Creativity and Distributed Intelligence

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Distributed Intelligence

There is overwhelming evidence that research on creativity should be grounded in the basic assumption that power of the unaided individual mind is highly overrated. [John-Steiner, 2000]. Although creative individuals are often thought of as working in isolation, much of our intelligence and creativity results from interaction and collaboration with other individuals, with their tools and with their artifacts [Csikszentmihalyi, 1996]. In many traditional approaches, *human cognition* has been seen as existing solely "inside" a person's head, and studies on cognition have often disregarded the physical and social surroundings in which cognition takes place. *Distributed intelligence* [Fischer, 2005; Hollan et al., 2001; Salomon, 1993] provides an effective theoretical framework for understanding what humans can achieve and how artifacts, tools, and socio-technical environments can be designed and evaluated to empower human beings and to change tasks.

Individual and Social Creativity

Individual Creativity. The claim by Csikszentmihályi [Csikszentmihalyi, 1996] that *"an idea or product that deserves the label 'creative' arises from the synergy of many sources and not only from the mind of a single person"*, does not exclude individual creativity. Creative individuals can make a difference, as analyzed and shown by Gardner [Gardner, 1995] in exemplary cases, such as movie directors, champions of sports teams, and leading scientists and politicians. Individual creativity comes from the unique perspective that the individual brings to bear in the current problem or situation. It is the result of the life experience, culture, education, and background knowledge that the individual has, as well as the personal meaningfulness that the individual finds in the current situation. Creative actions cannot be completely planned actions; rather, they can only be situated actions, after reflecting upon the situational talk-back of the environments, either technical or social [Schön, 1983]. Therefore, individual creativity can be greatly enhanced by providing appropriate socio-technical environments [Mumford, 1987]. Creativity flourishes best in a unique kind of social environment: one that is stable enough to allow continuity of effort, yet diverse and broad-minded enough to nourish creativity in all its subversive forms.

Social Creativity. Much human creativity arises from activities that take place in a social context in which interactions with other people and the shared artifacts are important contributors to the process. Social creativity comes alive in socio-technical environments in which communities collaborate.

Communities can be characterized by distances and diversity and by the resulting *division of labor* [Levy & Murnane, 2004], among individuals who have unique experiences, varying interests, and different perspectives about problems, and who use different knowledge systems in their work. Shared understanding that supports collaborative learning and working requires the active construction of a knowledge system in which the meanings of concepts and objects can be debated and resolved. In heterogeneous design communities, such as those that form around large and complex design problems, the construction of shared understanding requires the interaction and synthesis of several separate knowledge systems.

Distances and diversity should not be considered as constraints to deal with but as opportunity to generate new ideas, new insights, and new environments [National-Research-Council, 2003]. The challenge is often not to reduce heterogeneity and specialization, but to support it, manage it, and integrate it by finding ways to build bridges between local knowledge sources and by exploiting conceptual collisions and breakdowns as sources for innovation. Social creativity can be distributed (1) *spatially* (across physical distance), (2) *temporally* (across time), and (3) *conceptually* (across different communities), and

(4) *technologically* (between persons and artifacts) [Fischer, 2005]. This distributed fabric of interactions can be supported by integrating diversity, making all voices heard, increasing the back-talk of the situation, and providing systems that are open and transparent, so that people can be aware of and access each other's work, relate it to their own work, transcend the information given, and contribute the results back to the community (as illustrated by the "collect / relate / create / donate" model [Shneiderman, 2002]).

Integrating Individual and Social Creativity. Creativity research should be grounded in the basic assumption that there is an *"and"* and not a *"versus"* relationship between individual and social creativity. Individual and social creativity can be integrated by means of proper collaboration models, appropriate community structures, boundary objects, process models in support of natural evolution of artifacts, and meta-design [Fischer et al., 2005]. By integrating individual and social creativity, support can be provided not only for reflective practitioners but also for *reflective communities*.

Towards a Enriched Framework for Creativity

To design the creativity support tools of the future requires an enriched framework for creativity. The following paragraphs describe some specific dimensions of such a framework (obviously many more dimensions exist and need to be developed and articulated).

Externalizations are critically more important for social interactions because groups have "no head". *Externalizations* support creativity based on: (1) they produce a record of our mental efforts that is outside us rather than vaguely in memory; (2) they cause us to move from vague mental conceptualizations of an idea to a more concrete representation of it, creating situational back-talk and making thoughts and intentions more accessible to reflection; (3) they provide a means for others to interact with, react to, negotiate around, and build upon an idea; and they contribute to a common language of understanding.

Meta-Design. To bring social creativity alive, media and environments must support meta-design. M*eta-design* [Fischer et al., 2004] characterizes objectives, techniques, and processes to allow users to act as designers and be creative. The need for meta-design is founded on the observation that creativity requires open systems that users can modify and evolve. Because problems cannot be completely anticipated at design time when a system is developed, users at use time will discover mismatches between their problems and the support that a system provides. These mismatches (perceived as breakdowns and conceptual collisions) serve as potential sources for new insights, new knowledge, and new understanding. Meta-design advocates a shift in focus from finished products or complete solutions to conditions, contexts, and tools for users that allow them to be creative in further evolving artifacts and organizations [Hippel, 2005].

Meta-design supports *informed participation* in which participants from all walks of life (not just skilled computer professionals) transcend beyond the information given to incrementally acquire ownership in problems and to contribute actively to their solutions. It addresses the challenges associated with open-ended and multidisciplinary problems. Meta-design requires *active contributors* (people acting as designers in personally meaningful activities), not just consumers [Fischer, 2002]. Creativity needs the "synergy of many", and this kind of synergy is facilitated by meta-design. However, a tension exists between creativity and organization. A defining characteristic of social creativity is that it transcends individual creativity and thus requires some form of organization; but elements of organization can and frequently do stifle creativity [Florida, 2002].

From Reflective Practitioners to Reflective Communities. The objective to educate "Renaissance scholars" (such as Leonardo da Vinci, who was equally adept in the arts and the sciences [Shneiderman, 2002]) is not reasonable in today's world [National-Research-Council, 2003]. We need to invent alternative social organizations that will support *"collective comprehensiveness through overlapping patterns of unique narrowness"* [Campbell, 2005] by integrating different interdisciplinary specialties which are partially overlapping with each other. Such an architecture will provide a foundation that people can understand each other based on common ground but at the same time their expertise will be complementary because they will know different things. This architecture will allow us to move beyond

the isolated image of the reflective practitioner towards the sustainability and development of *reflective communities*.

From Given Tasks to Personally Meaningful Activities. To motivate people to become active contributors and designers and share their knowledge requires a new "design culture", involving a *mindset* change [Fischer, 2002] and principles of *social capital* accumulation [Florida, 2002]. But before new social mindsets and expectations can emerge, users' active participation must be a function of simple motivational mechanisms and activities considered *personally meaningful*. Sustaining personally meaningful activities is essential for creativity. People are willing to spend considerable effort on things that are important to them. The value dimension for truly personal meaningful activities is more important than the effort dimension.

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