



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

## **Meta-Design**

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# Basic Message

- **meta-design = design for designers:** participants can express themselves and engage in personally meaningful activities
  
- **basic assumption:**
  - future uses and problems cannot be completely anticipated at design time, when a system is developed
  - Users, at use time, will discover mismatches between their needs and the support that an existing system can provide for them
  
- **meta-design**
  - **expands boundaries** by supporting users as active contributors,
  - **distributes control** among all stakeholders in the design process
  - creates foundations for **cultures of participation**

# Background on Meta-Design

- **Research Grant:** “*A Meta-Design Framework for Participative Software Systems (2006-2009)*”
  - “Science of Design” Program, NSF-CISE
  - objective: define the scientific foundation for designing participative software systems as socio-technical environments that empower users, as owners of problems, to engage actively and collaboratively in the continual development of software systems
  - more information: <http://l3d.cs.colorado.edu/~SoD/>
- **CHI Workshop 2007:** “Converging on a “Science of Design” through the Synthesis of Design Methodologies”
  - <http://swiki.cs.colorado.edu:3232/CHI07Design/>
  - methodologies: professionally-dominated, user-centered, learner-centered, participatory

# Design: Beyond Binary Choices

- **Turing Tar Pit:** *“Beware of the Turing Tar Pit, in which everything is possible, but nothing of interest is easy.”*
  - Turing Machines 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 artifacts and tools provide extensive support for certain problem contexts → but the ability to extend these environments is limited

# Meta-Design: Exploring Middle Ground

**Turing Tar Pit:**

Saw + Wood



**Inverse of the Turing Tar Pit:**

Plastic Car



**Construction  
Kits**



# Meta-Design: Design for Designers

- new media that allow users to act as **designers** and be **creative**
- the creation of context rather than content → **underdesign**
- does not define a product, but the conditions for a **process of interaction**
- supports problem solving processes that remain **liquid and open**  
("continuous beta")

# Why Meta-Design

- design for diversity (for “a universe of one” → CLever Project)
- complements planning with situated action
- design as a process is tightly coupled to use and continues during the use of the system
- prerequisite for cultures of participation, (social) creativity, innovation
- transcends a “consumer mindset”

# What Do Meta-Designers Do?

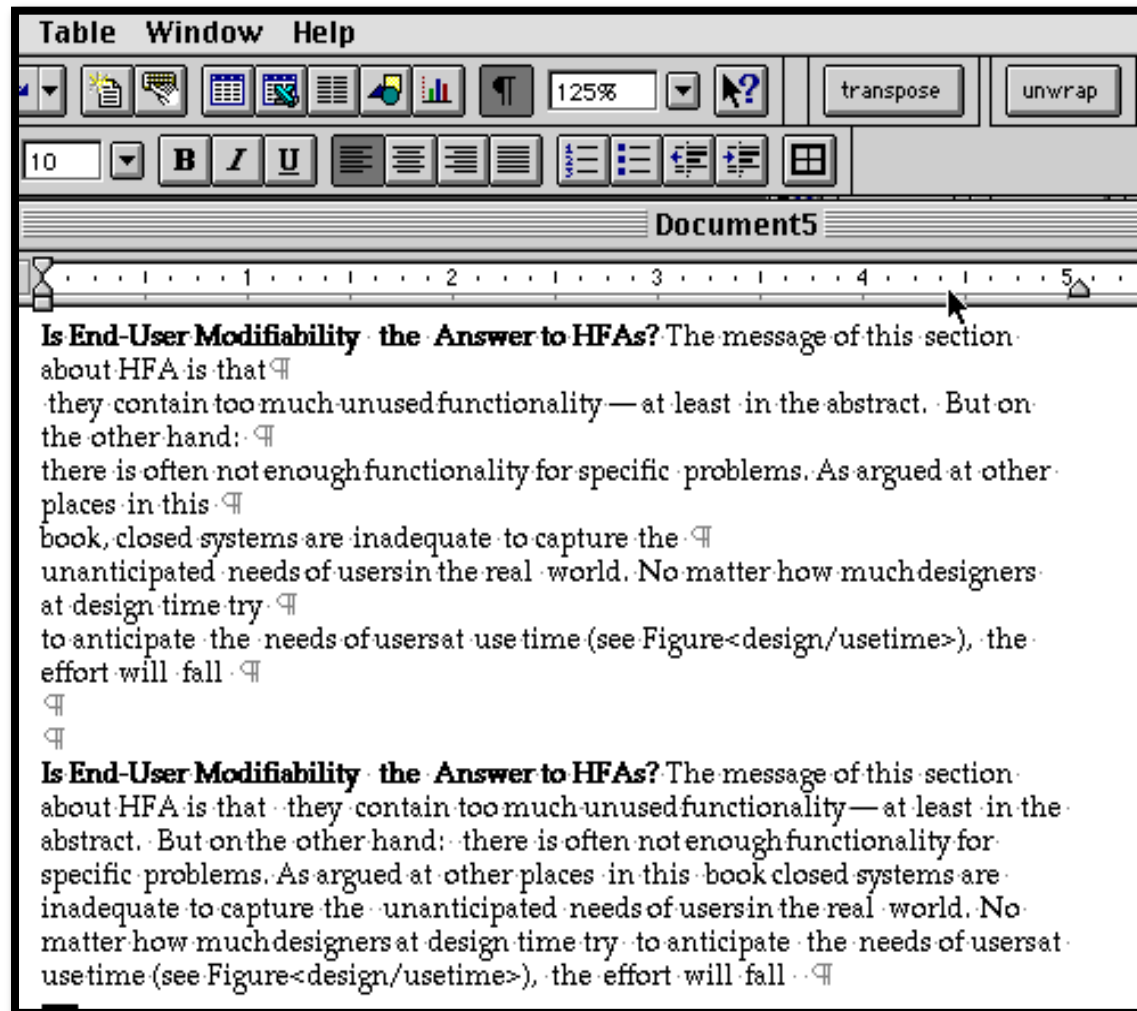
- use their own creativity to create socio-technical environments in which other people can be creative
- create **technical** and **social** conditions for broad participation in design activities which are as important as creating the artifact itself



## 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



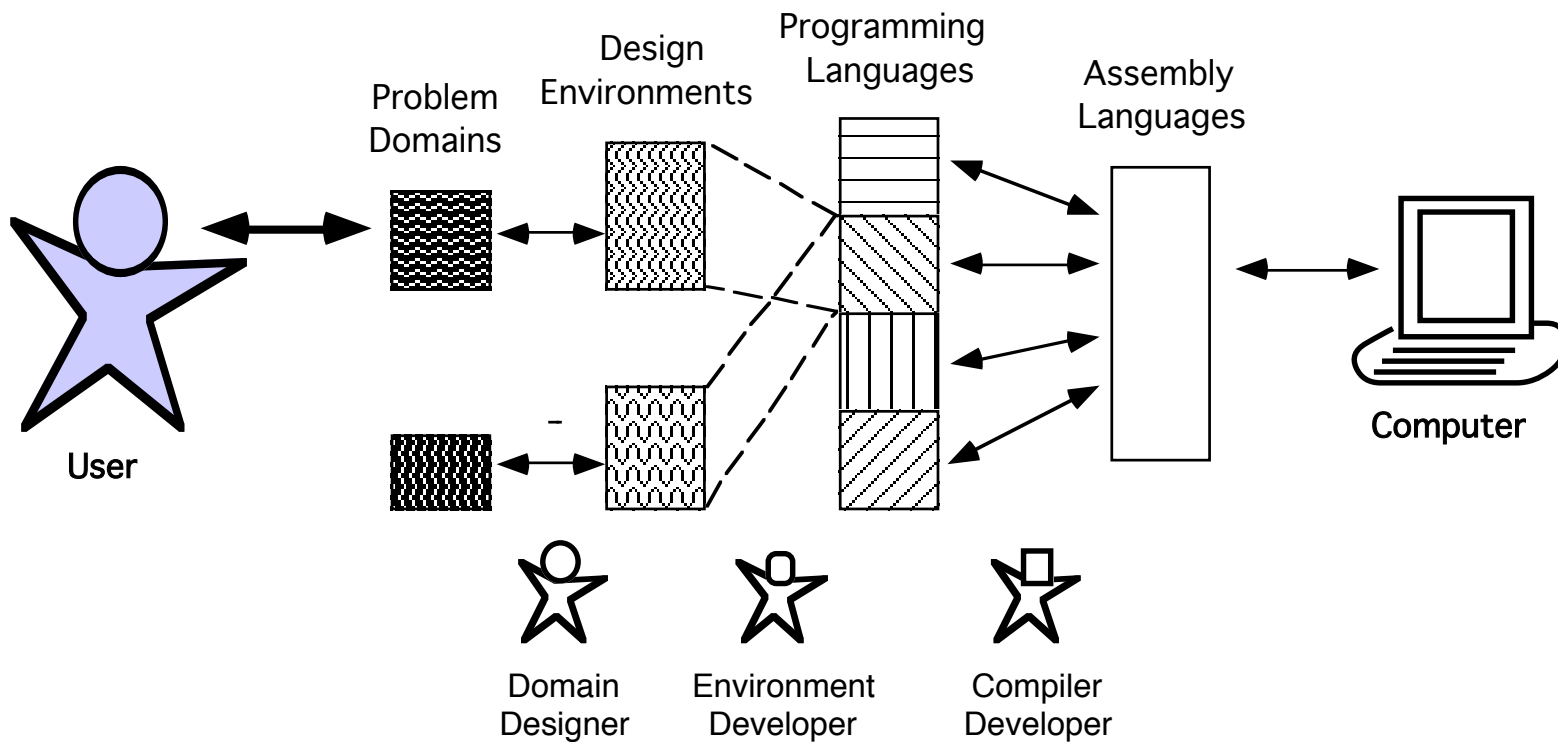
# Putting Owners of Problems in Charge

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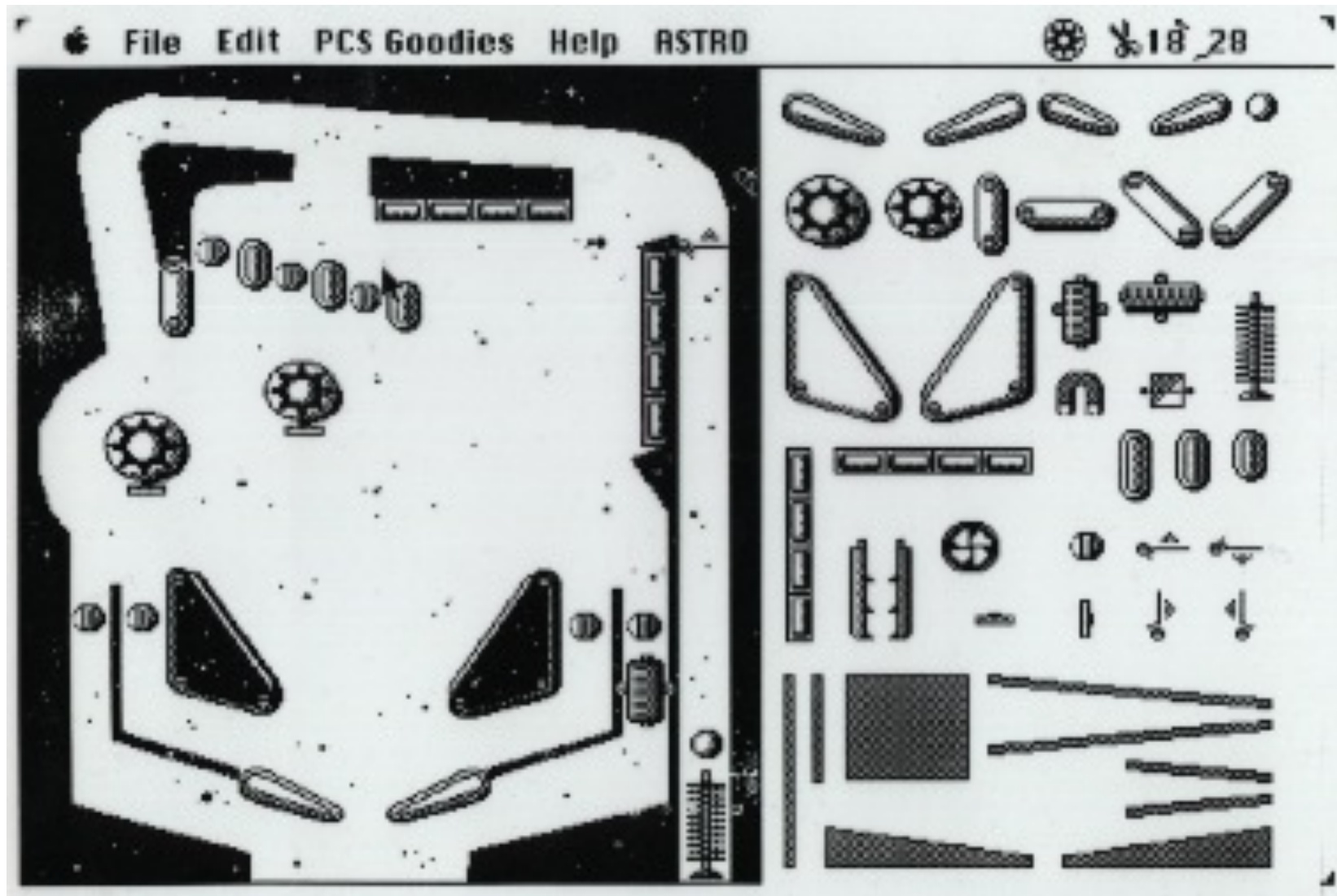
**Ill-defined problems cannot be delegated to professional software developers**

- **interview with a geoscientist** (University of Colorado):
  - *“I spend in average an hour every day developing software for myself to analyze the data I collected because there is not any available software.*
  - *Even if there is a software developer sitting next to me, it would not be of much help because my needs vary as my research progresses and I cannot clearly explain what I want to do at any moment.*
  - *So I spent three months to gain enough programming knowledge to get by.*
  - *Software development has now become an essential task of my research, but I do not consider myself a software developer and I don't know many other things about software development.”*

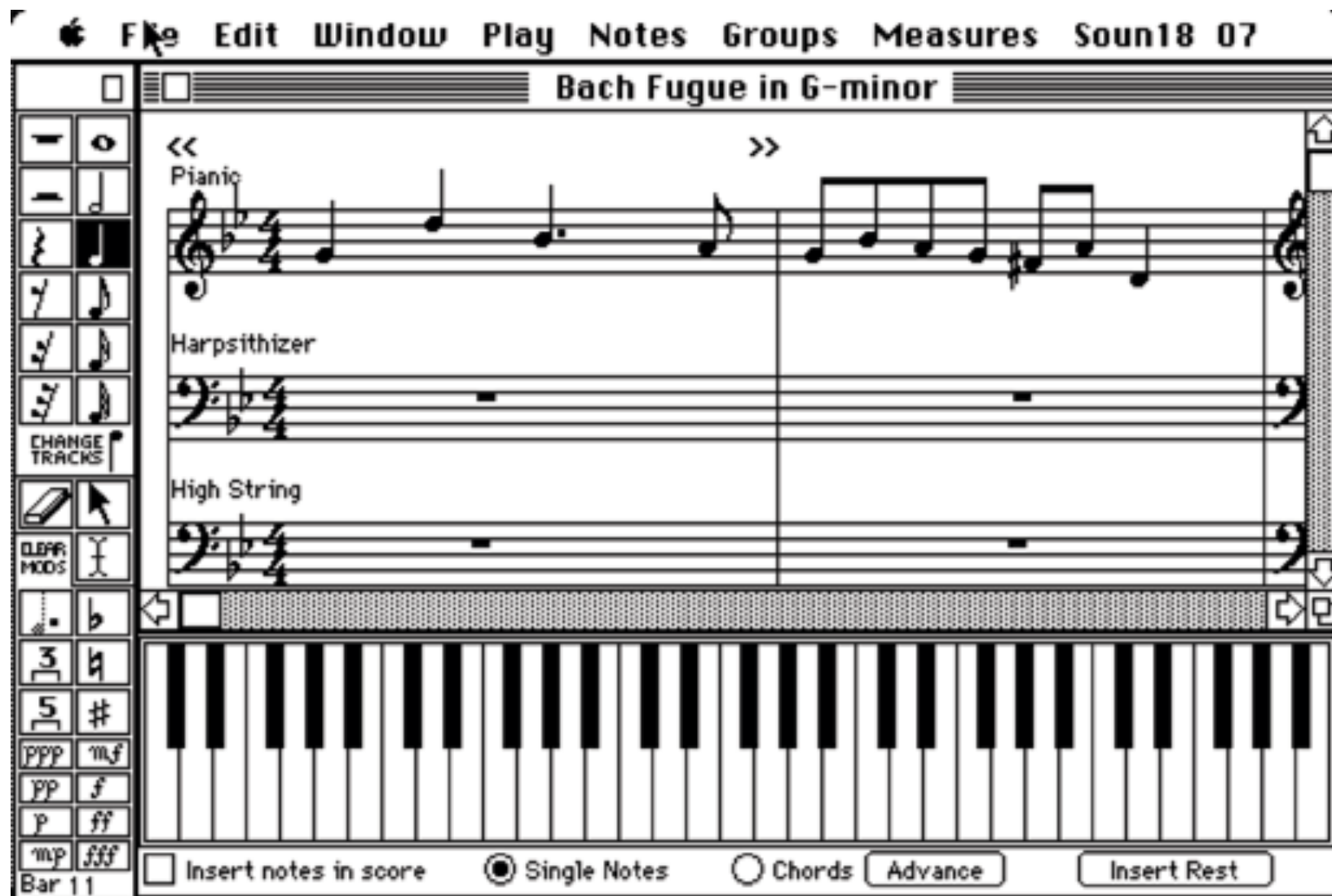
# A Layered Architecture Supporting Human Problem Domain Interaction



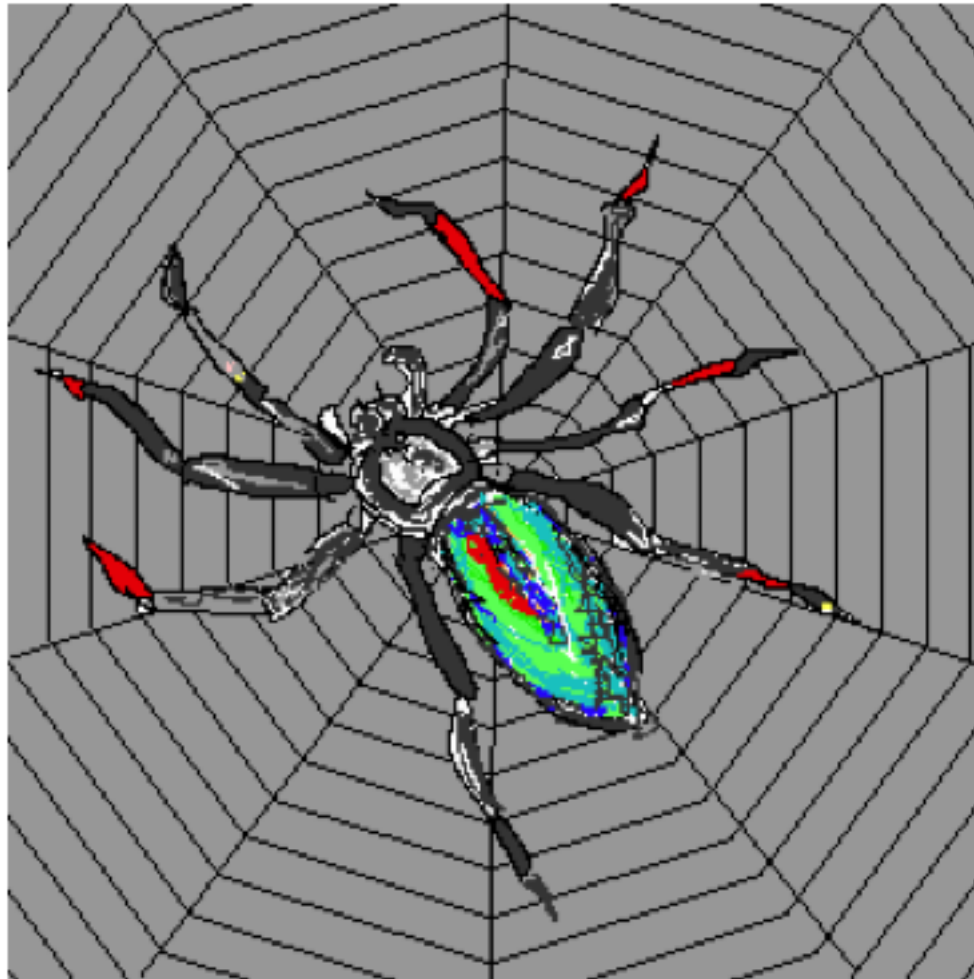
## Human Problem Domain Interaction — Pinball Construction Kit



## Human Problem Domain Interaction — Music Construction Kit



## **SchemePaint (M. Eisenberg): a programmable application combining direct manipulation with interactive programming**



# Computational Media

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## 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



# Concepts of Meta-Design

Concept	Implications
convivial tools	allow users to invest the world with their meaning and to use tools for the accomplishment of a purpose they have chosen
domain-orientation	bring task to the forefront; provide time on task
open, evolvable systems	put owners of problems in charge; in open systems, extension is an essential part of use
underdesigned systems	create seeds and constructs for design elaboration at use time
collaborative work practices	support design communities and the emergence of power users

# Traditional Design versus Meta-Design

Traditional Design	Meta-design
guidelines and rules	exceptions and negotiations
content	context
object	process
perspective	immersion
certainty	contingency
resolution	emergence
top-down	bottom-up
autonomous mind	distributed mind
creation	co-creation
specific solutions	solutions spaces
art	interactive art

# Users, End-Users, Programmers

- **computer use at work in 1997**

- 64 million Americans

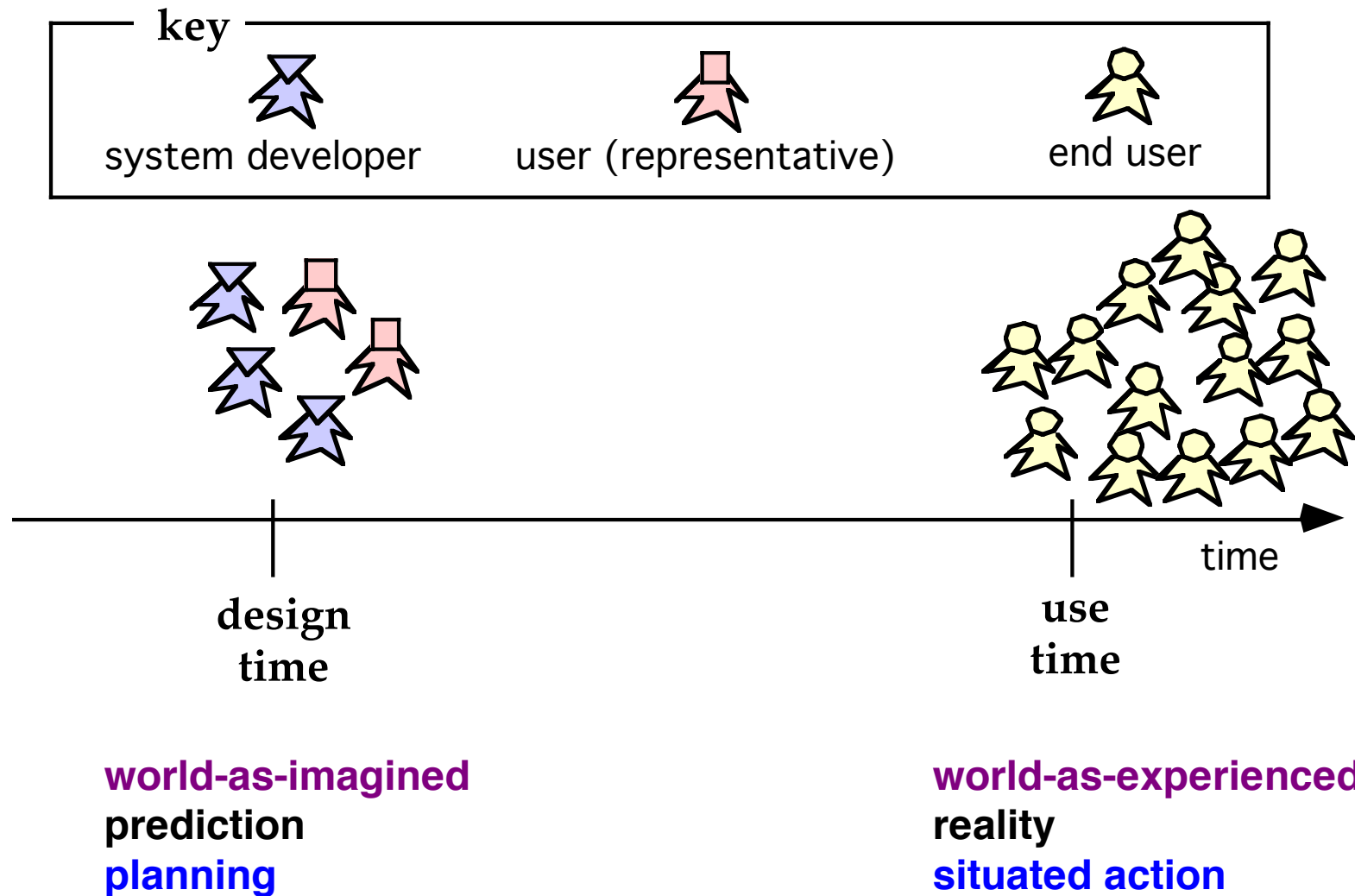
- **estimate for 2012**

- 90 million end users in American workplaces
- 55 million will use spreadsheets or databases (and therefore may potentially program)
- 13 million will describe themselves as programmers
- fewer than 3 million professional programmers

- **source:**

Scaffidi, C., Shaw, M., & Myers, B. (2005) "Estimating the Numbers of End Users and End User Programmers." In Proceedings of 2005 IEEE Symposium on Visual Languages and Human-Centric Computing, Dallas, Texas

# Design Time and Use Time



## **Meta-Design: Extending Other Design Methodologies**

- **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
- **learner-centered design**
  - draws attention to the changing needs of users
  - combine HCI interaction principles with educational interaction support
- **participatory design**
  - involve users more deeply in the process as co-designers
  - 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

# The Seeding, Evolutionary Growth, Reseeding (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

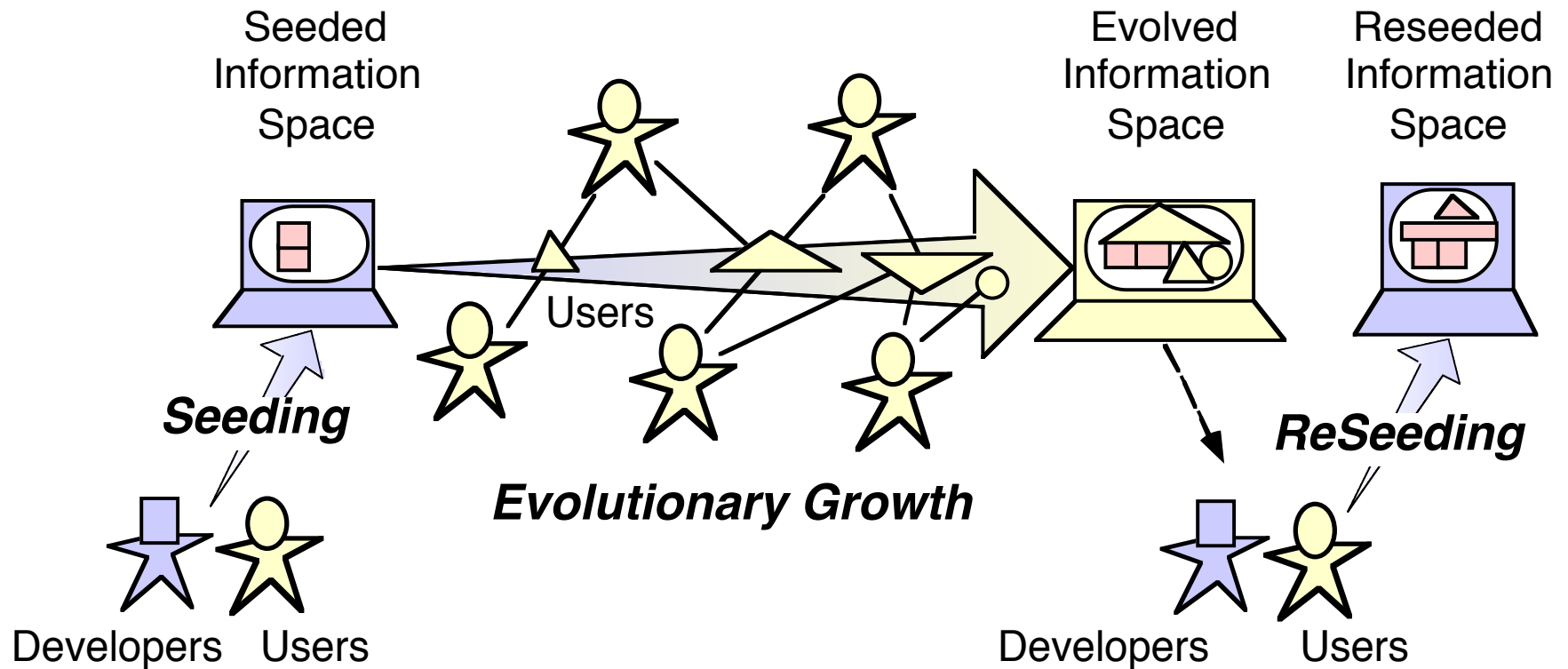
- **at use time:**

- 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

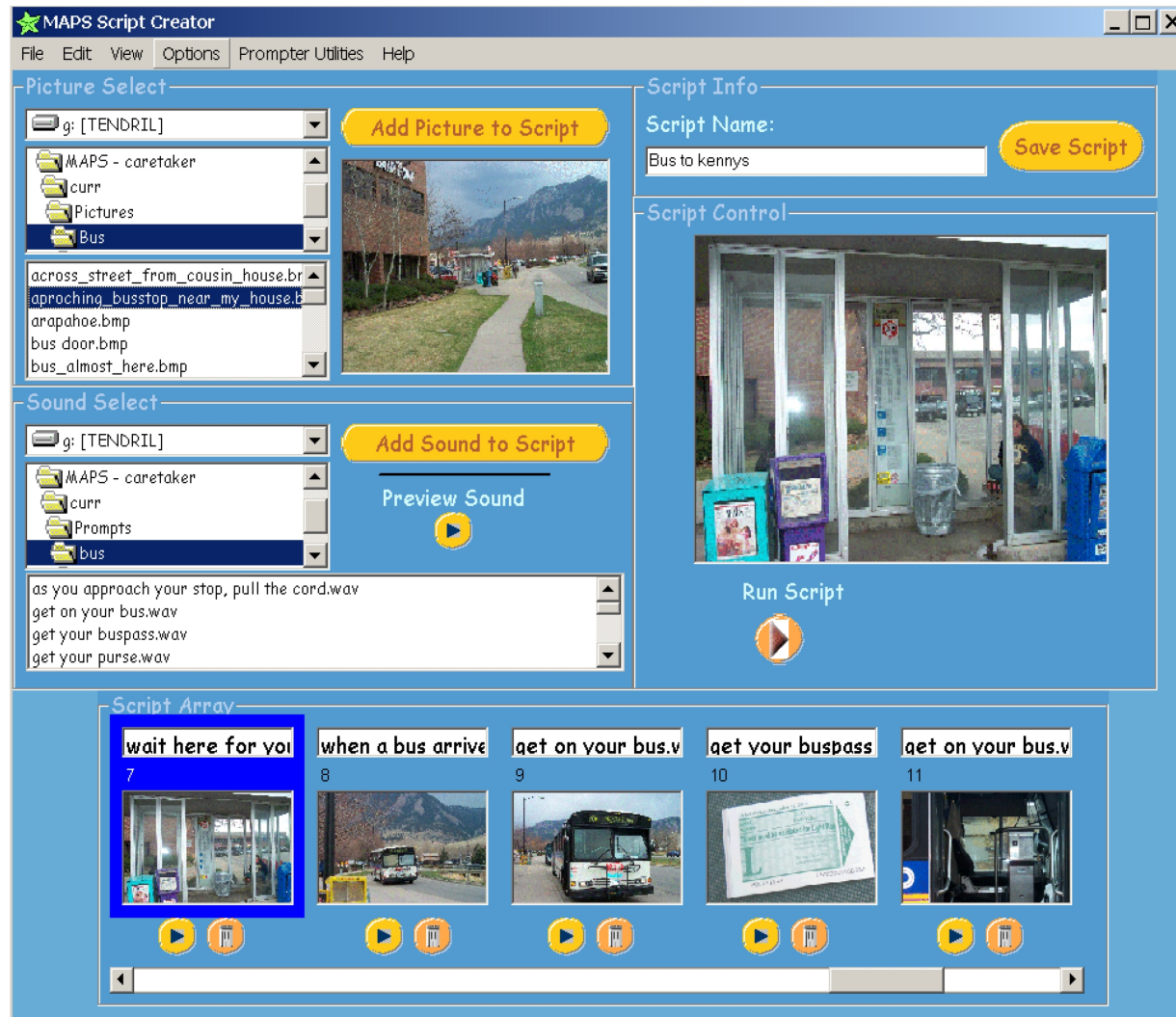
- **reseeding:**

- 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



# The MAPS Script Editor: Design for Designers





# **Assessment and Implications: Expanding Boundaries and Redistributing Control**

- **expanding boundaries:**

- power of the few → wisdom of the crowds
- socio-technical environments are living entities
- breaks down the sharp distinction between designers and users: users become co-designers

- **redistributing control:**

- developers and user-designers: sharing control
  - benign dictatorship
  - council control
  - complete decentralized
- control is desired only for personally meaningful problems
- the pitfalls associated with a “do-it-yourself” society

# Contributions of Meta-Design

- **improves the quality of life:** Web2gether and MAPS: an attempt to improve the quality of life for people with cognitive disabilities.
- **democratizes design and innovation:** meta-design eliminates the constraint that users are restricted to what is given to them
- **makes all voices heard:** participation and contributions of different stakeholders with various backgrounds.
- **changes professional practice:** creation of convivial tools and deprofessionalization (Illich)
- **revolutionizes the creation of systems:** creates foundation for social production and mass collaboration
- **establishes new paradigms in learning and teaching:** focus on community-based learning theories with innovative collaborative technologies

# Meta-Design: Transforming Application Areas

- **design:** customization, personalization, tailorability, end-user development, design for diversity — Lieberman, H., Paterno, F., & Wulf, V. (Eds.) (2006) *End User Development - Empowering people to flexibly employ advanced information and communication technology*, Kluwer Publishers, Dordrecht, The Netherlands.
- **architectural design:** underdesign, support for “unself-conscious culture of design” — Brand, S. (1995) *How Buildings Learn: What Happens After They're Built*, Penguin Books, New York.
- **teaching and learning:** teachers as facilitator, learning communities, courses-as-seeds — dePaula, R., Fischer, G., & Ostwald, J. (2001) "Courses as Seeds: Expectations and Realities," Proceedings of the Second European Conference on Computer-Supported Collaborative Learning (Euro-CSCL' 2001), Maastricht, Netherlands, pp. 494-501.
- **informed participation:** beyond access, social creativity — Arias, E. G., Eden, H., Fischer, G., Gorman, A., & Scharff, E. (1999) "Beyond Access: Informed Participation and Empowerment," Proceedings of the Computer Supported Collaborative Learning (CSCL '99) Conference, Stanford, pp. 20-32.

## Meta-Design: Transforming Application Areas — Continued

- **open source:** a success model of decentralized, collaborative, evolutionary development — Scharff, E. (2002) *Open Source Software, a Conceptual Framework for Collaborative Artifact and Knowledge Construction*, Ph.D. Dissertation, University of Colorado at Boulder.
- **living organizational memories:** living organizational memories such as Web2Gether — dePaula, R. (2004) *The Construction of Usefulness: How Users and Context Create Meaning with a Social Networking System*, Ph.D. Dissertation, University of Colorado at Boulder.
- **digital libraries:** community digital library — Wright, M., Marlino, M., & Sumner, T. (2002) *Meta-Design of a Community Digital Library*, D-Lib Magazine, Volume 8, Number 5, Available at <http://www.dlib.org/dlib/may02/wright/05wright.html>.
- **interactive art:** collaboration, co-creation, puts the tools rather than the object of design in the hands of users — Giaccardi, E. (2004) *Principles of Metadesign: Processes and Levels of Co-Creation in the New Design Space*, Ph.D. Dissertation, CAiiA-STAR, School of Computing, Plymouth, UK.

# Mindsets, Cultures, and Environments for Meta-Design

- how we can **educate and support skilled domain workers**
  - who are neither novices nor naive users, but
  - who are interested in their work and
  - who see the computer as a means rather than as an end
  
- how we can create **co-evolutionary environments**
  - in which users change, because they learn, and
  - in which systems need to be changed, because users become co-developers and engage in end-user modification and programming

# Summary

- **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