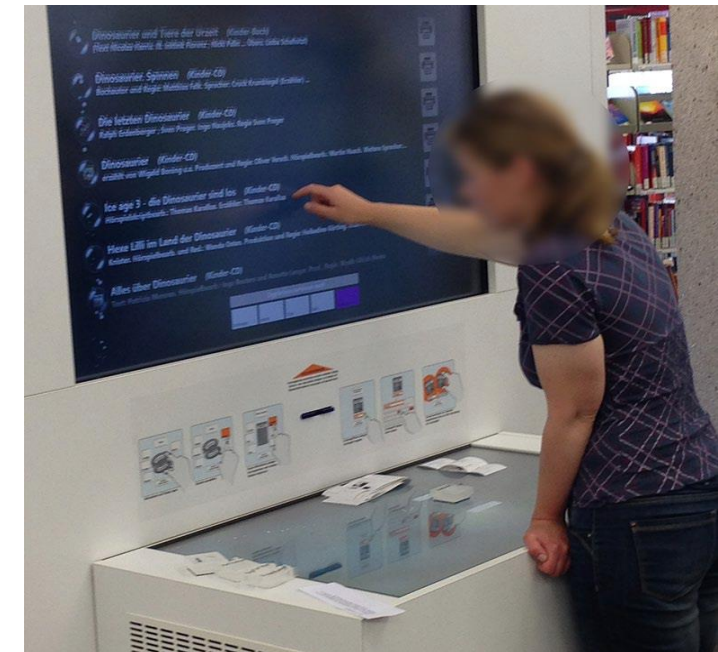
# fields studies

- Pros
  - Observation of real-world behaviours is possible
- High ecological validity
- Cons
  - Uncontrolled environment (but we can see the conditions under which tasks are accomplished)
  - You typically cannot give tasks to participants – they do what they want
  - Lots of “noise” in the collected data; messy data
  - Less generalizability

# Example: library study

## field studies

- Semi-controlled field study
- Recruiting participants into a study in a real-world environment (library)
- Participants are provided an open-ended search task of their choice
- Observations
- Interviews



# mixed-method approaches

- Mixing different methods of data collection
- Quantitative
  - Task efficiency & error rate
  - Likert-scale questionnaires (ratings from 1-5)
- Qualitative
  - Interviews
  - Observation
  - Focus group
  - Qualitative questionnaires
  - Make methods
- Mixing different study types
  - Observing people in the real world plus recruiting participants into the real-world environment of interest
  - Interviewing people plus conducting a survey
  - Running a semi-controlled lab experiment plus conducting an in-the-wild study

# Socio-Technical Systems and Social Factors

# Socio-Technical Systems and Social Factors

- All technology is part of a socio-technical system
- The technology and social system are interdependent and interact
- Understanding the role of social factors is essential for creating technology that is not only usable, but also aligned with the social contexts in which it operates
- If you do not spend time and effort understanding the existing social system, you risk adversely affecting it
- Social factors refer to the ways in which societal norms, group dynamics, cultural expectations, and interpersonal interactions influence how people engage with and experience technology

# General Implications for System Design

# Understand Socio-Technical Interdependence

- All systems are socio-technical and will interact with existing social systems
- It's important to understand these systems to ensure technology works within rather than disrupts existing social/group dynamics, workflows, etc
- Example:
  - London Ambulance Service CAD system

# Support Collaboration and Communication

- Design technology that facilitates both synchronous and asynchronous collaboration
- Provide tools for sharing information, supporting decision-making, and enabling team/group/social cohesion
- Example:
  - Group project tools such as Google Docs or Microsoft Teams enable students to collaborate in real-time on assignments, share notes, and communicate and collaborate asynchronously

# Optimise Social Distance and Interaction

- Consider the formality of interactions within the system based on context
- Personalise requests and interactions to foster engagement
- Example:
  - Interactions on LinkedIn vs Slack
  - Facebook groups

# Foster Motivation and Engagement

- Address intrinsic and extrinsic motivation
- Sustain user engagement and align rewards with both individual and team goals
- Example:
  - Stack Overflow Reputation System

# Diffusion of Responsibility

- Ensure tasks and requests are directed at specific individuals rather than generalised groups
- Use personalisation to make interactions feel more human
- Example: in group assignments, tools such as Trello and Notion help assign specific responsibilities to individuals to help avoid situations where no one feels responsible for completing a task

# Design for Team Evolution

- Account for team dynamics and changes over time
- Support team cohesion through features that promote shared values and knowledge transfer
- Example: course management tools such as Learn allow lecturers to onboard new TAs by providing access to past class materials, discussions, assessments, etc

# Address Organisational and Cultural Contexts

- Align the system with existing organisational procedures, regulatory requirements and cultural norms
- Example:
  - Allowing anonymous submissions for student feedback systems

# Plan for Flexibility and Change

- Remember that social and organisational environments evolve
- Design systems that are adaptable to changing workflows, team/group structures and cultural practices to ensure relevance and longevity of the system
- Example: a university course management system that allows lecturers/course organisers to update course materials throughout the semester to adapt to new research or address student feedback

# Encourage Shared Goals and Cohesion

- Support shared goals and values among users
- Provide features that foster trust, reduce unnecessary social distance, and encourage collaboration to enhance cohesion of teams or groups of people
- Example: Piazza can foster a sense of community by enabling students to ask and answer questions collaboratively

# Mitigate Negative Impacts and Ensure Acceptability

- Ensure the system does not detract from existing processes or increase user burden
- Where a system does introduce change, it must provide clear benefits and fit into users' way of working
- Example: lecture recording systems that ensure students who miss class can watch the lecture without disrupting their learning experience

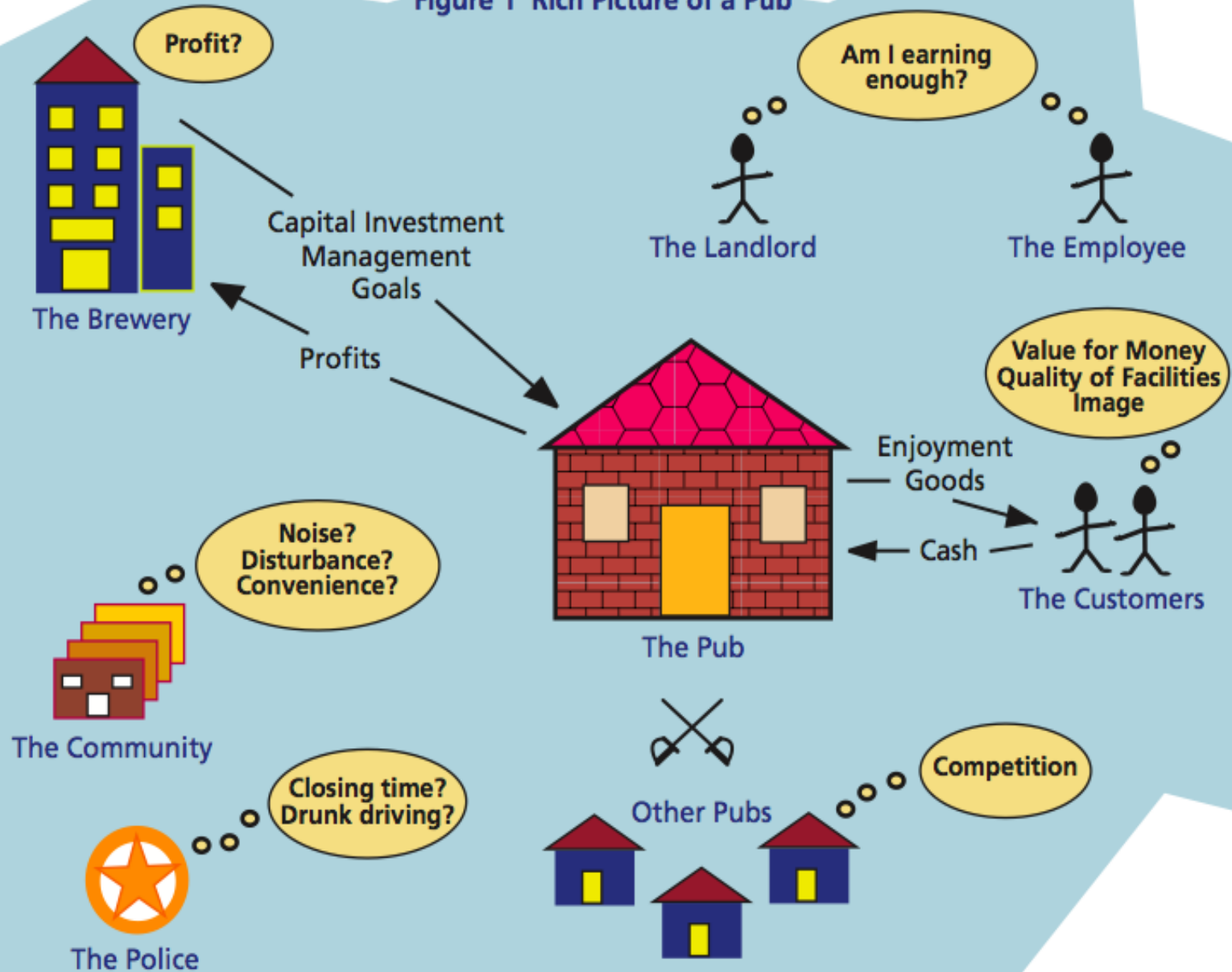
# Rich Picture

To help understand the context in which a system is or will be embedded

# Rich Pictures

- Rich pictures are **cartoon-like depictions** of
  - the primary **users/stakeholders** in a system,
  - their **interrelationships**
  - and their **concerns**
- Rich pictures help elicit and represent an understanding of the **social context** for a technology design project
- Monk, S. and Howard, S. (1998) The rich picture: a tool for reasoning about work context. Interactions 5(2), 21-30 <http://doi.acm.org/10.1145/274430.274434>

Figure 1 Rich Picture of a Pub

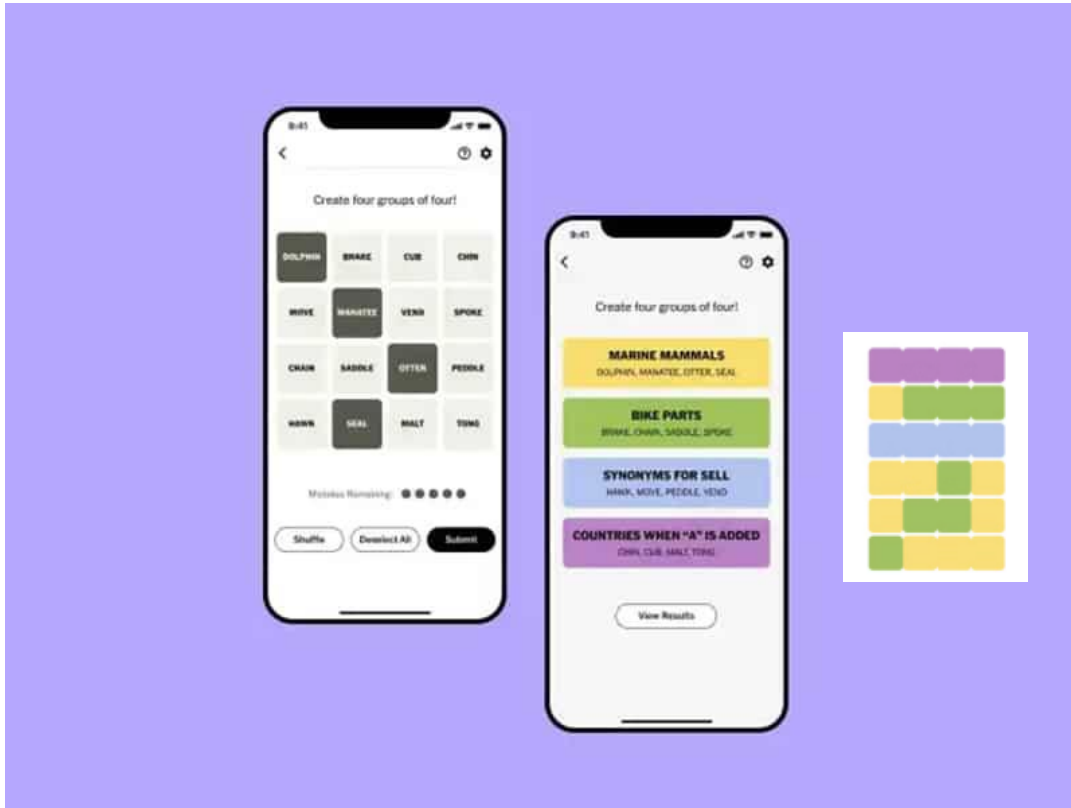


Based on Patching, 1995

**Table 1. Elements of an Effective Rich Picture**

| <b>Element</b>                                                 | <b>Comment</b>                                                                                                                                                                                                                   |
|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Include <i>structure</i>                                    | Include only enough structure to allow you to record the process and concerns. The latter requires that all the people who will use or could conceivably be affected by the introduction of the new system be included.<br>..... |
| 2. Include <i>process</i>                                      | Do not attempt to record all the intricacies of process; a broad brush approach is usually all that is needed<br>.....                                                                                                           |
| 3. Include <i>concerns</i>                                     | Caricature the concern in a thought bubble (see Figures 1–3 for examples). A fuller explanation may be provided in a supplementary document<br>.....                                                                             |
| 4. Use the language of the people depicted in it               | This will make the rich picture comprehensible to your informants<br>.....                                                                                                                                                       |
| 5. Use any pictorial or textual device that suits your purpose | There is no correct way of drawing a rich picture. There are as many styles as analysts and the same analyst will find different styles useful in different situations                                                           |

# Example: NYT Connections Puzzle

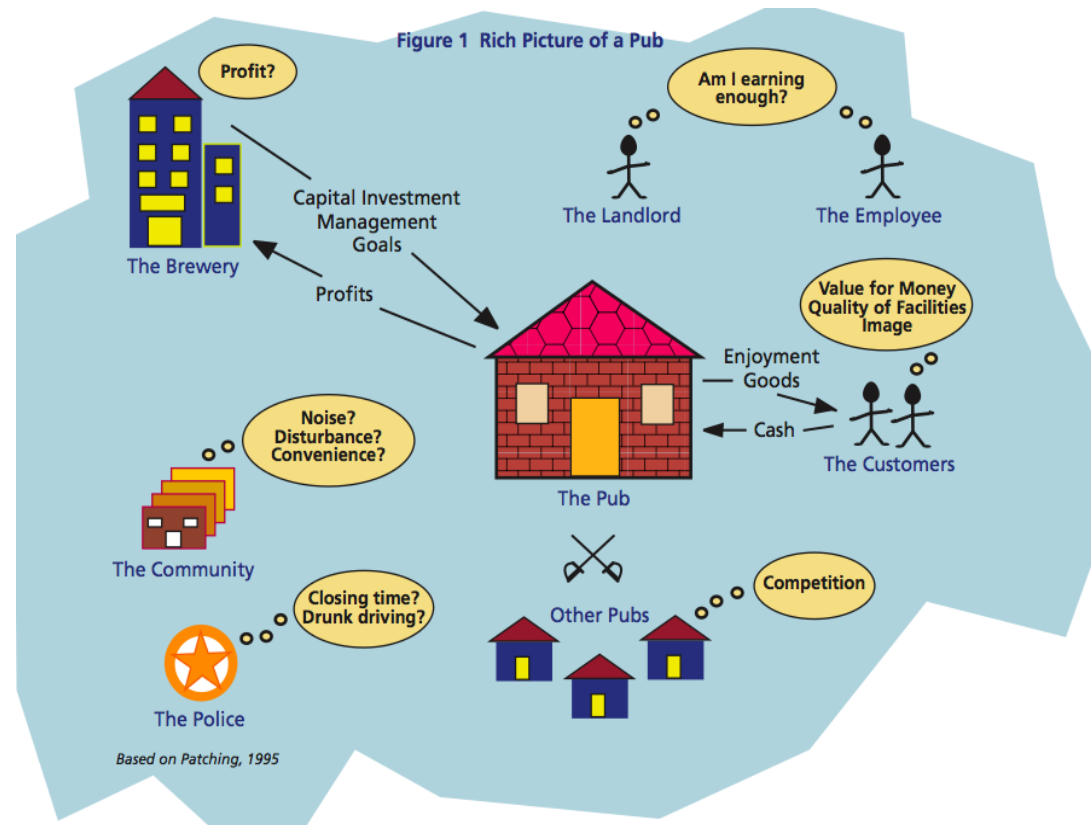


<https://www.devinedesign.net/new-york-times-connections/>

- Technology:
  - Interact with the puzzle through the app
  - Real-time feedback on correct or incorrect groupings of words
  - Online communities that share hints and tips for each new puzzle each day
- Social:
  - Individual use: complete the puzzle at the end of the workday
  - Shared experience: sharing puzzle results with family members
  - Competition: family members compete each day via this sharing
- Cultural:
  - The puzzle is created in the US
  - The puzzle varies in how challenging it is

# Activity 1:

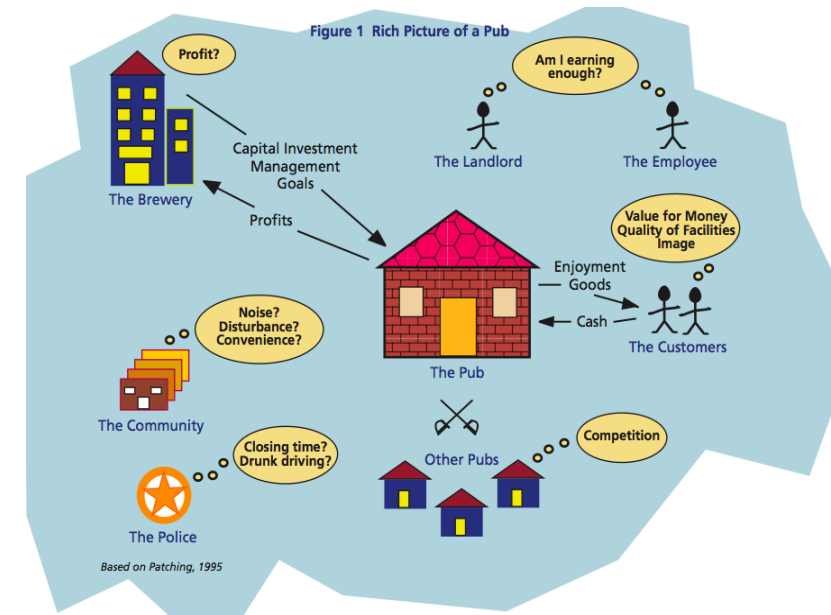
## Create a Rich Picture of your social context



## Activity 2: Work on Say Method

# Questions about the social context

- *Who was involved in x?*
- *What did they do? Why? How were they affected by x?*
- *Where did x take place? Can you tell me more about the place?*
- ...
- This is to get a broad understanding, so you can create re-design suggestions that work within the social context



Monk, S. and Howard, S. (1998) The rich picture: a tool for reasoning about work context. *Interactions* 5(2), 21-30  
<http://doi.acm.org/10.1145/274430.274434>

# Next steps

- Week 04 lecture: HCI frameworks and accessibility
- Continue to work on your project topic and “do”, “say” and “make” methods you would like to use for your study

Any questions?