Contextual Design and Related Explorations

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Research Setup

- User(s) with an informatics problem
- Current approach not optimal
- How do we know what to build?

Important Claims

- Understanding work in context – goals, motivations, priorities, behavior, difficulties, etc. is necessary for building better systems
  - Most go beyond just talking about computer systems to address bigger picture questions
- Successful implementations may require work redesign
  - Translating the same old methods and procedures to computers may not help much,
  - But reference to the familiar can be helpful
- In-depth qualitative research needed to inform these efforts

Key Questions & Tradeoffs

- Who to involve?
- When to involve users?
- How to collect information?
- How to interpret?
- How to inform design?
- How to evaluate success?

- Usual tradeoffs apply: Never enough time or money

Stakeholder Analysis

Rosson & Carroll 2002

- Identify stakeholder groups
  - Background
  - Expectations
  - Needs
  - Preferences
  - Concerns
  - Values

- An important, but often overlooked step

Stakeholders

- Anyone who has an interest in the outcome of a system
  - Work, play, or some other aspect of life
- Customer – those who pay for the work
- User – those who work with the system
- Others – perhaps those who are described by data in the system
  - Museum members must wait as staff complete data entry

Stakeholders - Challenges

- Defined by roles, not by person
  - Billing clerk for the hospital system is likely also a health-care consumer
- Must identify people who can speak to different roles?
- How can we meaningfully integrate understanding of needs of diverse users?
  - Patients, practitioners, financial people, bureaucrats?

How to Collect Information?

- Beyer & Holtzblatt
  - 2-3 hour semi-structured interviews
- "Master/Apprentice" model
- Interviewee goes through work in situ
  - Interviewer asks questions, tries to learn work , as if he or she was going to do the interviewer's job
- Strengths/Weaknesses?

Interview Mechanics – Data Capture

- Interview guide
  - background questions - description of work goals, participant experience, etc.
  - other key issues that you want to make sure to hit
  - sessions are mostly unstructured
- Take Notes
  - 2 people – one to talk and one to write?
- Audio/Video
  - Can be useful, but expensive to transcribe
- Screen shots of current work
  - But no sensitive information
- Artifacts
  - Printouts, etc.
- Sketch

How many users?

- Diverse users completing a wide variety of tasks?
- Hospital system
  - Larger numbers of public health consumers, chosen for diversity
  - Fewer domain experts
    - But more in depth
- Art, not a science
  - keep on going until you're out of resources, or you aren't learning any more
  - Saturation

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When to involve users?

- At the beginning of the project
- Go away and build a system
- Ask how they like it

- Will this work?

A Spectrum of Possibilities for Engaging Stakeholders

Traditional Written Requirements

Surveys

Focus Groups

Interviews

Diaries/ActivityRecording

Observation

Contextual Interviews

Ethnography/ Participatory Design

Low Cost, Low Fidelity

High Cost, High Fidelity

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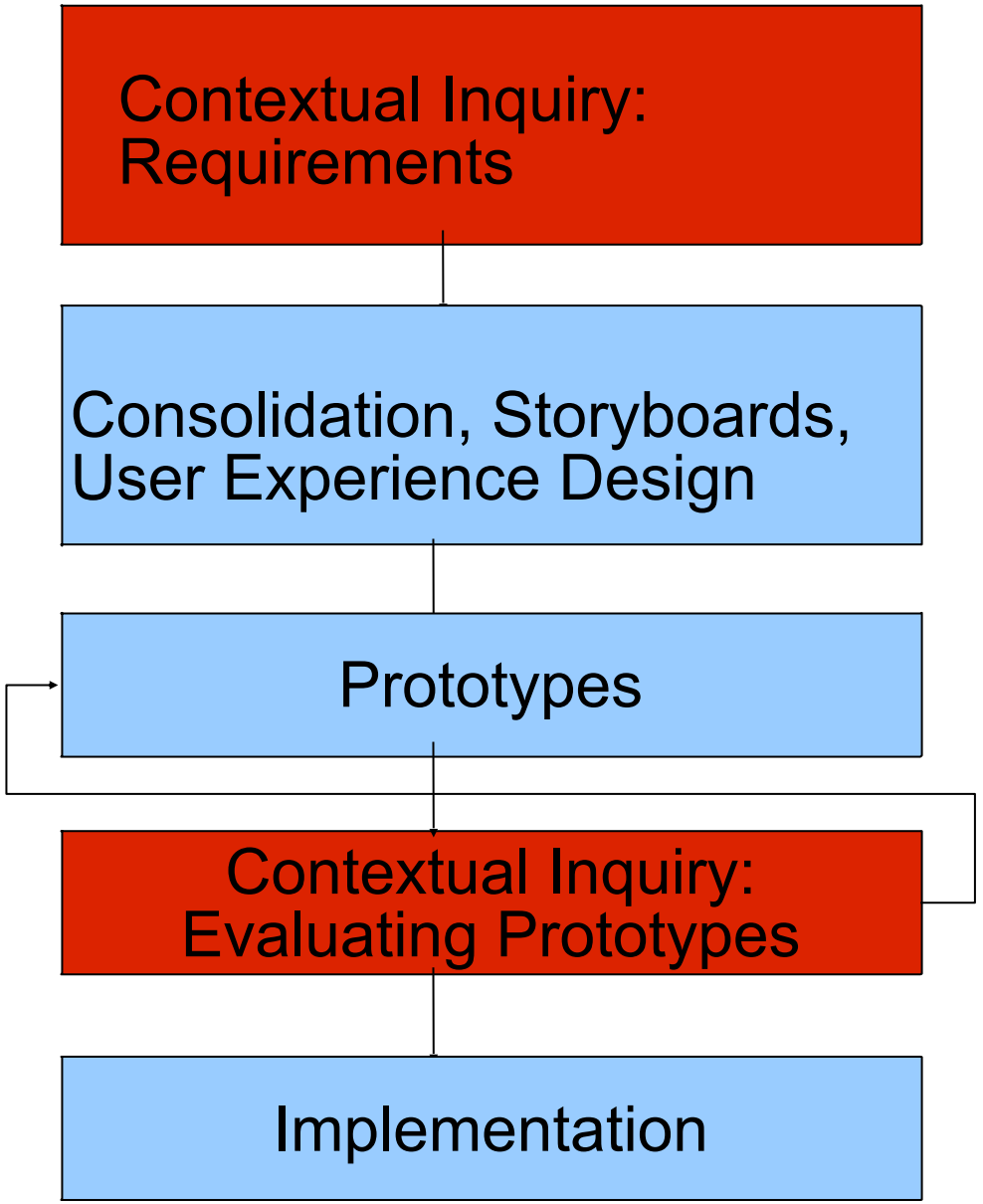
Contextual Design Process

Users Involved



Pros and Cons?

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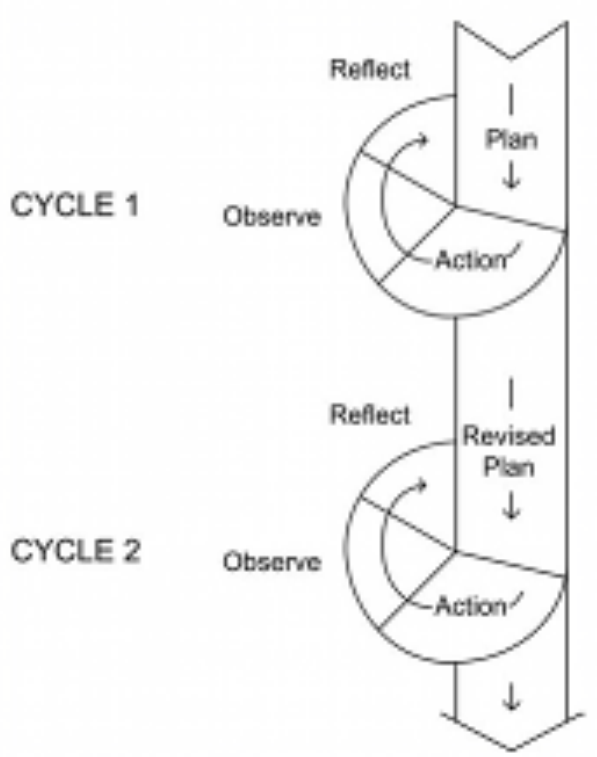
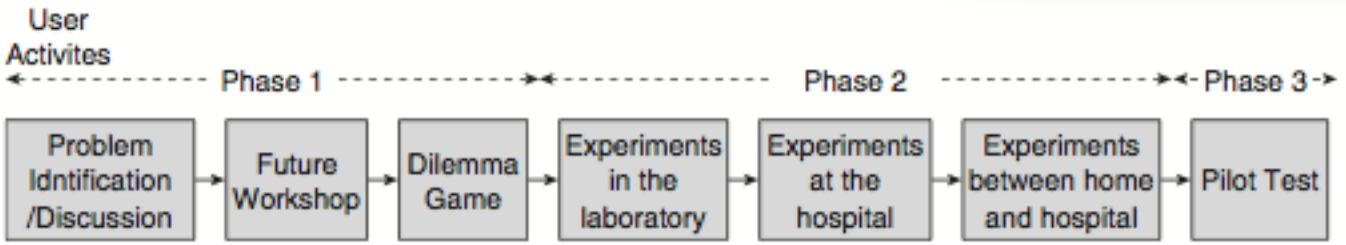
Participatory Design

- Users involved throughout
- Scenario design between CD and PD

- Pros and Cons?



Kemmis & McTaggart (1982)
reprinted in Clemensen, et al. 2007



Clemensen, et al. 2007

When Contextual Interviews might not work

- Greater depth
  - Complex work: Different tasks, contexts, environments, structures
- Greater breadth
  - Wider range of users, no obvious "work"environment
  - Highly-contextualized system use
    - Mobile applications

Ethnography

- Research in the field
- Become a member of the group that you are studying
- Range of possibilities
  - Observation, observer-participant, participant-observer, complete participant
  - Short-term vs. long-term
- Pros: richness of data
- Cons: cost, difficulty for researcher, risk of "going native"

Tradeoffs

- Usual tradeoff
  - More intense collection – more expensive
- "Pay me now or pay me later"?
  - Skimping on costs may lead to failed designs

Rapid Ethnography

Millen, 2000

- Narrow focus on important activities
- Key informants
  - "field guides" - introduce members of group
  - liminal informants -fringe members of groups
  - corporate informants
- Multiple observation techniques
  - multiple researchers
- Collaborative and computerized iterative data analysis: Nvivo

Eliciting Feedback

- Focus on tasks and goals, not systems
- Understand work, motivation, contexts
- Harder with new ideas
  - Lack of reference point,etc.
- Generally better for work contexts
  - May not be as good for less structured environments

How to Choose?

- Combine approaches
- Survey broad range of users
- Interview and observe smaller sets

Analytic Challenge

- Many hours of interviews
- Lots of notes
- Recordings, etc.
- How do we turn this into something useful?

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Interpretation Goals

- Goal: Separating the wheat from the chaff
- Summarize, organize, and communicate findings
  - Without losing potentially important insights.
- Many approaches
- Be prepared to iterate: interpretation and analysis may reveal holes in earlier understanding that defined data collection.

Grounded theory – qualitative analysis

- Starting point – no underlying theory about what's going on
- "Let the data speak"
- Identify, categorize, and organize themes and comments.

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Qualitative Coding

Preece, Rogers, Sharp, Interaction Design, 3/e

Coding Manual:

How are you doing it?

Open Coding

Identify categories, properties, dimensions

Axial Coding

Systematically elaborate On categories and link to subcategories

Selective Coding

Refine and integrate To develop a theoretical scheme

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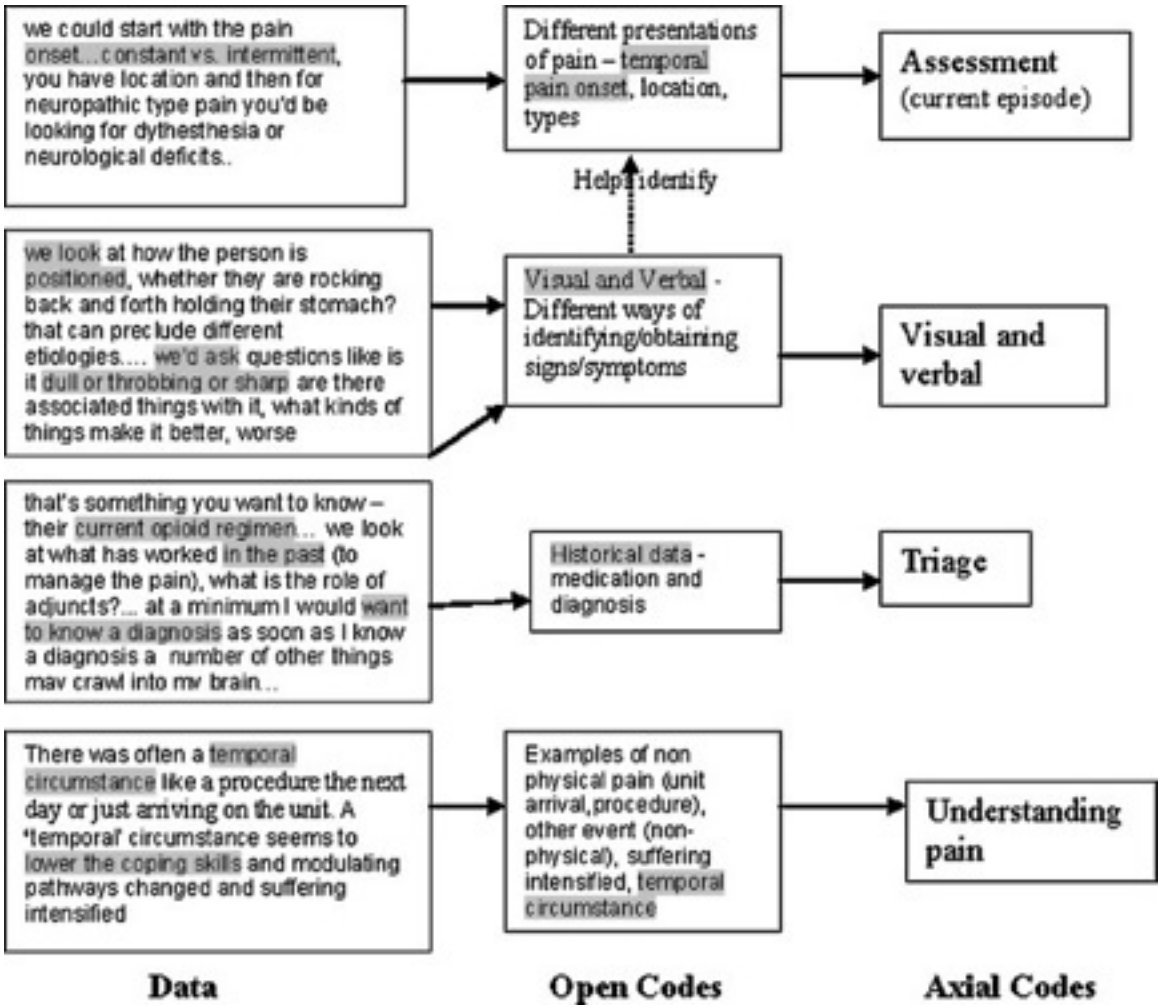
Other Types of Coding?

- J. Saldaña. **The Coding Manual for Qualitative Research**
- Not necessarily grounded -looking for something specific.
- First cycle
  - Attribute, Magnitude, Simultaneous, Structural, Descriptive, In Vivo, Process, Initial, Emotion, Values
- Second Cycle
  - Pattern, Focused, Axial, Theoretical, Elaborative, etc...

A grounded theory guided approach to palliative care systems design

Kuziemsky, Downing, Black, and Lau, IJMI 2007 http://dx.doi.org/10.1016/j.ijmedinf.2006.05.034



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Chains of Evidence

- Create a classification scheme
- Tie summarizations back to "raw data"
- Sanity check – avoids drift
- Do this throughout interpretation and analysis.

Identifying Roles

- Parts that stakeholders play
  - Primarily defined by task, not occupation
  - Role of a physician taking his children to the pediatrician?
    - Parent first, physician second.
- Generally more fine-grained than job title
  - Grad student is a researcher, student, writer, reviewer, analyst, software developer, knowledge engineer, etc...
- For each role: background, expectations, preferences, concerns (Carroll & Rosson, 2002)
- Implicit in Contextual Design

Tell Stories

- Goal: Communicate findings to others
- Graphical work models (Beyer & Holtzblatt)
  - Work flow
  - Sequence
  - Artifacts
  - Physical Environment
  - Cultural context
- Scenarios (Carroll & Rosson)
  - Text narratives

Allegheny County Health Department

Anind Dey, CMU Human-Computer Interaction Institute

Mike Wagner, DBMI, et al.

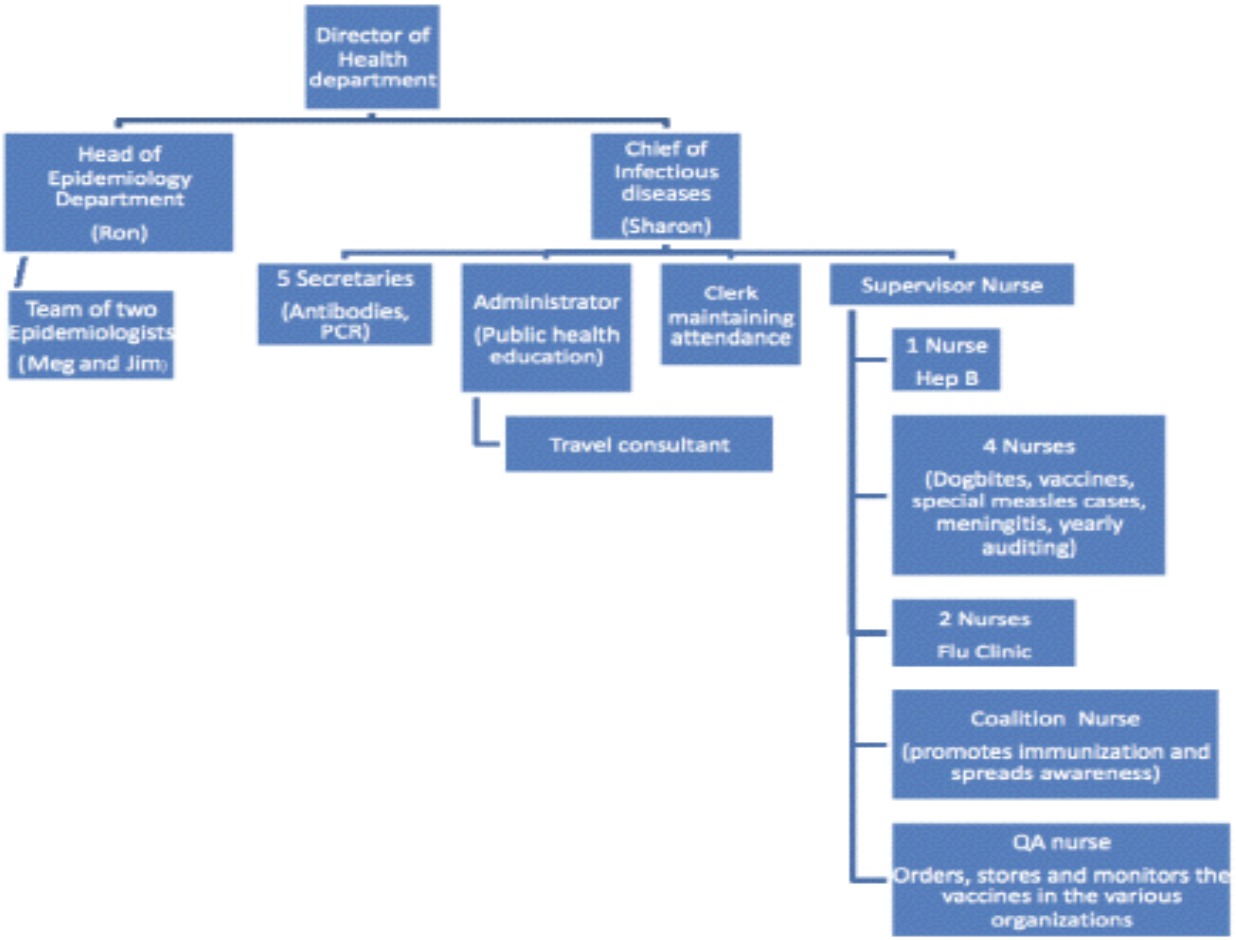
- Goal: "Understand work flow in dealing with infectious diseases in public health departments"

- Thanks to Anind Dey for content on the following slides.

Allegheny County Health Department

Anind Dey, CMU Human-Computer Interaction Institute

Mike Wagner, DBMI, et al.



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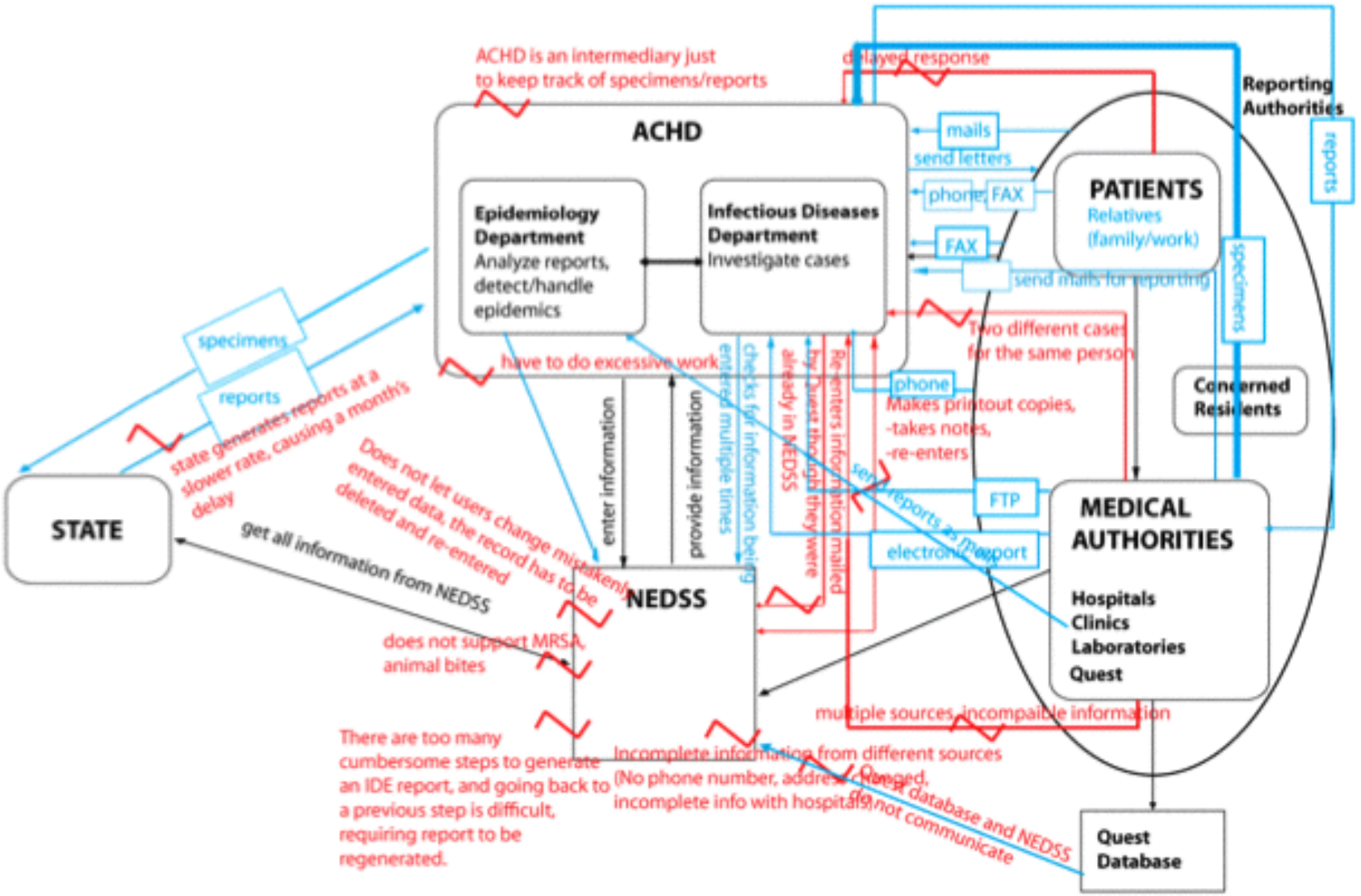
Flow Model

- Describe communication and coordination of tasks and information flow across roles

- Which roles are participants playing?
- How is work divided among people?
- Which people/groups are involved in getting work done?
- Which communication paths and tools are used to coordinate?
- Where do people go to coordinate?
- Where are the problems?

Flow Model



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Sequence Model

- Steps taken to complete tasks

- What are the steps?
- What is the intent?
- What are the triggers?
- Is there an order?
- Conditions?
- Problems?

Sequence Model

Activity	Intent		Abstract step	Breakdown
A1 - Handle applications	Make data accessable and easily sortable/shareable	S1 S2 S3	Receive apps Organize data Share app with reviewers	
A2 - Handle prereq decisions	Keep information coherent Support reviewers	S4 S5 S6	Get prereq decision from reviewers Consolidate data Share data	 Multiple versions Multiple versions
A3 - Meeting	Support comitee Produce a useful resource to build pre-req letters	S7 S8	Decision meeting Record decisions	
A4 - Communicate prereq decision	Get student acknowledgment and/or more information	S9	Inform student about prereq decision	Error prone template
A5 - Negotiate prereqs	Settle student pre-req status Keep track of communication between student and faculty Filter information	S10a S10b S11 S12	Receive appeal Receive acknowledgement Forward appeal to appropriate faculty reviewer Receive faculty decision	Communication tracking Communication tracking Communication tracking Communication tracking
A6 - Record final decisions	Finalize pre-req status	S13	Record final decision	Not enough information

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Physical Model

- Constraints of where work is done

- Components of environment that support work?
- Components that hinder?
- Tools that people use in these spaces?

Physical Model

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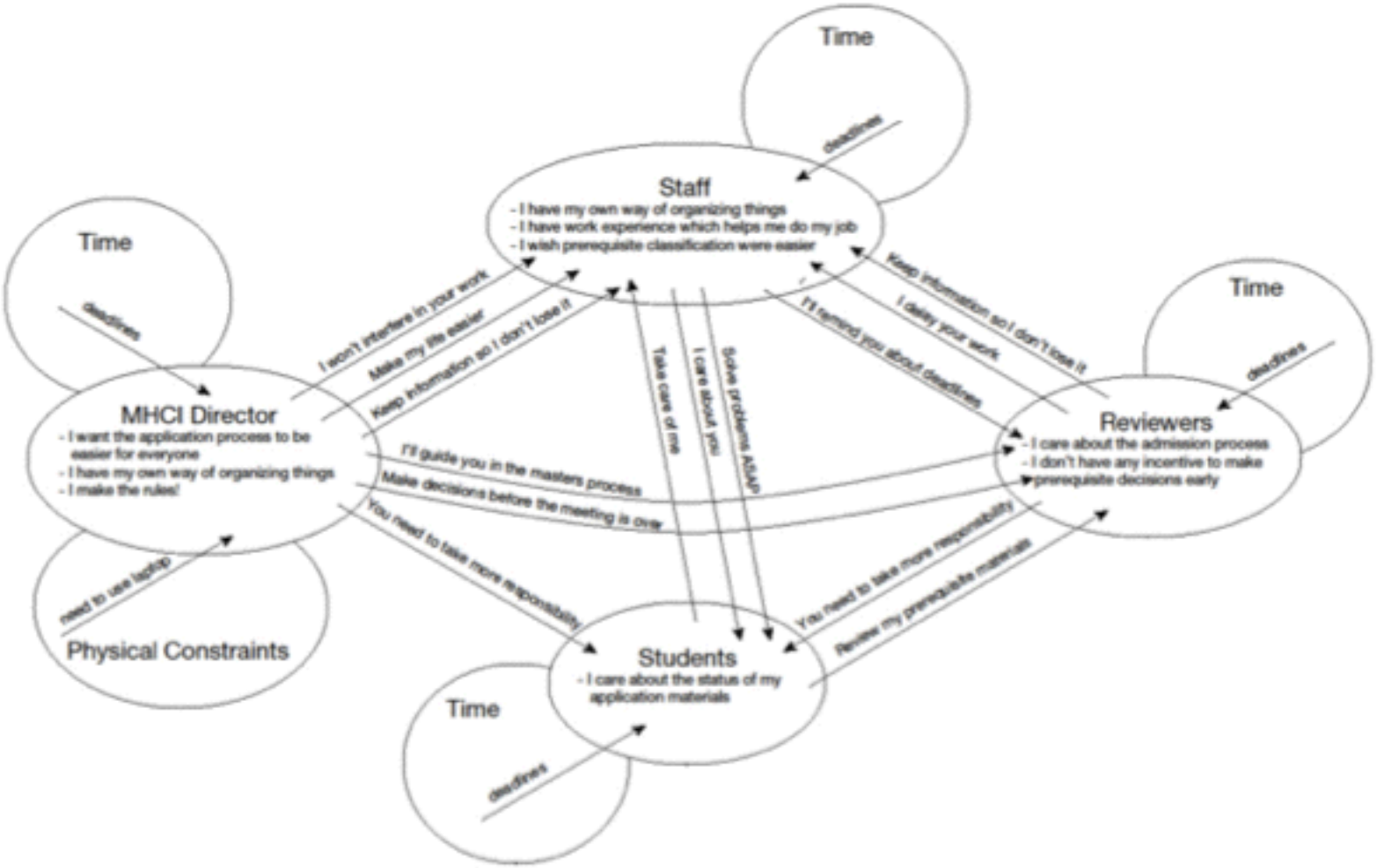
Cultural Model

- What is the overall political, organizational, social context?



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The modeling process

- Interpretation session for each interview
  - Draw models
  - Build shared design
- Consolidation of models
  - Affinity diagram – hierarchical categorization of notes from interpretation sessions
  - Consolidated diagrams – synthesis of salient components of diagrams from individual interviews
- Communicate it back to the organization?
  - But not the customers or stakeholders?

Affinity Diagram

(Anind Dey)

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Use of contextual inquiry to understand anatomic pathology workflow Ho, Arridor, and Parwani 2012

- Anatomic pathology workflow
- Contextual inquiry with 6 participants
  - varying experience
- Six initial sessions + 2 follow-ups
- 254 distinct affinity notes
  - 4-level categorization
  - Top-levels: technology, communication, synthesis/ preparation, organization, workflow

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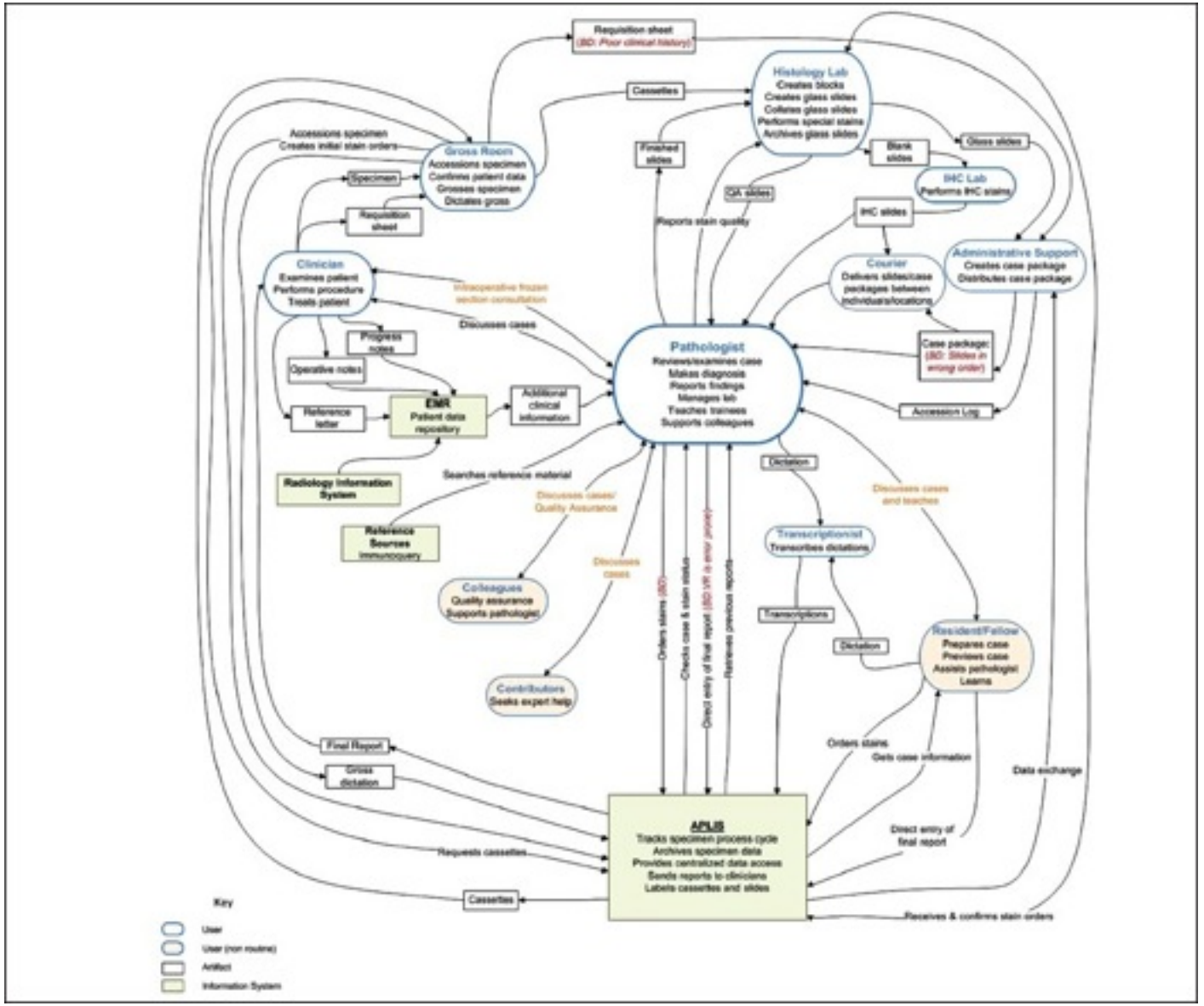
Flow Model

Ho, Arridor, and Parwani 2012



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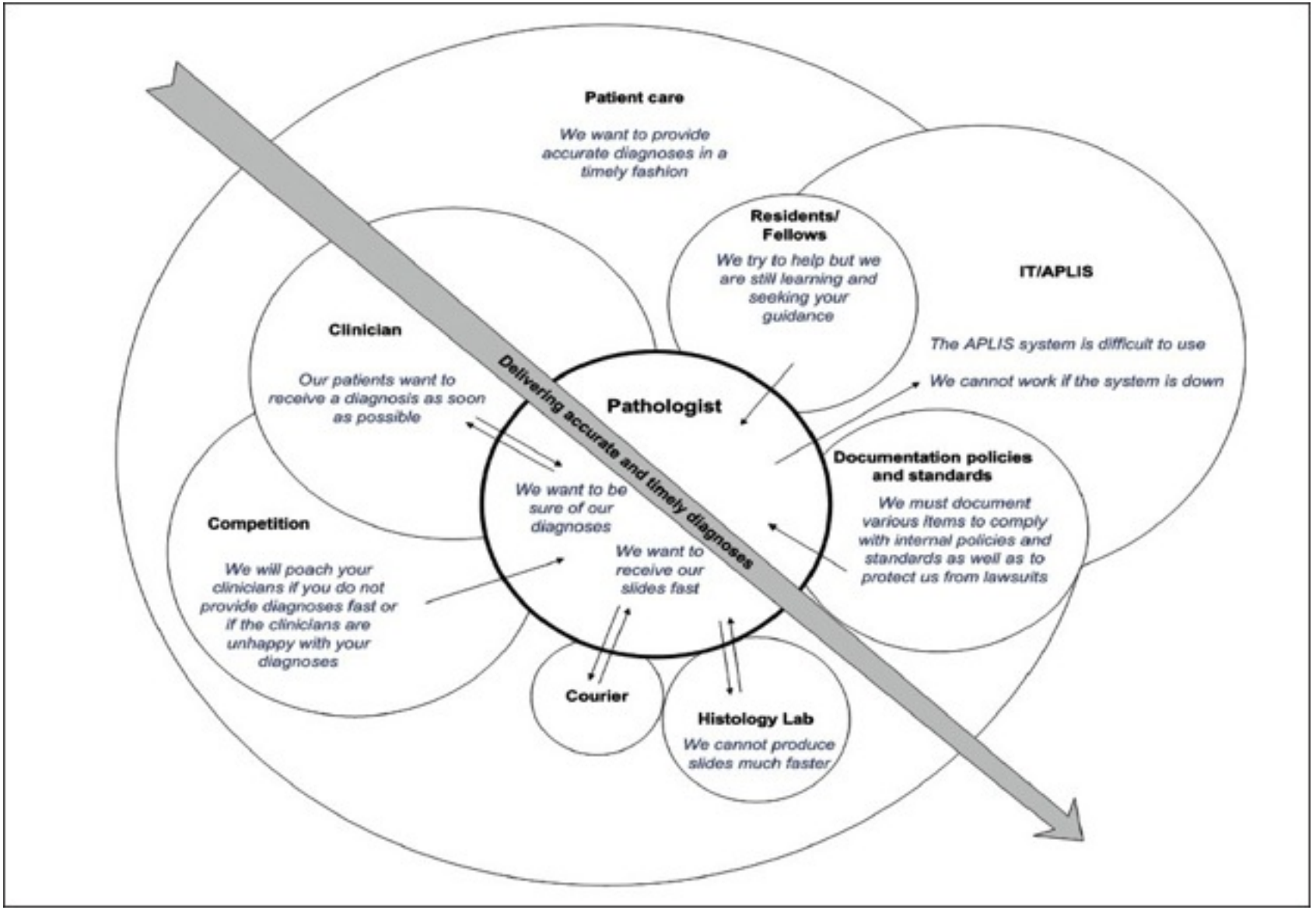
Cultural Model

Ho, Arridor, and Parwani 2012



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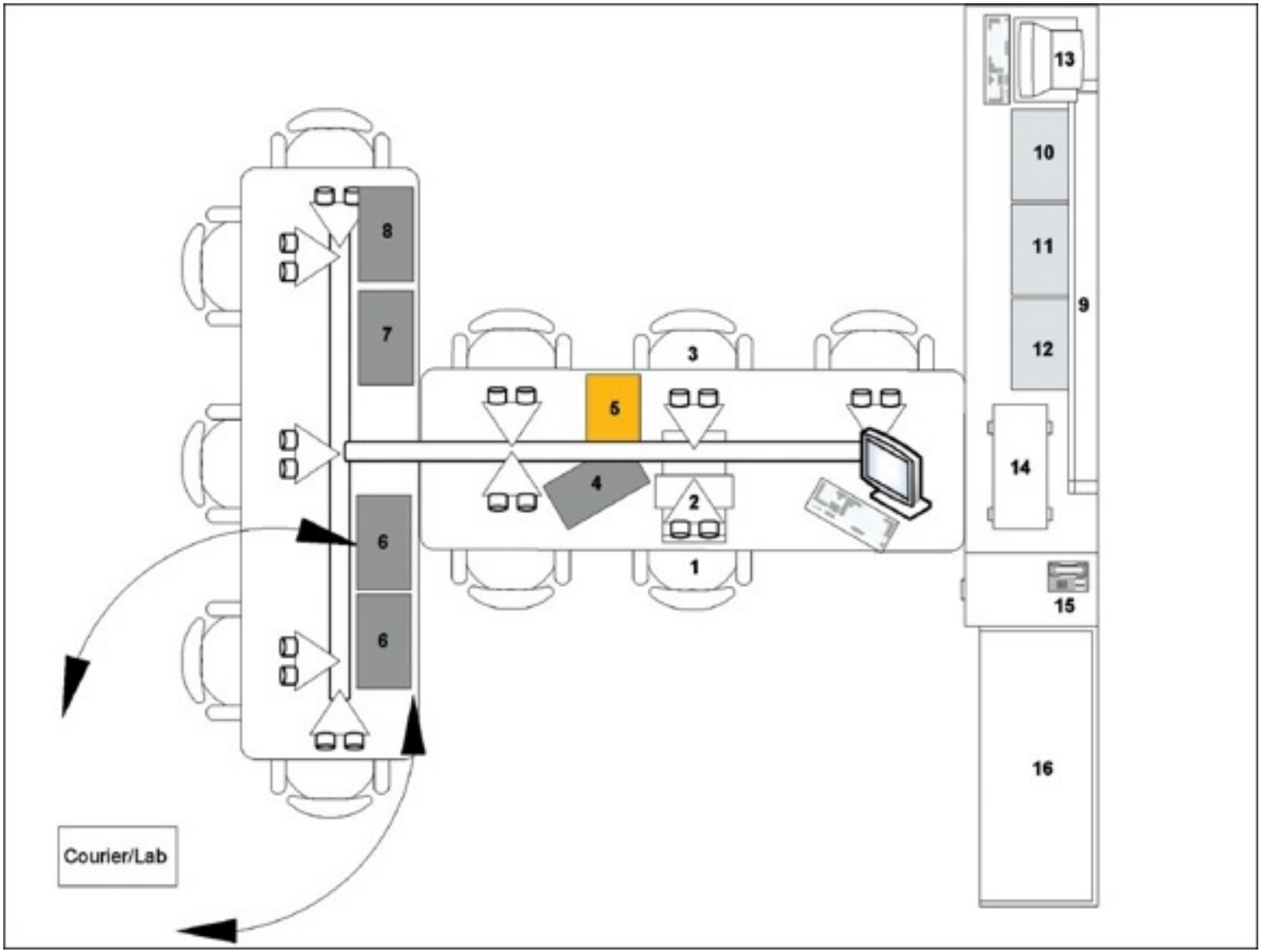
Physical Model

Ho, Arridor, and Parwani 2012



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Recommendations

Ho, Arridor, and Parwani 2012

1. Offer experience similar to glass slides
2. Include functionality of slide tray
3. Include virtual working draft of report
4. Reports must be accurate, complete, and timely
5. Help pathologists develop relationships with clinicians
6. Provide info on caseload - for planning
7. Support different approaches for different specimen types
8. Support communication/consultation
9. User multiple information sources
10. Clarify orientation of tissues within block and slide
11. Key task: recognize differences between normal and abnormal based on stains
12. Communicate between path. info. system and digital slide system

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Validity Concerns

- Goal – analysis should reflect reality..
- If it doesn't, there's a problem
- Where could we go wrong?
- How to address validity?

Validity

- If n researchers agree consistently, we can't be far off.
- Quantitative
  - Agreement
  - Inter-rater reliability
- Qualitative
  - Consensus – discuss and revise until convergence

Consolidated Models for data driven design – Flow Model

- Flow model
  - Eliminate redundancy -automate or eliminate roles, Organize roles, support task switching, reassign responsibilities or roles, support communication between roles, define new roles and job responsibilities
- Sequence Model
  - Eliminate steps that are not key, render goals or subgoals irrelevant, account for all secondary intents, redesign activities that are constrained by artifacts that might be changing – look at the why, not the what.
- Use models to identify opportunities for improvement

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Alternative Approaches – Scenario-Based Design (Rosson & Carroll 2001)

- Tasks Analysis – like sequence flows, but hierarchical
- Summary of themes
- Hypothetical stakeholders
- Series of increasingly-detailed scenarios
  - Refine towards design
- Claims Analysis – pros and cons of various features.
- Scenarios also good for communicating research results-
  - SearchTogether

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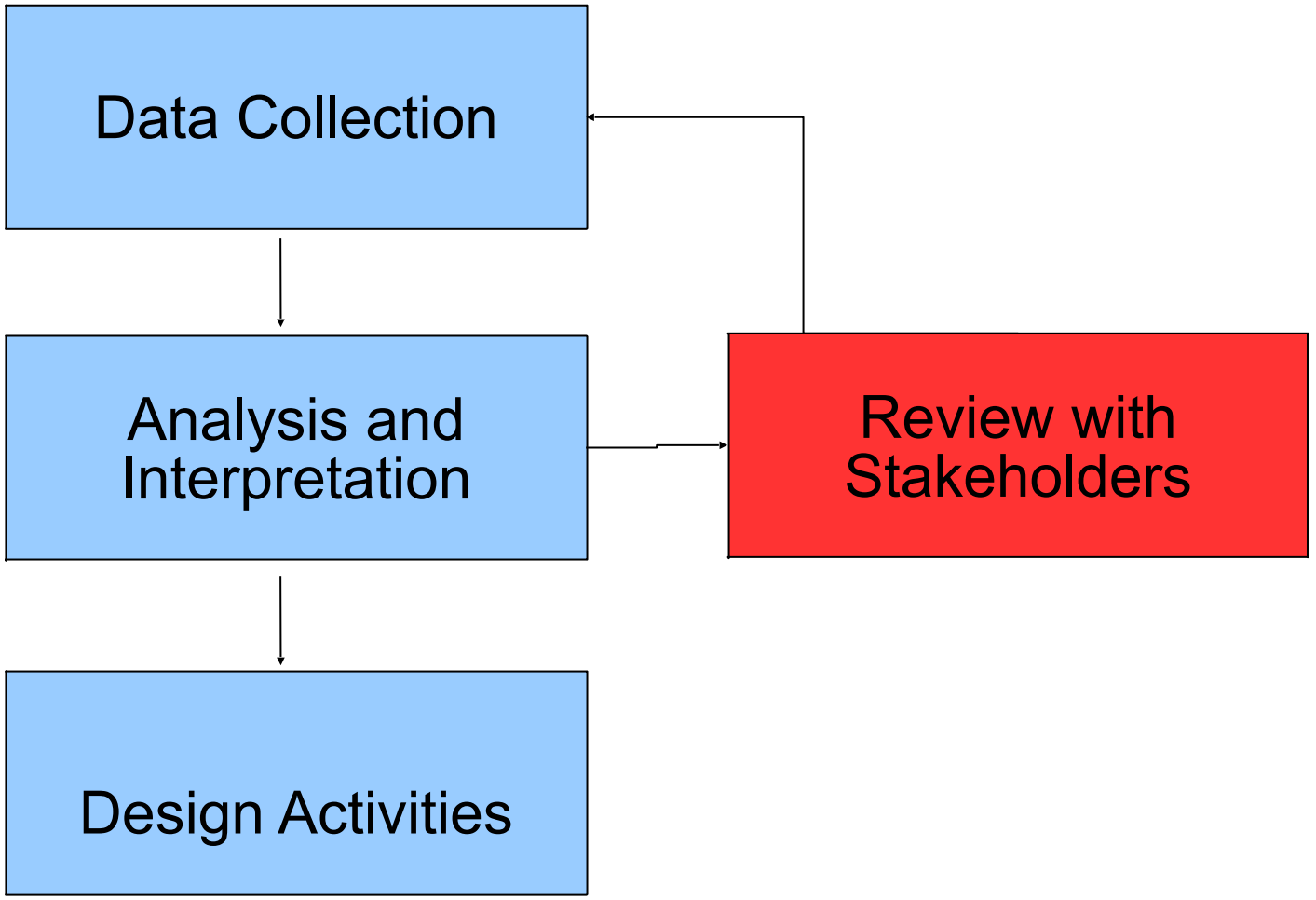
After Interpretation

Before designing..

How do you know you've got it all, and got it right?



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How to Inform Design?

- Goal – go from all of this data to design
- Design of what?
  - Software artifacts
  - Underlying work processes
- Easier said than done
  - Secondary intents
    - Systems for tracking medical device repair might be used to track productivity of individual technicians
  - Cultural issues: control, resistance to change, diverse stakeholders…
  - Issues of trust and authority – customers vs. stakeholders?

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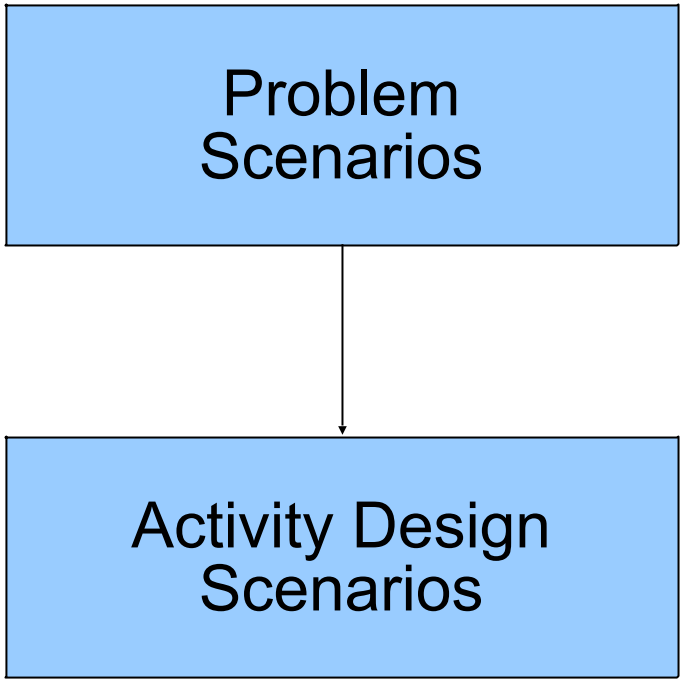
Activity Design Scenarios



Original description of motivating challenges

Description of how proposed design will meet those challenges

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Storyboards

- Cartoonish depictions of interaction designs/visions
- Design to communicate ideas
  - Particularly for stakeholders
- Tell the story graphically – graphical scenarios..

Storyboards

- Amal Dar Aziz – Guide to storyboarding http://hci.stanford.edu/courses/cs147/assignments/storyboard_notes.pdf

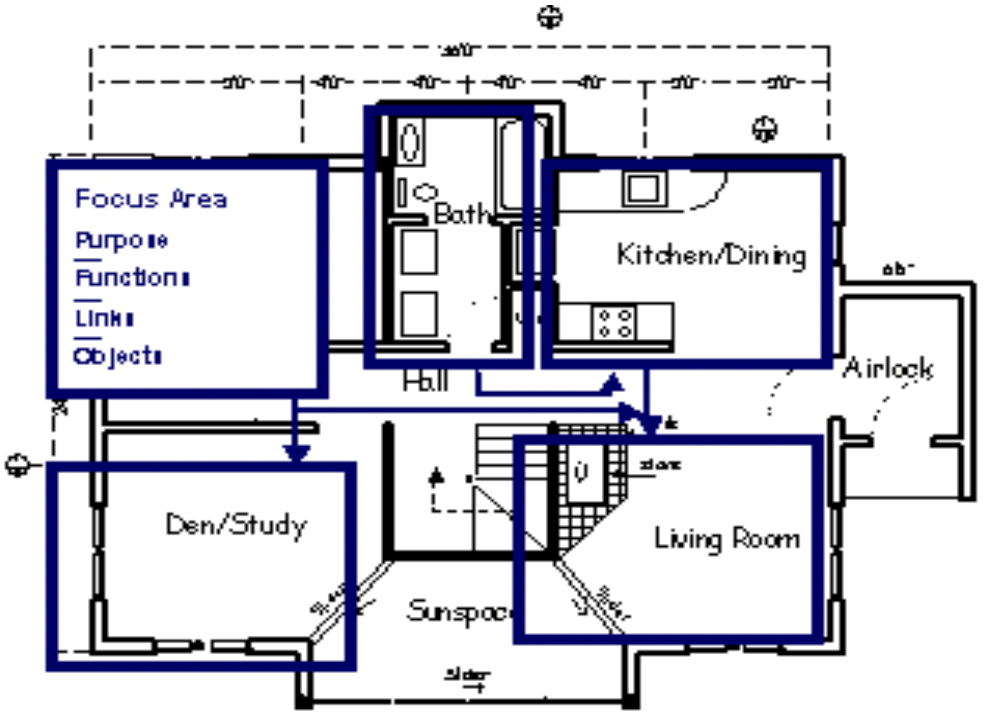
Storyboards/Scenarios are not prototypes

- Continuing goal: communicate vision
  - Avoid miscues
- Convey broad ideas of design
- Focus on big ideas
- Prevent/discourage rapid descent into micro-critiques
  - "That button should really be in the lower-right corner..."
- Prototypes will come along soon enough

User Environment Design

- Storyboards and scenarios are not necessarily complete
- Tie them together in some coherent whole?
- System-level view
- System-level diagrams to try to layout relationship between activities how well does it hang together.
- Analogy -architectural floor plan?

Floor plans as inspiration…



- Show overview of how things fit together – not too much detail

S. Wood 2003 Using a Floor Plan as a Metaphor for Design: Is your product a dream house, or a construction nightmare? http://incontextdesign.com/articles/using-a-floor-plan-as-a-metaphor-for-design-is-your-product-a-dream-house-or-a-construction-nightmare/

User Environment Design

- Focus areas with functions, link, objects.
- Defines overall structure of how things will get done
- Built up from storyboards
- Can guide development – one "room" or focus area at a time…
- Not UML Design!
- Beyer & Holtzblatt do not discuss with stakeholders.
  - Why not?

Prototypes

- User Environment Design - informs interface design
- Two challenges

- How to do the design
- How to use prototypes to engage users and validate design

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Prototypes

- Pre-release functionality for evaluation
- feedback prior to large investment in development

Storyboard

Paper prototype

Wizard-of-Oz

Video Prototype

Computer Animation

Rapid Prototype

Working System

Low Cost, Low Fidelity

High Cost, High Fidelity

Rosson & Carroll, 2002

Paper Prototypes

(thanks again to Anind)

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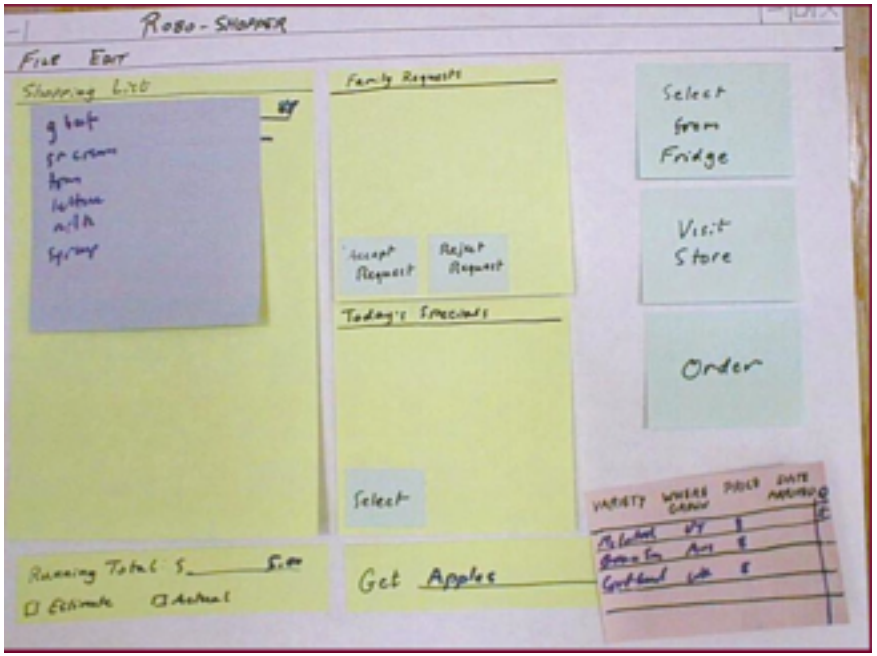
Prototypes evolve



H. Beyer & K. Holtzblatt, Contextual Design. ACM Interactions, 1999

- Explore with users
- Modify on the fly
- Insights inform
  - Redesign
  - Revision of earlier findings
  - New visions
- Iterate

- Other forms
  - More detailed mockup
  - "Wizard-of-Oz"

- Don't get too pretty too quickly
  - Discourages feedback

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Prototypes as means, not ends

- Final design may not look like prototype at all, and that's fine.

Paper Mockup of Stembook

www.stembook.org

Das, et al. 2008 Linked Data in a Scientific Collaboration Framework

The Prototype Paradox

- Prototypes are supposed to be throw-away, but...
- ..they tend to take on a life of their own
  - Especially when presented as (possibly minimally) working software
- Another argument for staying with paper as long as possible
- Try multiple prototypes to explore broader range of ideas