



Center for  
**LifeLong  
Learning  
& Design**

University of Colorado at Boulder

**Wisdom is not the product of schooling  
but the lifelong attempt to acquire it.  
- Albert Einstein**

## **Meta-Design: A Framework for the Future of End-User Development (EUD)**

**Gerhard Fischer and Hal Eden  
Spring Semester 2006**

**February 20,2006**

**paper:** Fischer, G., Giaccardi, E., Ye, Y., Sutcliffe, A. G., & Mehandjiev, N. (2004) "Meta-Design: A Manifesto for End-User Development," Communications of the ACM, 47(9), pp. 33-37.

<http://l3d.cs.colorado.edu/~gerhard/papers/CACM-meta-design.pdf>

## Feedback from Students

- **Malte:** I think meta-design is already quite prevalent and the social challenge for the end-user is not very inhibiting. I think people don't see this as a new concept that they have to learn but see it as another feature of a certain application.
  
- **John, Gary and Min-Chieh:** example LEGO —
  - It is also interesting to see that sometimes LEGO sets are sold with specific pieces and instructions. It would be interesting to see if kids prefer these types of very specific sets compared to their own unique creations.
  - Mindstorm set of Lego → is it a big commercial success?
  
- **Laoleng:** I've always been a little apprehensive about using Open Source products because there is no serious commitment or support behind it.
  
- **Nathan:**
  - Many people have a desire to customize their software but the option is just not there.
  - Meta-design gives them the opportunity to customize the application in a way that does not require them to learn how to be a computer programmer.

## Feedback from Students – Continued

- **Kei:** When we focus on the EUD aspect, concealing the underlying complexity of the problem domain from the user would be one of the difficult technical challenges.
  
- **Mark:** experts (software developers, teachers) have to relinquishing control
  
- **Lisa:** There is a learning curve associated with every new software, and there will be an even greater learning curve when users are expected to shift from passive contributors to active designers. It is a role shift that could be very hard for people to accept since they've been passive for so long and gotten accustomed to their old ways.
  
- **Kirill:** What's notable also are the several mentioned examples of EUD paradigm from non-software domains, such as:
  - Land use in National Parks (Mark),
  - Design of College Curriculum (Mark),
  - Reconfigurable Smart Car (Malte),
  - LEGO blocks (Matthew, John/Gary)

# Core Message

The future success of EUD depends on  
creating tools that end users are motivated to  
learn and use in daily work practices  
→ **meta-design**

# Meta-Design — How We Think About It

- “if you give a fish to a human, you will feed him for a day — if you give someone a fishing rod, you will feed him for life” (Chinese Proverb)

- **meta-design** extends this to:

“if we can provide the knowledge, the know-how, and the tools for making fishing rods, we can feed the whole community”

# Meta-Design

- **meta-design** = creating new media and new technologies that allow users to act as **designers and be creative** (rather than being confined to consumers)
- **meta-design emphasizes**
  - the creation of context rather than content
  - puts the tools rather than the object of design in your hands
  - does not define a product, but the conditions for a process of interaction

# Why meta-design?

- design for **diversity** (for “a universe of one” → CLever Project)
- design as a process is **tightly coupled to use** and continues during the use of the system
- addresses and overcome problems of **closed systems**
- prerequisite for **social creativity** and innovation
- transcends a “**consumer mindset**”

# Claims

- **meta-design** (= allowing people to act as designers) is **more than a technical problem**
- **meta-design**
  - design for “hackability” and “remixability”
  - design for cooperation, not control
- meta-design needs to provide tools, environments, and substrates for end user development — **this is necessary, but not sufficient**
- **meta-design** creates **new mindsets**, new **sources of creativity**, **cultures changes**, and **innovative societies** by providing new insights into
  - learning and working
  - communicating
  - design and design communities
  - collaboration
  - co-creation



# Cultures and Media

- **claim: cultures** are substantially defined by their media and tools for thinking, working, learning, and collaborating (most prominent example: oral → literal societies)
- **fundamental challenge for computational media:** to contribute to the invention and design of cultures in which humans can express themselves and engage in **personally meaningful activities**
- **new media change**
  - the tasks which humans do (→ new divisions of labor)
  - the structure and contents of our interests
  - the nature of our cognitive and collaborative tools
  - the social environment in which thoughts originate and evolve, and mindsets develop
- **empirical observation:** a large number of new media are designed from the perspective of seeing and treating humans primarily as **consumers**

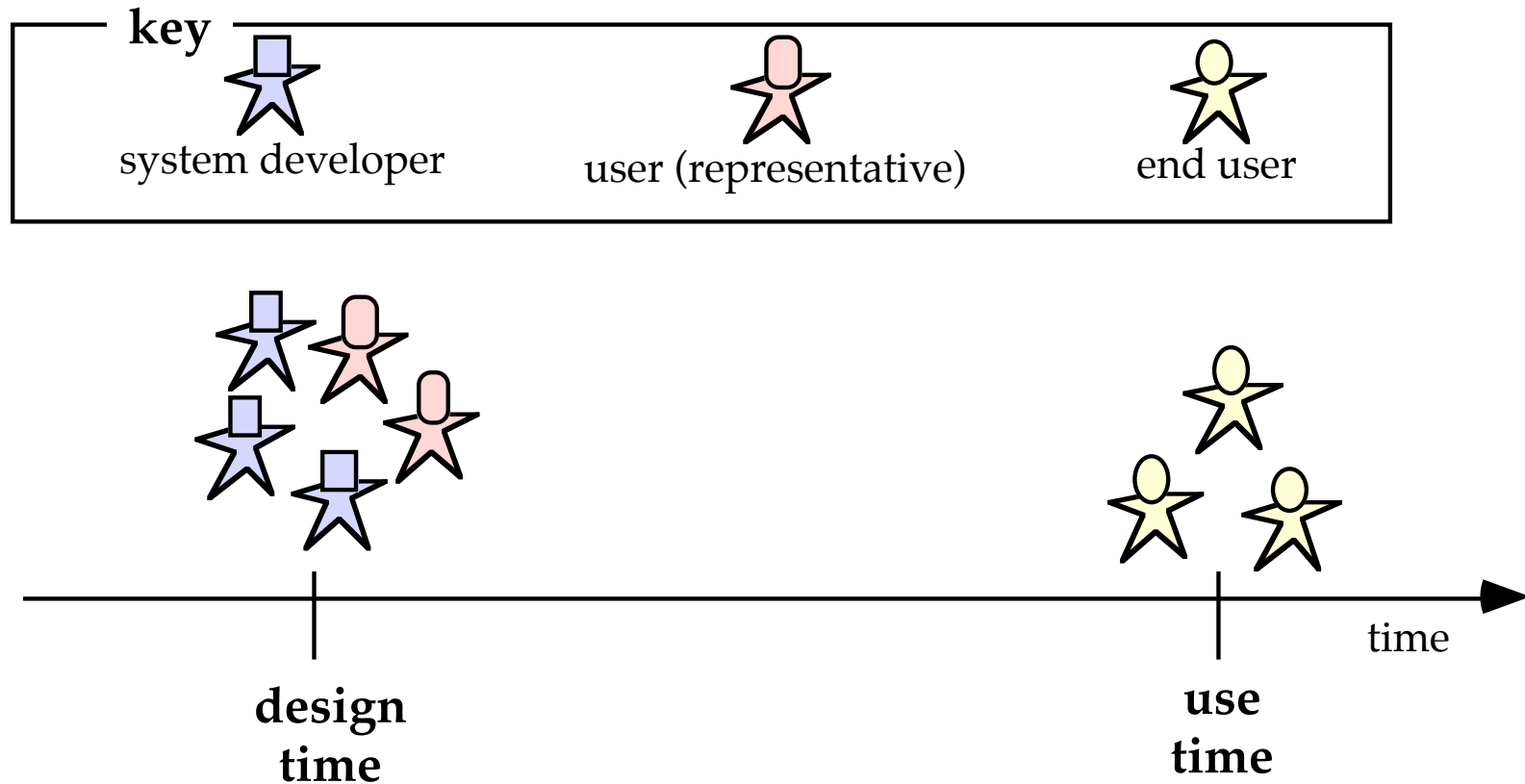
# Design: Beyond Binary Choices

- **Turing Tar Pit:** *“Beware of the Turing Tar Pit, in which everything is possible, but nothing of interest is easy.”*
  - why are current interactive programming environments, such as Logo, Smalltalk, Squeak, Agentsheets, ..... not sufficient for supporting meta-design?
  - claim: level of representation is still too far removed from the conceptual world of the domain workers
  - claim: they emphasize objective computability → the challenge: subjective computability
- **The Inverse of the Turing Tar Pit:** *“Beware of the over-specialized systems, where operations are easy, but little of interest is possible.”*
  - domain-specific tools (such as SimCity) provide extensive support for certain problem contexts
  - the ability to extend these environments is limited — even minor incremental changes are often impossible in these systems

# Cost-Scope Trade-offs in EUD Tools

|       |      | Cost of learning  |  |
|-------|------|---|--|
|       |      | High  | Low  |
| Scope | High | JAVA<br>C++<br><br>JAVA Script<br>VB Script               | EUD<br>ideal<br><br>Current EUD envs<br>Agentsheets<br>Alice<br><br>Excel macros   |
|       | Low  | Domain engineering<br>languages<br>SDL<br>Hardware design | Office Applications<br>Report writers<br>Query screen<br>builders<br><br>Domain-specific<br>languages<br>Customisation<br>Adaptation |

# Design Time and Use Time



**world-as-imagined**  
**prediction**  
**planning**

**world-as-experienced**  
**reality**  
**situated action**

# Computational Media

—

## Extending Design Opportunities at Use Time

- **print media:** a fixed context for use time is decided at design time
  
- **computational media:**
  - presentations at use time can take advantage of contextual factors only known at use time (about tasks, users, social systems,.....)
  - examples: specification sheets and usage data, supporting dynamic forms, dynamic websites, user and task specific maps and traffic schedules....
  
- **evolving existing systems:** users (acting as designers) can transcend at use time the boundaries of the systems as developed at design time

# **Meta-Design: Beyond Professionally-Dominated, User-Centered Design, and Participatory Design**

- **professionally-dominated design**
  - works best for people with the same interests and background knowledge
  
- **user-centered design:**
  - analyze the needs of the users
  - understand the conceptual worlds of the users
  
- **participatory design**
  - involve users more deeply in the process as co-designers by empowering them to propose and generate design alternatives
  - focus on system development at design time by bringing developers and users together to envision the contexts of use
  
- **meta-design:**
  - create design opportunities at use time
  - requires co-creation

# What Do Meta-Designers Do?

- use their own creativity to create socio-technical environments in which other people can be creative
- create the technical and social conditions for broad participation in design activities which are as important as creating the artifact itself

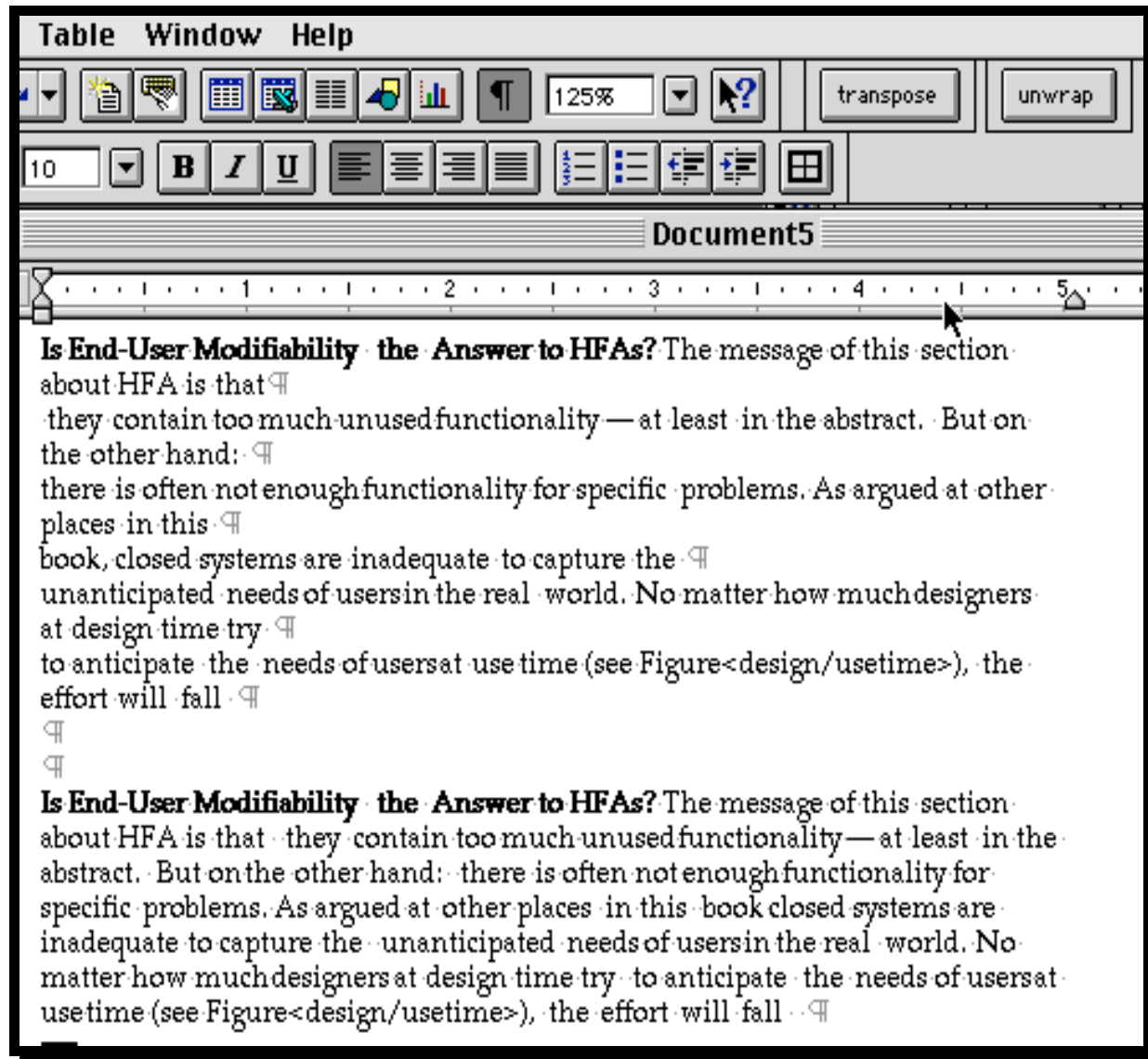
# Meta-Design Concepts (in Microsoft Word)

## — Users as Co-Developers

- ***tailor*** and ***customize*** the system by setting different parameters as their personal preferences
- ***extend*** and ***evolve*** existing information structures (e.g., menus, spelling dictionaries, auto-correct tables, ...)
- write ***macros*** to create new operations (an example of “programming by example” or “programming by demonstration”)
- create ***programs in VisualBasic*** to extend the functionality of the system
- ***share*** the user-defined extensions



# A Macro for Unwrapping Text



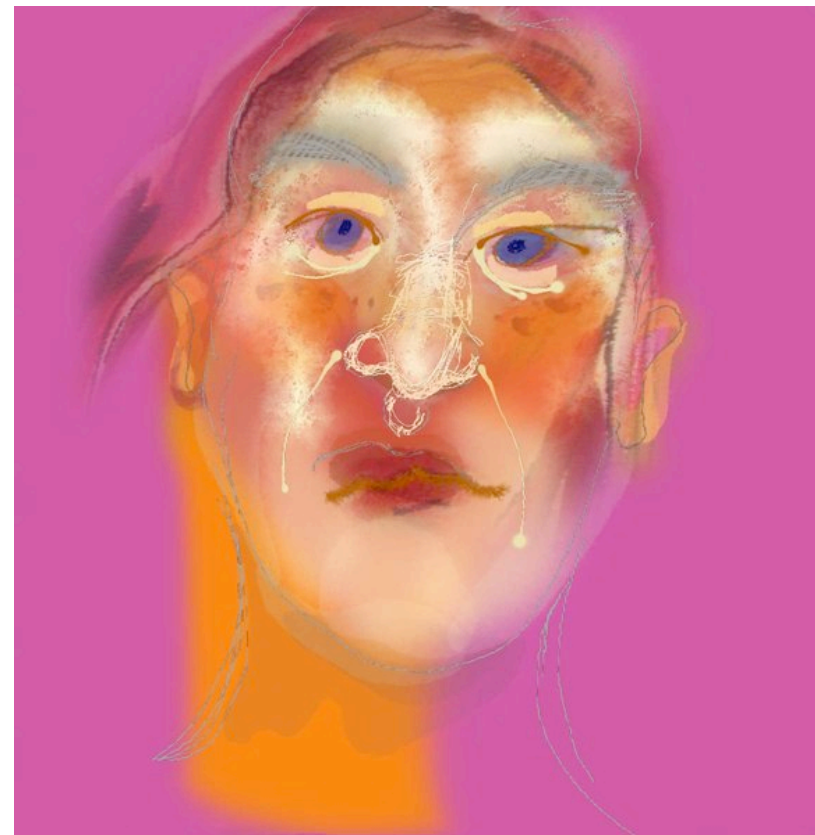
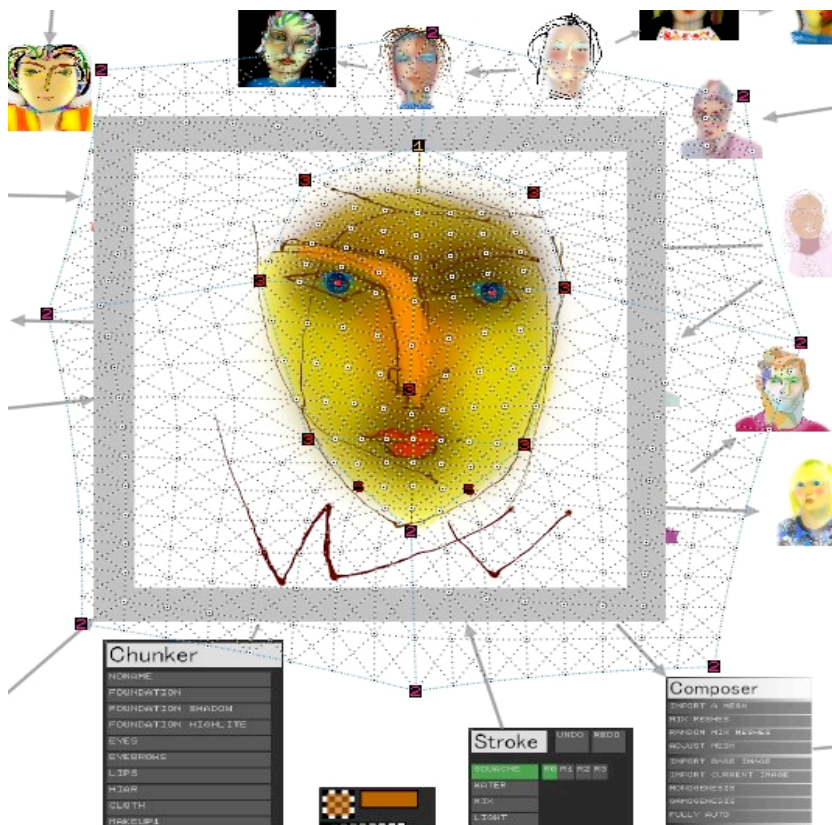
## Meta-Design Aspects in the EDC: Closed versus Open Systems

- **example for a closed system: SimCity** — too much crime
  - solution supported: build more police stations (**fight crime**)
  - solution not supported: increase social services, improve education (**prevent crime**)
- **important goal of EDC:** create end-user modifiable versions of SimCity, because:
  - background knowledge can never be completely articulated
  - the world changes
- **user control:**
  - end-user modifiability
  - conviviality (independence of high-tech scribes)
  - ownership (putting owners of problems in charge)

# Interactive Art: *Face Poiesis*

(creating new faces by mixing features from previously created faces)

original creators: Toshihiro Anzai and Rieko Nakamura



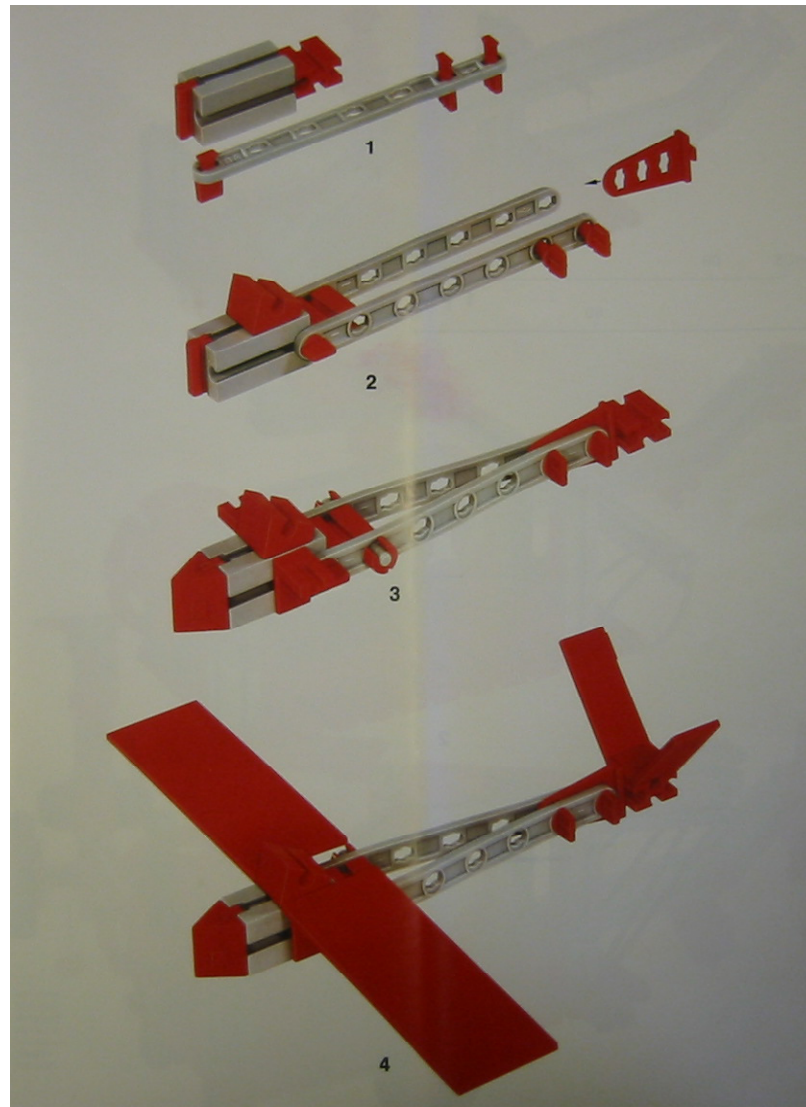
# Interactive Art: The Electronic Café Project

original creators: Kit Galloway & Sherrie Rabinowitz (founded 1984)

at: <http://www.ecafe.com/>



# Meta-Design and Technical Construction Kits: An Airplane



# Meta-Design and Technical Construction Kits: A Tipper Truck



# Consumer and Designers — Beyond Binary Choices

## ▪ **claims:**

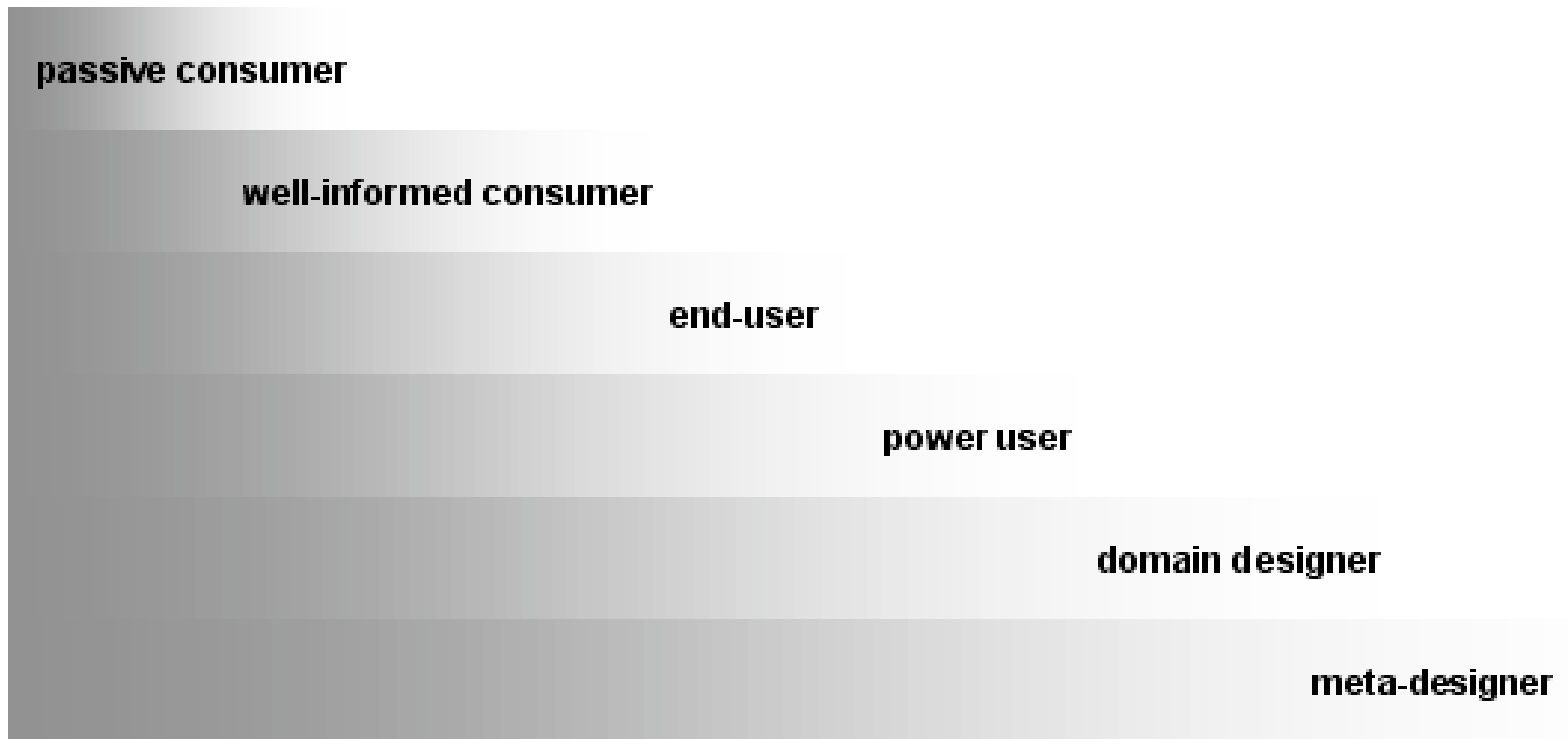
- there is nothing wrong being a consumer (watching a tennis match, listening to a concert, ...)
- the same person wants to be a consumer in some situations and in others a designer
- consumer / designer is not an attribute of a person, but of a context  
**consumer / designer ≠ f{person} → f{context}**

## ▪ **problems:**

- someone wants to be a designer but is forced to be a consumer → ***personally meaningful activities***
- someone wants to be a consumer but is forced to be a designer → ***personally irrelevant activities***

# Consumer and Designers – A Continuum

CONSUMER ←-----→ DESIGNER

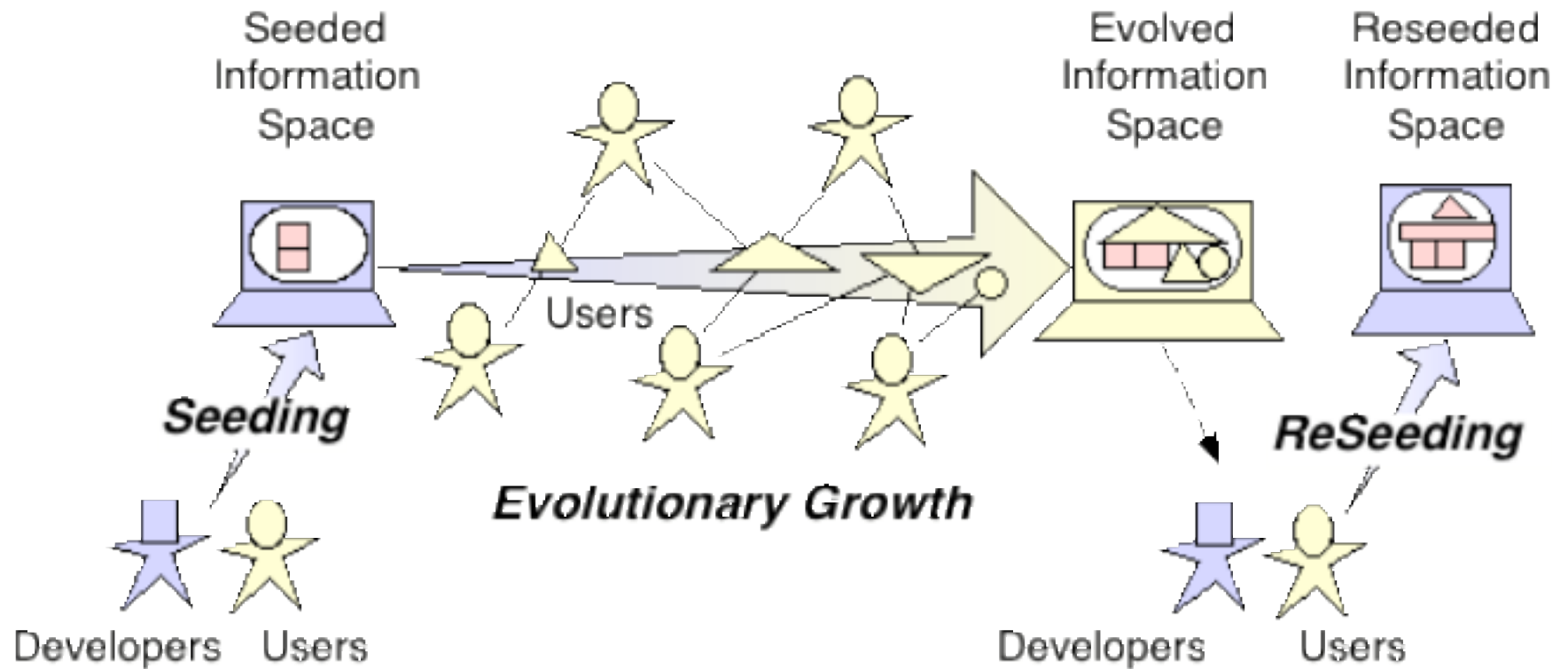




# The **S**eeding, **E**volutionary Growth, **R**eseeding (**SER**) Model Supporting Meta-Design

- **at design time:**
  - development of an initial system that can change over time (seed)
  - underdesign: creating design options for users
  
- **at use time:**
  - support for “unself-conscious culture of design”: users will experience breakdowns by recognizing “bad fit” at use time
  - end-user modifications allow users to address limitations they experience
  - evolutionary growth through incremental modifications
  
- **reseeding:**
  - significant reconceptualization of the system
  - account for incremental modifications, mitigate conflicts between changes, and establish an enhanced system

# The Seeding, Evolutionary Growth, Reseeding (SER) Model



## Comparing Self-conscious and Unself-conscious Cultures of Design

|                             | <b>self-conscious</b>   | <b>unself-conscious</b>  |
|-----------------------------|---|--|
| <b>definition</b>           | an explicit, externalized description of a design exists (theoretical knowledge)              | process of slow adaptation and error reduction;<br>situated  |
| <b>original association</b> | professionally-dominated design   | primitive societies, handmade things   |
| <b>examples</b>             | seeding and reseeded<br>designed cities: Brasilia, Canberra, Abudja                           | evolutionary growth<br>naturally grown cities: London, Paris   |
| <b>strengths</b>            | activities can be delegated; division of labor becomes possible                               | many small improvements → artifacts well suited to their function; coping with ill-defined, unarticulated problems |
| <b>weaknesses</b>           | many artifacts are ill-suited to the job expected of them                                     | no general theories exist or can be studied (because the activity is not externalized)                             |
| <b>requirements</b>         | externalized descriptions must exist—issue: how adequate are these externalized descriptions? | owner of problems must be involved because they have relevant, unarticulated knowledge                             |

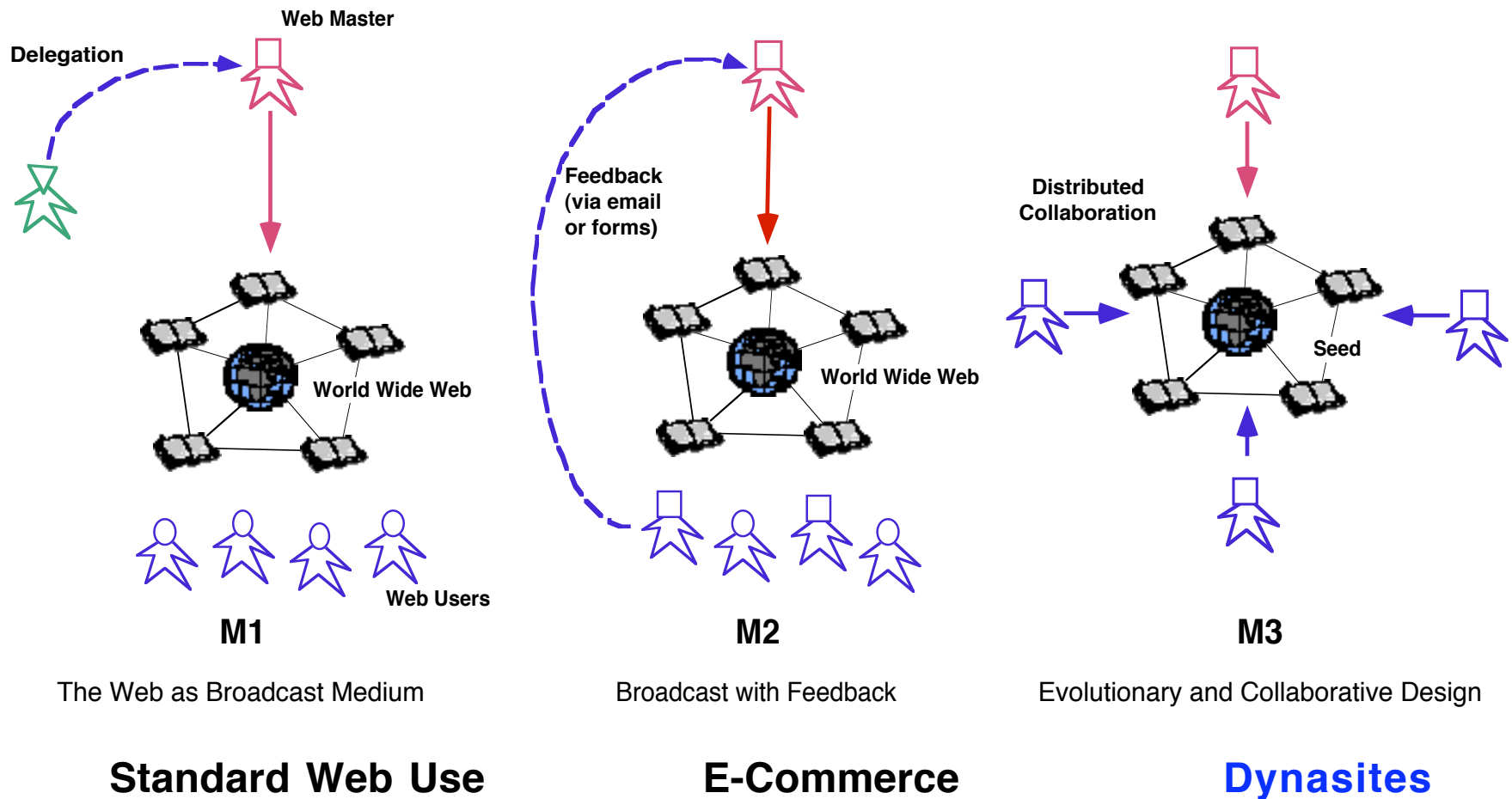
# Explore Technical Issues in Real-World Settings

## —

### Improvisations versus Standardization

- **example:** SAP Info, July 2003, p 33: “Reduce the Number of Customer Modifications”
- **rationale:**  
*“every customer modification implies costs because it has to be maintained by the customer. Each time a support package is imported there is a risk that the customer modification may have to be adjusted or re-implemented. To reduce the costs of such on-going maintenance of customer-specific changes, one of the key targets during an upgrade should be to return to the SAP standard wherever this is possible”*
- **compare:**
  - “forking” in Open Source
  - “reseeding” in Seeding, Evolutionary Growth, Reseeding Model

# WWW: From Broadcast to Collaboration Medium



# Web 2.0: A Focus on Meta-Design

- **source:** Tim O'Reilly "*What is Web 2.0 – Design Patterns and Business Models for the Next Generation of Software*"  
at: <http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html>

## Web 1.0

Britannica Online

personal website

publishing

content management systems

scheduled software releases

individual contributions

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## Web 2.0

Wikipedia

blogging

participation

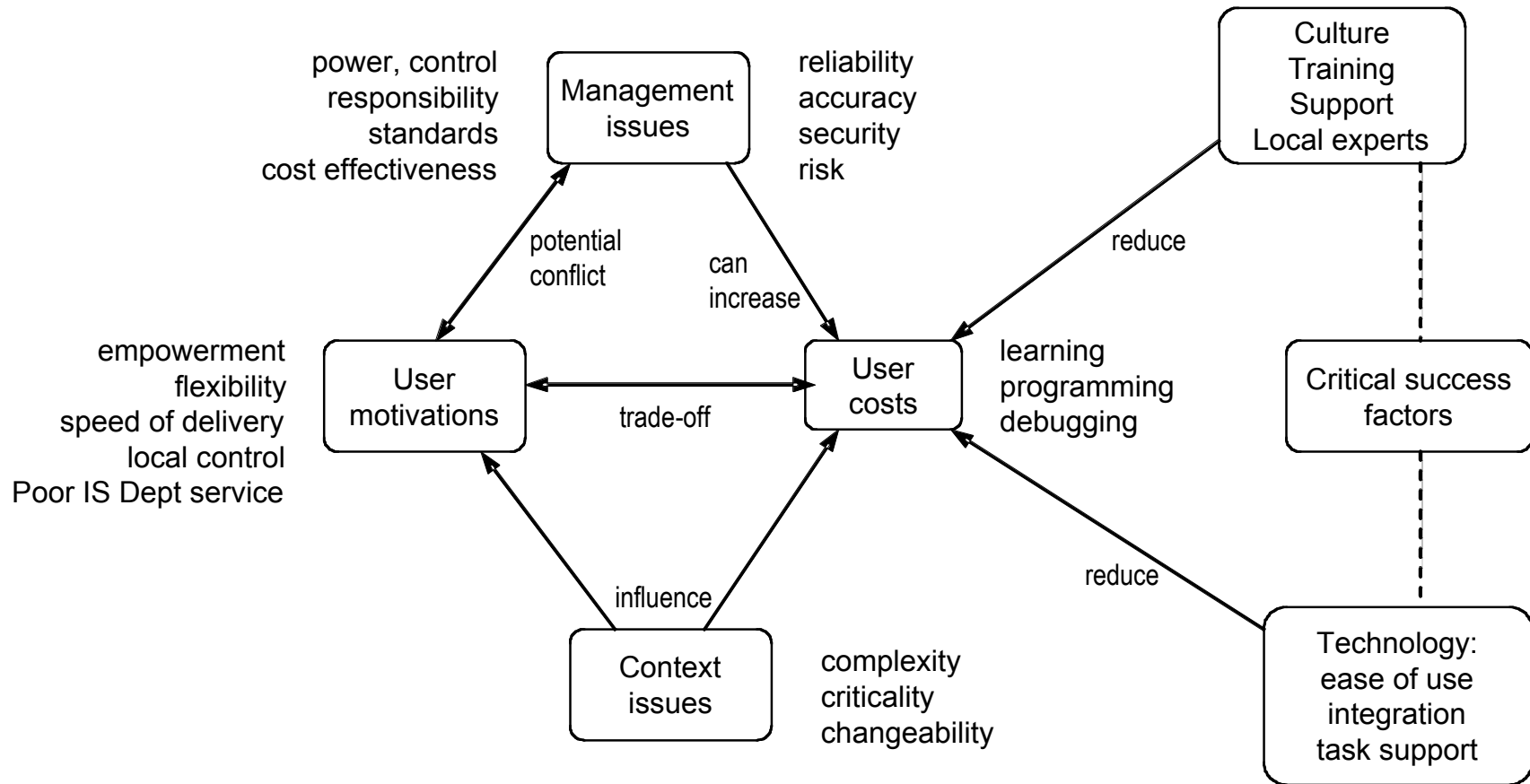
wikis

continuous improvements

collective intelligence

- **claim:** network effects from user contributions (= knowledge sharing) are the key to market dominance in the Web 2.0 era

# Relationships between Social and Managerial Issues in EUD



# Motivational Aspects and Meta-Design

- **what will make humans want to become designers/active contributors over time?**
  - serious working and learning does not have to be unpleasant but can be personally meaningful, empowering, engaging, and fun
  - comment by an artist: *“programming is not hard, but it is boring”*
- **what will make humans want to share?** → requires: mindset change, culture change, community knowledge bases, gift cultures, social capital
  - more details: Fischer, G., Scharff, E., & Ye, Y. (2004) "Fostering Social Creativity by Increasing Social Capital." In M. Huysman, & V. Wulf (Eds.), *Social Capital and Information Technology*, MIT Press, Cambridge, MA, pp. 355-399.
- **who is the beneficiary and who has to do the work?** → organizational rewards



## Utility = Value / Effort

- **increase in value: motivation and rewards for a “design culture”**
  - feeling in control (i.e., independent from “high-tech scribes”)
  - being able to solve or contribute to the solution of a problem
  - mastering a tool in greater depth
  - making an ego-satisfying contribution to a group
  - enjoying the feeling of good citizenship to a community (“social capital”)
- **decrease in effort:**
  - meta-design is hard
  - extending meta-design to design for design communities

# Meta-Design: Transforming Application Areas

- **design:** customization, personalization, tailorability, end-user development, design for diversity
- **architectural design:** underdesign, support for “unself-conscious culture of design”
- **teaching and learning:** teachers as facilitator, learning communities, courses-as-seeds
- **informed participation:** beyond access, social creativity

## Meta-Design: Transforming Application Areas – Continued

- **open source:** a success model of decentralized, collaborative, evolutionary development (Eric Scharff, PhD thesis)
- **living organizational memories:** livingOM (Jonathan Ostwald), Web2Gether (Rogerio dePaula), Swikis
- **digital libraries:** community digital library (Michael Wright and Tamara Sumner)
- **interactive art:** collaboration, co-creation, puts the tools rather than the object of design in the hands of users (Elisa Giaccardi)
  - examples: <http://www.sito.org/> — **Gridcosm, HyGrid**

# Conclusions

- **meta-design offers:**
  - to invent and design a culture in which all participants in collaborative design processes can express themselves and engage in personally meaningful activities
  
- **meta-design requires**
  - a new **mindset** of all participants
  - designers giving up some **control** at design time
  - **active contributors** and not just passive consumers at use time
  
- **meta-design raises many issues and research problems of fundamental importance** including
  - new design methodologies
  - a new understanding of cognition, collaboration, and motivation
  - the design of new media and new technologies