AC 2007-2106: CONVERGENT/DIVERGENT CREATIVITY

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Divergent/Convergent Creativity

Working With Different Modes of Creative Thought
in Interdisciplinary Settings.

Introduction

Currently, the Bachelor of Fine Arts degree in Industrial Design at _____University is housed and awarded by the College of Engineering and Technology. This came about in the Fall of 1999 when the Industrial Design program left the College of Fine Arts and Communications (where it had been for the 30 previous years) and moved to the newly formed School of Technology in the College of Engineering and Technology.

Even before the move from the College of Fine Arts to the College of Engineering senior level ID students began experimenting with cross-disciplinary collaboration by participating in a Capstone program with manufacturing and mechanical engineering students. One of the reasons for the move from Fine Arts to Engineering was to strengthen these collaborative efforts and to look for new collaborative opportunities.

However, strengthening and increasing the effectiveness of these collaborative efforts (and therefore student interest) has not been easy. One obvious difficulty in maintaining collaborative relationships between students from various disciplines is inherent in the school based system – that of quick turn over between students. However, a larger difficulty manifests itself when students and faculty lack a common understanding of the contributions of each group participant, and see differences as roadblocks rather than strengths to be leveraged. This lack of understanding contributes to motivational problems, lack of group cohesion, and decreased chances of success. Students argue that there are other experiences that would be more beneficial for them educationally and that the collaborative effort is not effective. This is not peculiar to our experiences at _____ University.

> *"Many talk about multi-disciplinary collaboration, but few are actually successful at sustaining attempts to see what will happen. Even strong partners often lose interest because they cannot get along well enough or long enough to see the fruits of the collaboration"* [1]

To break through the barriers to effective collaboration it is necessary to have a deeper understanding on the part of each discipline about their respective strengths and weaknesses, and how each discipline contributes to an overarching process. One specific area of confusion is how these two groups manifest and apply the principles of creativity in problem-based learning activities.

The effort to understand and teach principles of creativity has become an "engineering imperative" [2]. The "new division of labor"[3] that has come about due to the increased ability to automate and the availability of labor due to the flattening of the world has resulted in the opportunity and need for all disciplines to increase their creativity in order to be productive in a more strategic way. The Dean of Engineering at _____ University has recently focused on five new initiatives, one of which is "Innovation and Creativity."

Despite this collective call for creativity, we are far from a common understanding of what it is, how to teach it, and what role personality plays in a person's ability to "be" creative. This is apparent in watching the interaction of engineering students with industrial design students. It is a mistake to believe that one group is focused on creativity, while another group is focused on implementation. Creativity is evident in both groups, but manifests itself differently. But not all people see this.

This paper will work to present an overall, more inclusive definition of creativity and clarify it in terms of divergent and convergent processes. An understanding of how creativity affects group dynamics helps to reinforce the goals of interdisciplinary collaboration programs to help students appreciate and capitalize on the strengths of others in solving real-world problems.

Creativity

Many people mistakenly align their view of creativity with the concept of "ex nihlo" (i.e. "something from nothing"). Creative people are thought to have the dynamic ability to create things spontaneously. Because the connections that they make are often startlingly new and unique, they are thought to "come out of nowhere."

For this discussion, creativity is being defined as the result of a process that has the characteristics of being novel and appropriate within a set of circumstances. This focuses creativity into the realm of problem solving (of interest to engineering and business), and separates it from artistic expression. Artists are often novel, but without an obvious notion of application. In the case of artistic expression, the aspect of application or fit might be more subtle, yet to be discovered or not immediately obvious.

Four concepts that help to separate creative thinking from the idea of "ex nihlo" are: *flexibility, fluency, originality, and clarity.*[4] ***Flexibility*** refers to the concept that a creative person approaches a given problem from many different angles. All of their ideas are not based off of the same theme. The concept of ***Fluency*** refers to the need/ability to generate a large number of ideas to select a solution from. ***Originality*** refers to the novelty, uniqueness, or newness of the idea. Finally, ***Clarity*** refers to the idea that a creative idea is not vague. It is specific enough that others can understand the idea, talk about it, elaborate on it, and explore it further.

These concepts can be divided into two parts - outcomes, and processes. Originality and clarity are descriptive of creative outcomes; flexibility and fluency are characteristic of a creative process. Most creativity techniques focus on aspects of the process (especially flexibility) with the hope that by increasing the creativity of the process, creative outcomes will more easily follow.

However, there is another aspect of a creative process that more often than not determines the difference between creativity with a "small c" and creativity with a "Capital C".

Flavors of Creativity - Divergence and Convergence

All of these process or outcome characteristics that have been discussed are under the influence of two different thinking types - convergence and divergence. Both types of processes are recognized as being essential to creativity.

> *"In creative production both thought processes are necessary as one first diverges ideas in numerous quantity and then narrows and refines the array through convergence. Specifically in creative problem solving, or in any complex problem solving activity for that matter, one needs to be able to weave in and out of divergent and convergent thought patterns in arriving at an appropriate conclusion specific for a given situation."* [5]

Key to the discussion about breaking down barriers to effective collaboration through a better understanding of how each group member views creativity is the understanding of which process (convergent or divergent) is dominant in the underlying creative philosophy of each.

Convergence

Convergence is commonly defined as "the ability to use logical and evaluative thinking to critique and narrow ideas to ones best suited for given situations, or set criteria." [6] It is focused on finding the "single, best, 'correct' answer to a standard problem in the shortest time."[7] It emphasizes the personal characteristics of *speed*, *accuracy, logic*, and focuses on accumulating information, recognizing the familiar, reapplying set techniques, and preserving the already known.[8]

When asked "What does an engineer do?" one company web-site stated "engineers find solutions." [9] They then provided a list of problems that an engineer finds answers to. This list included:

- How can we make a glass building stand 1,776 feet tall?
- How can we make a cell phone take a picture?

These are very well defined problems that can be solved through a predominantly convergent process.

Convergence is at the core of the engineering process.

Divergence

Divergence can be defined by the ability to "generate many, or more complex or complicated, ideas from one idea or from simple ideas or triggers".[10] It is aimed at "'discovering' problems and looking for solutions by means of branching out, making unexpected associations, applying the known in unusual ways, seeing unexpected implications" [11]

Divergent thinking is one of the stereotypes of creativity as a whole. In order to become "creative", emphasis is placed on a person developing and adopting a more divergent process and developing personal characteristics such as *openness, tolerance for ambiguity*, and *willingness to take risks.* The additional characteristics of *curiosity, courage of ones convictions, openness, flexibility, and nonconformity* are also seen as being fundamental to creativity. [12]

Using the same examples given above in the section on convergence, someone using divergent thinking as the predominant model for creativity would ask:

- Who is in the building, and what are they doing. Could the same thing be done underground?
- Why does a cell phone user need a recordable image? Would they be just as happy with a recorded sound?

Divergence is at the core of the industrial design process.

Coming Together

At some point in time, it became customary to think of divergent thinking as good and convergent thinking (or "conventional thought") as status quo and therefore bad if you were trying to be creative. It has already been proposed that both processes are necessary for effective creative outcomes. Collaborative difficulties arise when one model is favored over another as the single defining model for applying creativity – whether it be convergent or divergent.

In his book "A Whole New Mind," Daniel Pink points out that we would not be enjoying the benefits afforded by today's society without the benefits of the left brain/convergent thinking that it took to get here.[13] But based on the pressures of global competition, advances in automation, and interesting paradoxes provided by our increasingly affluent society there is the need to develop more right-brain/divergent thought processes to compliment the traditional left-brain/convergent analytical activities that have created our current culture of affluence. That is the goal of multi-interdisciplinary projects in school – to help students understand the value of both types of creativity/thinking, and get experience using both.

Industrial design students are often asked to focus on originality, looking for new contexts and opportunities for innovation within a broad, general framework. The solutions that they present are thought to be representative of a range where many different solutions could have equal value. Engineering students predominantly work to define a set of parameters and target values up front that would define a specific, successful solution within a narrow range. They then work quickly to achieve, test, and validate that solution. These two mind-sets often clash as one seeks to broaden the scope of the problem, while the other is working to achieve closure. This contrast is illustrated in FIG. 1

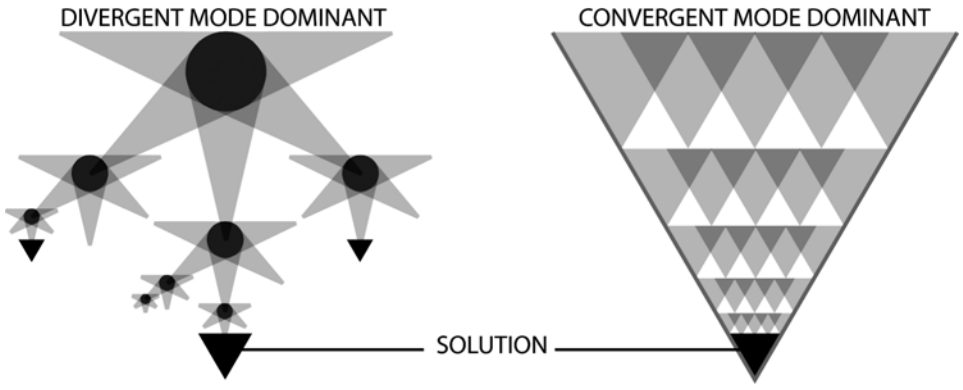

FIG.1
Contrast of divergent/convergent processes

Applying characteristics of creative thinking, and accommodating the different flavors of creativity, successful projects focusing on the collaboration between multi-disciplinary student groups should require students to be flexible, fluent, original, and have clarity in both divergent and convergent modes. Projects should encourage all students to gain experiences outside of their own professional tradition and personal comfort zones. Engineering students should participate in divergent, problem finding activities, and try to increase their tolerance for ambiguity. Industrial Design students should participate in focused implementation activities, and increase their ability to clarify and define a solution.

A process that covers the increasingly messy problems of the future should begin with a question or proposition without a clear answer or path. Students could then engage in an exploration phase that would help them understand the "whole", and work to create a specific problem definition. This early process would benefit the most from a strong core of divergent creativity/thinking. As the problem definition becomes clear, a shift would occur from a divergent to a convergent creativity bias. This becomes the implementation phase. (FIG. 2)

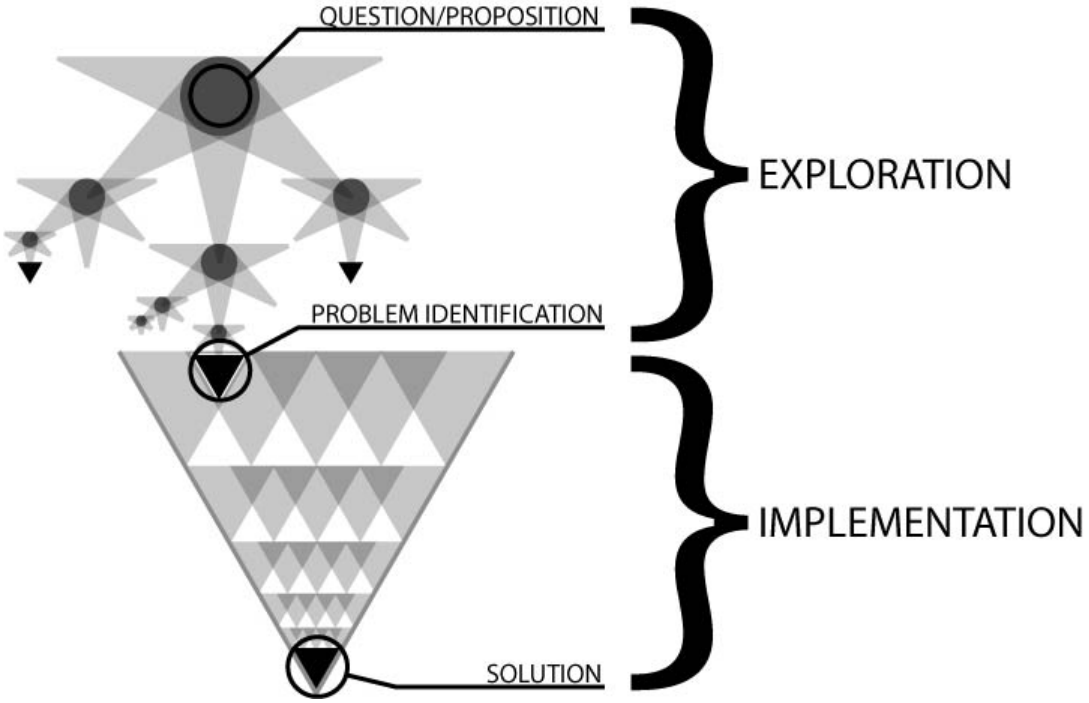

FIG 02
Combined Divergent/Convergent Process

Conclusion

Collaboration between Industrial Designers and Engineers can often be a difficult thing – both in educational as well as in professional settings. The philosophies underlying their respective disciplines regarding the purpose of creativity are often at odds with one another. This encourages conflict and frustration. By understanding and emphasizing the application of creative thinking principles in both types of processes (convergent AND divergent), the

deficiencies as well as strengths of each group can be discovered. This encourages admiration, as a weakness in one group is filled by a strength from another group.

Projects should be structured to include students from all participating disciplines in both problem finding and defining (predominantly divergent) with problem solving and implementation (predominantly convergent). But in each phase, students should be expected to be creative, and use the principles of design thinking.

The appreciation, understanding, and implementation of a divergent/convergent creative process model will be increasingly important as the world flattens, changes, and evolves. Speaking of the changing future…

> *"… there may come a day when many of us will be managing teams of [off site] developers…and working exclusively on the really, really unpleasant, complex, and messy problems that are left."*[14]

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