Nuove Sfide nell'Interazione Uomo-Macchina

Maria Francesca Costabile*
Nadja De Carolis*
Stefano Levialdi^

*Dipartimento di Informatica
Università di Bari Aldo Moro

^Dipartimento di Informatica
Sapienza Università di Roma

End-user development: new challenges of end user involvement in the software life cycle

Maria Francesca Costabile

Interaction, Visualization, Usability Lab

Dipartimento di Informatica
Università di Bari Aldo Moro
Via Orabona, 4, 70125, Bari

costabile@di.uniba.it

Calendario lezioni

- MF Costabile (6 ore)
  - Martedi' 22 marzo, Venerdi' 25 marzo, Martedi' 29 marzo, ore 9-11
  - End-User Development: nuove sfide per il coinvolgimento degli utenti finali nel ciclo di vita del software
- N De Carolis (6 ore)
  - Martedi' 3 maggio, Giovedi' 5 maggio, Venerdi' 6 maggio, ore 12-14:
  - Agenti socialmente intelligenti
- S Levialdi (4 ore)
  - Lunedi' 16 maggio ore 12-14, Martedi' 17 maggio, ore 9-11
  - Presentazione di due progetti di ricerca innovativi
- Congresso IS-EUD 2011, Hotel del Levante, Torre Canne (BR)
  - Mercoledi' 8 giugno: ore 9-13 (4 ore)
  - Relazione invitata (John Bacus, Google, Boulder, Colarado)
  - Presentazioni 3 articoli su EUD through Mashups

End-Users vs 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

IS-EUD 2011

Third International Symposium on End-User Development
Hotel del Levante, Torre Canne (Brindisi), Italy
June 7-10, 2011
www.iseud.net

Conference Chairs
Maria Francesca Costabile
University of Bari, Italy
Gerhard Fischer
University of Colorado, USA

Program Chairs
Yvonne Dittrich
University of Copenhagen, Denmark
Antonio Piccinno
University of Bari, Italy

Workshop Chairs
Anne-Marie Kanstrup
University of Aalborg, Denmark
Anders Mørch
University of Oslo, Norway

Doctoral Consortium Chairs
Daniela Fogli
University of Brescia, Italy
Elisa Giaccardi
Carlos III University of Madrid, Spain

Publicity Chairs
Paolo Buono
University of Bari, Italy
Rosa Lanzilotti
University of Bari, Italy

Local arrangement Chair
Carmelo Ardito
University of Bari, Italy

Steering Committee
Boris de Ruyter
Philips Research, The Netherlands
Volkmar Pipek
University of Siegen, Germany
Mary Beth Rosson
Pennsylvania State University, USA
Volker Wulf
University of Siegen, Germany

Toward End-User Development

- ***Users*** are people interacting with software systems
  Even software engineers are users of tools and environments they use for their work (e.g. CASE tools)
- ***End users*** are people not experts in computer science nor willing to be, who use computer systems for their daily activities, for work as well as for entertainment or other
- "Using the system changes the users, and as they change they will use the system in new ways" [Nielsen 1993]
- Interactive systems must be designed to ***evolve*** as needs of ***evolving*** end users might require
- ***Co-evolution*** of end user and system
  Interaction and Co-Evolution (ICE) model [Costabile et al 2006]
- Allowing end-users to personalize and evolve at run time their own software environments and tools ➔ ***End User Development***

End-User Development

- "End-User Development is a set of activities or techniques that allow users of software systems, who are acting as non-professional software developers, at some point to create or modify a software artefact "
  [EUD-Net 2002-2004]
- EUD means the active participation of end users in the software development and evolution processes
- New challenges for system design and implementation
- The need of EUD is not a luxory but a necessity: computer systems modeling some particular "world" are never complete
  - the world changes and new requirements emerge
  - Skilled domain professionals change their work practices over time
  [Fischer 2009]
- Systems are in a "perpetual beta"

Cultures of Participation

Application Domains

- Web 2.0
- Learning 2.0
- Digital Libraries 2.0
- Electricity 2.0
- Health 2.0
- Crisis 2.0 (CNN versus Bloggers, Twitter, ...)
- …

Cultures of Participation

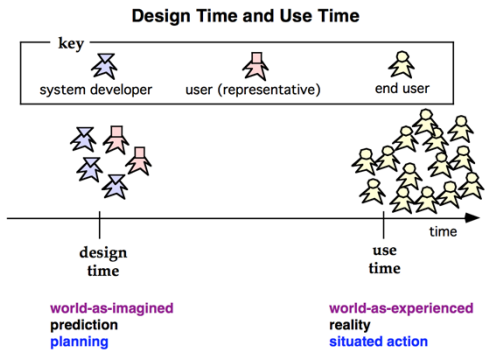
Fundamental Challenge and Opportunity

consumer cultures
focus: produce finished goods to be consumed passively

⇓

cultures of participation
focus: provide all people with the means to participate actively in **personally meaningful** problems

Fischer, G. (2010) "End-User Development and Meta-Design: Foundations for Cultures of Participation," Journal of Organizational and End User Computing 22(1), pp. 52-82.



Comments about Cultures of Participation

- "The experience of having participated in a problem makes a difference to those who are affected by the solution. People are more likely to like a solution if they have been involved in its generation; even though it might not make sense otherwise" [Rittel, 1984]
- "I believe passionately in the idea that people should design buildings for themselves. In other words, not only that they should be involved in the buildings that are for them but that they should actually help design them" [Alexander, 1984]
- "The hacker culture and its successes pose by example some fundamental questions about human motivation, the organization of work, the future of professionalism, and the shape of the firm" [Raymond & Young, 2001]
- "Users that innovate can develop exactly what they want, rather than relying on manufacturers to act as their (often very imperfect) agents" [von Hippel, 2005]
- "The networked environment makes possible a new modality of organizing production: radically decentralized, collaborative, and nonproprietary" [Benkler, 2006]

End users in sw life cycle

Traditional approach

use by end users ⟷ Development by software professionals

Participatory approach

use by end users ⟷ Development by software professionals **with** end users

EUD & Meta-design

development **by** end users
use by end users
evolution by end users
Development by software professionals with end users

Meta-design

- Design for designers
- It creates open systems at design time, which can be modified by their end users acting as co-designers at use time
  [Fischer and Giaccardi 2006]
- A design paradigm that includes end users as designers and provides all stakeholders in the design team with suitable software environments, whose languages and tools may foster their reasoning about development and evolution of interactive software systems that support end users' work
  [Costabile et al 2007]
- Creation of context rather than content

Esempio di interfaccia flessibile: Google, Home page personalizzabile

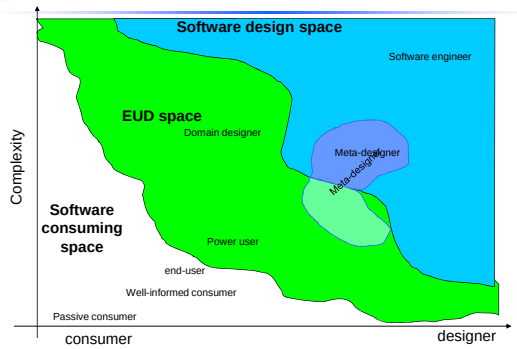
End users as Co-Developers (in Microsoft Word)

- ***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")
- …

Interfacce utente flessibili e personalizzabili

- Le **interfacce utente flessibili** e personalizzabili danno agli utenti la possibilità di configurare la presentazione e le funzionalità del sistema che usano senza dover necessariamente cambiare l'applicazione complessiva

Consumers and designers spaces



Adapted from: Fischer, G., Piccinno, A., Ye, Y.: The Ecology of Participants in Co-Evolving Socio-Technical Environments. Springer, LNCS 5247, pp. 279-286. (2008)

Designing systems that satisfy end users

- Some basic principles:

1. In an application domain, there are **different communities of end users**
2. End users need software environments in which they find **all and only the tools** necessary to perform their activities, without being overwhelmed by unnecessary tools and information
3. Systems must be designed for **co-evolution of users and systems**

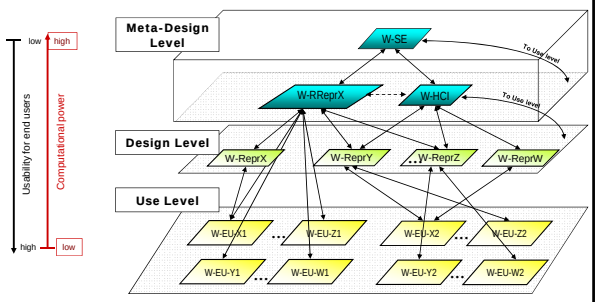
Software Shaping Workshops

- A useful metaphor for conceptual design: ***artisan workshop*** 
- A ***Software Shaping Workshop (SSW)*** is a software environment devoted to a specific community of end users
- It is organized as a virtual workshop
  - end users find all and only the tools they need
  - end users carry out their activities and adapt environment and tools using high level visual languages tailored to their needs
- ***Workshop*** as artisan workroom, not as people meeting
- An interactive system to support the work practice in a given application domain
  - cannot provide the same interaction environment to all end users
  - must be designed as a ***set of software shaping workshops***, each specific for a community of end users (SSW methodology)
- In some SSWs, end users perform EUD activities

From the field study

- Various operators use patient records in different ways and to accomplish different tasks
- Specific patient records for each ward, even in the same hospital
- Example:
  - in a children neurological ward, information about newborn feeding must be available
  - in an adult neurological ward, information about alcohol assumption is required
  - In a surgery department, a lot of specific data collected by different specialits (cardiologists, pneumologists, ..) to indicate if the patient can undergo a surgery are required
- Operators are reluctant to accept a common unified format, they want to adapt the patient record to their specific needs

Interactive system as SSW network



Each SSW provides only the tools to perform the desired activities

EPR design

- Patient records can be seen as being composed by modules for collecting patient data
- The patient records used in different wards assemble a subset of modules in different ways, customized to the need of the specific ward

➔

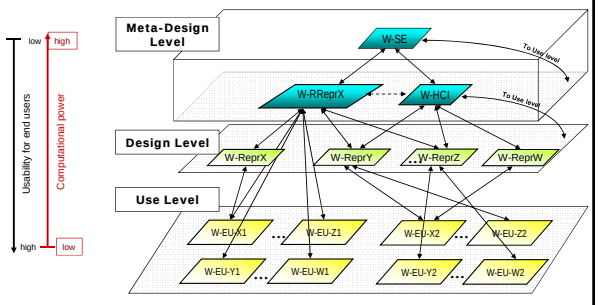
Our approach

- to identify the data modules that have to be managed in the whole hospital
- let each head physician to design the EPR for her/his ward by composing the ERP through direct manipulation of such modules
- physicians, nurses, … will use this ERP

Case study in the medical domain: designing the Electronic Patient Record (EPR)

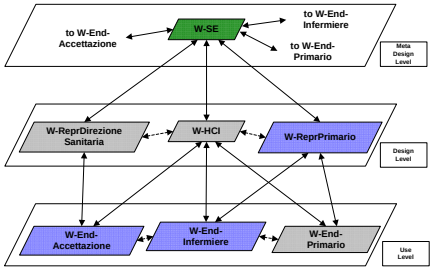
- Several projects on EPR
- Many hospital in Italy do not adopt EPR
- We conducted a field study on the use of paper patient record at the “Giovanni XXIII” Children Hospital of Bari, Italy
- Patient record is *many-sided*
  - it is a document to be read and understood by various and very different actors: physicians, nurses, patients’ relatives, the family doctor, etc.,
  - it must have the ability to speak different “voices”, i.e., to convey different meanings according to the actors using it

Interactive system as SSW network

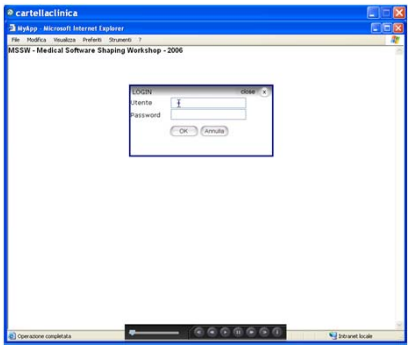


Each SSW provides only the tools to perform the desired activities

The SSW network in the case study

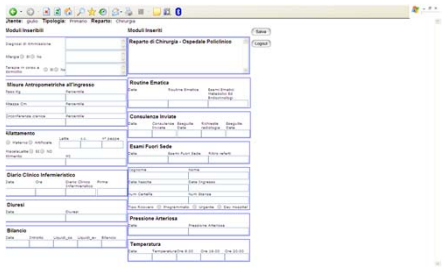


Video about the prototype

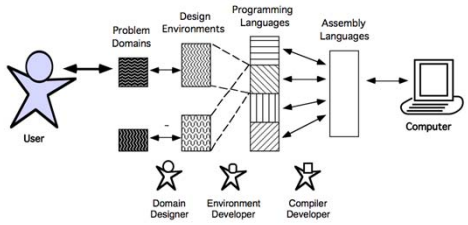


Workshop for Head Physician

W-RapprPrimario is used by each head physician to create and update the specific application workshops "W-End-Infermiere"



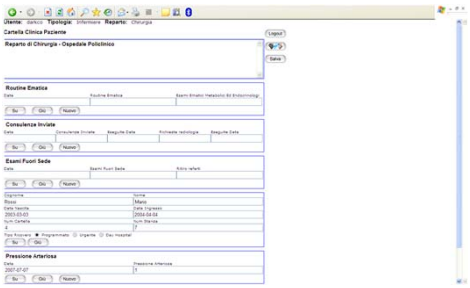
A Layered Architecture Supporting Human Problem Domain Interaction



Gerhard Fischer 14 University of Bari, 2010

Workshop for Nurses

- **W-End-Infermiere** is used by nurses to daily fill in the measurements on the patient (and required in the patient record)



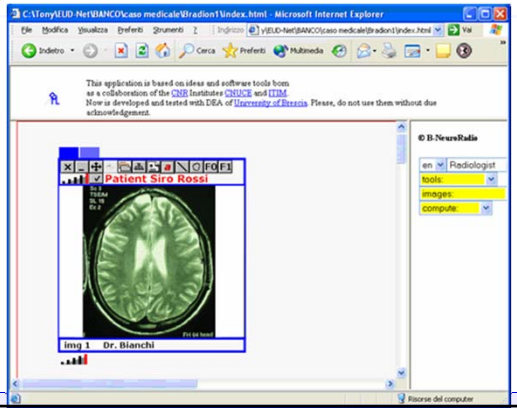
Another example in the medical domain

- Physicians of two categories collaborate to reach a diagnosis:
  - neurologists
  - Neuro-radiologists

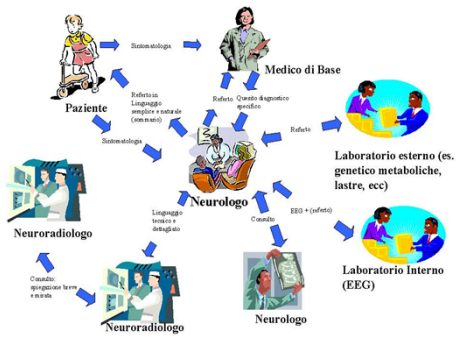
The medical scenario

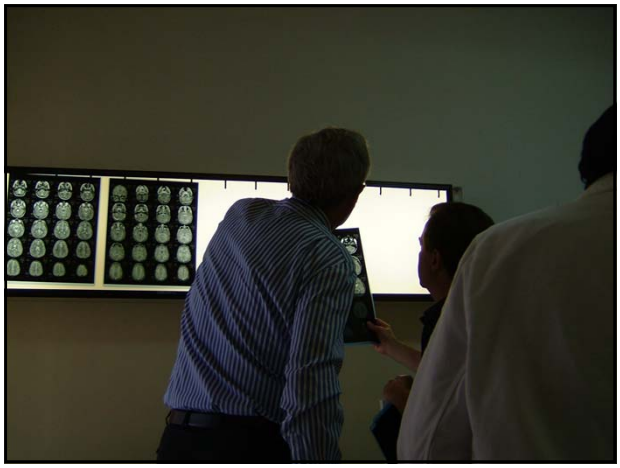
- Techniques offer physicians *new possibilities*
- Working organization requires physicians to use new *technologies for collaboration*
- Different physicians collaborate working in different hospitals and having different expertise
- They overcome their communication hurdles by using electronic tools in a naïve way
- They required us to improve the quality of their communication, and therefore of their diagnostic capabilities

Primo prototipo SSW neurologo

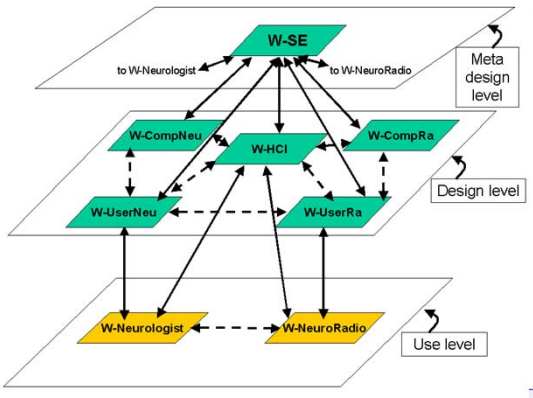


The scenario

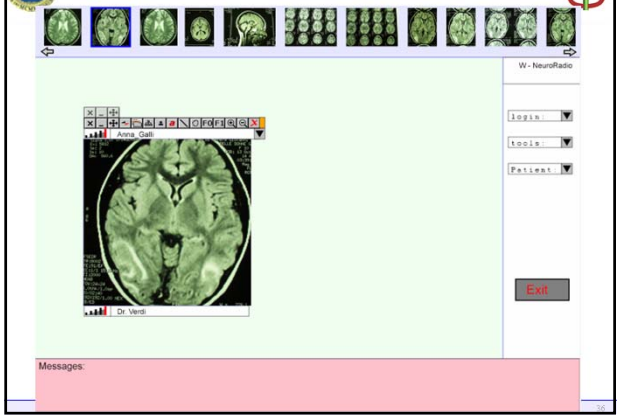




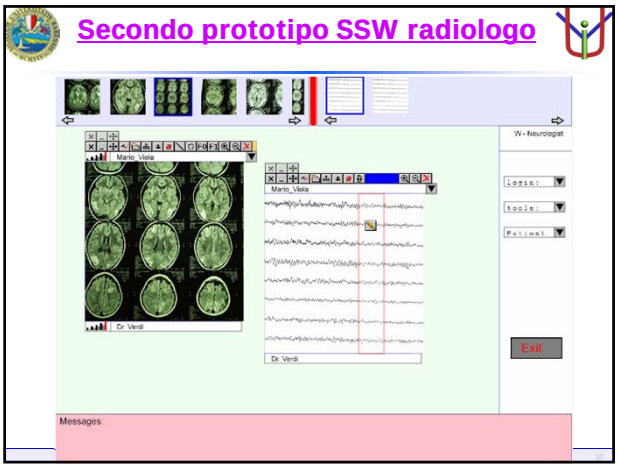
Rete di SSW nel caso medico

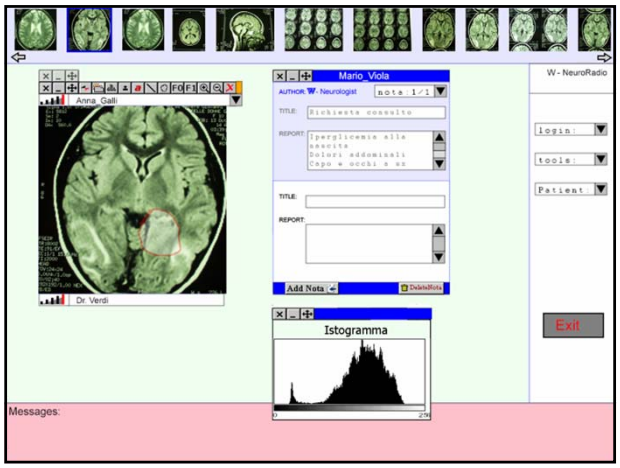


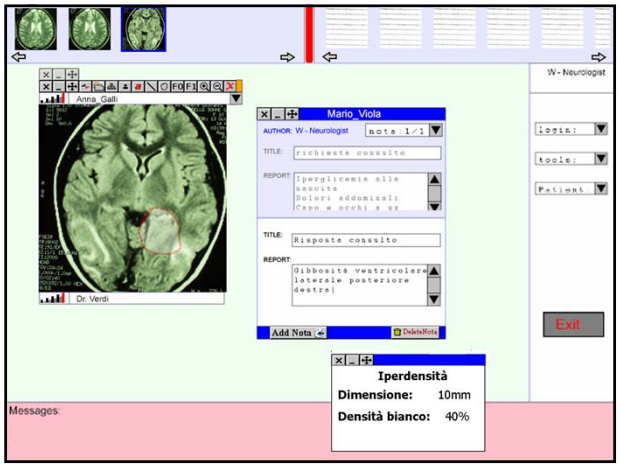
Secondo prototipo SSW neuro-radiologo

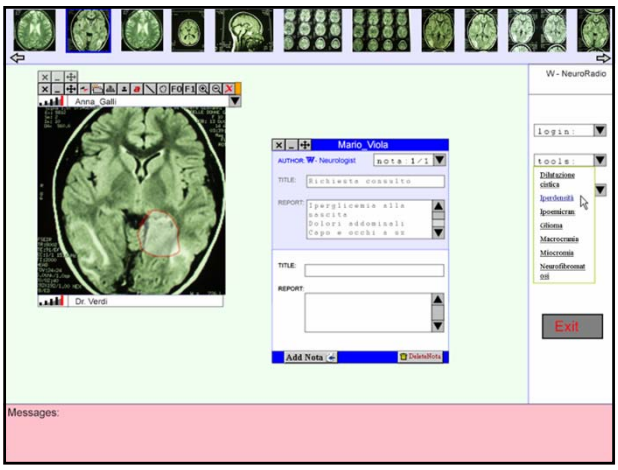


Secondo prototipo SSW radiologo







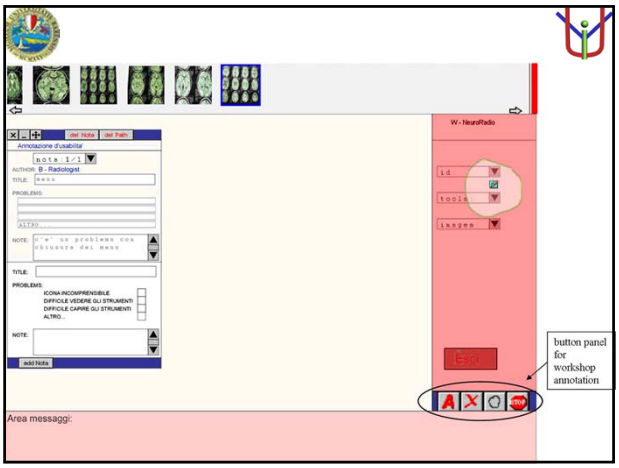


Workshops for neurologists and neuro-radiologists

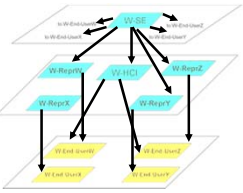
software environment for neurologists

software environment for neuro-radiologists

M. F. Costabile - End User Development: New Challenges of End User Involvement in the Software Life Cicle, Marzo 2011



Communication paths in the network

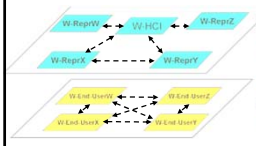


Exchange paths:
- the paths along which the exchanges of data and programs occur
- among the workshops at the same level

Request paths:
- concerned with the communications going from low levels to higher levels
- trigger the co-evolution process, carrying on the feedback from end users (requests for workshop modification or extension)

Generation paths:
- represent the activity of using workshops at a high level to generate, modify or extend workshops to be used at the lower level
- new or evolved workshops are made available to lower levels along such generation paths

Communication paths in the network



Exchange paths:
- the paths along which the exchanges of data and programs occur
- among the workshops at the same level

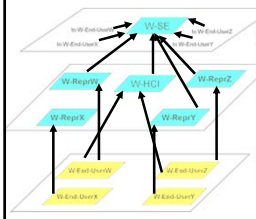
Request paths:
- concerned with the communications going from low levels to higher levels
- trigger the co-evolution process, carrying on the feedback from end users (requests for workshop modification or extension)

Generation paths:
- represent the activity of using workshops at a high level to generate, modify or extend workshops to be used at the lower level
- new or evolved workshops are made available to lower levels along such generation paths

SSWs permit to design and evolve a system through collaborative negotiations

- The negotiation is based on the exchange along the SSW network of two types of messages:
  - annotations about these workshops
  - executable specifications of workshops (XML-based documents)
- A stakeholder designs or updates a workshop (e.g. head phisician) by using a domain specific language. His actions modify the executable specification that, when interpreted by the browser, generates the new workshop

Communication paths in the network



Exchange paths:
- the paths along which the exchanges of data and programs occur
- among the workshops at the same level

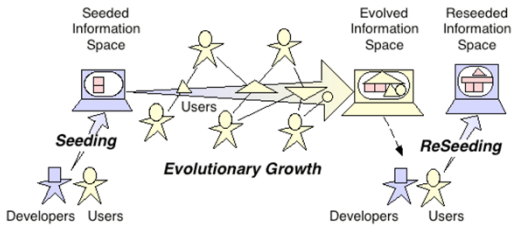
Request paths:
- concerned with the communications going from low levels to higher levels
- trigger the co-evolution process, carrying on the feedback from end users (requests for workshop modification or extension)

Generation paths:
- represent the activity of using workshops at a high level to generate, modify or extend workshops to be used at the lower level
- new or evolved workshops are made available to lower levels along such generation paths

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



Gerhard Fischer 25 University of Bari, 2010

Mass Customization

- New frontier in business competition
- It permits an increase in variety and customization of the manufactured products and services, avoiding cost increase
- As the costs of production and distribution fall, there is less need to lump products and consumers into one-size-fits-all containers
- Without the constraints of physical shelf space and other bottlenecks of distribution, narrowly-target goods and services can be as economically attractive as mainstream fare

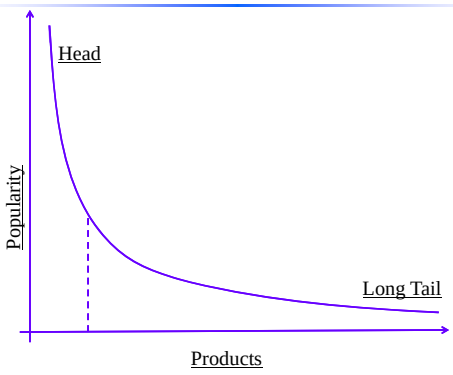
Contributions of Meta-Design

- **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.
- **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

Necessità di EUD a Università di Bari

- A una riunione in cui si presentava la proposta di un portale per certi servizi e' emersa l'esigenza di un utente di creare il suo report personalizzato
  Risposta del progettista: ci deve essere il call center, al quale fare la richiesta telefonica di creare un nuovo report secondo le proprie esigenze
- Un'attivita' di EUD dovrebbe mettere in grado l'utente di personalizzare il suo report

Long tail



Theory of the Long Tail

- Our culture and economy is increasingly shifting away from a focus on a relatively small number of “hits” (mainstream products and markets) at the head of the demand curve and toward a huge number of niches in the tail

Alcune considerazioni

- I configuratori attuali hanno funzionalità simili
  - modifica colore, modifica materiale
  - impossibilità di modificare forma e dimensioni
  - scelta tra una limitata varietà di opzioni predefinite

Vantaggi:

- assistono e guidano l'utente nel processo di personalizzazione del prodotto

Svantaggi:

- scarsa libertà decisionale all’utente

Configuratori di prodotto

Mass Customization
"un nuovo modo di concepire la competizione, in cui è di primaria importanza identificare e soddisfare la volontà e i bisogni del singolo cliente, senza sacrificare efficienza, efficacia e costi”
[Pine II, 1993]

CONFIGURATORI DI PRODOTTO

Programmi di configurazione che assistono e guidano l'utente nel processo di personalizzazione del prodotto e presentando un set di possibilità da cui scegliere

Azienda Maiellaro s.r.l.

mobili e complementi d'arredo in stile classico italiano

Riceve richieste di prodotti personalizzati

Obiettivo: **automatizzare il processo di ordine di prodotti personalizzati**

- mettere a disposizione degli utenti uno strumento che consenta variazioni su un mobile in catalogo e effettuare l’ordine d’acquisto

Esempi di configuratori

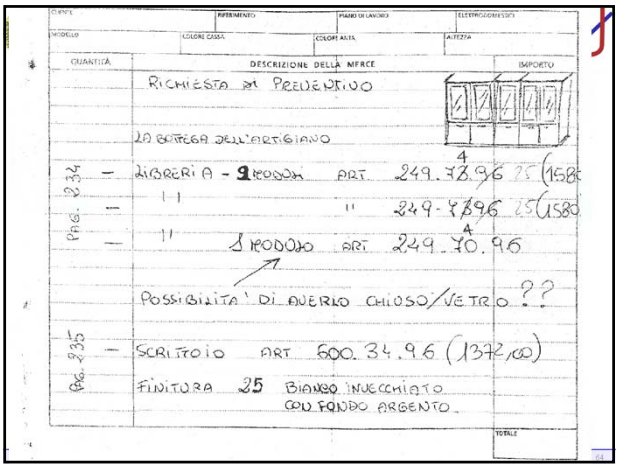
Nike
IKEA
...

Analisi dei requisiti

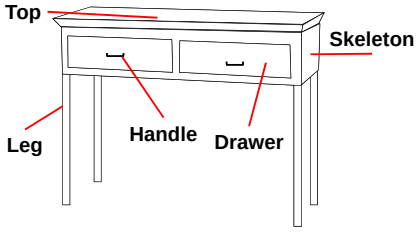
- Conoscere il dominio dei mobili d’arredo
- Definire i requisiti del sistema e degli utenti
- Progettazione di interviste per:
  - definire il workflow di processo all’interno dell’azienda
  - definire gli attori
- Visita sul posto
  - Osservazioni/Analisi documenti utilizzati
  - Attori individuati: Cliente, Ufficio vendite, Ufficio Acquisti, Magazzino, Fornitori

Stakeholders

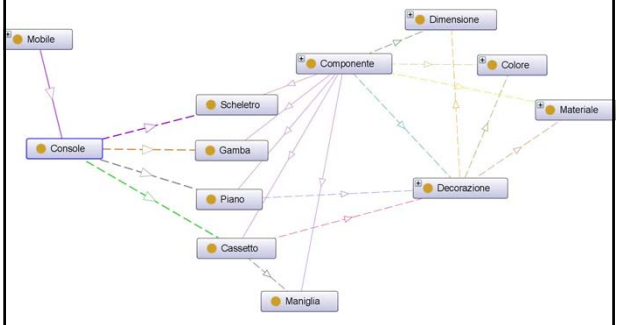
- software engineers (meta-designers)
- company managing director
- sales office employees
- technical department employees
- customers

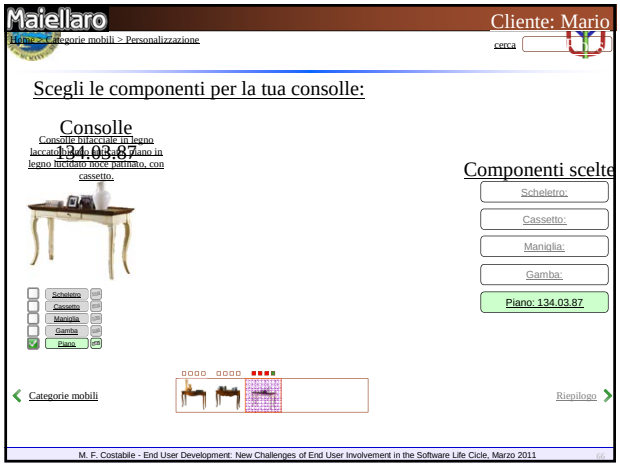


A console and its components



A portion the ontology representing a console





Conclusion

Future Scenario for Software

- Recent projects describe a future scenario for software systems
  - Software will increasingly be part of integrated, heterogeneous, and continuously developing infrastructures
  - End users will actively change the tools they work with and orchestrate different services as building blocks to provide the functionality they need
  - In cases where the required functionality cannot be obtained by simple tailoring, they will ***communicate*** and ***cooperate*** with local and other professional designers who in turn might call upon a network of peers or developers of the base products and frameworks used
- The described SSW approach supports this scenario