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Creativity and Evolution: A Metadesign Perspective

Abstract

In a world that is not predictable, improvisation, evolution, and innovation are more than a luxury: they are a necessity. The challenge of design is not a matter of getting rid of the emergent, but rather of including it and making it an opportunity for more creative and more adequate solutions to problems. Whereas user-centered and participatory design approaches (whether done *for* users, *by* users, or *with* users) have focused primarily on activities and processes taking place at design time, and have given little emphasis and provided few mechanisms to support systems as *living entities* that can be evolved by their users, *metadesign* is an emerging conceptual framework aimed at defining and creating social and technical infrastructures in which new forms of *collaborative design* can take place. Metadesign extends the traditional notion of design beyond the original development of a system to include *co-adaptive processes* between users and systems, which enable the users to *act as designers and be creative*.
This paper presents the results of our studies and design activities in the last two decades at the Center for LifeLong Learning & Design of the University of Colorado at Boulder.

Keywords

Metadesign, design time, use time, multidimensional design space, open systems, adaptable interaction, embodiment, co-creation, co-evolution, social creativity, boundary objects, seeds, mediators, SER process model, critics, reuse, affect.

Introduction

In a world that is not predictable, improvisation, evolution, and innovation are more than a luxury: they are a necessity. The challenge of design is not a matter of getting rid of the emergent, but rather of including it and making it an opportunity for more creative and more adequate solutions to problems.

Generally considered to be the conception and planning of the artificial (or invented) as a normative form of science ("how things ought to be") in contrast to natural sciences ("how things are"), design is better defined today as an inquiry and experimentation in the activity of "making". That is, design is conceived as a humanistic enterprise in which the subject matter is not fixed [Buchanan & Margolin, 1995], and is meant to envision possibilities ("how things might be") and elaborate them in order to enable people to experience the world in more and richer ways [Maturana, 1997].

In the context of such a development of the design discourse, and related design methodologies [Cross, 1984], the notion of metadesign has developed inside a precise linguistic inheritance that leads to a strong sense of "change of place, order, or nature" [Giaccardi, 2005a], matching ideas of design as "modification" [Norman, 1992] or "evolution" [Jantsch, 1975]. In our design approach, metadesign represents an issue of how to construct socio-technical systems that allow users to cope with the emergent aspects of reality by enabling them, when needed and desired, to *act as designers and be creative*.

This paper highlights the relationships between creativity and evolution in our metadesign framework [Fischer & Giaccardi, 2005; Fischer et al., 2004], stressing the role of situated processes [Suchman, 1987], possible "breakdowns" [Schön, 1983], and emergent opportunities [Johnson, 2002] in the creative evolution of socio-technical systems. In the first part of this paper, we present the conceptual framework of metadesign; in the second part, we describe the methodologies, process models, and support mechanisms we have identified and developed to link creativity and evolution in collaborative design, drawing examples from our studies and design activities.

Foundational Concepts for Metadesign

Metadesign supports change in order to fit new needs and opportunities that arise during the use of artefacts. In doing so, metadesign addresses the following challenges:

- *Coping with Ill-Defined Problems*. Being ill-defined, design problems cannot be delegated (*e.g.*, from users to professionals) because they are not understood well enough to be described in sufficient detail [Rittel & Webber, 1984]. The integration of problem framing and problem solving is critical because the conceptual structures underlying complex systems are too complicated to be specified accurately in advance and be built faultlessly.

- *Supporting Reflective Practitioners*. Schön characterizes design as a "reflective conversation with the materials of the situation"

[Schön, 1983]. He argues that this conversation with the materials of the design situation is how designers gradually build their understanding of a design problem and its solution. The act of creating and arranging the design situation over time reveals assumptions and implications that otherwise would have remained hidden.

- *Design as a Collaborative Process*. Complex design problems require more knowledge than any single person can possess [Salomon, 1993], and the knowledge relevant to a problem is often distributed among stakeholders from different perspectives and backgrounds. In a world in which solutions are neither given nor confined in one single mind [Bennis & Biederman, 1997], the possibility for the user to transform into the role of designer requires not only participation, but also an expansion of the creative process.

Users' needs and tasks, as well as situations and behaviours, cannot be fully anticipated because they are ill-defined and change over time. As *owners of problems* [Fischer, 1994a], users and communities need to be engaged in the fundamentally joint process of problem framing and problem solving, both when the system is designed and when the system is used. The necessity of keeping the system open to participation and evolution at use time is meant to bond social and technical systems not only to make them more efficient, but also to allow them to cope with emergent, unintended, or even subversive uses.

By putting owners of problems in charge and enabling them to migrate along different roles from consumer to designer [Fischer & Giaccardi, 2005], metadesign contributes to the invention and design of cultures in which humans can express themselves and engage in personally meaningful activities. Metadesign provides the foundation for an *unselfconscious* (or spontaneous) *culture of design* [Alexander, 1964], in which the failure or inadequacy of the system and unexpected opportunities lead directly to an action to change or improve the design.

Design Time and Use Time

In all design processes, two basic stages can be differentiated: design time and use time. At design time, system developers (with or without user involvement) create environments and tools. In conventional design approaches, they create complete systems for the "world-as-imagined". At use time, users utilize the system even though their needs, objectives, and situational contexts could only partially be anticipated at design time; thus, the system often requires modification to fit the user's needs. To accommodate unexpected issues at use time, systems must be "under-designed" at design time so the users directly experience their own world at use time (*i.e.*, the "world-as-experienced"). In our framework, *under-design* [Brand, 1995] is fundamentally different from creating complete systems: rather than developing solutions, under-designing means developing systems that allow users to create the solutions themselves. *It is not less design, but a different kind of design.*

Whereas user-centered and participatory design approaches (whether done *for* users, *by* users, or *with* users) have focused primarily on activities and processes taking place at design time and have given little emphasis and provided few mechanisms to support systems as *living entities* that can be evolved by their users, metadesign is an emerging conceptual framework aimed at defining and creating social and technical infrastructures in which new forms of *collaborative design* can take place.

In *user-centered design*, designers generate solutions that place users mainly in reactive roles [Norman & Draper, 1986]. Participatory design approaches [Schuler & Namioka, 1993] seek to involve users more deeply in the process as co-designers. Participatory design has focused on system development at design time by bringing developers and users together to envision future contexts of use and empowering users to propose and generate design alternatives themselves. But despite the best efforts at design time, systems need to be evolvable to fit emergent needs, account for changing tasks, and couple with the domain in which users are situated [Fischer, 1998]. Compared to traditional participatory approaches, metadesign supports *co-adaptive processes* between users and systems, and it addresses participation as a *participative status* [Dourish, 2001], in which the user spontaneously couples with the system, rather than as a way of increasing the probability a design will be used as intended.

Metadesign shares some important objectives with these approaches, but it transcends them in several important dimensions. Different from these approaches, metadesign creates *open systems* that can be modified by their users and evolve at use time, supporting more complex interactions. Compared to traditional design approaches, metadesign changes the processes by which systems and content are designed by *intentionally* shifting some control from designers to users, enabling users to create and contribute their own visions and objectives, and keeping the world and the system in sync.

The Art of Open Systems

Systems supporting creativity and evolution need to be *open systems* — allowing users to modify content and functionality as they use the system to solve problems. Open systems provide opportunities for significant changes at all levels, making enhancement and evolution of the system “first-class design activities”. Over the years, our research has identified the following principles for the development of open systems:

a) *Software systems must evolve; they cannot be completely designed prior to use.* System developers cannot anticipate and design for every possible situation. Seeds (described later in the paper) represent an initial construct that can be applied to some situations, facilitating the construction of new situations.
b) *Systems must evolve at the hands of the users.* Giving the owners of problems the ability to change systems as they explore their problems

leverages the insight that uniquely belongs to those experiencing the problems. It is important to provide different avenues for modification that are appropriate for different kinds of users.

c) *Systems must be designed for evolution*. Extending an application in an initially closed design is difficult due to the assumptions implicit in a system designed without extension in mind. Designing a system for evolution from the ground up can provide a context in which change is expected and can take place.

d) *Evolution of systems must take place in a distributed manner*. Users will be distributed in space, in time, and across different conceptual spaces [Fischer, 2004].

A Multidimensional Design Space

The redistribution of engagement and design activities between design time and use time encompasses a design space comprising *three planes* [Giaccardi, 2004], in which different dimensions are composed, and for which different methodological approaches need to be integrated. These three planes of design, interestingly recalling the etymology of the suffix "meta-", can be summarized as follows:

(1) **Designing Design, or Design by Anticipation ("Meta-" as "Behind")**
This plane of design promotes the malleability and modifiability of computational structures and processes, rather than producing fixed objects and contents. It entails *anticipatory methods and techniques* for the design of the design process (such as, in our framework, *under-design*). At this level, metadesigners play an important role in setting the conditions that will allow users to become designers in turn by anticipating both their needs and the potential changes that will occur at use time. The possibility of modifying the system that is provided at this level by metadesigners will allow the users to respond to the mismatch between what can be foreseen at design time and what emerges at use time. This possibility will provoke a creative and unplanned "opportunism" [Wood, 2000], building on situated processes and emergent conditions.

(2) **Designing Together, or Design by *and* for Participation ("Meta-" as "Together")**
This plane of design is centered on the way in which metadesigners and users participate in the design activity, both at design time and at use time. It entails both traditional *participatory methods and techniques* for letting the users be involved by the metadesigners in the initial setting at design time, and *support mechanisms* (such as, in our framework, *critics* and *reuse*, described later in this paper) for enabling the users to learn and in turn to become designers at use time. At this level, metadesigners and users play fluid roles in the collaborative design activity, being able to intervene at different times and different planes of social interaction (*i.e.*, from the individual to the community [Fischer, 2004]).

(3) **Designing the "In-Between," or Design for Emergence ("Meta-" as "Among")**
This plane of design is concerned with how people can experience and negotiate their systems of relationships, and engage in the creation of meaningful activities when "embodied" in the socio-technical setting

provided by the system. It entails *affective methods and techniques* (such as the use of *mediators* and related support mechanisms, described later in this paper) for enabling those sensorial and emotional activities that intervene into the active relationships among people [Hansen, 2000; McCarthy & Wright, 2004; Norman, 2004], and it can sustain collaborative practices. At this level, users are crucial in opening up the system to unintended and creative uses.

These three planes of design are interdependent. They provide metadesign with a *structural openness* supported by the computational malleability of the system (first plane), which corresponds to and is integrated with an *interactive openness* given by the participative (second plane) and affective (third plane) relationships and activities in which the users can engage by means of the system. These planes of design provide a structure for how the computational and cognitive, but also affective, social, cultural, and historical dimensions have to be promoted and correlated to support metadesign.

Creativity and Evolution in the Metadesign Framework

How are creativity and evolution linked in metadesign? How can this link be promoted? In his analysis of the relationships between creativity and evolution, Taylor [Taylor, 2002] emphasizes that in order to support *open-ended and creative evolution* (such as that advocated by metadesign) is fundamental for individuals to be part of the environment experienced by other individuals (see also [Arthur, 1994]). From Taylor's perspective, an open-ended and creative evolution is "fundamentally new", as he makes reference to "the ability of individuals to interact with their environment with few restrictions and to evolve mechanisms for sensing new aspects of this environment and for interacting with it in new ways" [Taylor, 2002]. The embodiment and richness of interactions that will lead to the ability to perform new tasks are crucial. In our socio-technical systems, we share this belief by promoting situated processes, breakdowns, and emergent opportunities, and by sustaining users' participative status, or *engagement*, by both embodiment (in the sense expressed here by Taylor) and adaptable interaction. This section provides an understanding of evolution and creativity in the metadesign framework; concepts, process models, and support mechanisms for embodiment and adaptable interaction are detailed in the following sections.

The open systems created by metadesign: (a) *promote the transcendence of the individual mind*; (b) *support the users' engagement in the collaborative construction and sharing of meaningful activities*; and (c) *enable the mutual adaptation and continuous evolution of users and systems* by letting users modify the system at use time and adapt it to their dynamic practices.

Social Creativity for Transcending the Individual Mind. Because solutions are not confined in a single mind [Bennis & Biederman, 1997], we need to expand the creative process beyond the individual mind; in relation to this transcendence, we have adopted the notion of "social creativity" [Arias et al., 2000]. The difference among knowledge, abilities, and motivations that exist in individuals and compose social creativity provides the ground for the collaborative activity and is crucial for both co-creation and co-evolution. A good example of social creativity is the development of open source software [Raymond & Young, 2001], demonstrating that the sharing of source code makes it possible for others to go forward, when the original developers cannot go further due to various reasons such as loss of interest, limited time, or lack of new ideas. Another good example is interactive art [Candy & Edmonds, 2002], in which artworks are produced by interactions among several participants, and results are achieved that the single artist could have not thought of in isolation.

Co-Creation for Engaging in Meaningful Activities. To act as designers and be creative, users need to be able to express themselves and engage in personally meaningful activities. That is, they need to be "embedded" and active in the system of relationships provided by the socio-technical setting. *Co-creation* [Giaccardi, 2005b] is the collaborative construction and sharing of meaningful activities that result from the users' embodiment in the socio-technical system. It is engendered by the context and collection of interactions among participants and is moulded by these without any central guidance towards specific objectives or determined strategies. Co-creation is usually triggered by a combination of synchronisation and improvisation, and is based on enabling users in the socio-technical environment to share emotions, experiences, and representations.

Co-Evolution for Coping with Experience. The evolution of a socio-technical environment is conceived in the metadesign framework as the evolution of a *living entity*, by which the changes by each participant in the interaction process (either the software or the human subject) influence the evolution of the other participants. This co-evolution takes place over time in the joint process of problem framing and problem solving, and is a result of reciprocal and recursive interactions. To support co-evolution, we have extended the traditional notion of design beyond the original development of the system to include a *co-adaptive process* between users and a system, in which users change by using the system, and in turn the system changes at the hands of the users. While using an existing system, users will discover mismatches between their needs and the support the system can provide for them, in terms both of failures and opportunities. These mismatches will lead to "breakdowns" that serve as potential sources of new insights, new understanding, and new knowledge [Fischer, 1994b].

Inspired by our design approach, and on the basis of our studies, we have defined and developed concepts, process models, and support mechanisms to link creativity and evolution in collaborative design according to the schema depicted in Table 1.

Table 1: Creativity and Evolution in the Metadesign Framework

Objective	Conceptual tool	Main support mechanism
Social creativity	Boundary objects	Critiquing
Co-evolution	Seeds	Reuse
Co-creation	Mediators	Affect

Boundary Objects, Seeds, and Mediators

One particular aspect of supporting social creativity that we have explored is the *externalization* [Bruner, 1996] of tacit knowledge and the interaction with *boundary objects* [Star, 1989] capable of communicating and coordinating the perspectives of various constituencies, eventually activating information relevant to the task at hand in order to increase the *back-talk* of the situation [Schön, 1983]. Externalizations and boundary objects are essential to participation and to the performance of the users' "distributed mind" [Salomon, 1993] in that they assist in translating vague mental conceptualizations of ideas into more concrete representations and provide a means for users to interact with, react to, negotiate around, and build upon ideas. They focus discussions upon relevant aspects of framing and understanding the problem being studied, thereby providing a concrete grounding and a common language among users. The Envisionment and Discovery Collaboratory (EDC) [Arias et al., 2000] is an environment that we have developed in which participants collaboratively solve problems of mutual interest. The problem contexts explored in the EDC, such as urban transportation planning, flood mitigation, and building design, are all examples of open-ended social problems. In these contexts, "optimal" solutions to problems do not exist, and the solutions depend on the participation of diverse stakeholders. Solving problems in the EDC requires social creativity, and the technical and social features of the EDC are designed to support and enhance such creativity.

In relation to supporting co-creation and co-evolution, we have identified and explored two interrelated aspects: *adaptable interaction* and *embodiment*. *Adaptable interaction supports the co-evolution of users and a system over time, whereas embodiment supports the co-creation of meaningful activities during the process of interaction*. Two notions are important for adaptable interaction and embodiment, respectively: the notion of *seed* [Fischer & Ostwald, 2002] and that of *mediator* [Giaccardi, 2005b].

In our framework, a *seed* is neither a template nor a design schema, but rather *a "piece" of knowledge, content, or code that can be fundamentally created, evolved, and recombined by means of mechanisms that allow its sharing and modification*. Seeds keep the system structurally open to be adapted to emerging needs and situations. We have explored the notion of seeds in a number of specific application areas including:

- *Courses-as-seeds* [dePaula et al., 2001]: courses as communities of learners in which participants shift among the roles of learners, designers, and active contributors. An essential element of learning in such an environment is peer-to-peer; the teacher acts as a "guide on the side" rather than as a "sage on the stage". Courses are reconceptualized as seeds that are jointly evolved by all participants rather than as finished products delivered by teachers. The role of technology is to form and sustain active communities of learners who contribute ideas from their own unique perspectives and connect them in new ways. The active participation inherent in courses-as-seeds contrasts to mere *access* to existing information and knowledge (e.g., seeing courses as finished products, either in the classroom or on the web), which is a limiting concept that leads to “consumer” cultures [Fischer, 2002].

- *Domain-oriented design environments* [Fischer et al., 1998b]: systems that integrate construction and argumentation supporting "reflection-in-action". This integration is made possible by the presence of *software critics* (described later in this paper) that analyze an artefact under construction (conceptualized as a seed), signal breakdown situations, and provide entry points to the space of argumentation directly relevant to construction situations. The design environment has proven to be a powerful concept in a large number of domains, but a major challenge has been to provide adequate support for design tasks not foreseen by the creator of the design environment, thereby transcending the limits of envisioned activities.

Mediators are an emergent phenomenon, rather than a construct (as seeds are). They are instantiated by classes of environment excitations dynamically generated over the course of the interaction by the interplay between affordances [Gaver, 1991] and externalizations [Bruner, 1996], that is, between the opportunities for action provided by the system and the external representations produced by the participants during the interaction process. Mediators drive the users from one state of the interaction process to another by affecting participants’ attitudes and emotions and providing a *social and dynamic context* for the emergence of meaningful activities. Unlike an externalization (which represents the product of an individual’s subjective perception of the external world), a mediator can be described as an *active and situated structure* generated by the environment over the course of interaction, resulting from the collective interpretation (broadly defined) of users’ mutual perceptions and actions. For example, in distributed applications for visual interaction meant to enable users to collaborate on the production of visual images and narratives, a mediator is the pattern of lines and strokes, or the combination of colours, or the set of figurative elements (and so on) that is generated and continuously modified by the overall drawing activity of the users. The spatial or chromatic or narrative relationships that these structures identify on the canvas instantiate the mediator and are responsible for the emotions and modes of conduct that will emerge over the course of the interaction, as well as for the activation of collective mechanisms (such as the pattern recognition that kids play while looking at clouds).

Support Mechanisms for Critiquing, Reuse, and Affect

Critics and reuse support the evolutionary growth of the seeds by both highlighting potential failures or constraints and providing new opportunities. In contrast, sustaining the users’ mutual engagement in the creative process, affective mechanisms support the appearance of mediators, and thus the collaborative construction of meaningful activities.

Computational critiquing mechanisms, or *critics* [Fischer et al., 1998a], are generally embedded into the system. They increase the users' understanding of the problem by pointing out significant design situations and locating relevant information in large information spaces. Critics afford *learning on demand* by letting designers access new knowledge in the context of actual problem situations. Critics instantiate and transcend Schön's theory of design; they support "reflection-in-action" and they increase the "back-talk" of the design situation, which in Schön's framework is determined solely by the designers' skill, experience, and attention [Schön, 1983].

Reuse [Ye & Fischer, 2002] provides the opportunity to exchange and manipulate seeds within the system or even across different systems. We can find good examples in both interactive art and open source software development. A peculiar example of reuse is "Face Poiesis" (http://www.renga.com), an art system by Japanese artists Toshihiro Anzai and Rieko Nakamura. By means of an original painting system, the two artists compose faces by mixing features (such as outlines, hair, lips, eyes, and other traits) from faces previously created by the artists themselves. The idea is to create a pool of "pixema", or individual pieces (seeds, in our context), which can be dynamically identified and exchanged to synthesize new paintings. Another example of reuse is "Codebroker" [Ye & Fischer, 2002], in which the original system developer creates an innovative new software system as a seed, and when the seed is distributed and shared by other interested users and software developers, these participants are able to interact with the system and use it creatively in more situations than what the original designer had intended. "CodeBroker" monitors a software developer's programming activity, infers the immediate programming task by analyzing semantic and syntactic information contained in the working products, and actively delivers task-relevant and personalized reusable parts from a reuse repository created by decomposing existing software systems.

Affective mechanisms support the conditions and dynamics for mutual interaction, ensuring the users' embodiment into the socio-technical environment (more information can be found in [Giaccardi, 2005b]). Two mechanisms have been identified that can manage and balance the effects of mediators, and thus enable and activate co-creative processes for the emergence of shared activities and meanings: (1) *agency patterning*, and (2) *emotional seeding*.

Emotional seeding [Giaccardi, 2004] is about stimulating the *emotional tone* of the interaction. It is based on enabling the users to experience the temporal and spatial features of the environment in terms of intentionality and proximity (or intimacy), rather than in informational terms; that is, how "closely" people interact with each other, and how their intentions determine and recognize chains of actions and meaningful events over time. For example, "Open Studio" (http://draw.artcontext.net) is Java-based drawing system that concurrently links users to a single pictorial interface and allows them to participate in the creation of a graphic animation. In "Open Studio", the drawing tools have been designed to be expressive and reactive to the participants' movements (speed, direction, curving, and so on). The visual behaviour expressed by the "bodily" quality of the strokes, marks, and colours drawn by the participants affect users' feelings and intentions (*i.e.*, seed the emotional tone of the interaction), encouraging or discouraging the emergence of visual narratives.

Agency patterning [Giaccardi, 1999] is about setting specific spatial and temporal parameters aimed at letting *dynamic agencies* emerge from the system. It defines the size, resolution, and character of the agency that is performing a global activity, that is, the nature of the collection of interactions among participants considered as individual agents. For example, the "Poietic Generator" (http://poietic-generator.net) is an online distributed system for visual interaction that enables a large number of people across the world to participate, in real time, in the emergence of a virtual and ever-changing image resulting from many local images. In the "Poietic Generator", the association of the users with the local images—and their mutual interactions—produces the collective agency responsible for the global image; the features and constraints of the interface determine the nature of such an agency.

Seeding, Evolutionary Growth, Reseeding (SER) Process Model

The Seeding, Evolutionary growth, and Reseeding (SER) Process Model [Fischer & Ostwald, 2002] depicts the lifecycle of large evolving systems and provides a structure for the exploration of the constructs, phenomena, and support mechanisms presented in the previous sections. It postulates that systems that evolve over a sustained time span must continually alternate between periods of activity and unplanned evolutions, and periods of deliberate (re)structuring and enhancement (see Figure 1). The SER model requires supporting users as designers in their own right, rather than restricting them to being passive consumers only.

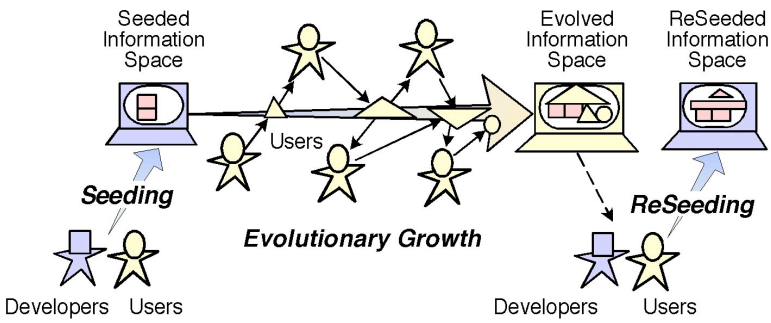

Figure 1: The SER Process Model.

Through the SER model, users of a seed are empowered to act not just as passive consumers, but also as active contributors who can express and share their creative ideas. System design methodologies of the past were focused on the objective of building complex information systems as "complete" artefacts through the *large efforts of a small number of people*. Conversely, instead of attempting to build complete and closed systems, the SER model advocates building seeds that can be evolved over time through the *small contributions of a large number of people*. The evolution of complex systems in the context of this process model can be characterized as follows:

Seeding concerns the creation of a seed capable of evolving in relation to the objectives of a specific application domain. During this phase the seed is created through a participatory design process.

Evolutionary growth concerns small-scale evolutionary changes. During this phase, the seeded system plays two roles simultaneously: (1) it provides resources for work (information that has been accumulated from prior use), and (2) it accumulates the products of work, as each project contributes new information to the seed. During the evolutionary growth phase, users focus on solving a specific problem and creating problem-specific information rather than on creating reusable information. As a result, the information added during this phase may not be well integrated with the rest of the information in the seed.

Reseeding is a deliberate effort to organize, formalize, and generalize information and artefacts created during the evolutionary growth phase. Drastic and large-scale evolutionary changes can occur during the reseeding phase.

Socio-technical environments based on the SER model provide a framework for creativity and evolution in which all participants have a chance to contribute in a manner appropriate to their ability.

Conclusions

This paper focuses on the co-creative and co-evolutionary aspects of the metadesign framework. It provides concepts, process models, and support mechanisms to link creativity and evolution in collaborative design, drawing examples from the studies and design activities pursued at the Center for LifeLong Learning & Design (L3D) in the last two decades. This work tightens the relationships among open systems, creativity, and evolution while promoting and advancing the conceptual and methodological framework of metadesign. Of course, to make metadesign a more ubiquitous activity, the forces that prohibit or hinder creativity and evolution must be understood and addressed. Examples of such forces are: (a) the resistance to change because it requires learning efforts and may create unknown difficulties and pressures, (b) the problem of premature standards in system development, (c) the difficulties created by installed bases and legacy systems within existing organizations, and (d) the issues of who are the beneficiaries and who has to do the work in order for evolution to occur. Likewise, to deal with the complexity of decentralized socio-technical systems, an ethical reflection is also necessary, stressing how metadesign does not have to be understood and addressed as a kind of moral action. In fact, a normative approach to design would impose ethical demands on the praxis of design rather than extract new ethical principles from the actual designing [Mitcham, 1995]. Metadesign must be conceived as a *mode of design* [Giaccardi, 2004] rather than a fixed model of design; that is, as a “mode of making” embodied in the evolving design practices of fluid and interdependent communities. An understanding not only of organizational issues [Fischer et al., 2004], but also of more complex social, cultural, and ethical issues (such as those involved in the topics of this paper) will provide a better framework for the solution of the problems that threaten to prohibit or hinder metadesign.

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