LCA tutorial on The Importance of Understanding User Requirements: how can Models help?

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Collaboration with Industry
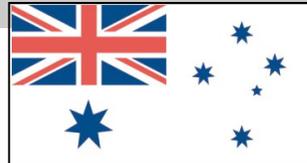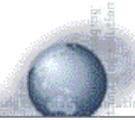
A four part tutorial

Intro to HCI, usability and models

UCD and its models

Task modeling and what we use it for

Conclusion

Introduction to HCI, Usability and Models…

The true story of the Swing

1. The product as proposed by planning.

2. The product as specified by market requirements.

3. The product as designed by program architecture.

4. The product as delivered by development.

5. The product as installed at the user's site.

6. What the user wanted.

HCI design goal

To produce systems that:

- fit into the end-user's environment,

- allow users to accomplish their tasks and obtain the information they require in an efficient and effective manner,

- take into account the interests and objectives of the clients & stakeholders.

Usability

ISO 9241-11 (1998) defines Usability as:

"The extent to which a product can be used by specified users to achieve **specified goals** with effectiveness, efficiency and satisfaction in a **specified context of use**."

An example and Exercise
"The Psychology of Everyday Things", by Donald A. Norman

🌼 Task: Make freezer warmer and
                keep fresh food constant

NORMAL SETTINGS   C   AND   5
COLDER FRESH FOOD   C   AND   6-7   1 SET BOTH CONTROLS
COLDEST FRESH FOOD   B   AND   8-9   2 ALLOW 24 HOURS
COLDER FREEZER   D   AND   7-8   TO STABILIZE
WARMER FRESH FOOD   C   AND   4-1
OFF (FRESH FD & FRZ)   0
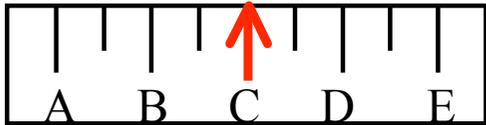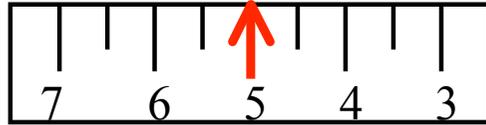
    A   B   C   D   E   7   6   5   4   3
        FREEZER   FRESH FOOD

Different Perspectives

"Those who know the most about technology are in many cases the worst equipped to appreciate its implications for the lives of ordinary people. Consumed by technical and corporate objectives that become ends in themselves, they fail to see that their work may very often be contrary to the interests of their fellow citizens" –

Reineke 1984 quoted in Kling 1996.

The user's model

FREEZER

Freezer control

A B C D E

FRESH FOOD

Fresh Food control

7 6 5 4 3

The engineer's model

+ % of air in FF -

A B C D E

FREEZER

Valve

FRESH FOOD

- °C +

7 6 5 4 3

50° 30° 20° ?
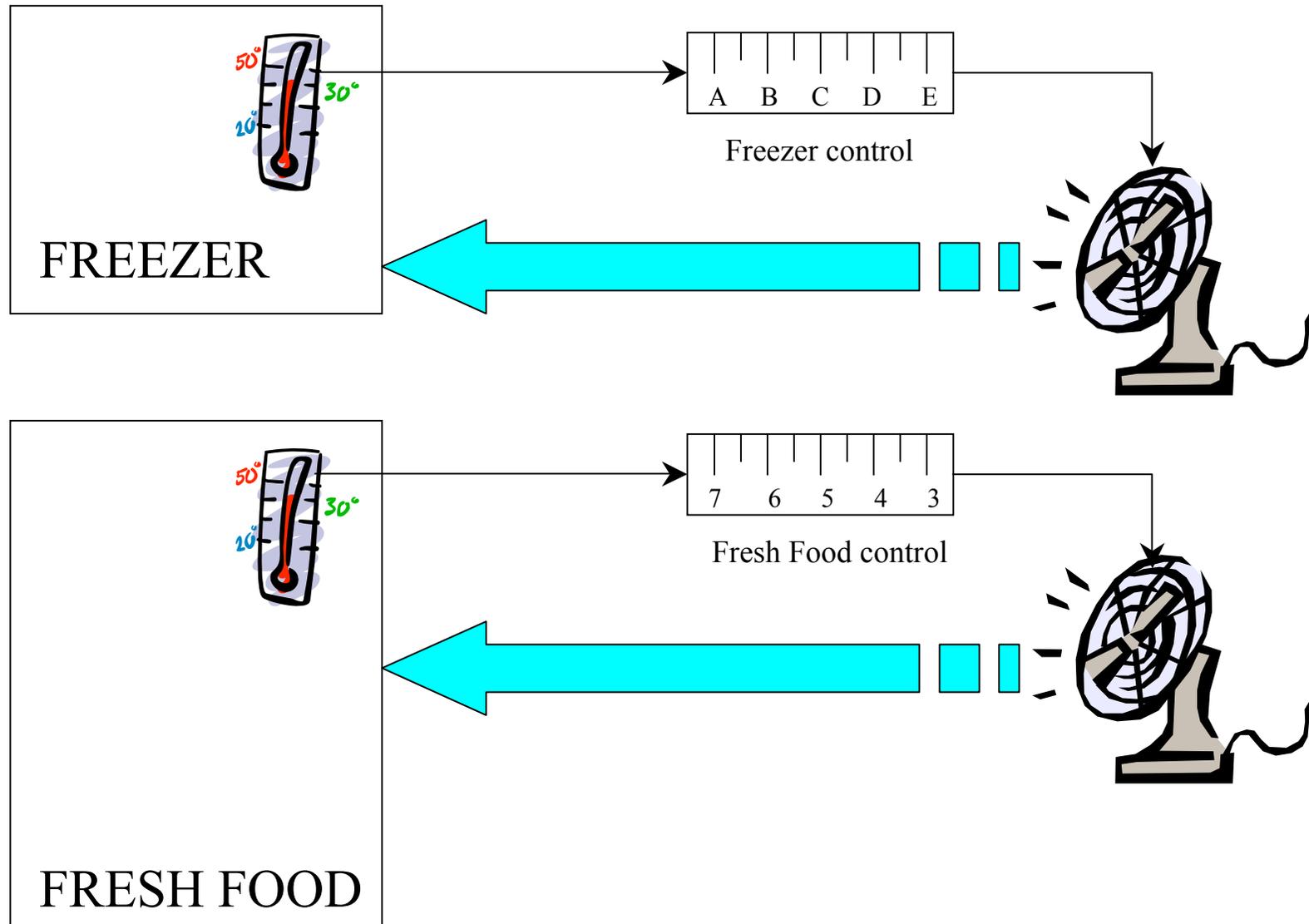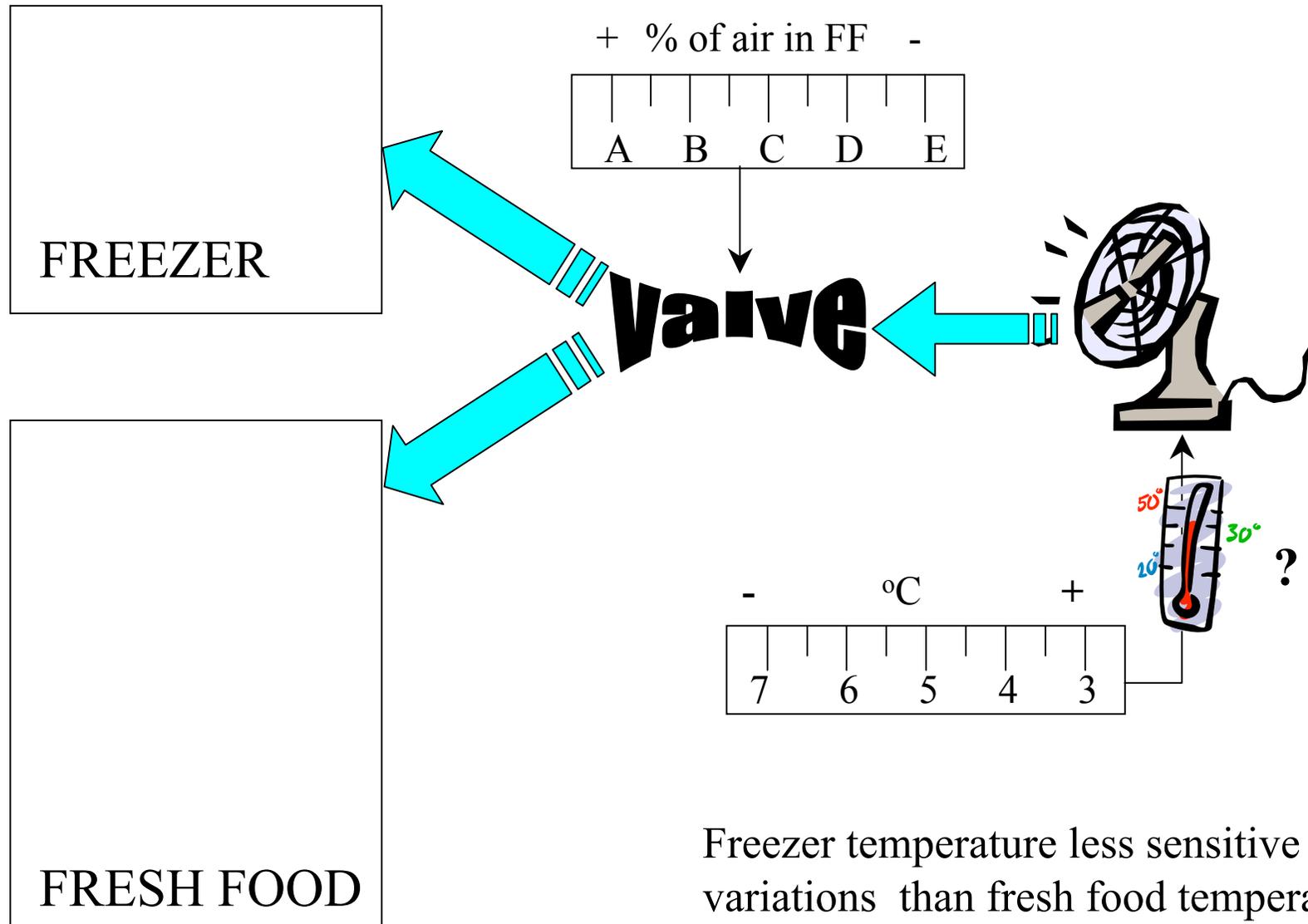
Freezer temperature less sensitive to small variations than fresh food temperature

A 'Gap' in Comprehension and Understanding?

Development Context
Systems built and tested by software developers

GAP

Workplace/Home
Users working in social setting

Systems Delivery

Requirements

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Systems Delivery

Development Context
Systems built and tested by software developers

Workplace/Home
Users working in social setting

Requirements

The Volere templates: http://www.systemsguild.com/GuildSite/Robs/Template.html
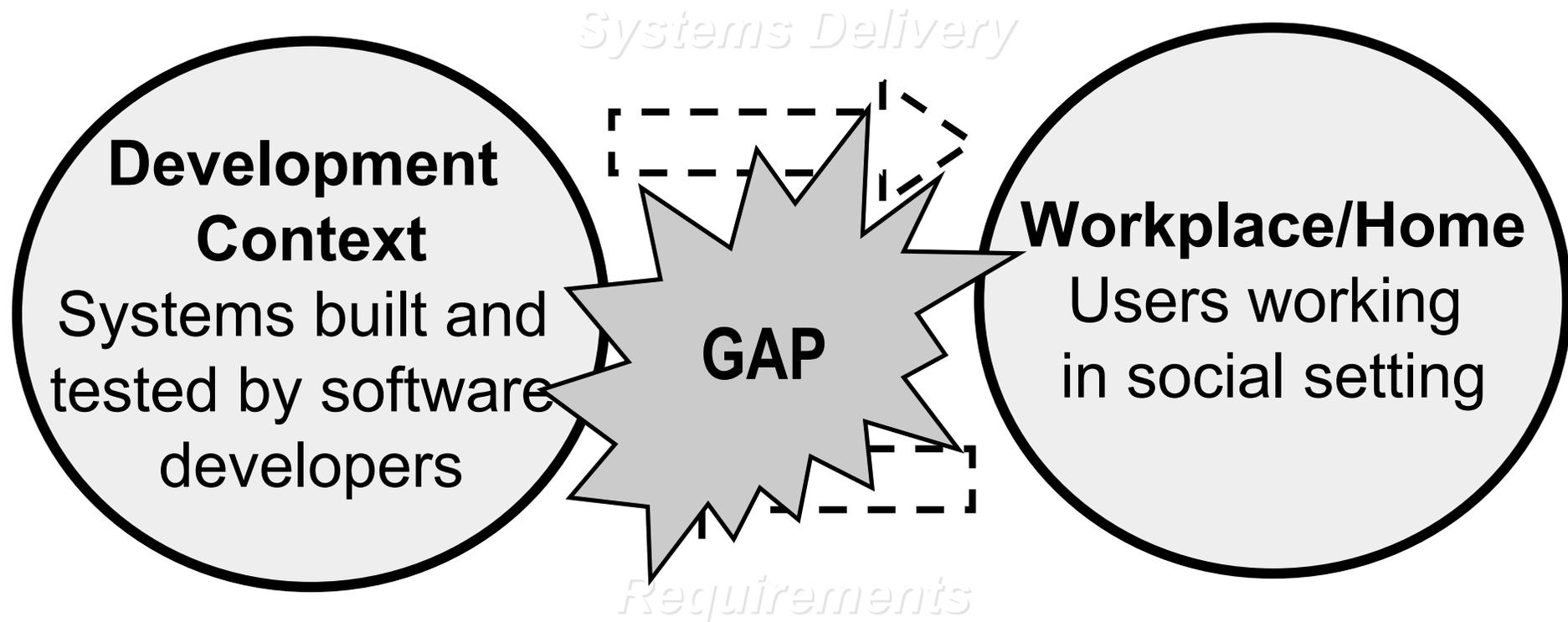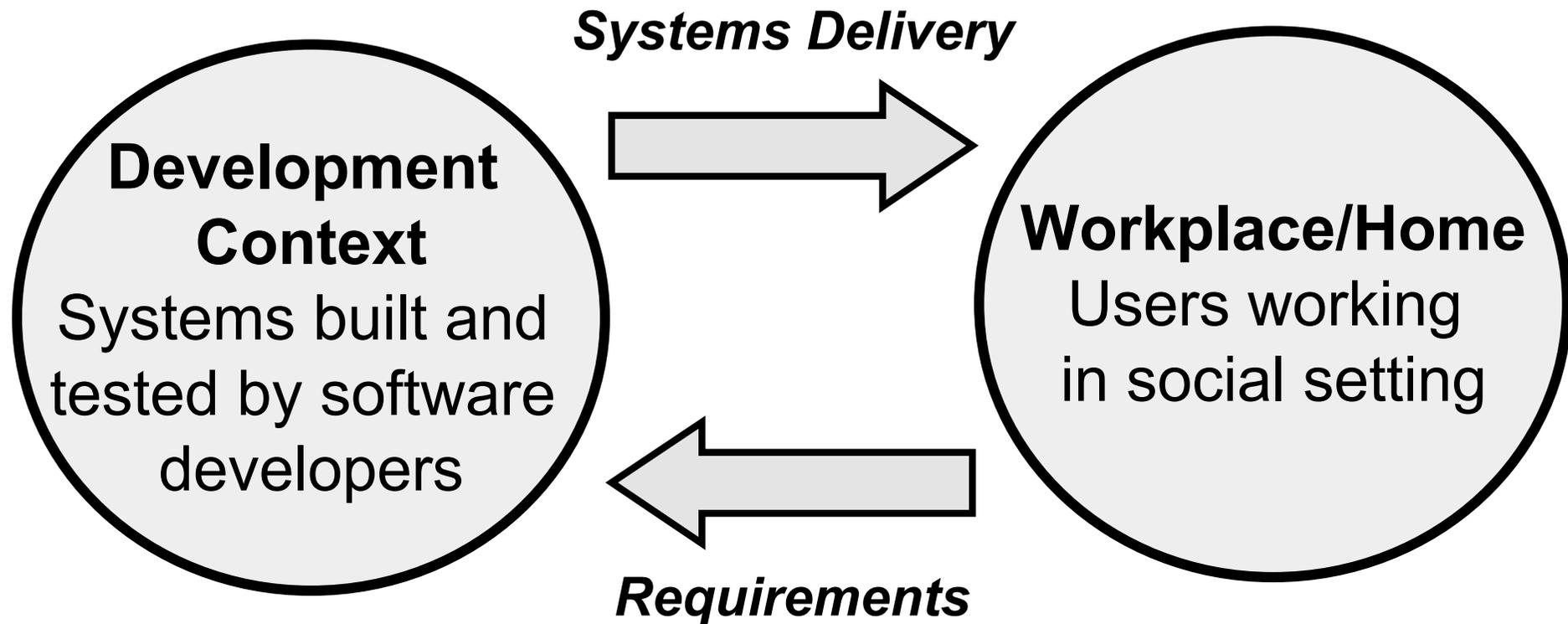
Key points

Engineers don't have the same mental models as users

System image should present a clear, correct model

BUT

Projecting the engineer's model onto the system is not necessarily **good usability/design**

Projecting the user's model onto the system is not necessarily **possible**

User-Centred Design and its Models

Bridging the Gap

System models

User models

Development Context
Systems built and tested by software developers

Observational Studies

User Participation

Workplace/Home
Users working in social setting
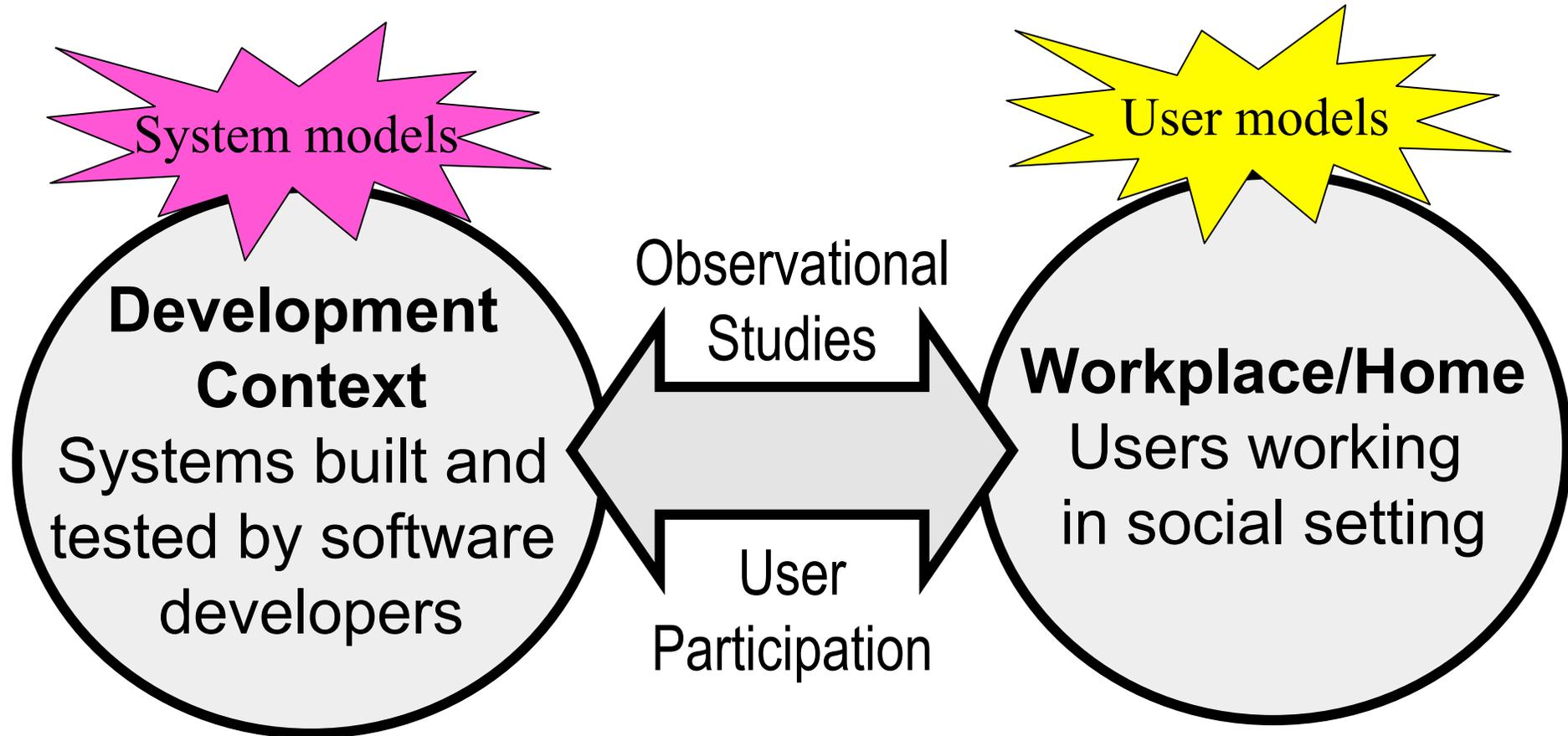
Methodologies Designed To Circumvent These Obstacles

- User Centered Design (UCD) places the user at the center of the design process
  - 'Design from the human-out'
  - 'Make design fit the user' **not** 'Making the user fit the design'
- Key principles:
  - An early focus on users and task
 - Iterative design – repeated cycles of design, modification, testing

Methodologies Designed To Circumvent These Obstacles

🐝 Methodologies and techniques for enabling UCD:

– **Ethnography**

– **Contextual Inquiry and Contextual Design**

– **Work/Task-Oriented Design and Analysis**

– Collaborative prototyping

– Storyboards

– Etc.

Note: All these methodologies make use of a variety of techniques for qualitative investigation (observational studies) and participative design
Note: No single technique is capable of fully capturing the diversity of work setting; need to be selective about techniques and methods used

Iterative Design
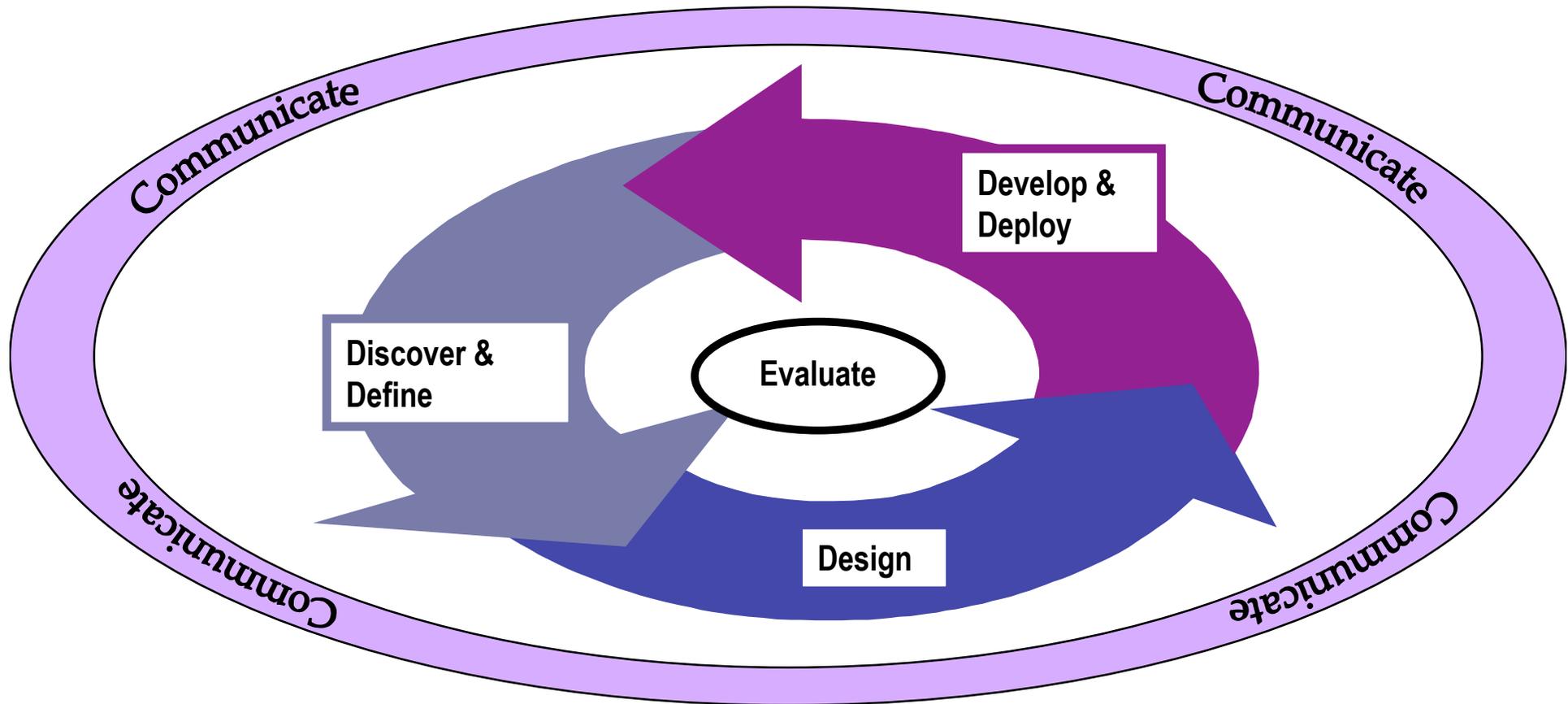
Who is the User?
Example of a web team

Users:

Solution team:

Client:

Stake holders

Experts

End-user

Project mgr

Brand strategist

Market researcher

Business analyst

HCI engineer

Software engineer

Graphic artist

Copywriter
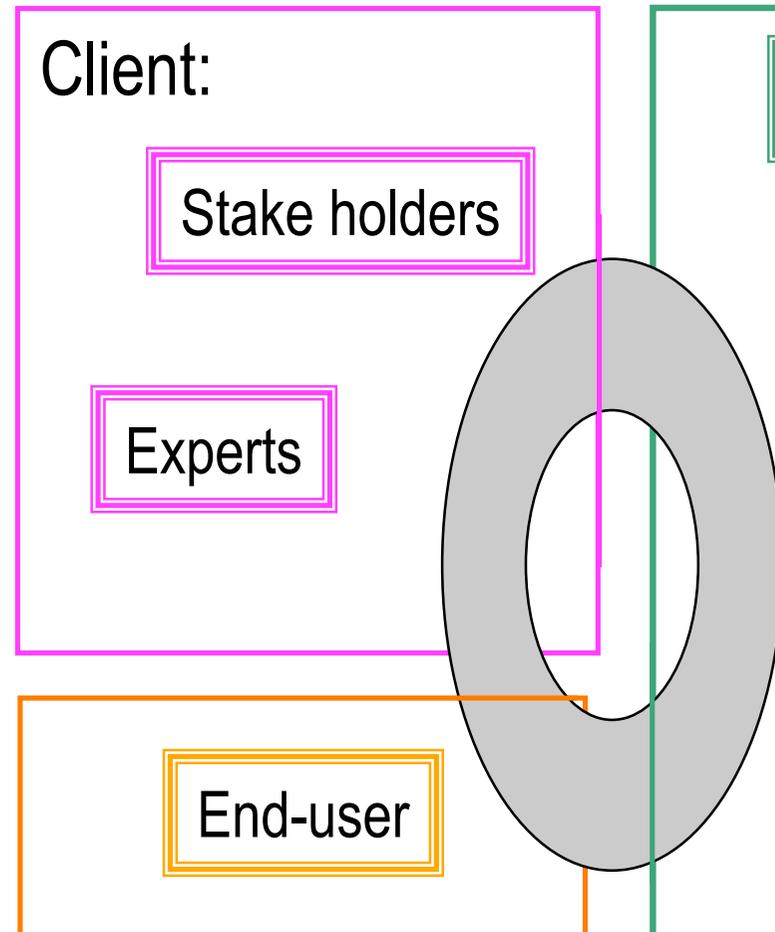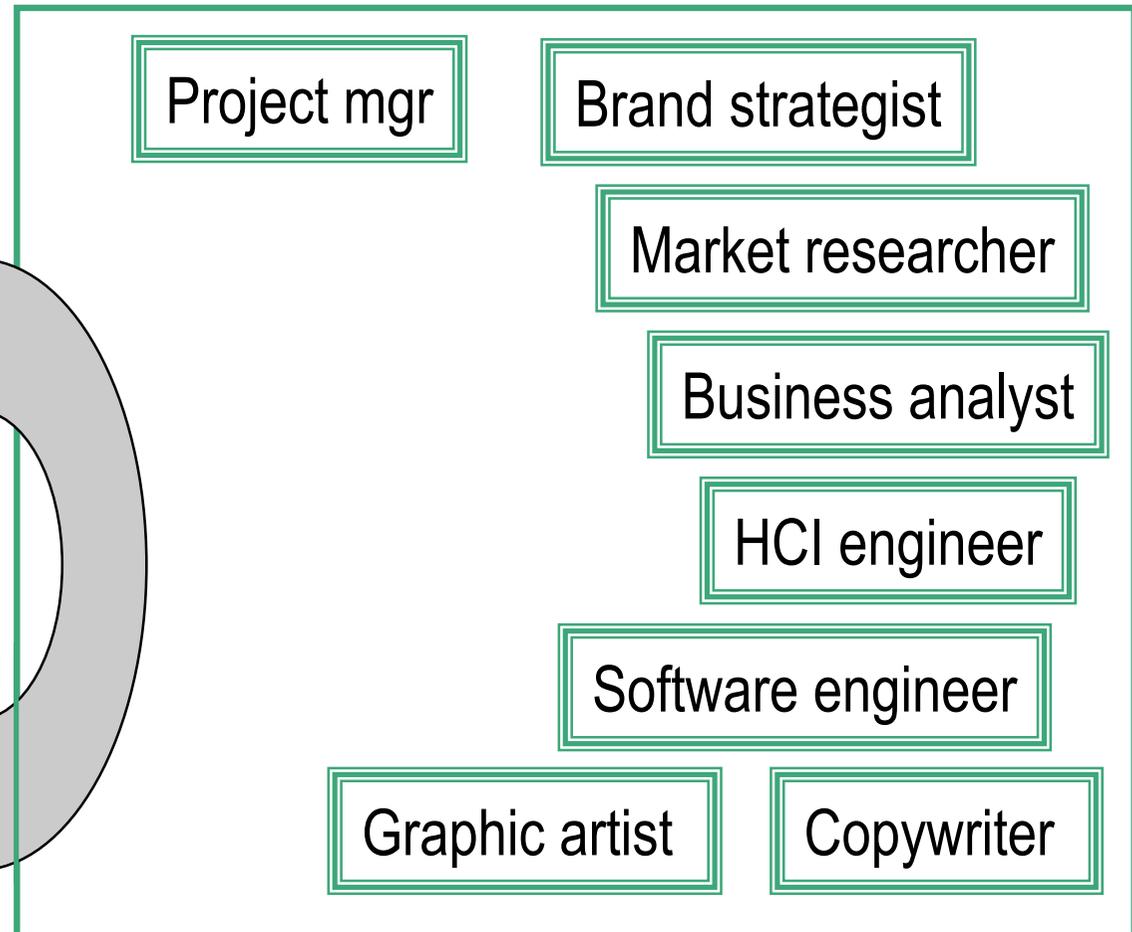
Involvement Roles and Development Conditions

- Involvement role and development conditions influenced by user characteristics and organisational climate
- Involvement roles:
  - Who should participate?
  - What is the role of participants in development?
- Development conditions (project characteristics):
  - What type of system is being developed?
  - What stage of the development project should participation occur?
- Answers to these questions determine type and degree of user involvement

Motivations for Participation: Why Participate?

Client:
- Morally right
- Motivates commitment
- Promotes understanding so organisational goals are better achieved
- Informed negotiation takes place
- Easier to achieve unpopular changes

End-user:
- Prevents undesirable changes
- Promotes interesting jobs
- Avoids imposing the 'company line'
- Promotes responsibility
- Enhances group harmony
- People 'master of own destiny'

Developer:
- Identify what actually happens
- Introduce valuable know-how
- Produces willingness to accept design decisions
- Appreciation of others' perspectives

Types of User Involvement

- Consultative: where consultation with relevant user groups is practiced

- Representative: where all levels of the user group are represented in the design team

- Consensus: where an attempt is made to involve all workers in the user department through communication and consultation

(Ives and Olsen 1984)

Degree of User Involvement

1. No involvement (Users unwilling or not invited to participate)

2. Symbolic involvement (User input is requested but ignored)

3. Involvement by advice (User advice is solicited through questionnaire or interviews)

4. Involvement by weak control (Users have 'sign-off' responsibility at each stage of development)

5. Involvement by doing (Users are members of design team)

6. Involvement by strong control (Users control project budget)

(Ives and Olsen 1984)

Outcome of User Involvement

- Two class of outcomes (benefits):
  - Systems quality
  - Systems acceptance
- Systems quality 'mediated' by cognitive factors:
  - Improved: understanding of the system; assessment of system needs; evaluation of systems features
- Systems acceptance 'mediated' by motivational factors:
  - Increased user perceived ownership of system; decreased resistance to change; increased commitment to new system

Obstacles To User Involvement

- Motivating potential **users** to participate
- Motivating **developers** to participate
- Identifying representative (relevant) users/groups
- Obtaining access to relevant users/groups
- Gaining benefit from user contact: too much or too little?
- Gaining benefit from existing users/groups: how to incorporate insights into design process?

Observational Studies

- Two broad 'Classes' of observational studies:

- Naturalistic
  - Understand current work in real-life context
  - For example: interviews, work observation, "show me", "train me", ethnography, contextual inquiry…

- Experimental
  - Understand new technology in "laboratory" context
  - For example: Experiments, testing, trials, scenarios, prototyping…

Note: hybrid techniques that combine features of both are possible
e.g. cooperative prototyping

Roles for the HCI/IA/Ethno expert

1. Conducting specific studies for a given project

2. Project management

3. "first user" of prototype

4. Informing usability studies

5. Keeping up with relevant research/literature

6. Injecting users' perspective throughout the project

(Nardi 1997)

Techniques to Observe

- *Ethnography: looks at everything*

- *Contextual inquiry: 5 axes of observation (flow, context, sequence, artefact, physical)*

- Task Analysis: 1 axis of observation

Task modeling and what we used it for

Task analysis is not about...

- User characterisation

- Structure and usage of artefacts

- Flow of action between people/roles

- Physical environment

- Context/culture which constrains how the task is done

Task analysis is about...

- The study of the end-user's needs, goals, and tasks in order to support analysis and design

- Data capturing methodologies:
  - Interviews with the various stake holders, end-users, and also solution team members
  - Observations in the wild / zoo
  - Think aloud protocol
  - Workshops / focus groups with stake holders / managers / end-users

- The tangible result of a task analysis is a task model

What do we mean by task model?
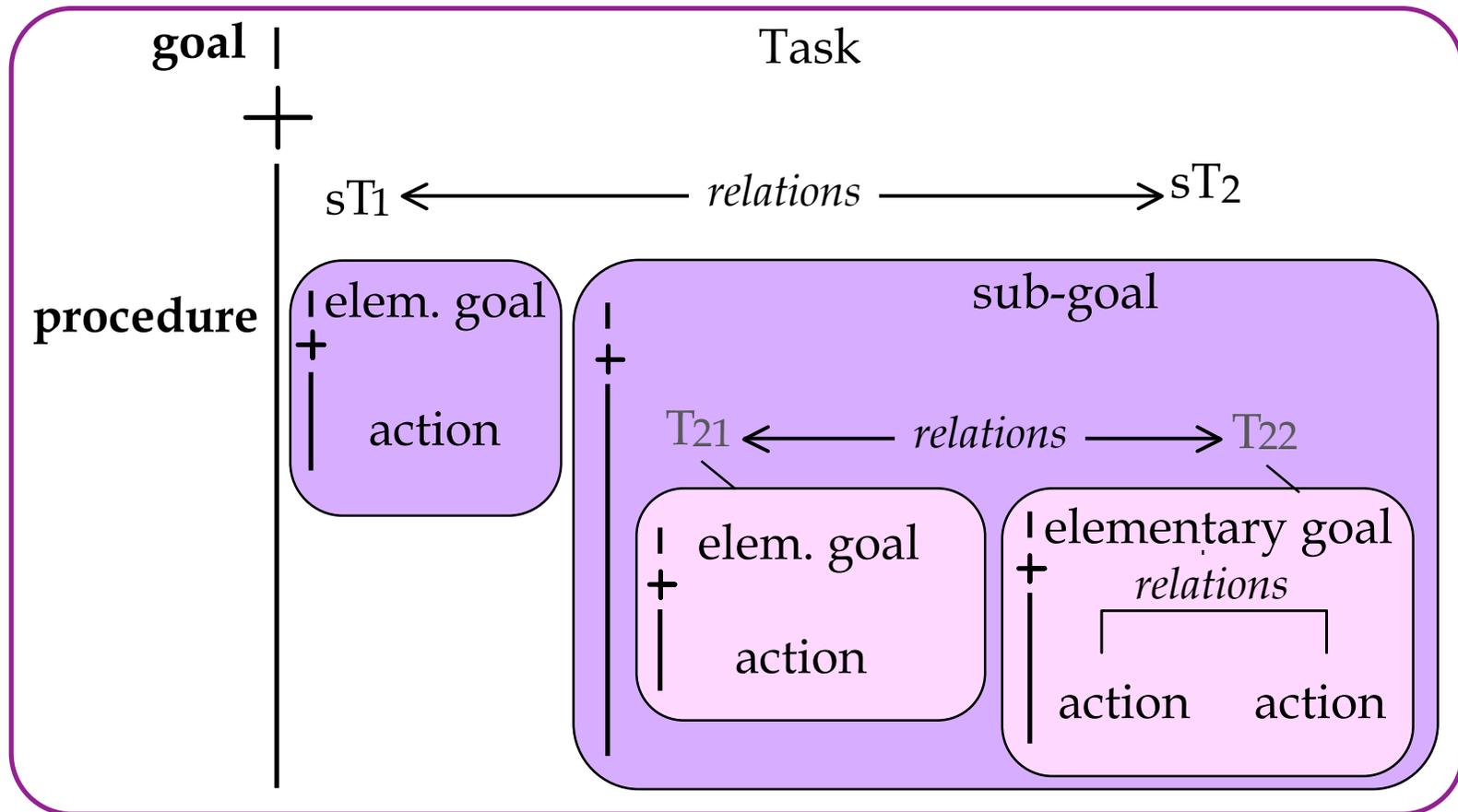
Granularity of the elementary procedures/actions

Task Models

- Need to express:
  - Mandatory vs optional
  - Actor
  - Synchronisation (seq., par., iter.)

- Many notations:
  - Diane+
  - Functional Flows
  - Essential Use Cases   **Not** UML Use Cases
  - MAD, GOMS, GTA, UAN, etc.

(Balbo, Ozkan, Paris 2004)

Illustration 1

The Use Case example

(Constantine & Lockwood 1999)

The Use Case example
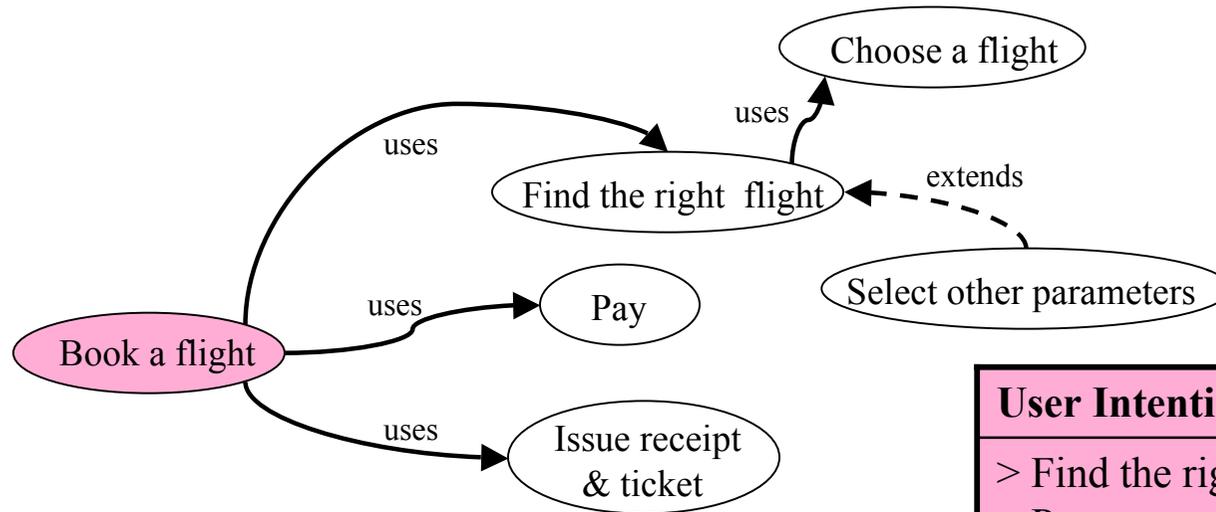
User Intention	System Responsibility
> Find the right Flight > Pay	> Issue Receipt & Ticket

(Constantine & Lockwood 1999)
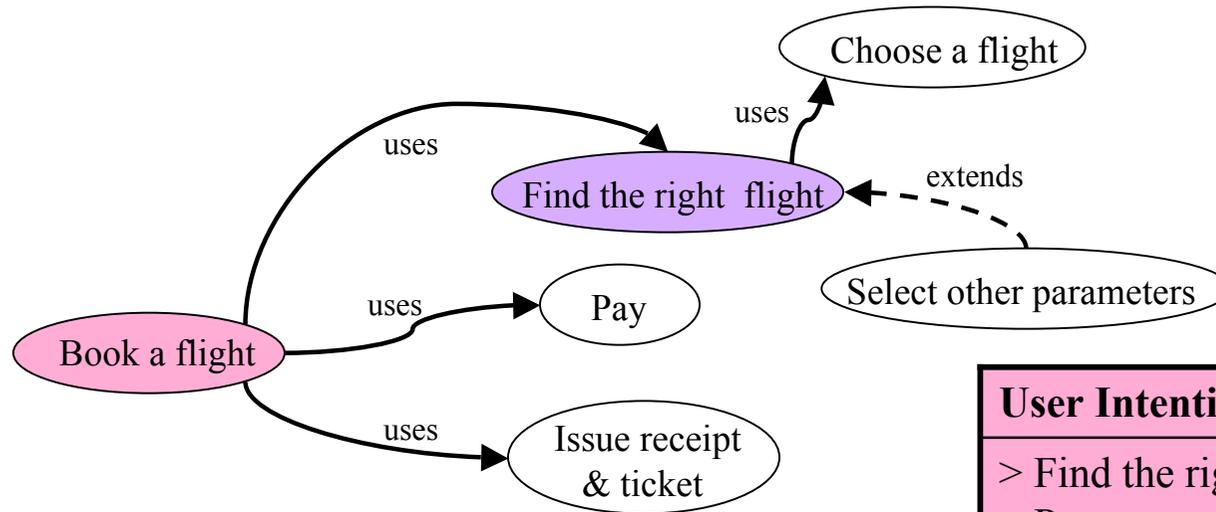
The Use Case example

Choose a flight

uses

Find the right flight

extends

uses

Select other parameters

uses

Pay

Book a flight

uses

Issue receipt & ticket

User Intention	System Responsibility
> Find the right Flight > Pay	
	> Issue Receipt & Ticket

User Intention	System Responsibility
Select departure airport Select return airport > Choose a flight	Update return airport list Flight selected

(Constantine & Lockwood 1999)

The FFlow example

Go-fly.com availability & booking page

Select departing airport from pull-down menu → Update arrival airport pull down menu

Select arrival airport from pull down menu

Select all other parameters

Select 'Check availability & book' — Check for errors

Error → Error message

No errors → Select flight page

Error message → click 'Ok'
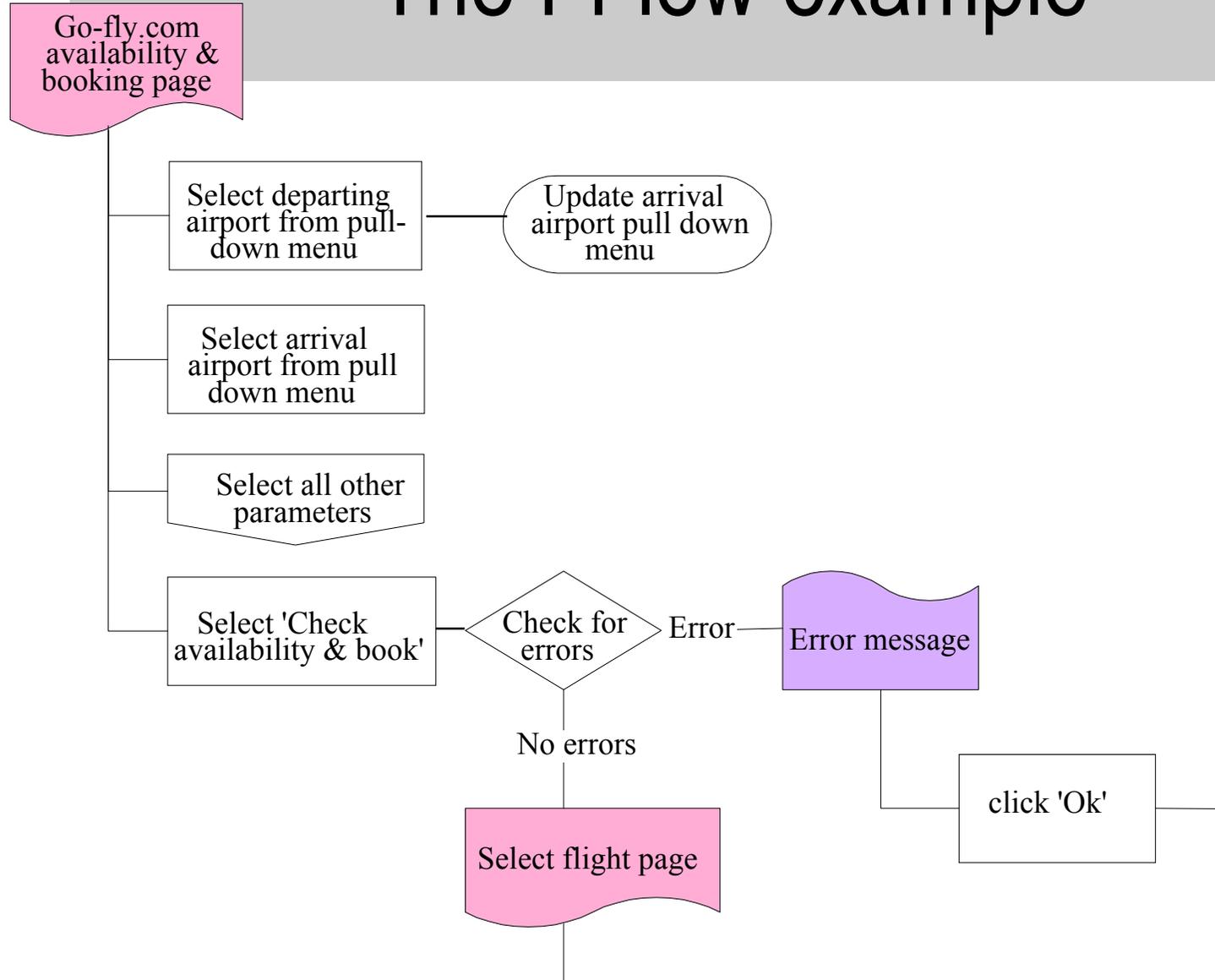
The Diane+ formalism

- Another visual formalism for task modelling
- Defines classification and relationships between tasks:
  - Mandatory vs optional
  - Actor (manual, auto, interactive)
  - Feedback
  - Synchronisation (seq., par.)
  - Iteration (minCard, maxCard)
  - Pre/Post-conditions

The Diane+ example

Book a flight ── Find the right flight

Find the right flight:
- Pay
- Issue receipt and ticket

Enter flight details → Display all flights corresponding to details → Choose a flight

Select departure & arrival airports

Select other parameters

Select departure & arrival airports ── Select departure airport → Update return airport list with possible flights → Select return airport

⚜ Details of the notation

⚜ The Village Cinemas example

Short Activity

Reading a task model

The Drink machine example

Using Task Models to gather requirements

What are Task Models used for?

Communicate

Communicate

Communicate

Communicate

Develop & Deploy

Shaping UML, DB

Hierarchy of tasks:
Scoping & Structuring URS

Discover & Define

Evaluate & Predict

Evaluating usability

Design

Defining/ Organising [new] functionalities

Terminology:
Categories / Tutorial / Help / Documentation generation
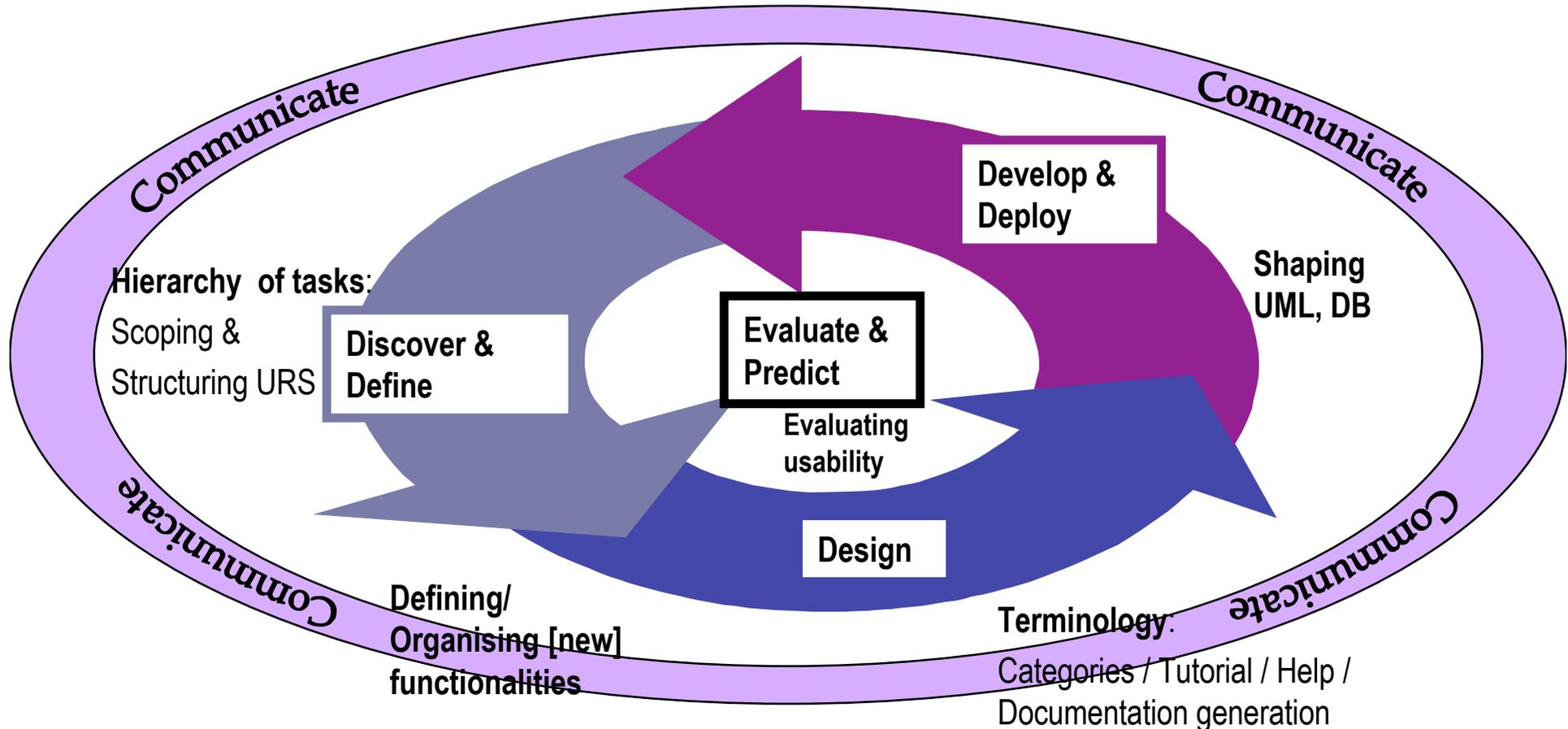
Extract expertise, validate
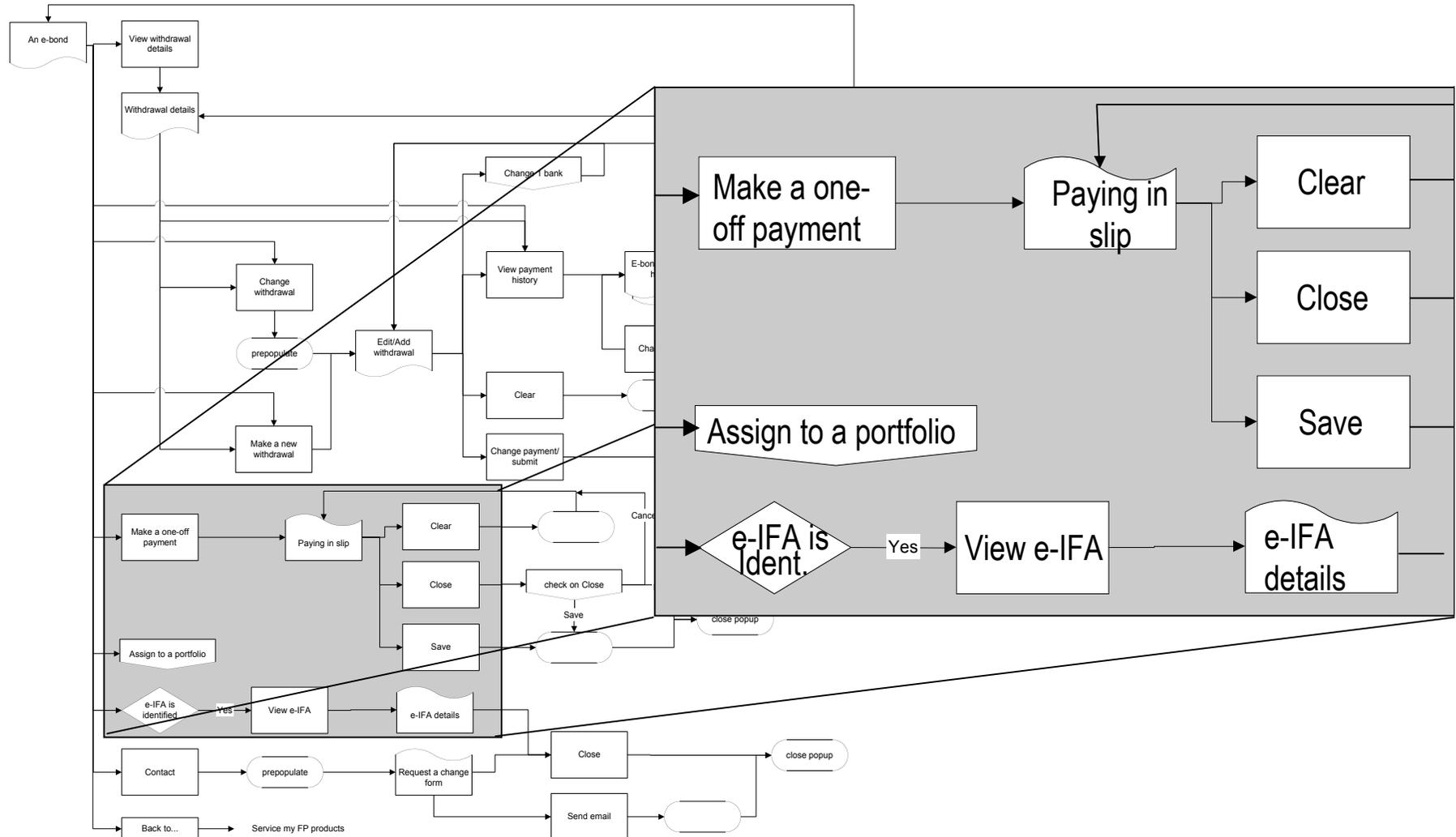
Scoping & Structuring URS

Write controls & topics help:

XOR

Write for all controls — Per control

Write for all windows — Per window

Write for all topics — Per topic

Find out how application works

Write for all topics

Find out how one topic works

Write for the topic — Per control / Per window / Per topic

Write for remaining controls — Per control
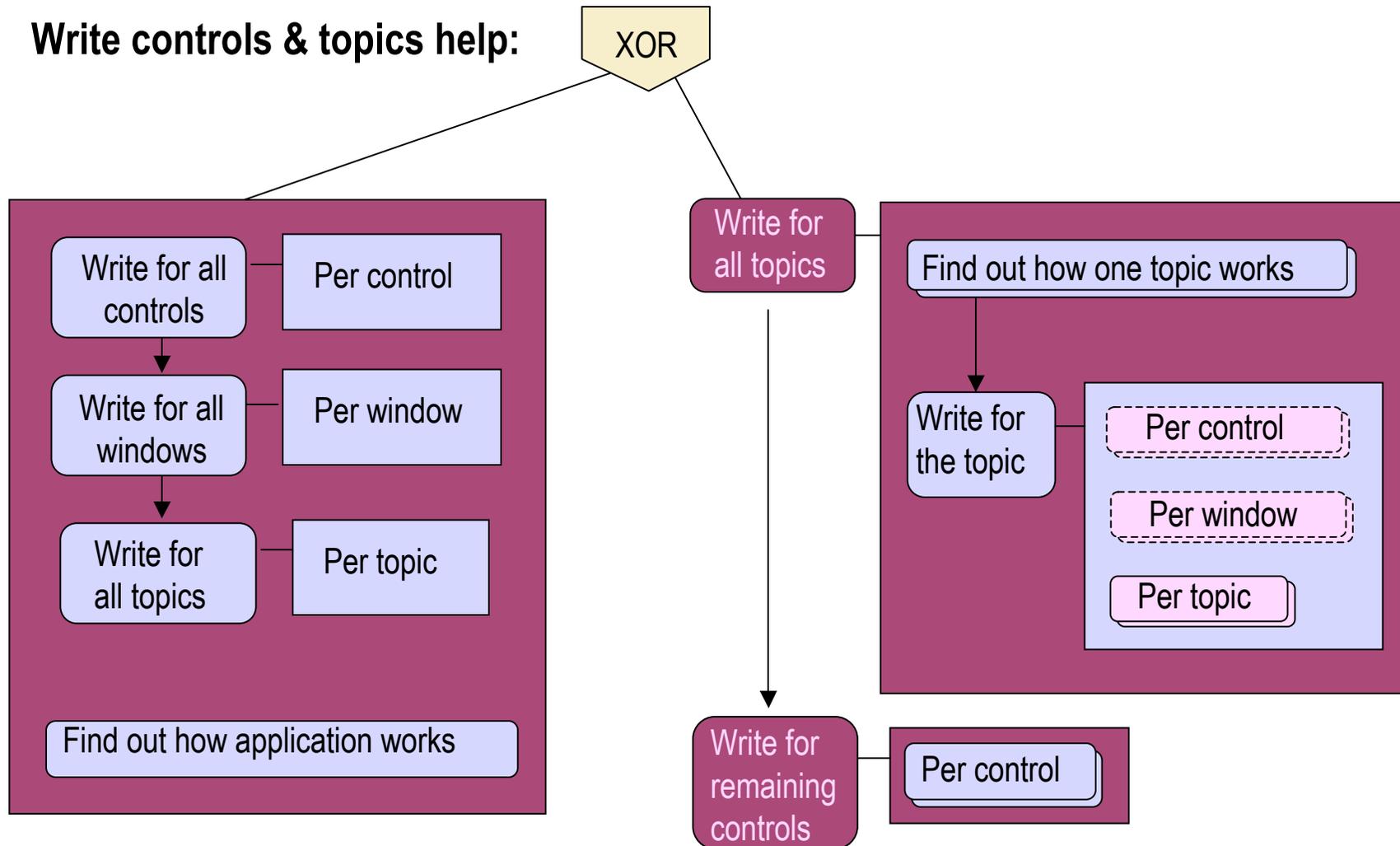
Defining the right terminology

- To provide information about the end-user's **vocabulary**

- To help build **categories**, **indexes**

- To provide structure for **tutorials**

- To automatically generate the procedural on-line **help** ("how-to"), as in Isolde

Defining the right terminology

User & System's TM

User's TM

Choose/Get a model

Load models or/and digitised designs

Digitise

Open

scan

System's TM

Load models or/and digitised designs

Digitise

Open model

Open digitised design

scan

Defining new functionality

User's TM

System's TM

Choose/Get a model

Load models or/and digitised designs

Open

Digitise

scan

Load models or/and digitised designs

Open model

Open digitised design

Digitise

scan
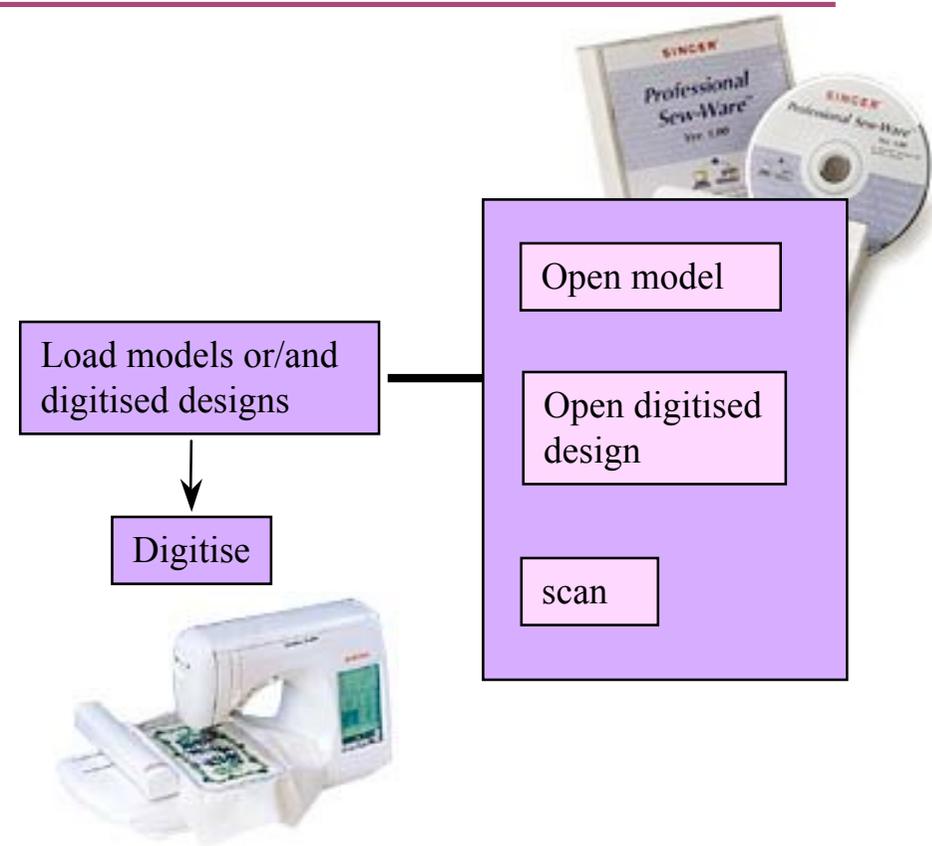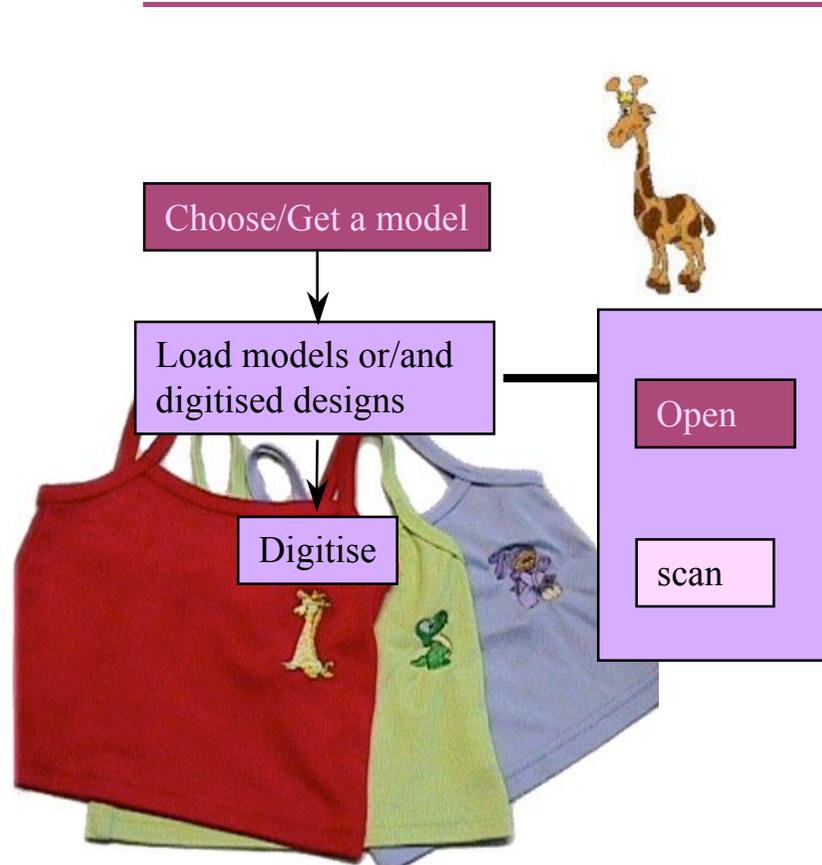
Defining new functionality

User / System's TM

Choose/Get a model

Load models or/and digitised designs

Digitise

Open model or digitised design

scan
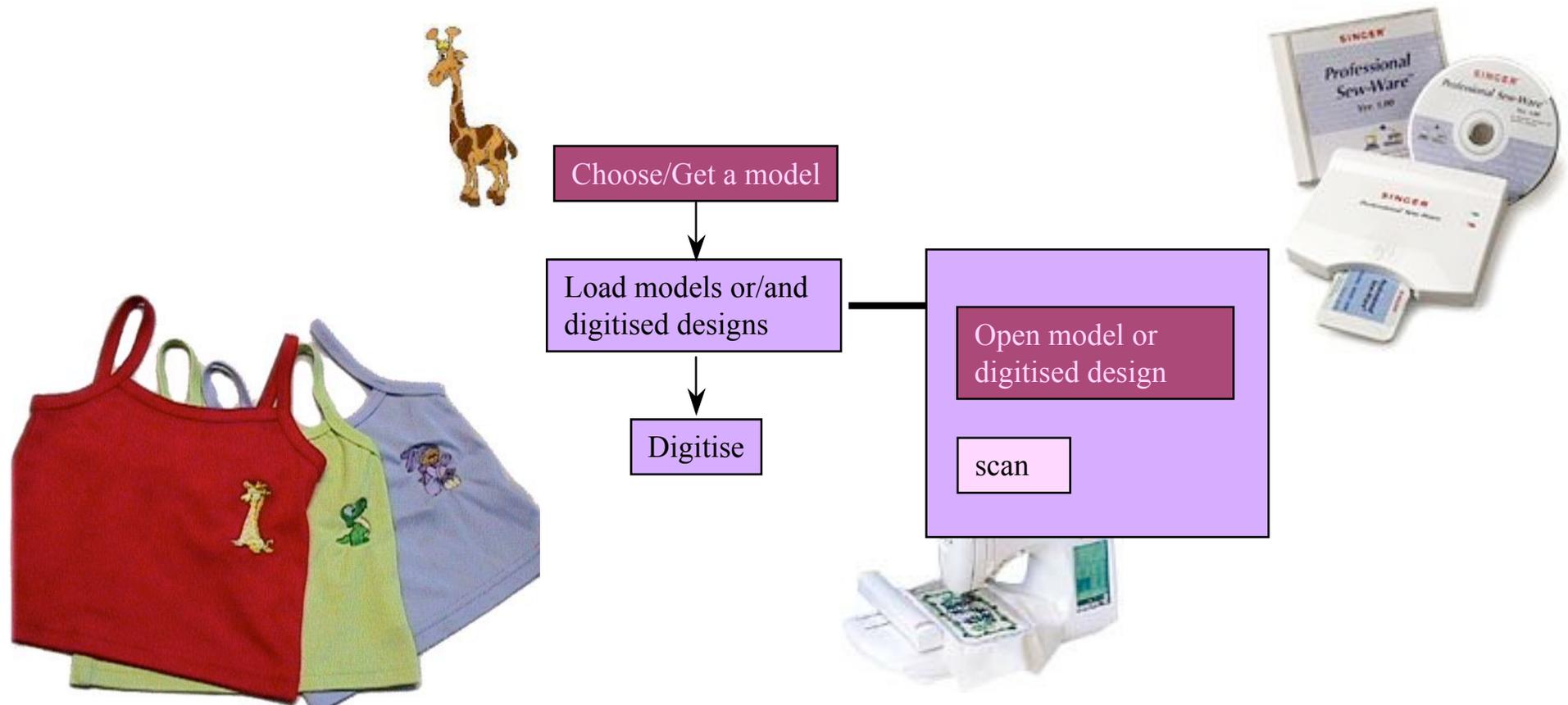
Conclusion

Case studies / What did we use TM for?	RAN APLCRATES	CSIRO Isolde	Wilcom Embroidery
New functionalities	✓	✓	✓
User Req. Spec.	✓	✓	
Documentation	✓	✓	
Usability evaluation			✓
Communication	✓	✓	✓

Conclusion – Models in general

Drawbacks:

– Methods of applying ethnography/contextual design/TA to IS design still evolving

– Time and resource intensive

– Need experts with an awareness of IS development practices

– Focus on existing work practices

Benefits:

– Knowledge transfer and user representation (negotiation)

– Injecting users' perspective into design

– **Disciplined** understanding of social organisation of work

– Uncover 'invisible' work

– 'Sanity check' on design

A good ethnography provides a basis on which to judge a product's potential impact and can be a fertile source of design ideas. (Nardi 1997)

Conclusion – TM/FF specific
(Balbo, Ozkan, Pitula & Bonneville 2005)

- TM (Diane+) and FF usage:
  - As a design tool
  - Communication with client
  - Communication with software engineers

- Diane+ usage:
  - Represent user's intentions
  - Easy to read/create *
  - Support for automatic generation of online help
  - Support for usability testing

(* Ozkan, Paris, Balbo 1998)

Conclusion – D+/FF specific

(Balbo, Ozkan, Pitula & Bonneville 2005)

TM (Diane+)	Functional Flows
Simple representations	No semantic meaning to repeated sub-tasks.
Representation of cognitive tasks	
Enables a step-by-step analysis: some decisions can be tackled at a later stage.	Only deals with user-systems interactions
	No hierarchy, represents only linear processes
A tool for analysis & representations	A tool for representations

Thanks!

Any further question?

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References

TAMOT

http://ict.csiro.au/staff/Cecile.Paris/From-CMIS/Projects/Isolde/Tamot/Index.asp

- A **tool** for producing Diane+ Task Models

- Developed at CSIRO, Sydney

- Produces HTML reports
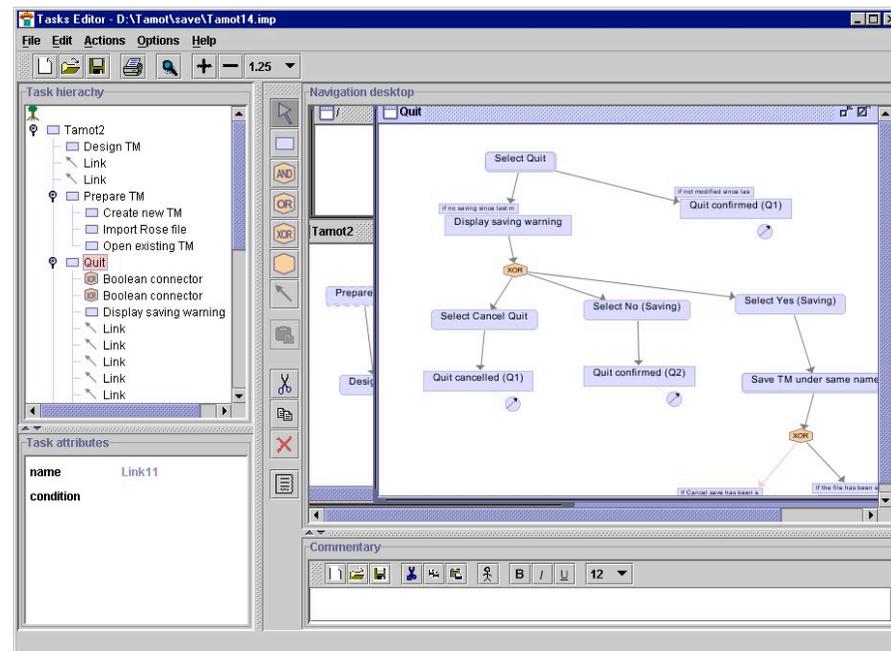
Selected Publications by Sandrine Balbo et al around Task Models

- ⚜ 2 book chapters:
  - Sandrine Balbo, Nadine Ozkan and Cécile Paris. **Choosing the right task modelling notation: A taxonomy**. In the Handbook of Task Analysis for Human-Computer Interaction, D. Diaper and N. Stanton (Eds.), 2004
  - Cécile Paris, Sandrine Balbo & Nadine Ozkan. **Novel Uses of Task Models: Two Case Studies.** In Cognitive Task Analysis, J.M.C. Schraagen, S.E. Chipman, V. Shalin (Eds.), Laurence Erlbaum Associates, 2000

- ⚜ A few conference publications:
  - Sandrine Balbo, Nadine Ozkan, Kristina Pitula & Elise Bonneville. **Usability Design Notations: A Comparison Of Functional Flow Diagrams and Task Models**. In Proceedings of the Usability Professional Association Annual Conference. Montreal, Canada, 2005
  - Sandrine Balbo, Steve Goschnick, Derek Tong & Cécile Paris. **Leading Web Usability Evaluations to WAUTER**. In Proceedings of the 11th Australian World Wide Web Conference (AusWeb), Gold Coast, Australia, 2005.
  - Aaron Mullane & Sandrine Balbo. **DIANEnx: Modelling Exploration in the Web Context**. 6th Asia-Pacific Conference on Computer-Human Interaction (APCHI), Rotorua, New Zealand, 2004.
  - S. Balbo & M. Specht. **Extending the Scope of Task Models in Industrial Context**. in Proceedings of OZCHI'99 conference, Wagga Wagga (Australia), November 1999
  - N. Ozkan, C. Paris & S. Balbo. **Understanding a Task Model: An Experiment**. in Proceedings of People and Computer XIII - HCI'98, Sheffield (UK) , Springer-Verlag, p. 123-137, 1-4 September 1998
  - S. Balbo & C. Lindley. **Adaptation of a task analysis methodology to the design of a decision support system**. in Proceedings of INTERACT'97, Sydney (Australia), Chapman and Hall (IFIP publishers), 1997

Web sites and HCI, a short selection

(accessed 22/01/2008)

- ❧ HCI Reading lists:
  - http://degraaff.org/hci/
  - http://www.hcibib.org/readings.html
  - Usability SIG of the Society for Technical Communication
    http://www.stcsig.org/usability/resources/bookshelf/index.html
  - http://www.research.umbc.edu/~asears/hci/readings.html (a good old list - not updated since 2000)

- ❧ Reading lists more about Web design and IA:
  - http://www.eleganthack.com/reading
  - http://www.boxesandarrows.com/view/our_favorite_books_recommendations_from_the_staff_of_boxes_and_arrows (a 2002 article)
  - http://www.adaptivepath.com/publications/readinglist.php

- ❧ HCI Societies:
  - Australian CHISIG – http://www.ozchi.org/
  - Association for Computing Machinery, SIGCHI - http://www.acm.org/sigchi/
  - Information Architect Institute - http://iainstitute.org/
  - Usability Professional Assocation - http://www.upassoc.org/

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Thanks to Martin Gibbs (University of Melbourne) for his help in setting up this list

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Ethnography

Ethnography

- **Study of culture, study of people**
  - Ethnography: *ethnos-* [race/people] *-graphos* [writing]
- **Observer-participation:**
  - A study technique whereby the observer also participates in social life to gain an understanding from the 'natives' point of view
  - But, 'outsider' status means the observer can see taken-for-granted aspects of social life that are often invisible to 'natives'

Ethnographic Principles

- Principles:
  - Takes place in 'natural' settings (in-situ, not lab studies)
  - Holistic (i.e. human behaviors must be understood in context)
  - Develops descriptive understanding (not prescriptive)
  - Grounded in a member's ("native's") point-of-view

- Techniques include:
  - Observation, interviewing,
    videotape, observer-participation…
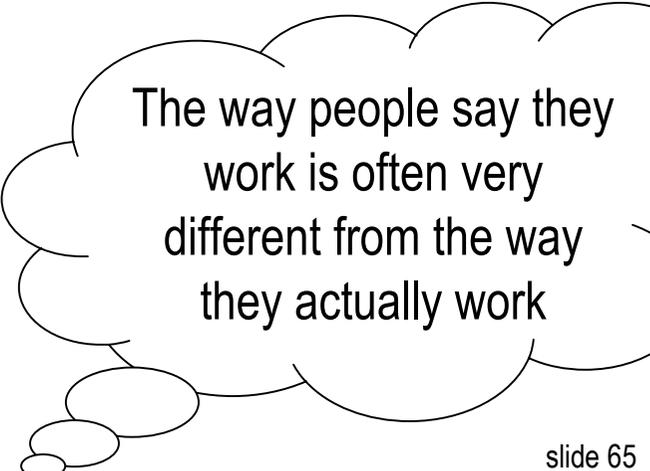
The way people say they work is often very different from the way they actually work

Ethnography in the Design of IS

- A method of "informing" systems design
- Recognizes work as socially organized and situated
- Brings a social dimension to the design process by focusing on how work is actually done rather than looking at these processes through some idealized organizational view

- Focuses on the situation of use rather than the user *per se*
- Oriented towards the group (i.e. CSCW) rather than the individual
- Useful place in design cycle:
  - Requirements/specification
  - Prototype testing

For interactive systems it is vital that designers understand the work setting as a **preliminary** to design.

Contextual Design

www.incent.com

Contextual Design
www.incent.com

- Major influences
  - Participative design (Scandinavian approaches)
  - Ethnography
  - Cooperative prototyping
- Focus on usefulness issues as well as usability issues
- Aims to shape new technologies by generating insights into what is useful "out-there" in real work settings

# Contextual Design
www.incent.com

- Premise: understanding work is critical to IS design
- Provides method of user collaboration through lifecycle
- Interviewing and observation occur in the workplace
- Generates interpretive understandings from users' POV
- Inquiry generates rich qualitative data for use in design process
- Design team is immersed in 'customer data'

Contextual Design
www.incent.com

Talk to customers while they work
Provides reliable knowledge about what customers actually do and what they care about

Interpret the data in a cross-functional team
Creates a shared perspective of the data

Consolidate data across multiple customers
Cr... single statement of work practice for your ...er population

Invent solutions grounded in user work practice
Pro... w...

Structure the syste... to support the ne... work practice

Iteration with cus... through paper m...

Design the object model or code structure for implementation
...hitecture and ensures ...structure

5 models: flow, sequence, artefact, cultural and physical

A Contextual Design team is truly immersed in customer data.

Beyer and Holtzblatt 1999