Computer Support for Enhancement of Creativity

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Abstract

This document at first describes the informal notion of creativity in general before delivering deeper insight in computer support of creativity. Advantages and disadvantages as well as the broad application areas and common solutions are introduced and discussed. Are state of the art technologies really able to support instead of hindering?

1. INTRODUCTION

Within living memory, mankind has always been highly ambitioned to force the creation of innovations. This creative process traversed centuries and milleniums of varying enforcement policies within every conceivable discipline which has been (and probably still is) an interesting subject for the human race.

Although the principle of creating and innovating has always been the same, methods have changed and support has highly increased. As in early stages of the human existing, the so called highly creative innovations like the wheel had a very limited range of supporting technology tasks: very simple and primitive tools for cutting, carving, graving and clouting.

From time immemorial until now, the procedures of innovation differ but are arranged to build up on each other (Henry Ford wouldn't have invented his Model T without knowing the functionality of the wheel). And, of course, a wide spectrum of supporting tools have been developed and used successfully. One of the perhaps most interesting aspects of modern times creativity support tools may be the computer, which this article pays its attention.

2. THE TERM OF CREATIVITY

2.1. Isolating the definition of creativity

As many faces any form of creativity may have, so also the definition of this term differs in a broad way. While many people would mention art or design, when asking them for direct associations with creativity, literature on this subject as well as dictionaries offer different approaches [Herbjørnsen_2003] for (a) 'create': to cause to exist, bring into being, originate, to give rise to, bring about, produce, to be first to portray and give character to a role or part; to evolve from one's one thought or imagination to make by investing with new character or functions, author, bring into being, compose, conceive, parent, form, give rise to, throw together, (b) to be 'creative': characterized by originality and expressiveness, imaginative; generative, ground-breaking, innovative, originate, handmade, or (c) the 'creation': an original product of human invention or imagination.

As a result of those definitions and explainations of creativity we recognize that this term is a multi-faceted and complex object. Anyway, creativity should cover a certain grade of novelty.

2.2. Levels of creativity

Many papers related to creativity and literature consider a few different levels of creativity. There are two probably most common levels defining the diverse stages in which creativity may be categorized.

Einstein's relativity theory and Watson and Crick's discovery of the DNA's double-helix belong to the first level of highly creative innovations, the so called *revolutionary acts* of creativity [Shneiderman_2000]. These innovations represent the low quantity of really revolutionary breakthroughs and paradigm-shifting brilliant vertexes in human history. Since such creative masterworks are (mostly) only covered by a small number of Nobel Prize candidates, we'll focus on the second category called the *evolutionary creativity* which is more easily to be supported by software tools.

Evolutionary acts of creative innovations tend to apply existing paradigms by refining, deepening and associating those. Unlike its opposite, evolutionary tasks construct novelty by relaying on any existing constituent compontents. Ben Shneiderman, University of Maryland, gives examples of such evolutionary acts of creativity, like doctors making cancer diagnostics or lawers preparing briefs. Therefore, there may be a chance for software tools supporting evolutionary creativity, they eventually also offer the possibility of helping to produce revolutionary breakthroughs.

2.3. Divergent vs. convergent approaches to creativity

Creativity itself often relies on more *divergent* methods of thinking, opposed to *convergent* approaches. The reason for such assumption may be traced back to the fact that convergent attempts for inventing/finding creative solutions may lead to a constricted basic position in the creative process. The art of divergent thinking presumes the facing of problems in various ways (which don't even have to be within a classical relationship to the problem) and to think about not such familiar/common solutions.

The early pioneers of flight for example [Eaglestone_2002] tried to construct flying machines by imitating the techniques used by birds to fly, so they were devising effective flapping wings which may be entitled as a very convergent method of getting a solution. Not until a more divergent thinking process was established, the first adoptable outcome was reached when deciding for just using one fixed wing (a concept which remained successfully until nowadays). For a deeper analysis of divergent and convergent creative thinking I'd refer to [Nagasundaram_1997].

3.PRINCIPLES OF COMPUTER-AIDED/SUPPORTED CREATIVITY

3.1. Computer support for creativity: Help or hindrace?

A supposition that creativity is inherently human and no software tools or other computer-based supporting systems should ever be brought into the creative process may be an interesting point of view but is not a long-living concept. Since strengthened and proven technologic acquisitions as well as state of the art technologies have always been (and will always be) part of the creative process aiding humans and leading to previously unimaginable results.

Therefore, computers may rather help examining convergent processing tasks. However, convergent thinking is still a very fundamental element in creativity as divergence is finally reached by combining relatively disultory (each convergent) concepts and creating a new

relationship between uncommon principles. We also call this principle „Free Associating“ as described below.

In general, computers may find application as great support systems which offers completely new directions. On the other hand there is a feasibility of narrowing possible positive results because of hindering the etablishment of conceptional completely different ideas.

3.2. Fields of application for expedient software support

A quite interesting example of combining the creative process with software tools, is the reference to the *Tema* – project [Eaglestone_1994] which dealed with music composition processes while committing supportive/creative software systems. The base concept relies on the fact that composers reach for distinguishing their (not yet composed, new) music from existing tunes (the need for a quite divergent approach). However, software tools in case of melodical creativity may help the composer with a broad range of support tools for synthesizing and transforming musical sounds in a digital way. This kind of software support may be entitled as high-level abstract knowledge representation for reuse in newly arranged concepts (in this case, musical compositions using software which 'knows' a lot of musical theory, sound production, etc).

Another broad application area today's industries couldn't survive without, is the process of simulation. Perhaps not directly seeming to relate on creativity, even software game productions already took advantage, shown to us by highly successful games like „The Sims“ where simulation is the basic concept. Computer simulation lets pass through innumberable situations applying innumberable parameters which mostly couln't be done outside a virtual world, and finally lead to results offering completely different approaches on the subject. This process is one way of computer-supported creativity enhancement.

3.3. A phase-driven framework for excellence

A really desirable activity environment would be a (raw) design structure supporting innovations and advancing creative functioning. Exactly such a train of thought B. Shneiderman followed when constructing the so called genex framework which defines several phases a creative process will most likely pass through [Shneiderman_1998]:

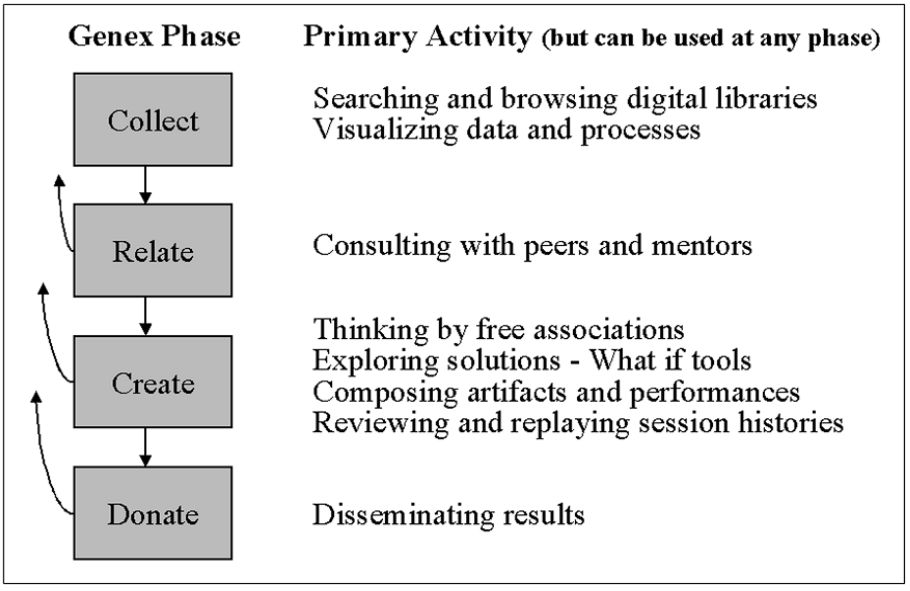

Figure 1: Genex phases and their related primary activities [Shneiderman_2000]

As shown in Figure 1, the phases of collecting, relating, creating and donating may iterate several times and may comprehend any of the eight primary activities. Dr. Shneiderman gives a very impressive example by explaining the processing of a creative idea using an architectural scenario [Sheinerman_2000].

4.EXAMINING HCI SYSTEMS FOR SUPPORTING CREATIVITY

There are several software projects occupied with the subject of creativity enhancement like Spotfire (http://www.spotfire.com/), MindManager (http://www.mindjet.com/) and Axon Idea Processor (http://web.singnet.com.sg/~axon2000/). Maybe the most interesting of those three is the Mind Manager. This tool is quite successful and widespread within companies nowadays.

Key Benefits of the MindManager are:

- Capture ideas:
  Graphical map interface for the documentation of ideas.
- Create visually maps:
  Draw relationships between ideas, add callouts and color to highlight important information, group similar ideas with boundaries and insert icons and images.
- Create presentations:
  Use the MindManager Presentation Mode or export map contents to Microsoft PowerPoint.
- Integration with Microsoft Office:
  Enables quick import and export of data to Microsoft product including MS Project and Visio.
- Web-Ability:
  Email the maps or publish them via HTML and post it to the intranet or WWW.

MindManager Map-Example:

At their simplest, MindManager maps function like street maps. They represent complex information in an organized, visual format. And they enable to easily grasp connections, obstacles, and paths. MindManager maps shall improve processes, projects, and planning.

First Step: Capture (Figure 2)

Click anywhere on the interface and type a central topic. From there, the map welcomes creative thinking. It's possible to pull in external information from websites, databases, spreadsheets, blogs, and more. Customizable wizards and templates, and a task pane, streamline and standardize map creation.

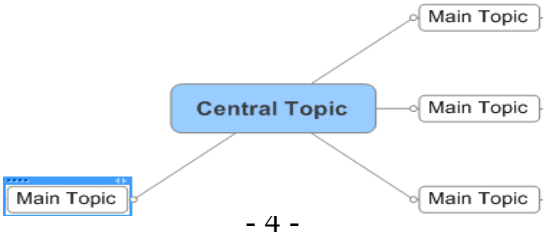

Figure 2: Capture

Second Step: Organize (Figure 3)

MindManager maps show the "whole picture" through cascading connections between related topics and sub-topics, plus pictures, icons, formats, and highlighting. Maps are also blueprints, enabling to assign and manage tasks, resources, timelines, and deliverables.

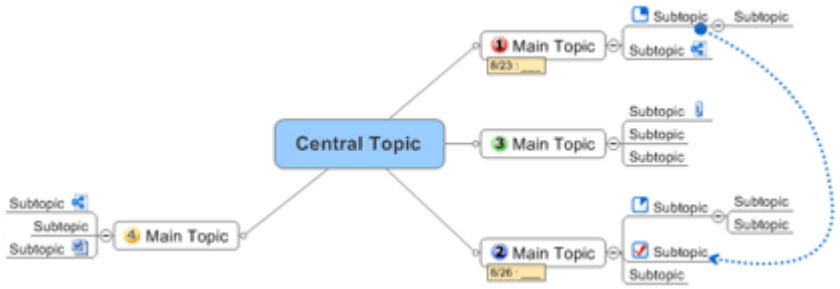

Figure 3: Organize

Third Step: Share (Figure 4)

It is easy to extend information enterprise-wide. The free MindManager Viewer allows searching, navigating, printing, and publishing capabilities. For enterprise-wide distribution it's possible to save maps as bitmaps, Adobe PDFs, and web pages or export maps to Microsoft Office applications and other enterprise applications. Maps are also pen-enabled for tablet Pc's.

Figure 4: Share

Moreover, [Janssen_2003] gives an interesting overview of (group-) creativity methods for collaboration with people in different locations (using CSCW).

5.CONCLUSION

Creative processes and creativity itself have always proven their existance in the human minds and won't quit when technology cames crossing – on the contrary, technology has been forced to support creative tasks which also concernes computer software.

The idea of computers supporting creativity on a grand scale is preferable but not obligatory without dangers in sight. The use of the World Wide Web and its colossal

functionatlity of searching and communicating may lead to (a) wrong results because of deficient proven facts available on the Web and (b) the possibility of kind of disabling more novel and exotic ideas because of (most likely) refering to recent or current work/workers.

With selective/systematic approaches on HCI in support systems however, computers definitely are helpful and provide very powerful tools (see MindManager). From this point of view, an upcoming question may be creativity methods for groups ([Janssen_2003]).

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