Research Approaches to Creativity: Weaving the Threads

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Abstract
In this brief communication I first give an overview of for different branches in creativity research: investigating psychological/cognitive mechanisms of creativity; designing creativity support tools; metaphysical/philosophical/anthropological explorations on the nature of creativity; and computational models of creativity. Then I discuss their relations and complementarity and finally, in the conclusion, I suggest that an attempt to create a unified framework for creativity research would benefit the field as a whole.

Introduction
While it is relatively easy to recognize a creative deed, it is extremely difficult (as demonstrated by creativity research so far) to define what creativity is. The past (almost 70) years of research definitely shed some light on different aspects of creativity, but we are still far from a commonly agreed upon definition of it and consequently a deep understanding of this phenomenon. For an extended historical overview of creativity research, please refer to (Stojanov, 2013). Here are four branches which can be identified in the creativity research:
- Investigating psychological/cognitive mechanisms of creativity;
- Designing Creativity Support Tools (CSTs);
- Metaphysical/Philosophical/Anthropological explorations on the nature of creativity;
- Computational models of creativity;

In what follows I will elaborate briefly on the research conducted within these four (admittedly somewhat overlapping) branches, and will try to suggest the field as a whole can benefit from a unified framework.

Investigating psychological/cognitive mechanisms of creativity
From the 1950’s on, researchers from psychology initially tried to find the underlying personality traits of individuals considered to be creative, as well to design some sort of creativity assessment tests (much like the IQ tests). The (often) implicit assumption shared by many was that creativity required special and rare cognitive processes found in exceptional creative individuals and radically different from those employed by the majority of people (e.g. Hershman and Lieb, 1988) However, Ward et al. (Ward et al. 1999) have convincingly argued an alternative view that “[…] creative capacity is an essential property of normative human cognition and […] the relevant processes are open to investigation”. In support of this view, I would like to mention the research of Picciuto and Carruthers (Picciuto and Carruthers, 2012) that put forward the hypothesis that pretense play might be the key factor in understanding creativity. Pretense play occurs typically in children at about the age of 18 months and is universal across all human cultures. Picciuto and Carruthers suggest that it might have evolved in order to enable humans to practice the ability to detach themselves of their actual situation and enact imaginary scenarios. Please refer to our discussion on this and other early cognitive developments’ relation to creativity in (Stojanov and Indurkhya, 2013).

Another interesting result which is nowadays widely accepted is the so called “threshold theory” about the relation between creative capacity and the IQ of a person. According to this theory a creative person is likely to have an IQ above a certain threshold (120 being the suggested minimum). On the other hand a high IQ does not imply that the person is likely to be creative (Runco and Albert, 1986).

Most of the models proposed within this branch of the creativity research have been descriptive, recognizing that in every creative endeavor there is a generative phase.
followed by an exploratory and evaluative process. During the generative phase, the creator tries to come up with many novel ideas attempting to conceptualize the various aspects of the problem at hand. During the exploration and evaluation these ideas are refined and checked against the solution criteria and constraints. The process is iterative and it is usually repeated many times until some acceptable final product is achieved. GENEPLOR (Finke et al. 1992; Finke, 1995) may be seen as a prototypical example of these types of models (Fig. 1).

Concluding this section, in most of the creativity research presented above, there seems to be an implicit assumption that creativity can be explained through the processes within the individual. Probably, Theresa Amabile (1982, 1983) and Michaly Csikszentmihalyi (1988) were among the first to promote the new contextualist and socio-cultural approach to creativity. The individual is immersed in their social milieu (local and global) and their creative work cannot escape the culture they live in, with all its norms and conventions. The same applies to their creations.

Designing Creativity Support Tools (CSTs)

I now turn to the research in the CST area. As creativity has been widely recognized as an intrinsic component of the social capital [Westlund et al., 2013], Creativity Support Tools (CST) is now a vibrant research area which can bring benefits to the individuals, groups, and society as a whole. CSTs come in all shapes and forms:

- Exercise activities to enable a person to get a new perspective on the problem at hand (lateral thinking, bissociation, “making the familiar strange”)
- Tools for sketching, “mind-mapping”, Lego-kits, and other forms of visualization, re-presentation, and manipulation of ideas;
- Intricate software platforms which enable fast prototype building, recording and easy retrieval of previous attempts, automated checking of constraint satisfaction, etc;

Many of the above techniques have been developed from studies of real-world problem solving (de Bono 1975; Gordon 1961; Schön 1963). A workshop organized by Mary Czerwinski, Mitch Resnick, and Brad Myers was held in 2005 at the University of Baltimore and gathered dozens of influential CST researchers. The outcomes were published in the INTERNATIONAL JOURNAL OF HUMAN–COMPUTER INTERACTION (Schneiderman et al. 2006), and among other things, the authors listed these design principles for CSTs:

2. Low threshold, high ceiling, and wide walls.
3. Support many paths and many styles.
4. Support collaboration.
5. Support open interchange.
6. Make it as simple as possible—and maybe even simpler.
7. Choose black boxes carefully.
8. Invent things that you would want to use yourself.
10. Iterate, iterate—then iterate again.
11. Design for designers.
12. Evaluate your tools.

Although most of the participants did not explicitly refer to the descriptive models of creativity from the previous section (with the exception of Csikszentmihalyi’s theory), we can see that the proposed principles directly facilitate the processes present in those models: from enabling the generation phases (principles 2 and 3) to supporting easy exploration (1, 6, and 10). The CSTs aim to create a permissive environment where playfulness, bold steps, and taking risks are encouraged. Speaking generally, it appears that most of these CST seem to support creative behavior by enabling the user to “think like a child”, the motto of many creativity researchers.

Metaphysical/Philosophical/Anthropological explorations on the nature of creativity

Even a superficial overview of these explorations would be well beyond of the scope of this paper. Sawyer (2006) brilliantly tells the history of how the meaning of creativity as a concept, changed through history from Ancient Greece to the middle ages, Renaissance, the Romantic period, and finally to our times. In what follows, I will try to summarize Sawyer’s take on creativity and the history of changes in the meaning of our understanding of the concept and what does it mean to be a creative person. All
the references to the original sources can be found in Sawyer’s book.

Plato argued that artists could produce their works only because they were possessed by divine inspiration. They were merely messengers since only gods could create something new, beautiful, and, well, divine. For the most part of history (at least in the western world) artists were considered primarily as craftsmen. When a client (usually a noble or a rich man/woman), was purchasing a work of art (a painting, a sculpture) a detailed contract was to be signed between them and the artist specifying in detail ‘the quantities of gold and blue paint to appear in the work, the deadline, and penalties for delays’.

In addition, these works of art were usually produced by a studio under the guidance of ‘a master’ and only rarely signed by a particular individual. The association of the notions of novelty and originality with artwork dates back to the Renaissance as, before, creativity was associated with the ability to imitate established masters or to represent Nature accurately. Our modern construal of independent, gifted artist, working alone, powered by his/her inspiration or the urge to produce a work of art that will convey some message, unconstrained by others’ wishes, along with the idea of artists being individuals of high social status and definitely not craftsmen, is probably not older than about 200 years. Only in the 1800s the term genius was first used to describe creative individuals (both in arts and sciences). Moreover, the term was associated with rational and conscious processes related to imagination, judgment and memory. A counter movement, Romanticism, followed (in which Sawyer locates the origins of our contemporary common understanding of artists and creativity) which viewed creativity as requiring a regression to a state of consciousness free from rationality and conventions and close to emotions and instincts. Also, it is with Romanticism that creativity began to be associated to mental illness. Thus in the Romantic movement, we can see the origins of today’s common understanding of artists as special individuals, particularly gifted, usually asocial, capricious, moody and often bordering on mental illness. The beginnings of the 20th century witnessed the emergence of Modernism. According to Sawyer this is a modified form of Rationalism characterized by focused conscious effort, coolness, isolation, and detachment. This modern aesthetics rejected the ‘ mushy emotivism ’ of the ‘ romantic subjectivism ’ in the words of the poet Ezra Pound. Russian constructivists and futurists, Czech formalists, as well as the German Bauhaus movement, promoted a detached, analytical worldview, deliberately focusing on pure abstract forms with the intention to make their works devoid of any common emotional and cultural associations. Finally, from the 1960s, the emergence of post-modernism (or post-modernisms in all their variety) can be seen as a full return to the rationalism which: ‘is critical of our culture’s conceptions of creativity—deconstructing notions of spontaneity, originality, and individual genius […]’.

Minimalism and pop art explicitly rejected Romantic-era beliefs about art; they could not have been more obviously unemotional, carefully planned and executed, and in fact reveled in their own artifice by noting the parallels with advertising, product design, and comic strips’ (Sawyer, 2006). This account of the changes in our understanding of what creativity represents would not be complete if we don’t mention the institutions and professions which have appeared through history: museums (usually originating from artworks collected by passionate individuals), professional curators, art critics, connoisseurs and elite audiences (as opposed to the audience at large), artistic and scientific associations, auction houses, national academies of arts and sciences, and the media. All of these institutions have the power to not only shape our perception and appreciation of the works of arts and sciences but also their market value, as well as, to some extent, determine their future directions. It is not surprising then that it is so difficult to find a satisfying, concise, informative, and useful definition of such a complex, multi-layered, moving-target concept like creativity.

**Computational models of creativity**

Boden’s work (1990) undeniably shaped the discourse regarding artificial creativity research. She has introduced the notions of P and H-creativity. P-creativity refers to ideas/objects/skills that are produced by an individual and that are new to that particular person. In contrast, H-creativity refers to the production of ideas/objects/skills that have never occurred before in all human history. Regarding the creative processes Boden (1990) has also introduced: a) exploratory, b) combinatorial c) transformational types of creativity. Much of the research in computational modeling of creativity so far, has aimed at designing programs that produce artifacts which would be perceived as creative by a wide audience (i.e. H-creativity). Boden’s work had less impact on the actual implemented artificial creativity systems (however there was an attempt by Wiggins (2006) to formalize some aspects of Boden’s theorizing). The computational models of creativity thus showed the same individualistic bias just like the research in psychology. However, very few researchers tried to inform their computational models by the psychological findings. It can probably be said that most of the AC systems can be categorized as exploratory and/or combinatory over a domain defined by the designer. For detailed discussion see (Stojanov, 2013). Below, I summarize the features exhibited by the majority of computational creativity:

- As mentioned above, most of the computational models are focusing on the product (a consequence of the product generating paradigm
they are working within) rather than on the process.
- Most of them have a detailed description of the domain. This can be: language syntactic rules, narrative structure, some semantics; musical notation and rules; basic drawing primitives; basic mathematical operations; a lot of search heuristics with evaluation functions; large knowledge/fact base;
- All of them appear to be closed systems in the sense that there is no way to appreciate and build upon feedback from naïve (or not) observers;
- Related to the previous remark, simply said, they are not socially embedded except maybe via their designers who, themselves, receive the feedback and eventually make changes in their programs;
- Virtually all of the researchers within AC looked for inspiration into existing theories of the domain in which their systems were to work: literature and narrative theory, music theory, visual arts, etc. This goes against our intuitions and the empirical facts that many artists and scientist actually report that combining domains (in which they not need be widely recognized but simply be familiar with) has resulted in some of their most creative outputs;
- Predictably, the most difficult part to be computationally modelled was the evaluation of the outcome;

In a nutshell, most of the research in computational creativity seems to be towards emulating human’s craftsmanship in particular area. Recently however we see attempts to model the creative process by letting the artificial agent “communicate” with its audience via internet (e.g. Colton and Wiggins, 2012; Veale, 2013).

Discussion

Domain general creativity is uniquely human phenomenon. We can easily recognize creative ideas, products, or behaviors but it is extremely difficult to give a general definition of creativity. In the previous sections I have tried to give short overview of four branches of research, each dealing with creativity driven by its own motivations and goals. I hope that I was able to demonstrate that (except for computational creativity research) the three other branches, although relatively isolated from each other, converged in their general overall understanding of aspects of creativity. My suggestion is that in order to advance our understanding we should attempt to find a unifying framework where it will be possible to compare, contrast, and reconcile the findings coming from the four different branches.

References


