Insight or Ideas: Escaping the Idea Centered “Box” Defining Creativity

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Abstract

Because creative success often results from recognizing that the original problem definition is hiding effective solutions, it may be advantageous to explore a definition of the creative event not as “an idea that is newer and better” but as “a shift in perspective or belief that makes new possibilities obvious”. In the classic phrase “Don't raise the bridge, lower the water” the creative event is seen as the shift of problem definition to "getting the boats past", thus making a great many new possibilities obvious.

This alternative perspective shifts the focus for deliberate creativity from “out of the box thinking” to “better box thinking” and validates the role of experience, expertise, and knowledge in the creative process. It is especially useful in understanding the more complex creative work of people like Einstein and Darwin, and in guiding the management of complex and cross functional creativity.

1. Introduction

This article is for those who are less than delighted by the state of the art in the various computer, Internet, and multi-media systems designed to enhance team creativity. It explores a hypothesis that certain common assumptions about team creativity and problem solving make it nearly impossible to develop systems which can measurably assist the richness and complexity of real world problem solving and design collaboration.

In their exhaustive review of the experimental research into group support systems (GSS), Fjermestad and Hiltz [1] found a number of ways in which these systems did not seem to make the contributions which so many had thought possible. For example, they reported that the majority of comparisons of GSS teams to Face to Face teams found no positive impact for the GSS. They also criticized the relevance of the research with small groups of students spending a short time solving simple problems to the realities of workplace collaboration.

Simplistic problems have infected creativity research since the early days of evaluating the worth of brainstorming. Unfortunately any research design which compares the idea productivity of a face to face group to the combined efforts of individuals working alone (the “nominal group” that evolved into “nominal group technique”) requires the use of problems simple enough for individuals working alone to solve them, eliminating the types of problems which seem to benefit more from the technique. Further, in the search for “objectivity” no assessment was done to determine whether groups generated ideas new to the individuals, or even more importantly, if people in groups were more likely to generate ideas new to themselves. To discount the value of ideas new to the creators because someone else on the planet had the idea independently seems to inappropriately mix issues of creativity with issues of history.

The tension between the requirements for reliable, possible research and the requirements for good practice is not unique to this issue. For example, although they found that the measurability of the contribution of GSS seemed to increase as larger numbers of larger heterogeneous groups worked for longer times on more complex problems, very little research would be in the literature if the researchers cited had waited until they could arrange and afford such efforts.

Beyond this scaling problem, there may be another hindrance to the research into Group Support Systems. That hindrance is the theoretical perspective taken. Facilitators of deliberate creativity have learned that in any endeavor, when many bright people have tried hard on a problem of interest with less success than expected, the underlying issue may well be the very way they think of the problem.

To lay a foundation for proposing strategies for designing and researching group support systems, we can look at some alternative ideas about creativity, about teams, and about complexity.

2. Focusing on insights rather than ideas

Most research into creativity and innovation has focused on the production and implementation of ideas, with little clarification of how an idea is defined. For example, tracking specific explicit ideas as unchanging stable entities through the creative, innovative, and implementation processes can be quite difficult, especially when the process is working well and the ideas keep transforming, merging, stimulating better ideas, etc. To investigate the creativity of cross functional teams, Barlow [2] based part of the research design on an alternative perspective which focuses on the change in the “creator” rather than upon the idea. In this model the dynamics of discovering ideas new and more satisfying to the creator are isolated from the measure of the usefulness of that idea or perspective to some other context or field.

This alternative perspective has its roots in that most subjective and individualistic phenomenon of all, the "AHA" or "Eureka!" experience. Throughout history, various individuals have described this reaction a person has to getting an idea, such as Koestler [3]. Barlow suggests that this intensely physical, emotional, and intellectual experience marks our fundamental recognition that a profoundly advantageous change has taken place in our own thinking and proposes that this self-perceived advantageous shift in perspective or paradigm can be used as the essential and defining phenomenon of subjective creativity. The model is described in figure 1.

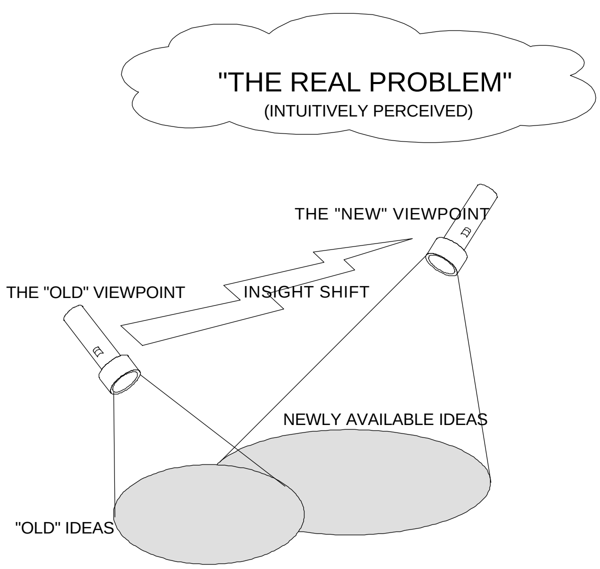

Figure 1. Shifted Insight Model

1. A flashlight was chosen for the model as an analogy for our perception of a problem. The surface below represents all the things anyone could ever do. The area of that surface illuminated by the flashlight represents the set of ideas that fit the problem statement. If the flashlight represents a problem statement or intention like "raise the bridge" the illuminated circle represents all the various actions that might raise the bridge.

2. A second flashlight represents a new formulation of the problem, such as "increase the gap between the bridge and the water" or "get tall boats past the bridge." In successful creativity, some of the alternatives illuminated or made obvious by this new viewpoint are better than the best of the ideas made obvious by the old perspective.

3. The lightning bolt represents the shift to the new definition or perspective. Although getting such an insight might take years, when it happens, it seems as fast as that lightning bolt.

4. The cloud above represents the "real" problem, the complex interaction of wants, wishes, and reality that is only approximated by our viewpoints and problem statements. Locating the second flashlight of the new viewpoint closer to that cloud represents our perception of a closer fit of the new perception to the total problem.

It is certainly true that problem redefinition as a technique for discovering ideas has been discussed in more places than it is possible to mention, but for research in some areas, it might be useful to treat that shift in definition as **the** creative event, and the resulting ideas as the aftereffect, not as the creativity. The structure and dynamics of this alternative model seem to have a better fit to some interesting issues about creativity and its reception, especially in cross-functional projects.

1. From the perception of someone holding to the old flashlight or perspective, these new ideas are outside the limits of the problem. This matches the "box" people refer to when speaking of "out of the box" thinking. It is interesting that what makes these new ideas valuable is **not** that they are out of the old box, but their better fit to the ultimate problem, as represented by the new defining vision. Therefore, it might be more appropriate to refer to creativity as "**better box**" thinking.

2. To a person with the old viewpoint, the new ideas are outside their perspective, and make no sense, until they shift to a new perspective that fits the new idea. This certainly relates to the reaction commonly labeled as "resistance to change."

3. The AHA response as a measure of subjective creativity is independent of idea generation. In this model, when someone else's idea triggers an advantageous shift of perspective in you, you are being creative. This "appreciative AHA" is an essential aspect of team creativity. In a team situation, it is possible for a person to generate and state an idea that may give them

only a mild AHA, but triggers an intense AHA reaction in someone else who can better see the potential.

4. This model certainly fits the experience of discovery creativity. When Alexander Fleming discovered penicillin, people had known for years that something in the air was killing off the bacteria when you tried to prepare cultures for research [4]. Fleming's contribution was shifting to the perspective that this killing of bacteria might be a good thing, inside the body.

5. The AHA we feel when the shift happens is a very real experience, but it is proportional to the subjective advantage of the observer, not necessarily the long term usefulness of the solution. Its strength seems to depend on how much we care about the problem, how "far" we have to shift, and how much better the insight seems. If we care a great deal about a problem (or the person with the problem) and/or if the insight seems especially profound, we feel a tremendous surge of excitement, joy, and satisfaction.

6. The AHA may be a search for a perspective which better fits our knowledge and experience. Therefore, the less a person knows and understands about a problem or situation, the easier it may be to have the AHA experience, since there are more models that could fit their limited knowledge. On the other hand, a strong AHA reaction by the well-informed to their own or other's ideas can be seen as a strong indicator of successful creativity, and might be referred to as "relevant AHA's.". Gruber's [5] analysis of Darwin's notebooks found extensive amassing of detailed information about structural variations in plants and animals as well as constant attempts to formulate a theory that would best fit all the data. Only when paleontology pushed the origins of life back into millions of years and Malthus' description of species outgrowing their food supplies showed one way that species could disappear, did his idea of evolution seem to fit his understanding. It was his extensive knowledge that made his AHA reaction valid as a predictor of the usefulness of the model as a tool of science. This search for the "relevant AHA" can serve as a guide for the strategies and techniques of deliberate creativity.

7. It is also critical to notice that as team members learn and shift their perspectives, not only do new ideas emerge, but the team members change in ways that make old ideas newly acceptable. This learning and transformation by team members is not a trivial issue for innovation, since AHA reactions by those with the resources to make the changes, leads to almost instant implementation. Many creative teams have unjust expectations of organizations and executives. After extensive and intensive work, the team comes to a new perspective on the problem that leads to a creative course of action. Then they present their plan, expecting the listeners to make the same shift of perspective and understanding instantaneously. This seems a bit unfair.

In light of this insight perspective, some of the confusions about creativity research seem to make more sense. For example, if you define ideas as things people say in creativity sessions, and if creativity is measured by the quantity of ideas and the deviance of those ideas from those "in the box", enthusiastic ignorance would be measured as creativity, and there would seem to be an advantage to avoiding those who have knowledge about the problem.

Another critical problem is that research basically consists of measure - event - measure. Notice that in this model the creative process being investigated actually changes the measurement parameters of quality. For example, as creative and advantageous as lowering the water might seem, in the context of "how well did it raise the bridge" the idea has zero quality. So, either there is no common ground for measuring the quality of the ideas before and after, or the criteria do not emerge until after the phenomena -- a strange way to do research.

3. Problems: From Simple to Complex to Wicked

One factor which certainly affects the dynamics of creative productivity and the relevance of research in this area is the complexity of the problems being solved. Complexity is itself a complex issue.

Most are familiar with the distinction of structured vs. ill structured problems. There seems to be a natural progression from having the answer available in memory to being able to follow an algorithm to get the answer. Most people have memorized the answer to multiplying 7 times 8, but have to use an algorithm to multiply 52 times 86. Problems for which we can identify and apply a successful algorithm are considered "well structured". Of course, algorithms can be quite complex. Calculating the optimum dimensions for a 12 ounce aluminum beverage can is computationally complex, but well structured. There is a process to get an answer and you can check it when you are done.

3.1. "Cognitive Complexity"

The term "cognitive complexity" is used in psychology for the ability to process information which is not well defined and internally consistent. It is generally worth the effort to attempt to transform an "ill structured" problem to a "well structured" problem, but with even the most competent and diligent effort, there seem to be residual "irreconcilable differences".

One source of this confict can be non-congruent dynamics of the subsystems, often referred to as "sub-optimization". In a company where everyone is working on the same goal of maximizing profits, different departments have different optimization strategies, which often conflict. Marketing effectiveness is best served by a production system that can deliver a "one of a kind" product by tomorrow morning, and a finance system that gives the customer 12 months to pay. Manufacturing efficiency is best served by receiving orders six months in advance and then making the same version continuously for three months. Accounting is most successful when cash is received before the sale is accepted, so they can purchase the raw materials well in advance for production. Finding the best positioning on manufacturing flexibility and credit flexibility is an extremely complex task. Ability to memorize theories and findings in finance, production, and marketing do not predict an ability to integrate these strategically.

Jaques [6] proposes that properly constructed organizational levels differ in the cognitive complexity of managers in order to handle increasing levels of problem complexity. Excelling at one level does not imply effectiveness at the next higher level, nor does functioning at one level imply competence at lower levels. In sports, the best player is often the worst coach, and many coaches were mediocre players. Managers promoted to a level for which they lack the required thinking complexity can be recognized because the only way they can help their subordinates is to do their work for them.

An especially intriguing observation by Jaques is that when people act with complexity matching a level higher than their assigned tasks, it is labeled as creativity.

3.2. Wicked Problems

The term wicked problems was coined to designate problems that are complicated by goal and values conflicts among the stakeholders. These can sometimes be reduced by relating decisions to ultimate goals on which the different parties agree, or by inventing detailed concrete solutions which leave both parties equally dissatisfied. Both of these strategies can benefit from participatory creative efforts, but even after the best rationality and creativity, goal conflict can remain. For example, when couples go shopping for a house, their preferences often conflict. This is the zone of negotiation, whether it is family members working out inheritance issues or union-management negotiations about who gets to take home the greatest part of the profits of their joint work. Even here, the insight model suggests that the effort of attempting problem solving together may transform the perspectives of the participants, opening up new zones of possible solutions.

4. Complex Teams

As problems grow in complexity, it becomes more difficult to find individuals with the required blend of knowledge, perspective, and cognitive complexity to solve them effectively and completely, and it becomes more difficult for organizations to slice them up into independent sub-projects within the capacities of individuals available in the organization.

As has often been discussed, once individuals are teamed to create solutions, issues such as group dynamics, culture, communication, and group maturity affect the solution process. However, it is important to note a special dynamic of cross functional teams that has to do with trust.

If a team project is assigned to a single discipline group, such as an MBA finance class or a VRML Coding group, each team member can be expected to have the ability to check the work of other team members in great detail. The issues of trust are around levels of effort and reliability of commitments.

In collaborative projects, every member brings knowledge and processes that cannot be checked in detail by other team members. The marketer can't really check the engineering calculations and the engineer is rarely equipped to check the allocation decisions of the accountant. This reality strongly affects team performance and the earning of trust from each other is a critical team dynamic, one that requires time and process.

Another obvious assumption about teams may need to be questioned: the idea that the work of teams is the sum of the work of its members. Nonaka [7] describes product development team processes and makes an interesting analogy, based on the idea of hypertext, the mechanism underlying the world wide web. A "normal" page contains what it contains. A "hypertext" page links to an entire spectrum of knowledge and resources.

Nonaka points out that in collaborative teams members are links to their home departments and disciplines, not just independent experts. Matrix organizations and project teams often think of their members as limited to using their individual capacities, when it is their access to resources and ability to blend those inputs with others that defines their usefulness to the team. Seeing team members as portals to resources would seem to trigger significant shifts in the design of support systems and in the research into these teams.

5. Beyond Words to Images

While the ability to perceive, create, and manipulate images in the mind has long been associated with effective creativity, it may be that the use of sketches and physical models can compensate for lack of this talent, while opening the process up to team members and other collaborators. Some excellent work has been done to increase the detail and flexibility of communicated images in Group Support Systems, but the viewpoint of what the image contributes can affect its design. The cognitive contribution of images and models do not seem to be directly linked to their ability to simulate the sense impressions of reality, no matter how exciting that technical challenge seems.

5.1. Spatial Visualization

Spatial visualization is the ability to picture a physical item in one's mind and to infer what it would look like if transformed in different ways. You may have taken tests in which you were asked to pick out which drawing could be a rotated version of another drawing.

Many great inventors and artists report picturing their creations in detail before producing them, and early researchers found correlations between this ability and performance on standardized tests of creativity. The quest for deliberate creativity leads to the question: can those of lower skill in this area reach the creative production levels of those who have this talent? There is a hint in some research about testing for the ability.

One effective test for spatial visualization is the solving of anagrams, those scrambled combinations of letters which can be rearranged to form known words. The better your spatial visualization ability, the faster you can solve these problems. Gavurin [8] did some methodological research on anagrams to determine if there were any problems with allowing test subjects to manipulate the materials. He discovered that when the anagrams were presented with each letter on a separate piece of cardboard which could be moved around on the table, spatial visualization ability no longer affected the speed of solving the problem. As a test developer, he learned that if you want to effectively measure this talent, you must not allow the subject to use any external materials which can be manipulated. On the other hand, this research also means that allowing people to move the letters around externally allows those low in spatial visualization to perform as well as those who excelled in it. This is a good thing for deliberate creativity.

5.2. The Use of Models

This advantage to using external representation seems to be the same as in mathematics, where most of us can solve far more difficult problems on paper than we can in our heads.

The table in Figure 2 below explores in more detail an analogy between creativity and arithmetic. If I want to multiply two numbers, there are several possibilities. I might know the answer already, although most people have only memorized the answers for multiplying pairs of single digit numbers. A few might be able to calculate the answer unconsciously, but this ability is labeled “idiot savant” because it is usually accomplished by severe defects in other cognitive areas. This is what the movie “Rainman” was about.

Some have practiced "mental arithmetic" and have learned tricks to handle problems of three, four, or more digits in their minds. Most of us could take paper and pencil to work these problems out, with our ability limited by our patience, carefulness, and the size of the sheet of paper. Of course, most folks would simply use a calculator.

Applying this same structure to creativity, we note that sometimes we already have an answer as part of our knowledge. Getting these previously known answers from others is one of the dynamics of brainstorming sessions.

Level	Arithmetic	Creativity
Remembered or Known	Memorized multiplication tables	Knowledge
Unconscious process	"Idiot Savant"	Intuition and Incubation
Conscious, internal process	"Mental arithmetic"	Thinking about a problem, possibly following a process
External model	Paper and pencil, graphing	Journaling, doodling, writing. PERT charting
External and Social	Group problem solving with chalkboard	Group problem solving with paper, models, facilitated process
External processor	Calculator	?

Figure 2. Levels of Processing

Other times an answer seems to arise from our subconscious with no indication of where it came from. Many authors label this process intuition, and use the term incubation to label the process of doing something else while waiting for the answer to emerge.

We also have a certain level of ability to solve problems in our minds, but most of do better with paper or some other medium for listing and/or sketching our ideas.

Just as with arithmetic, various techniques enable us to handle more complex and extensive problems, both in our heads and on paper. Part of the function of external models may be to hold for reference more information than we can hold in our heads at one time. When we use paper and pencil to multiply large numbers, we carefully write down the intermediate steps and basically solve lots of little single digit problems with those answers we memorized as children. The writing helps us keep track of our progress and remember our sub-answers.

5.3. Imagery and Experience

There is other research that indicates that image focused thinking is more effective when attempting more difficult problems. Gier Kaufmann [9] investigated the usefulness of visual images in the solution of concrete problems. He took problems and puzzles which had already been assessed for their difficulty and presented then in different ways. He took easy, moderately difficult, and difficult problems and presented them to different people as: word problems requiring word answers; picture problems requiring sketched answers; or actually putting the subjects in the physical situation described in the problem.

The most difficult problems were only solved by people working in a physical version of the problem. The easy problems were solved quite effectively when given as word problems, and presenting them as pictures or real world situations just slowed down the solution.

Problems of moderate difficulty were difficult to solve as word problems, but generally well solved as picture problems, with little advantage from putting the subjects in the real world.

This seems to indicate that word focused thinking is only effective for the easiest of problems. With more difficult problems, there is an advantage to drawing pictures to understand and solve the problem. And for the most difficult problems, it seems that you need to just jump into the situation and muddle around until you get it solved.

Three dimensional prototypes, scale models, and virtual reality systems may also fit this “reality” category. Designers of buildings and products have known for a long time that while some people can make sense of blueprints, others need a physical model to begin reacting to ideas or contributing to a design.

5.4. Shared Images

Drawing pictures and manipulating models seems to be very valuable to those working alone, but there also seem to be several advantages for team collaborations. Keeping notes of ideas and facts and work in progress in front of a problem solving group on flip chart sheets around the room seem to help them handle more complexity.

Blueprints of building or product designs give us a similar capability of looking together at various details in the context of the whole. Charts such as flow charts and PERT charts can represent complex interactions in a form which allows groups to both see the whole interaction and to focus on simpler details and relationships.

The architect and planner Alexander [10], noted that while there seem to be a limited number of people who can invent new structural patterns, there are many more who can effectively evaluate those structures, their details, and their implications. So external models may permit people of higher cognitive complexity to present and manipulate their complex structural ideas while permitting those who operate at lower cognitive complexity to check their implications against their knowledge and values.

Therefore, it would seem that since deliberate creativity will often benefit from external sketches, notes, prototypes, and physical models, facilitators should be able to call on a variety of different techniques for different problems, and group support systems should be provide similar capabilities.

6. Proposed Shifts

Fjermestad and Hiltz [1] have made many excellent recommendations of ways to improve the research and development of group support systems, including testing whether easier to use systems based on more recent technology reduce negative effects while enhancing positive effects, as well as a combined mode approach, using a pattern of different methods for different kinds of work within the collaborative process. This combined mode approach seems especially appropriate since many facilitators lead teams through sequences of modes of interaction that differ physically, socially, and/or cognitively.

While the concepts discussed above suggest that those already immersed in the research and development of group support systems may have the most useful and relevant AHA’s about implications of the ideas on group support systems, the author, immersed in the field of cross functional team facilitation, takes the liberty of suggesting a few for their consideration.

6.1. System Design Implications

6.1.1. Focus on the changes in the group and its members. Designing a system to capture ideas and track their progress through cycles of evaluation and development is quite different from designing a system that helps problem solvers (whether individual, group, or organization) to transform their knowledge until a solution is obvious. Fortunately, such a system can use many of the same elements and technologies.

One advantage that a sophisticated GSS system might have is the ability to more clearly capture the intermediate transformations of knowledge, goals, and perspectives that eventually lead to a perspective that has the advantage of making better alternatives obvious. With this tool, various facilitation and support strategies can be tested for their relative effect on this knowledge development.

An interesting aspect of researching this area would be looking at changes in beliefs and values about the problem in the team members from the beginning to the end of the process, and asking the team about the advantages of those shifts. The often researched Delphi process of voting-sharing-voting is an example of the changing of knowledge and belief by team members as they share insights with each other. This probably is a key dynamic of the "Not Invented Here" syndrome, in which participants in a design value it highly and outsiders may undervalue it.

6.1.2. Representing Complexity. If our goal is to assist people in getting smarter about a particular problem, then the support system might be designed to help them not only keep track of the many details of work in progress, but also to help individuals comprehend and process more complexity than their minds can handle internally, and to share knowledge in forms that are useful to others in the process. By exploring the "levels of complexity" models proposed by various authors, systems should result which merge words, pictures, and simulated experiences in structures of increasing complexity. Many useful structuring systems have been implemented in software, whether PERT charts, flow charts, causal maps, or other structures.

Critical to this representation of complexity is its ease of manipulation, allowing both new structurings and multiple simultaneous structurings to be experimented with.

It can be argued that any team that solves the problem as it is stated has not been very creative, so it would seem necessary for these systems to capture and utilize the lessons implicit in the ideas that emerge, allowing shifts in the project definitions and stakeholder expectations. Multiple conflicting views of the problem and its drivers would be essential.

6.1.3. Group Complexity and Dynamics The history and maturity of a group are certainly dimensions worth investigating. Anecdotes often point out that cohesive groups with well-established relationships are far more capable of creative collaboration through distance technologies. Researching the impact of the system on the social factors and the impact of the social factors on the effectiveness of the technology is quite complex, but worth the effort. It is important to note that this relationship is further complicated by individual differences in preferred styles of social interaction, a breadth of difference that may not be well represented within the community designing the systems.

When researching these social dynamics it is helpful to recognize that face to face groups use a much greater bandwidth than words. As problems grow in complexity, the technical conflicts can easily trigger social conflicts. Strong teams handle greater cognitive conflict with minimized social conflict by adjusting the meaning and implications of words based on historical relationships as well as non-verbal physical behaviors (some researchers would even suggest chemical messengers). Rather than trying to add "virtual pheromones" to conferencing systems, it might be more efficient to build team cohesiveness with face to face meetings and continue with an appropriate blend of face to face, distant, and asynchronous technologies.

6.1.4. Support Hypertext Teams A rather interesting challenge would be to design a Group Support System based on the idea that teams, like a hypertext page, contribute not only the members' abilities and knowledge, but access to the specialized resources of their departments and disciplines. In the asynchronous mode, one could imagine each team member linking complex elements into a shared interconnected workspace, dynamically linked back to resources of the team member's field. As various team members shifted around their submodels, the system might be able to provide instant feedback (of the linear rational kind) on implications for the other domains.

One could also envision a face to face system in which the team members faced each other across the table and had their support system screens behind them, allowing them to immediately and dynamically draw on domain resources while in the midst of an intensive problem solving effort. This might provide access to critical reference information, access to the tools of their field, and even access to colleagues for quick bits of advice and even additional ideas.

6.2. Research Design Issues

6.2.1. Objectively Assess the Subjective. Although the ultimate usefulness of ideas is the target of collaborative efforts, that usefulness seems to be the interaction of the knowledge/abilities of the team and the subjective creativity of their efforts. GSS research seems targeted on getting the best out of the resources provided, so its main focus should probably be subjective rather than "objective" creativity.

Therefore, even on the simplest tasks, the judgment of "expert" evaluators from some particular domain is probably not as useful as the team's own experience of the relative creativity of different ideas and the creative effectiveness of different processes and support tools. In the original "brainstorming vs. nominal group" research, the conclusions might have been quite different if the participants had been asked to judge the relative creativity and quality of their ideas under the different conditions, and the effect of the process on their own thinking.

Subjectivity also helps in understanding the dynamics of "ill-structured" problems, which are much easier to analyze when they are thought of as problems which must be solved simultaneously in multiple subjective domains. Interestingly, Barlow [2] found that teams who used the criteria decision matrix to judge ideas discovered more ideas considered extremely creative.

6.2.2. Investigate more complete systems. The field may have accomplished all that it can with comparing procedures to procedures, such as brainstorming to nominal group. To seek out the most effective approaches to more complex problems it is probably necessary to investigate the dynamics of more complete approaches.

By identifying phases of the collaborative process and alternative approaches to each phase, it should be possible to generate a series of alternative patterns and compare their effect on the creative effectiveness of the collaboration. The very large number of distinct alternatives can probably only be handled by deliberate "design of experiments" such as is commonly used in market research and manufacturing process design.

6.2.3. Knowledge Depth and Complexity. As difficult as it makes research design, deliberate processes and techniques for bringing out and realigning deeply understood knowledge and goals are probably quite different from the dynamics of utilizing some explicit process points handed to a subject on a card as the session starts.

Even more interesting is the process of combining the knowledge of disparate experts and stakeholders. This process demands much more complex and realistic problems, problems which demand collaboration with people whose work one cannot check.

Part of this research may require a standardized protocol used with existing groups working on problems of interest to them. Assessing the group's experience of certain problem variables, process dynamics, and the quality of results may allow conclusions to be drawn across dissimilar groups working on dissimilar problems. Other researchers may be able to access populations of similar teams facing similar problems, such as small business unit management teams in the same industry or company developing strategies or budgets.

6.2.4. Break the effect/source link Many input variables being researched probably have no direct connection to collaborative effectiveness, but rather enhance some intervening variable that more directly affects results. Even more confusing, some input variables affect multiple intervening variables in different, even conflicting ways. And of course, more than one input variable can trigger a change in any intervening variable. All of which is compounded by individual differences in reactions to input factors. Basadur et al. [11] points out that most creativity research uses training or instructions as an input variable, without measuring whether the input had any real effect on the attitudes or behaviors on the subjects.

For example, a cohesive group that can share ideas quickly and effectively seems to be more successful in solving complex problems. That cohesiveness can result from a cultural trait shared by all members (national culture or organizational culture), a particular social structuring of the process (such as anonymity), strong training in a deliberate process, good internal leadership, an outside facilitator, even the physical structure of the workspace. Or, more likely, a combination of all.

7. Summary

Many competent researchers have learned a great deal by doing a variety of research and development in Group Support Systems. Many difficulties in the field would have been avoided if previous work in the fields of creativity, groups, and facilitation had more robust methods and validated constructs which could be used to guide the development and testing of these systems.

Broadening the scope of design and research to the whole collaboration process and including all modes of interaction, not just the computer mediated, seems likely to enable the development and validation of collaboration management and support systems capable of extracting far more leverage from available knowledge and resources. Lobert, et al. [12] propose a more complex model separating outcomes from creative outputs from processes from organizational inputs. Woodman et al.[13] go further with an interactionist approach, noting that most dynamics also work in reverse, such as individuals or outcomes affecting the organizational inputs.

The increment offered by the insight perspective is that these interactions not be seen as ways to facilitate creative production, but that these very shifts in the perspectives and behaviors of individuals, teams, and organizations **are** the creativity. Whether this is a advantageous shift in perspective for the design of GSS and other collaboration management processes can only be determined by those doing the design and research.

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