Looking Back ...

- Humans
  - Understanding them needs knowledge from many fields
  - Processing information by humans can be modelled
  - Human physiology plays an important role for designing systems
  - Vision
    - eye tracking, eyes can be tricked, preattentive processing
    - Gestalt psychology
  - Hearing
    - audibility, pain threshold, spatial hearing
  - Touch
    - input and output
  - Memory
    - sensorial, short term (working), and long term memory
    - short term memory: 7 ± 2 chunks
    - long term memory: episodic and structural memory
    - generate new information: deduction, induction, abduction

Looking Back ...

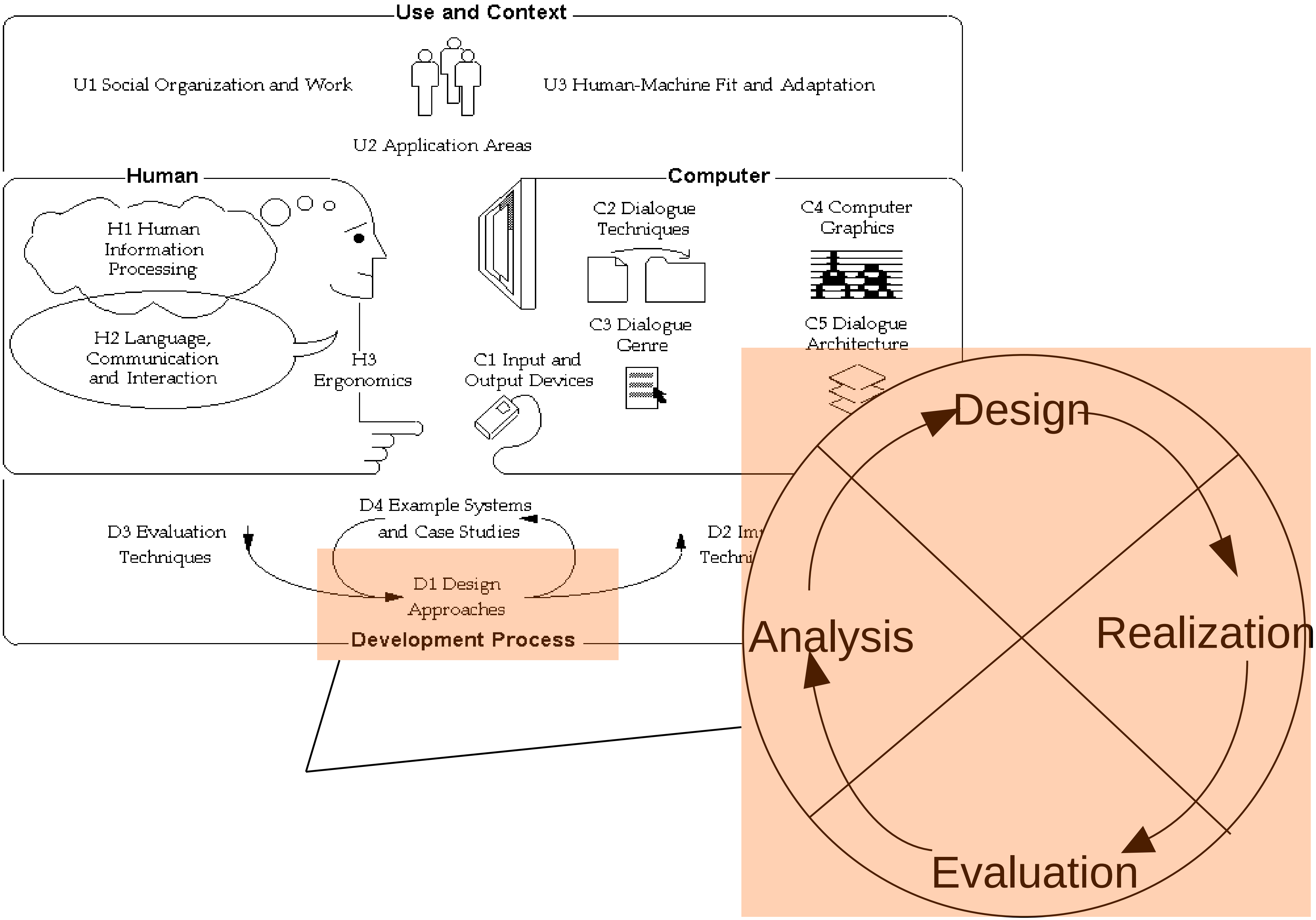
- Affordances
  - – Attractive things ‘work’ better (i.e. are often perceived as easier to use)
  - – Perceived affordance is the perceived possibility for action
    - » not only bc learned by conventions, feedback, etc.
- Intuitiveness
  - – Do not rely on something to be intuitive, especially with regard to virtual interfaces
  - – Providing clear perceived affordances and constraints can help the user
  - – Use previous knowledge, e.g. metaphors for interaction
- Signifiers
  - – Indicators in the physical or social world that can be interpreted meaningfully
  - – Help to make possible actions and states visible
  - – Often unconsciously / unintentionally (e.g. are still people waiting for the bus?) but can be applied intentionally (show a scrollbar to indicate length)

8 User-Centered Development Process

8.1 Software Development Process Models

8.2 User-Centered Development

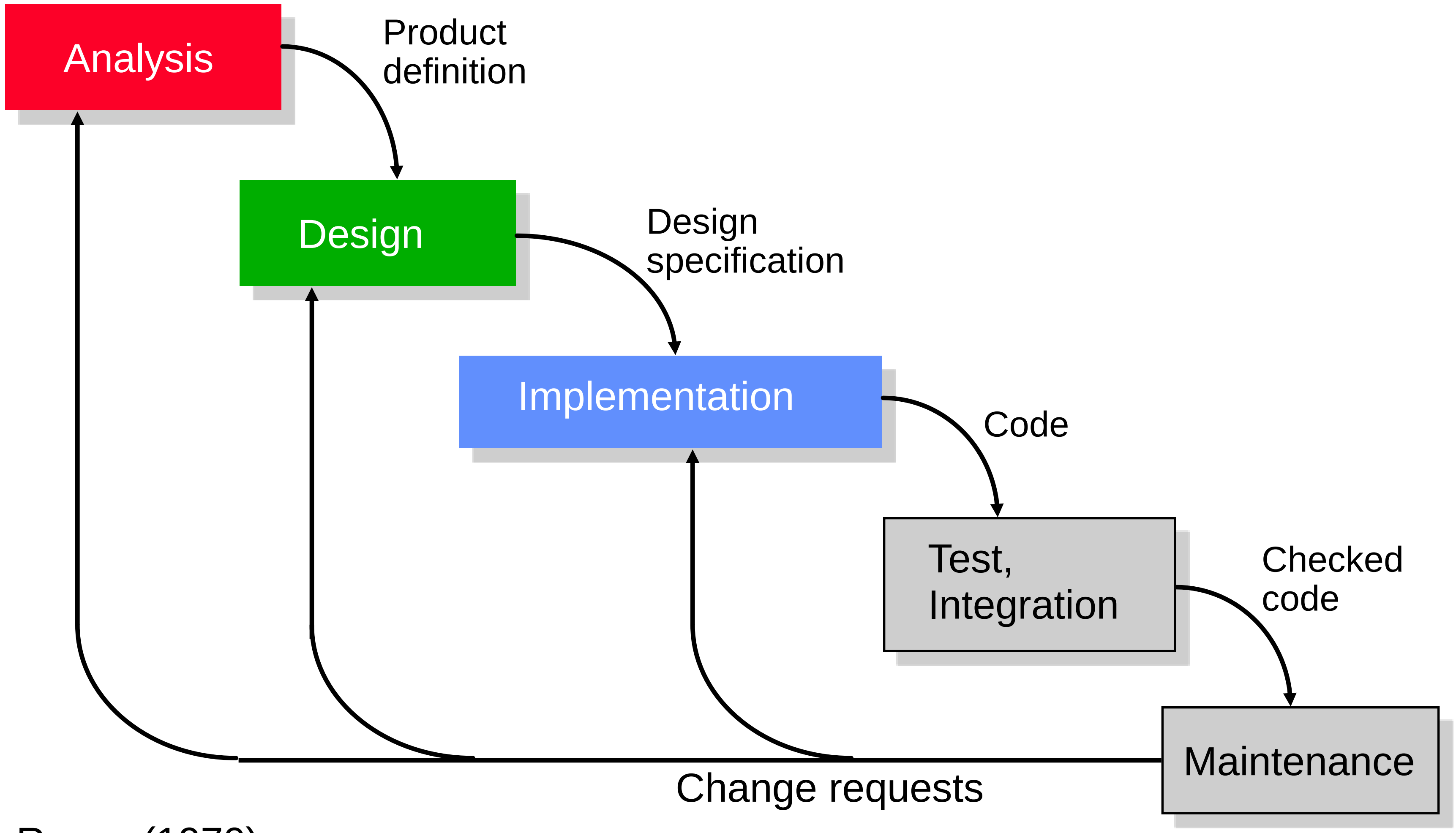
8.3 Integrating Usability into the Development Process


Use and Context
U1 Social Organization and Work
U3 Human-Machine Fit and Adaptation
U2 Application Areas
Human
Computer
H1 Human Information Processing
H2 Language, Communication and Interaction
H3 Ergonomics
C2 Dialogue Techniques
C4 Computer Graphics
C3 Dialogue Genre
C5 Dialogue Architecture
C1 Input and Output Devices
D4 Example Systems and Case Studies
D3 Evaluation Techniques
D2 Im
Techni
D1 Design Approaches
Development Process
Design
Realization
Evaluation
Analysis

Software Development Process Model

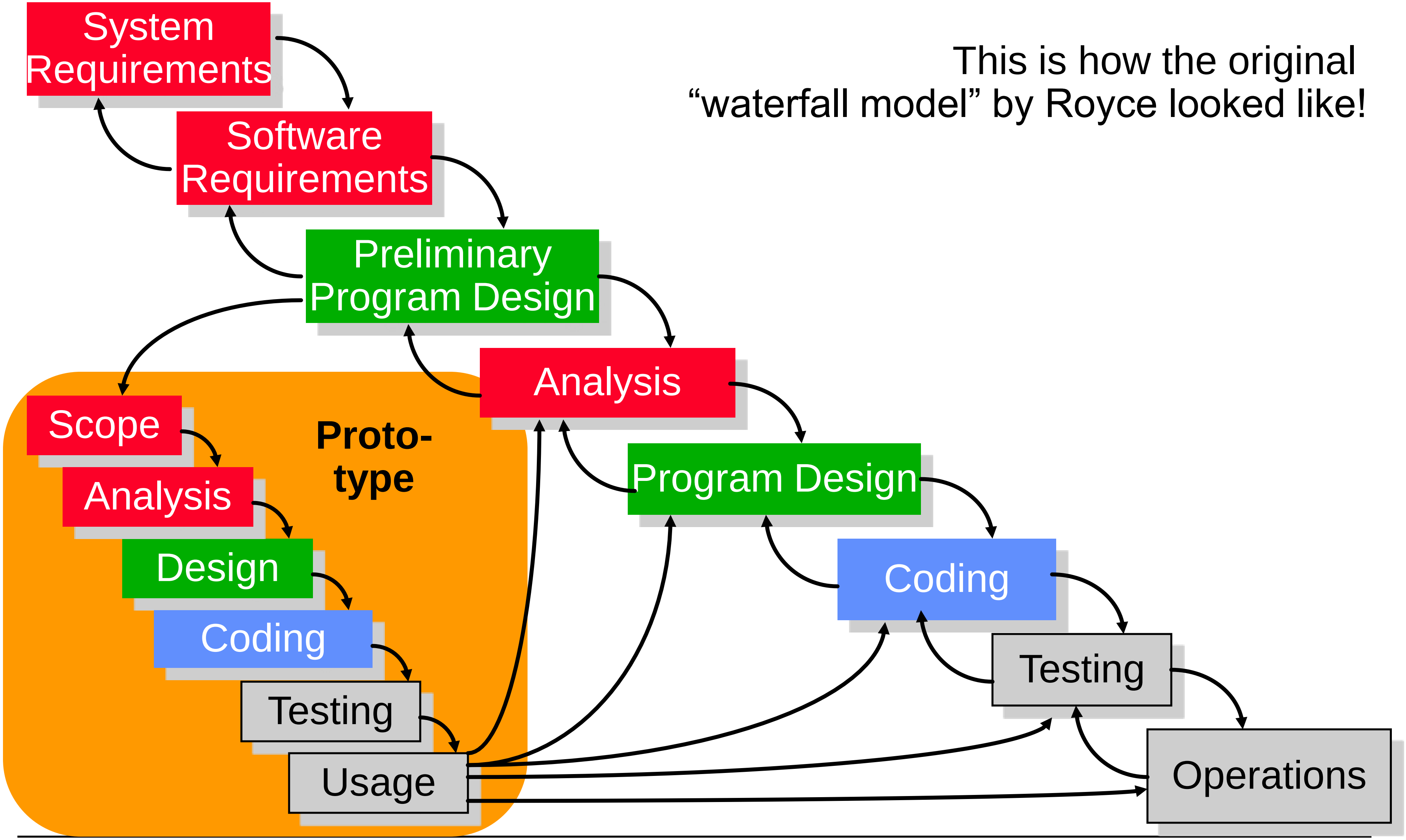
- ***Process model***
  - Segmentation of the overall (team) activity of software development into smaller portions of work
    - » high-level structure: phases
    - » low-level structure: steps, activities
  - Definition of an order for carrying out work units
  - Guideline for the production of intermediate results
- Basic activities covered in all models:
  - Analysis
  - Design
  - Implementation
  - Validation (in particular Test, Integration)
  - Deployment (in particular Maintenance)

“Pure” Waterfall Model



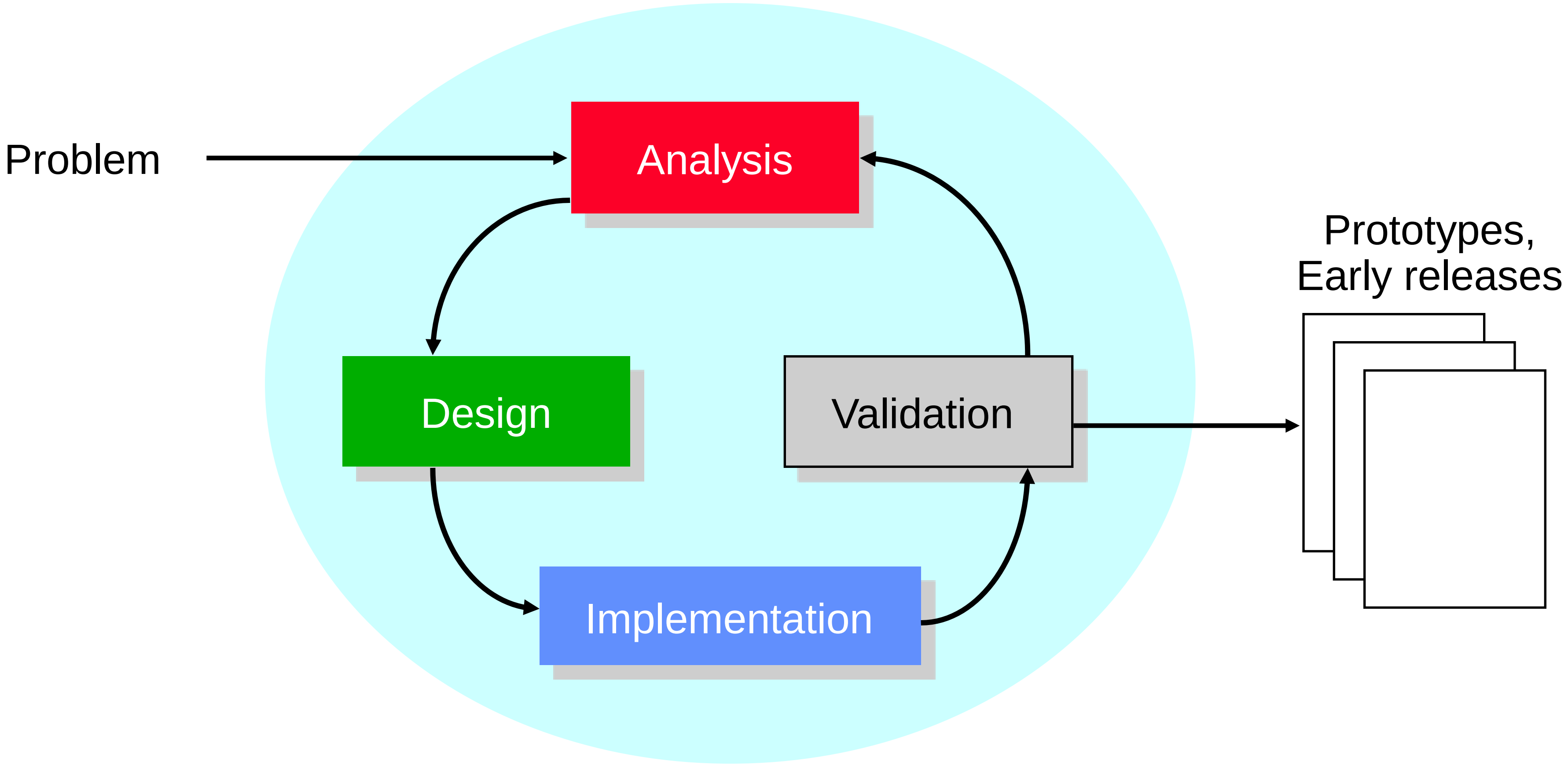
W. Royce (1970)

"Waterfall" with Feedback Loops and Prototyping



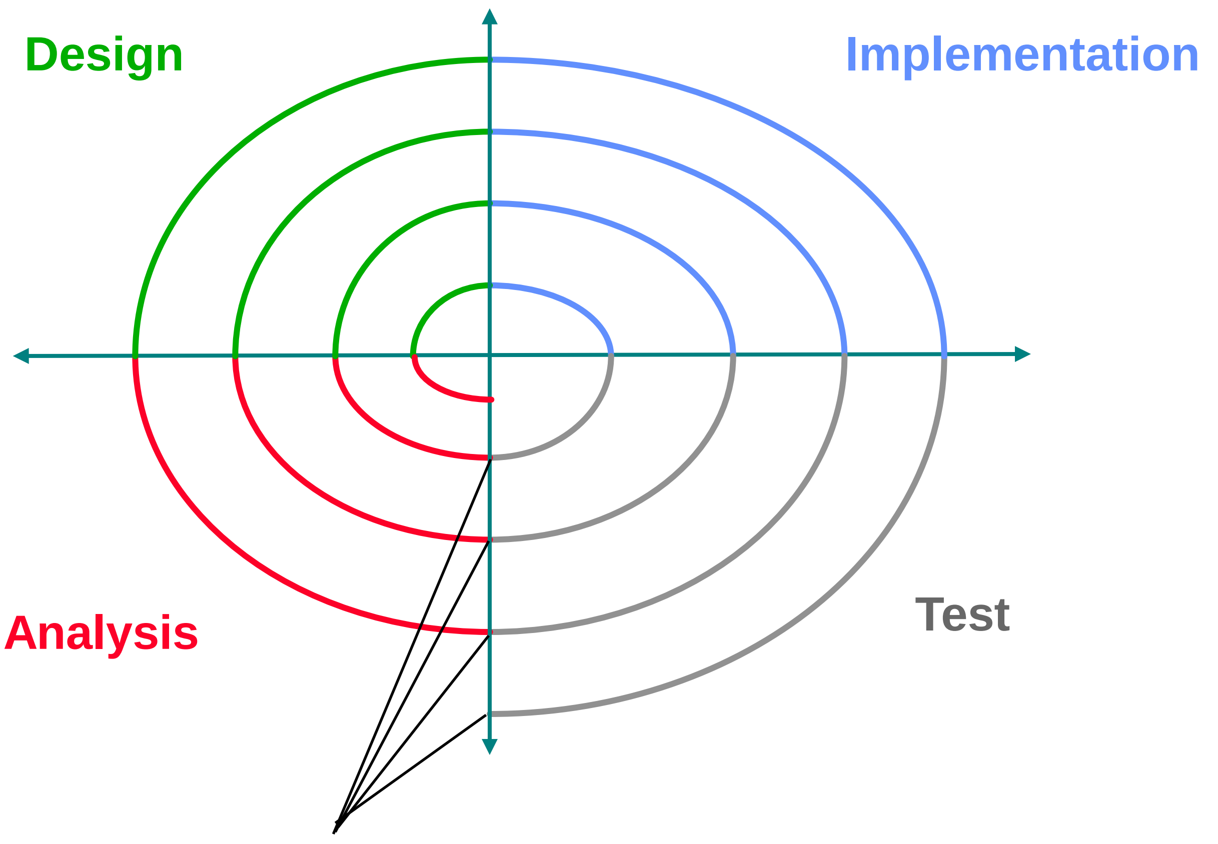
This is how the original "waterfall model" by Royce looked like!

Evolutionary Development



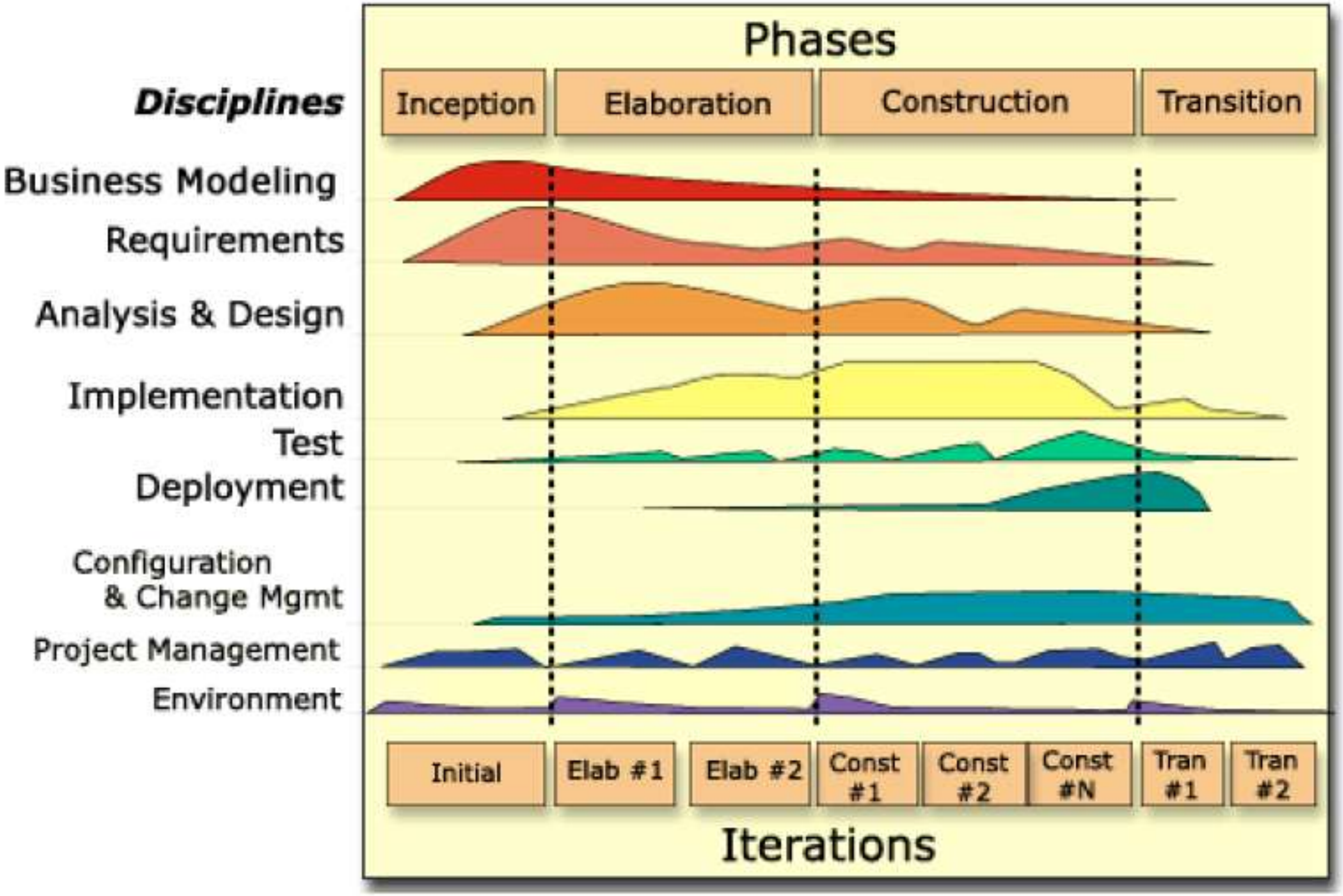
- Typical for small projects and experimental systems
- Technological progress (e.g. object orientation) may have improved scalability to large systems

Modern Adaptation – “Spiral Model”



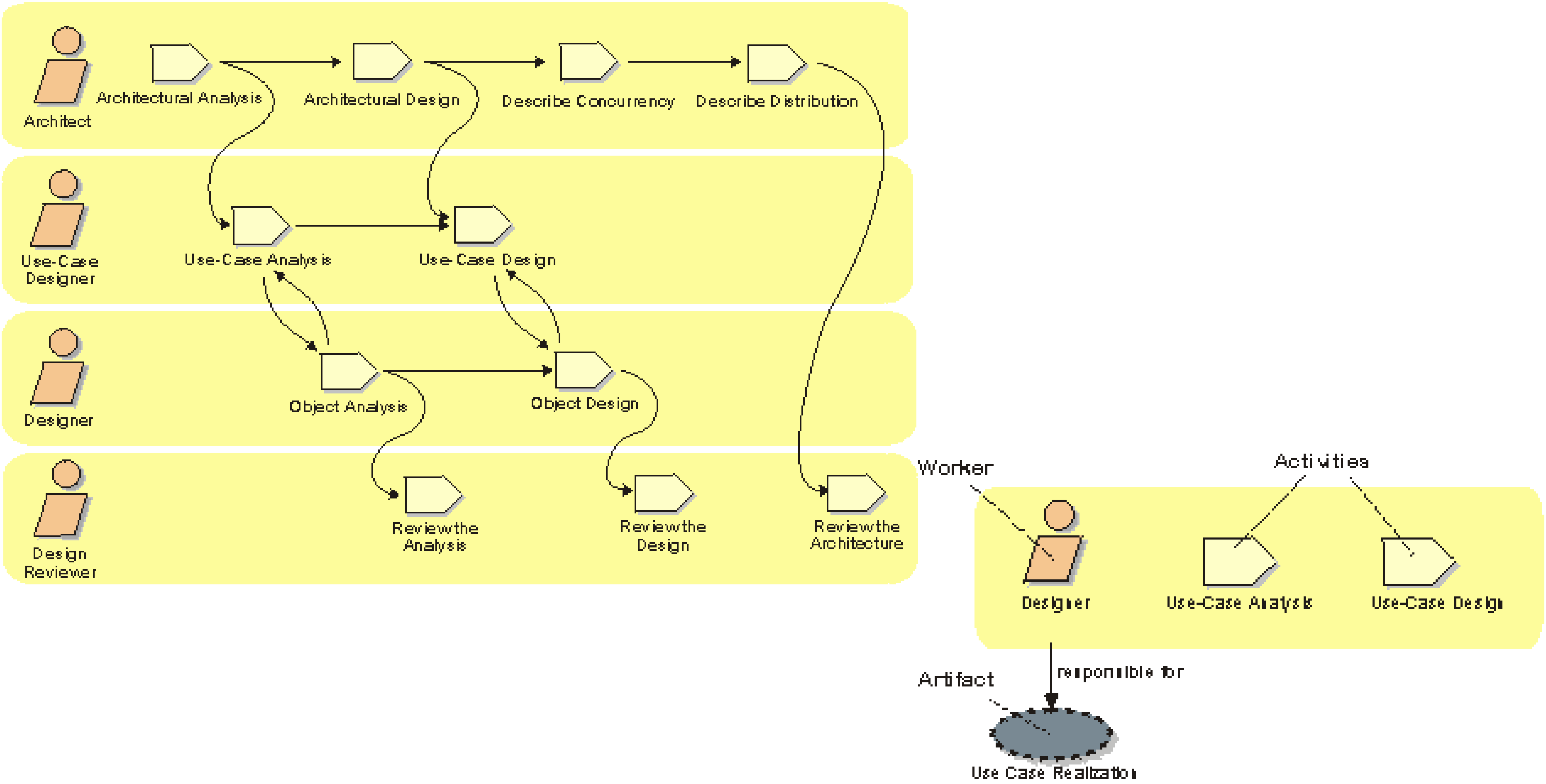
Products (Releases)
including *Prototypes*

Rational Unified Process (RUP)



Software Process framework is a commercial product of Rational, now IBM.

Detailed Prescriptions in RUP



- Developers often consider this as not flexible enough fo creative work.

Agile Development

- "Agile" Software development (www.agilemanifesto.org):
  - E.g. Extreme Programming (XP), Crystal, Scrum
- Recent trend in software development processes
  - Radical evolutionary development
- Key characteristics of agile development:
  - Individuals and interactions (rather than processes and tools)
  - Working software (code rather than extensive documentation)
  - Customer collaboration (instead of contract negotiations)
  - Responding to change (instead of following a plan)
- Agile development is not just “hacking along”!
  - Clear and strict rules
- Mixed information about success in practice
  - Good experiences in small and innovative projects
  - Large-scale projects tend to stay “conservative”, mainly due to transparency for project management

8 User-Centered Development Process

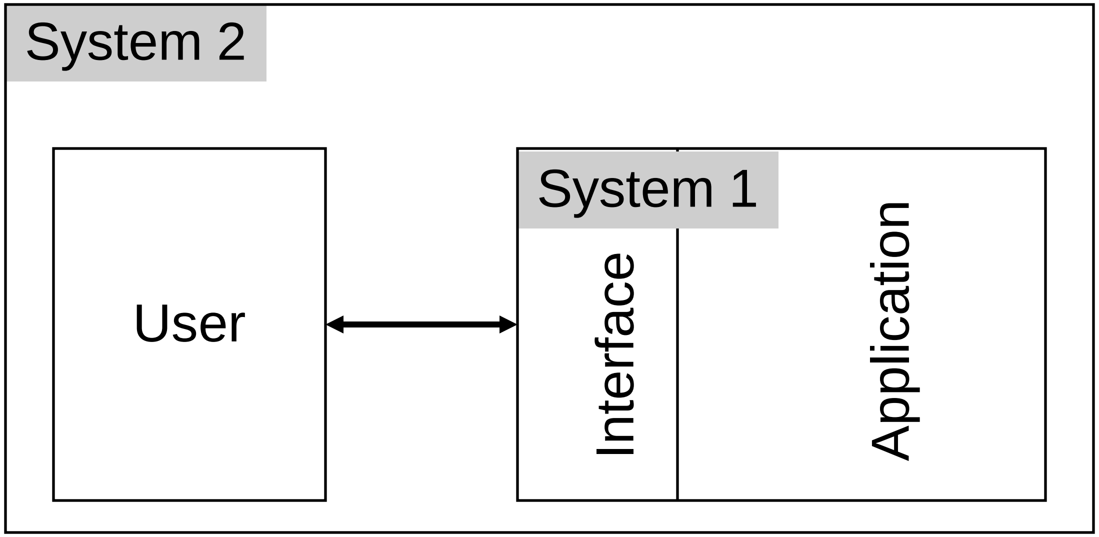
8.1 Software Development Process Models

8.2 User-Centered Development

8.3 Integrating Usability into the Development Process

Usability Aspects are Mostly Ignored by Software Engineers

- Example:
  - IEEE “SWEBOK” body of knowledge definition for SE mentions HCI as “related discipline” under the name “software ergonomics”
- System perspectives
  - SW Engineers take the “System 1” perspective
  - Usability Engineers take the “System 2” perspective (following examples)



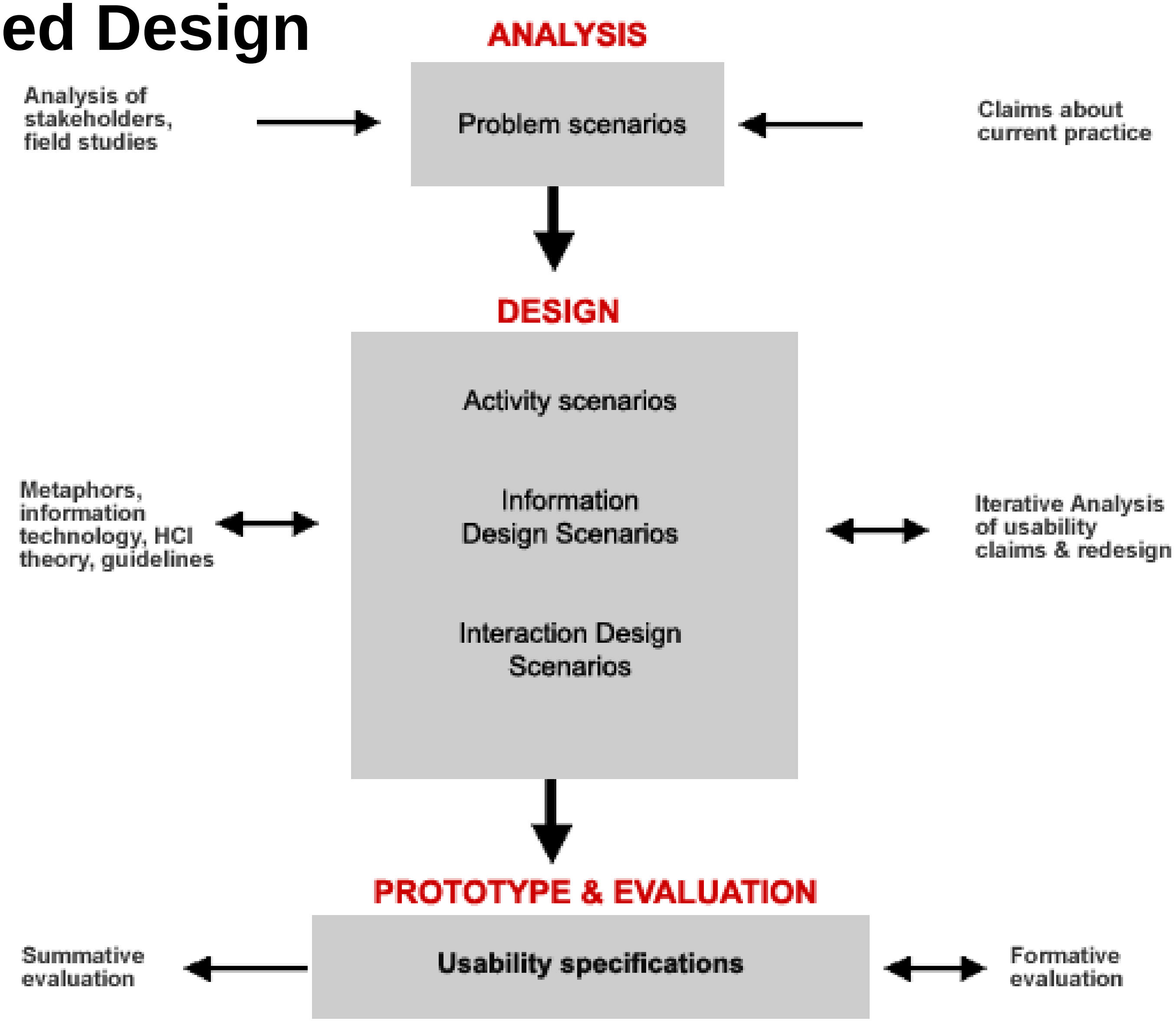
Seffah/Desmarais/Metzker

Separation between Interaction Design and Technical Design

- For interactive applications a separation into a two stage process is often advisable
- 1st – Interaction design (iterative)
  - concept
  - Interaction analysis
  - Prototypes
  - Evaluation
  - Stable and tested design
- 2nd – Technical realization
  - Technical analysis
  - Technical specification (e.g. architecture, platform)
  - Implementation
  - Evaluation and Quality management

Scenario-Based Design

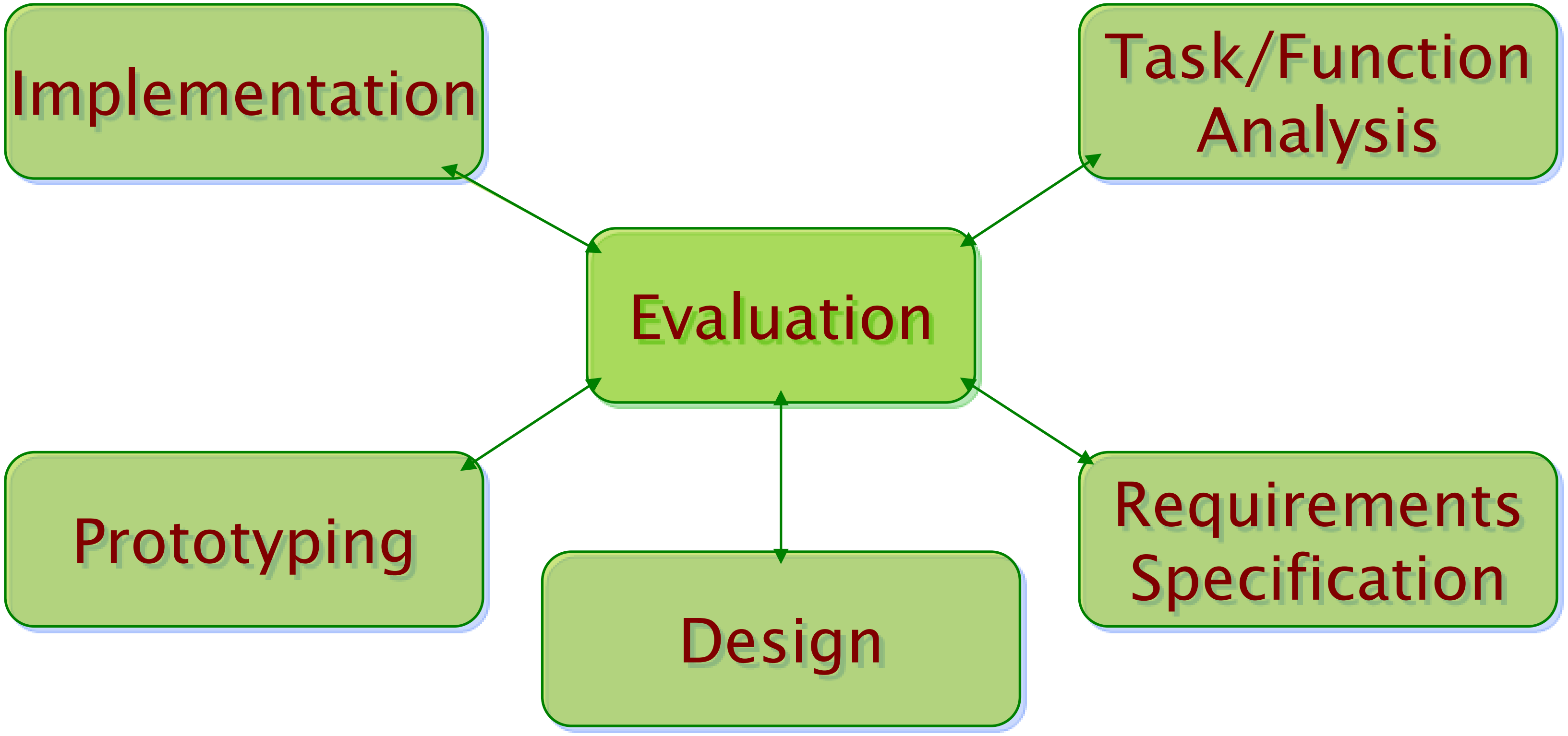
- Mary Beth Rosson, John M. Carroll: Usability Engineering - Scenario-Based Development of Human-Computer Interaction, Academic Press 2002


ANALYSIS
Analysis of stakeholders, field studies
Problem scenarios
Claims about current practice
DESIGN
Activity scenarios
Information Design Scenarios
Interaction Design Scenarios
Metaphors, information technology, HCI theory, guidelines
Iterative Analysis of usability claims & redesign
PROTOTYPE & EVALUATION
Usability specifications
Summative evaluation
Formative evaluation

Scenarios and Claims

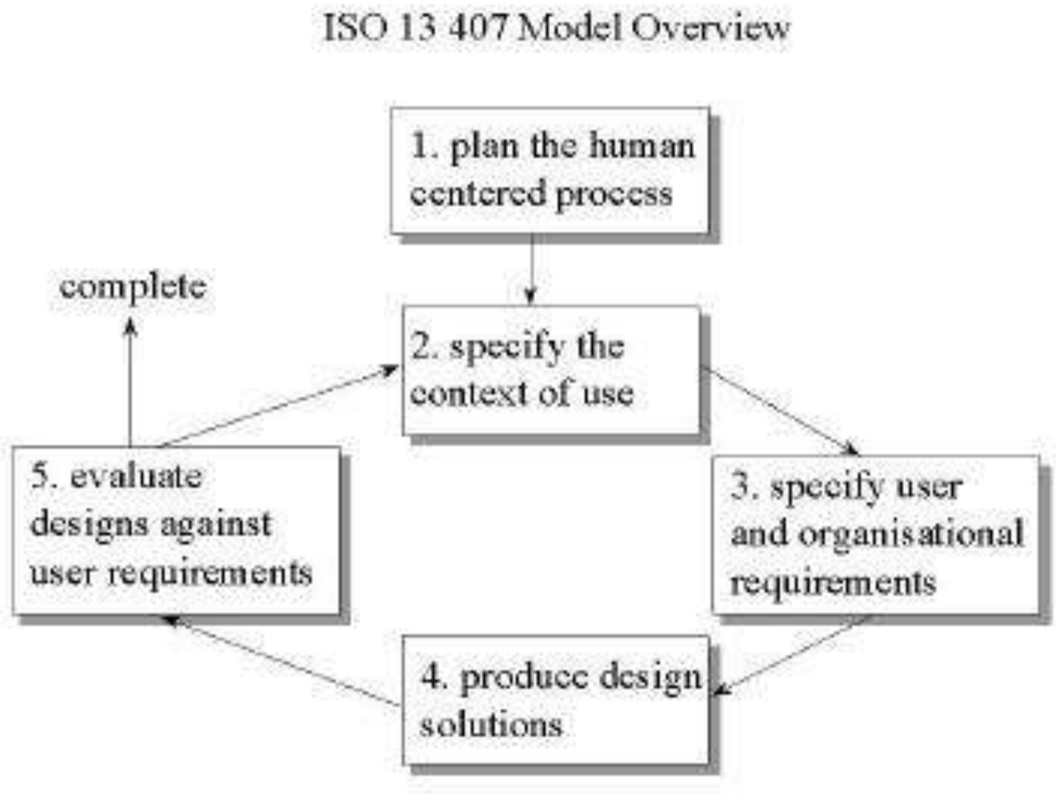
- Scenario
  - Scenarios describe an existing or envisioned system from the perspective of one or more real or realistic users.
    - » Example: "A person turned on a computer; the screen displayed a button labelled Start; the person used the mouse to select the button."
- Claim
  - Claims are psychologically motivated design rationales that express the advantages and disadvantages of a design as a usability issue
  - Relating properties of the artefact with specific psychological consequences, under the scope of a basic task usage situation
    - » Example: including open-ended exercises in an instruction manual supports learning-by-exploration
    - » Example: “returning the user to the Create or Revise menu is adequate feedback that an option change attempt is successful *(but may not be enough feedback for users who are unsure or confused)*”
  - Encourages designer to reason about trade-offs rather than accepting a single guideline or principle

Star Lifecycle



- Hix, Hartson 1993
  - Non-sequential: any order of activities
  - Evaluation-centric: every activity is evaluated
  - Interconnected: evaluation connects everything

ISO 13407


ISO 13 407 Model Overview
1. plan the human centered process
2. specify the context of use
3. specify user and organisational requirements
4. produce design solutions
5. evaluate designs against user requirements
complete

- Guidelines for integrating usability aspects into the development process
  - Proposes iterative process
  - Stresses evaluation
  - Design solutions cover also lightweight prototypes, mock-ups etc.
- See e.g. http://www.ucc.ie/hfrg/emmus/methods/iso.html

Problems of User Centered Design

- Users may be wrong
- Users may be resistant to change
- Users may expect disadvantages (e.g. being replaced by software)

- Be aware – you are expected to create an optimal system with regard to ***the goals specified***
  - this is unfortunately NOT necessarily the system users would like to have (e.g. trade-off between employers and employees)

8 User-Centered Development Process

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Concurrent Workflows, Competing Cultures

- User Interaction Design and Software/System Design are concurrent activities
  - One depends on the other, one influences the other
- Separate cultures led to competing models of the development process
  - Software Engineering: Artefact-centric (e.g. design documents), disciplined order of steps, quantitative evaluation (metrics, tests), highly compatible to project management needs
  - User-Centred Development: Interdisciplinary, loose (e.g. rough guidelines), flexible in order of steps, open to late changes, continuous qualitative evaluation (e.g. user tests with prototypes), difficult to “sell” to project managers
- Ambiguous overlaps in terminology
  - The same terms are used in many methods with differently defined or weakly defined semantics
    - » E.g. “scenario”, “use case”, “test”
- Integration of process models
  - “Interface development is transitioning from an artistic exercise into an engineering discipline.” (Curtis/Hefley)

Concurrency of UI and SW Engineering

User Interface Engineering		Development Phase		Software Engineering
User & task analysis	⇐	**Requirements analysis**	⇒	Application design
Human vs. Machine	⇐	**Requirements allocation**	⇒	Hardware vs. Software
Dialogue design	⇐	**Preliminary design**	⇒	Architectural design
Screen design	⇐	**Detailed design**	⇒	Logical design
Coding	⇐	**Implementation**	⇒	Coding
Usability lab	⇐	**Implementation testing**	⇒	Unit & Integration testing
Contextual observation	⇐	**System testing**	⇒	System testing
Human performance	⇐	**Optimization**	⇒	Machine performance

(Curtis/Hefley)

User Experience “Plugin” for the RUP

- Extensions of roles, activities and (UML) artifacts
  - Use cases extended by “use case storyboards”
  - UI Prototyping as a specific activity
  - Screens as special cases of classes
(derived from Conallen’s UML-based Web Design Method)

- Steps to create User Experience Storyboards:
  1. Add actor characteristics to the use case.
  2. Add usability guidance and usability requirements to the use case.
  3. Identify UX elements.
  4. Model the use-case flows with the UX elements.
  5. Model screen navigation for the use case.

http://www-128.ibm.com/developerworks/rational/library/content/RationalEdge/nov03/f_usability_jh.pdf

User Experience “Plugin” for the RUP

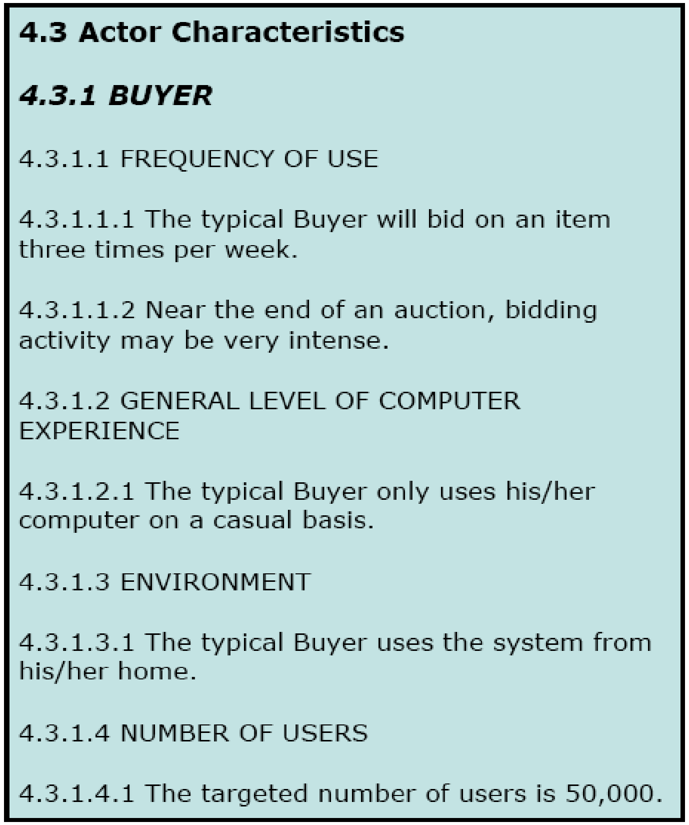
Actor characteristics

Usability guidance / requirements

UX elements

Use-case flows

Screen navigation



4.3 Actor Characteristics

4.3.1 BUYER

4.3.1.1 FREQUENCY OF USE

4.3.1.1.1 The typical Buyer will bid on an item three times per week.

4.3.1.1.2 Near the end of an auction, bidding activity may be very intense.

4.3.1.2 GENERAL LEVEL OF COMPUTER EXPERIENCE

4.3.1.2.1 The typical Buyer only uses his/her computer on a casual basis.

4.3.1.3 ENVIRONMENT

4.3.1.3.1 The typical Buyer uses the system from his/her home.

4.3.1.4 NUMBER OF USERS

4.3.1.4.1 The targeted number of users is 50,000.

Figure 5: Actor characteristics for the Bid on Item use case

User Experience “Plugin” for the RUP

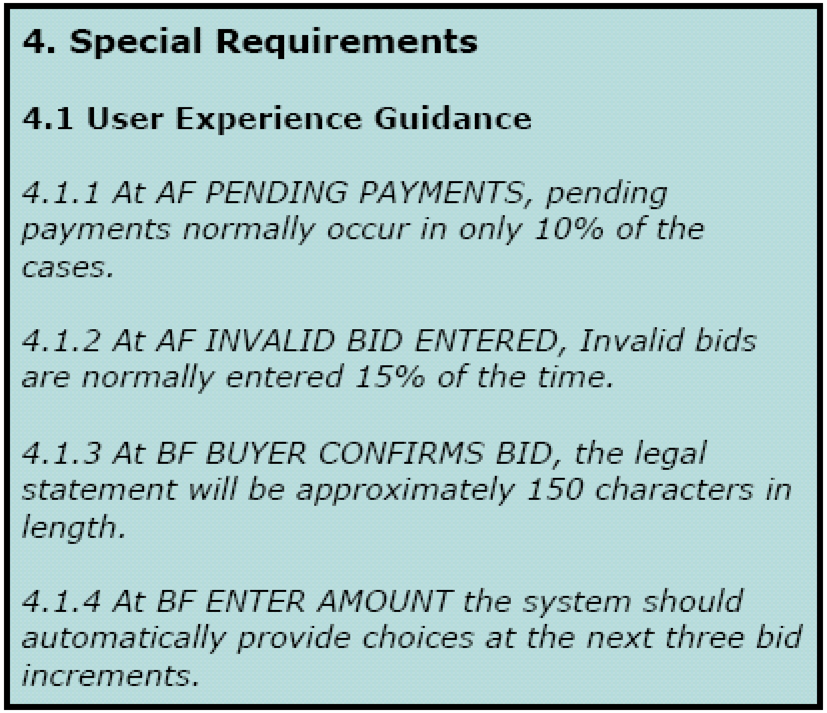
Actor characteristics

Usability guidance / requirements

UX elements

Use

Scre



4. Special Requirements

4.1 User Experience Guidance

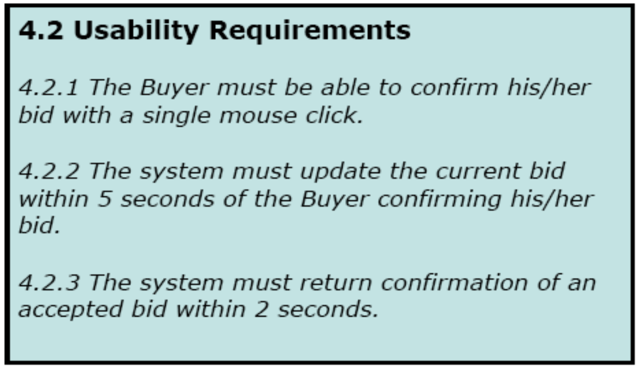
4.1.1 At AF PENDING PAYMENTS, pending payments normally occur in only 10% of the cases.

4.1.2 At AF INVALID BID ENTERED, Invalid bids are normally entered 15% of the time.

4.1.3 At BF BUYER CONFIRMS BID, the legal statement will be approximately 150 characters in length.

4.1.4 At BF ENTER AMOUNT the system should automatically provide choices at the next three bid increments.

Figure 6: Usability guidance for the Bid on Item use case



4.2 Usability Requirements

4.2.1 The Buyer must be able to confirm his/her bid with a single mouse click.

4.2.2 The system must update the current bid within 5 seconds of the Buyer confirming his/her bid.

4.2.3 The system must return confirmation of an accepted bid within 2 seconds.

gure 7: Usability requirements for the Bid on Item use case

User Experience “Plugin” for the RUP

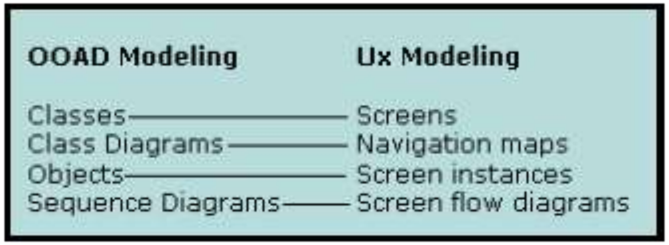
Actor characteristics

Usability guidance / requirements

UX elements

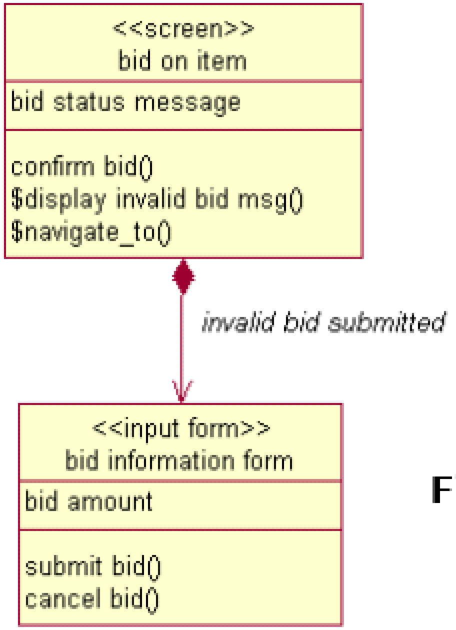
Use-case flows

Screen navigation



OOAD Modeling	Ux Modeling
Classes	Screens
Class Diagrams	Navigation maps
Objects	Screen instances
Sequence Diagrams	Screen flow diagrams

Figure 8: Mapping between OOAD and UX modeling elements



<<screen>>
bid on item

bid status message

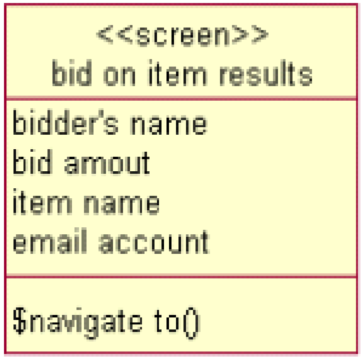
confirm bid()
$display invalid bid msg()
$navigate_to()

invalid bid submitted

<<input form>>
bid information form

bid amount

submit bid()
cancel bid()



<<screen>>
bid on item results

bidder's name
bid amout
item name
email account

$navigate to()

Figure 12: UML representation of a screen for Bid on Item use case (basic flow)

Figure 18: UML representation of a screen with an input form

User Experience “Plugin” for the RUP

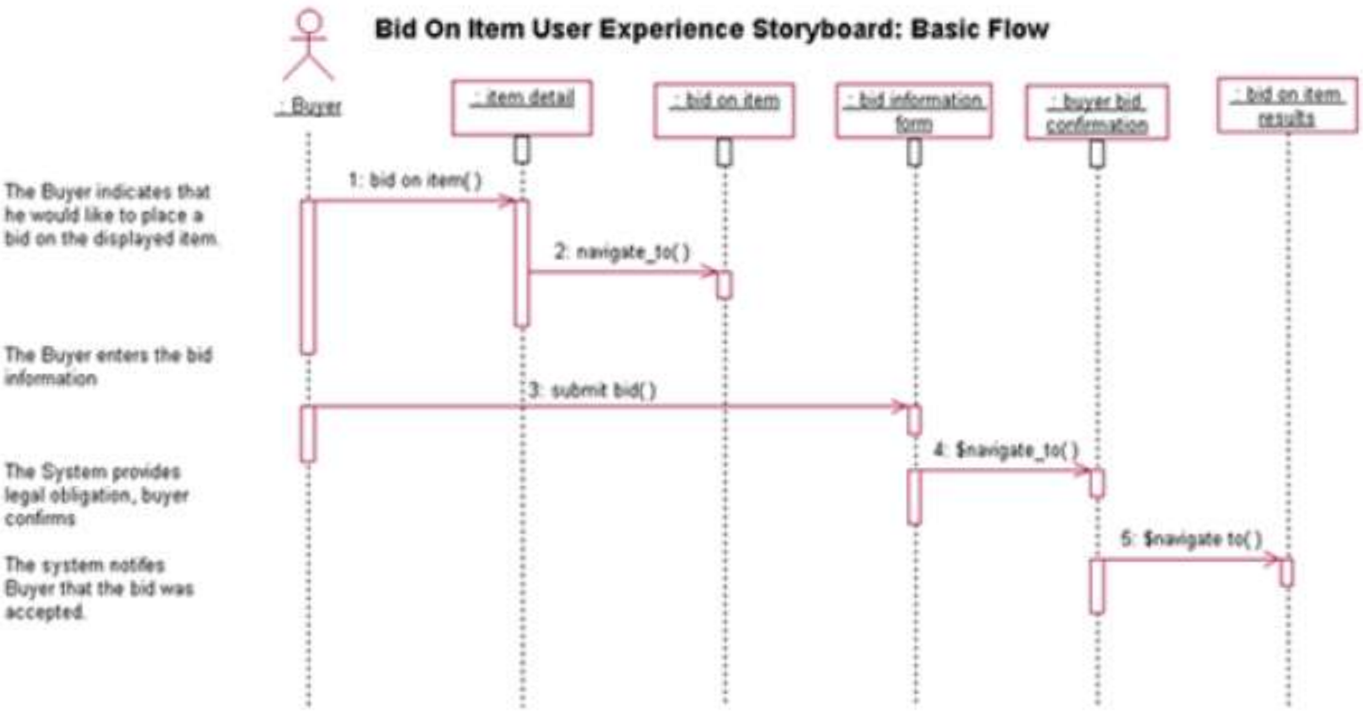
Actor characteristics

Usability guidance / requirements

UX elements

Use-case flows

Screen navigation



Bid On Item User Experience Storyboard: Basic Flow

The Buyer indicates that he would like to place a bid on the displayed item.

The Buyer enters the bid information

The System provides legal obligation, buyer confirms

The system notifies Buyer that the bid was accepted.

Figure 19: Sequence diagram showing the basic flow of events for the Bid on Item use case

User Experience “Plugin” for the RUP

Actor characteristics

Usability guidance / requirements

UX elements

Use-case flows

Screen navigation

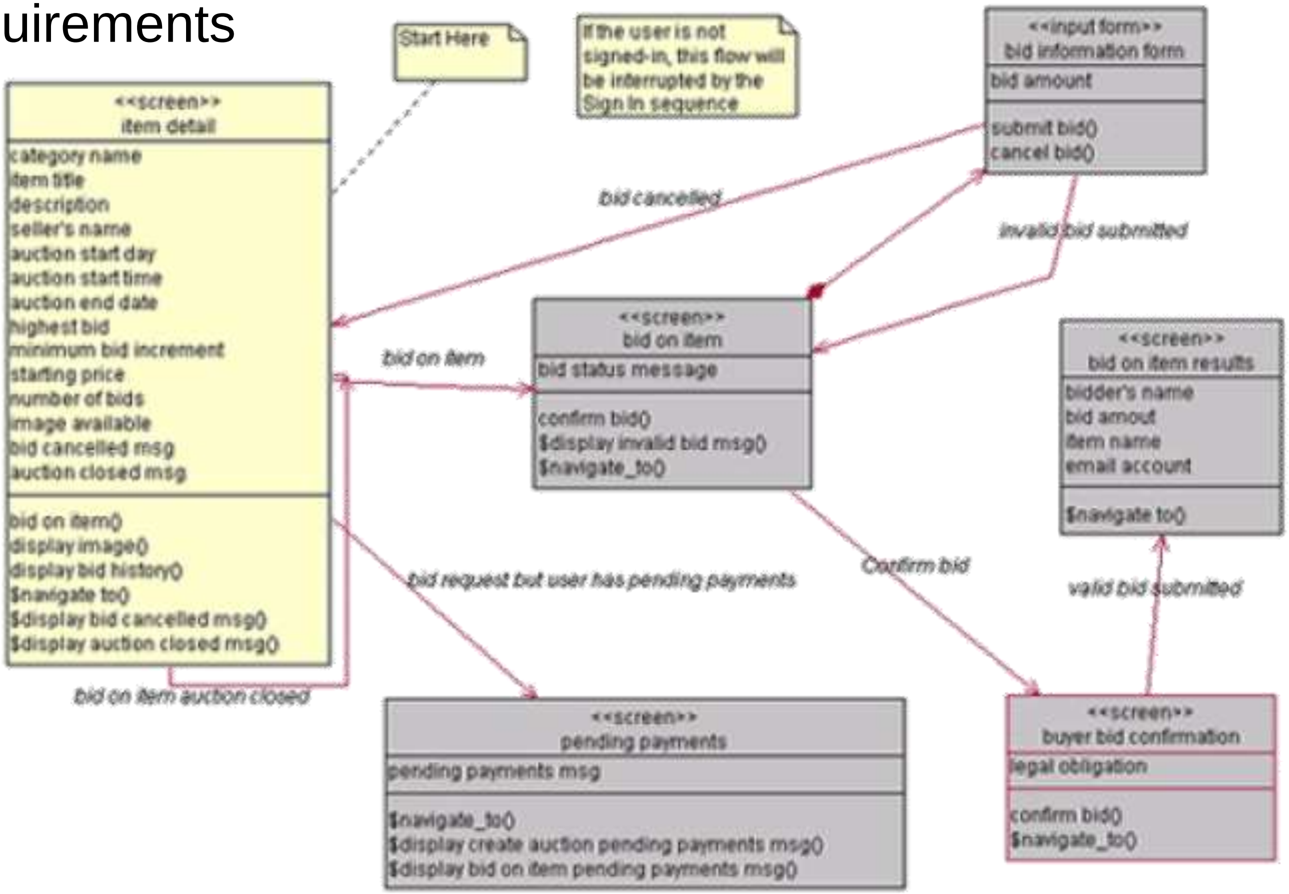
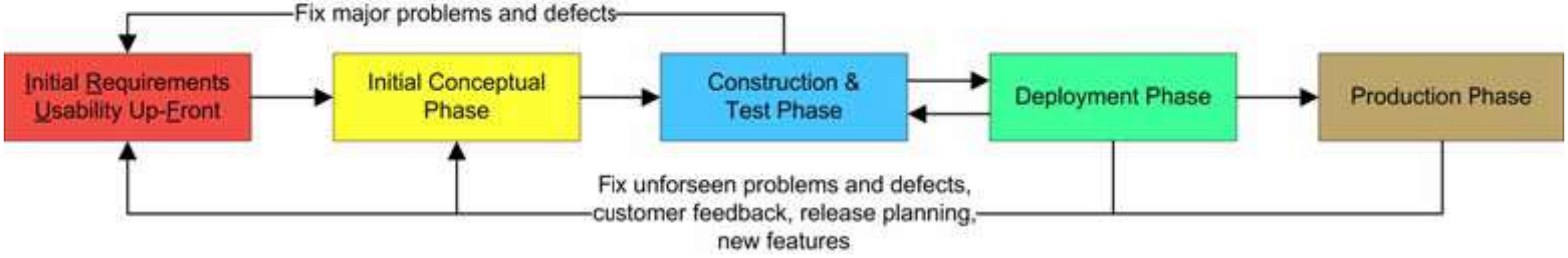


Figure 20: Navigation diagram for the Bid on Item use case

User-Centered Design and Agile Development

- Is a user-centered approach promoted or hindered by agile values?
  - *Negative*: users are ***not*** at the center of agile development:
    Focus on core functionality, no distinction between client and (end) user
  - *Positive*: high value of communication and customer collaboration support usability
  - *Positive*: iterative development and “response to change” are consistent with user-centered processes
  - *Positive*: simplicity is a common key value for user-centered design and agile development (“design the simplest solution possible”)
- Attempts to integrate user-centered design and agile development
  - Results similar to non-agile approaches integrating SW and UI engineering?
  - Example: “Agile Usage-Centered Software Lifecycle”


Fix major problems and defects
Initial Requirements Usability Up-Front
Initial Conceptual Phase
Construction & Test Phase
Deployment Phase
Production Phase
Fix unforseen problems and defects, customer feedback, release planning, new features

(Gundelsweiler/Memmel/Reiter, Mensch&Computer 2004, http://hci.uni-konstanz.de/downloads/fg_tm_hr_mc_2004.pdf)

References

- Ahmed Seffah, Jan Gulliksen, Michel C. Desmarais (eds.): Human-Centered Software Engineering - Integrating Usability in the Development Process, Springer 2005
- Mary Beth Rosson, John M. Carroll: Usability Engineering - Scenario-Based Development of Human-Computer Interaction, Academic Press 2002
- Deborah Hix and H. Rex Hartson: Developing User Interfaces Ensuring Usability Through Product & Process, John Wiley 1993
- Bill Curtis, Bill Hefley: A WIMP no more: the Maturing of User Interface Engineering, ACM *interactions* 1(1), January 1994, 22-34
- John Armitage: Are Agile Methods Good for Design?, ACM *interactions* 11(1), Jan/Feb 2004, 14-23
- John M. Carroll, Mary Beth Rosson: Getting Around the Task-Artifact How to Make Claims and Design Cycle: by Scenario, ACM Transactions on Information Systems, Vol. 10, No. 2, April 1992, 181-212