

## **Design Patterns for Practical Creativity Towards Innovation**

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### **Fostering Creativity**

According to Wikipedia creativity is “a mental and social process involving the generation of new ideas or problem solutions, or new associations of the creative mind between existing ideas or concepts”. Creativity towards innovation in product development settings are often used interchangeably. Innovation and creative product development refer to completely new as well as significantly improved products, processes or methods.

Creativity techniques have been developed by both academia and industry to shift a person's mental state into one that fosters creativity. Michalko (2006) in his book presents the various creativity techniques that have been proposed in the Oslo Manual which is the foremost international source of guidelines for the collection and use of data on innovation activities in industry (OECD, 2005). Several other web resources contain guidelines and examples of creativity techniques (e.g. <http://www.brainstorming.co.uk/tutorials/> or [http://www.mindtools.com/pages/main/newMN\\_CT.htm](http://www.mindtools.com/pages/main/newMN_CT.htm)) in effort to train and guide individuals and teams which technique to choose and how apply them. Of course, it is well known that “design patterns are potentially more general than existing guidelines, use more specific examples, deliberately scope their context of application, and explicitly reflect particular values” (Dearden and Finlay, 2006).

Thus, the scope of this paper is to propose two design patterns for two well known creativity techniques, namely the Six Hats technique and the SCAMPER technique. The ultimate goal is to create a pattern language about the various creativity techniques that promote collaboration for innovation. This is actually the context of our current research and development work within the EU funded idSpace project (<http://idspace-project.org>). In the idSpace project we investigate the collaborative development process of innovative products, and it should be best supported by a groupware system, a system that is computer-based and supports two or more users engaged in a common task, and that provides an interface to a shared environment. In our attempt to aid the groupware systems designers, we needed to cooperate with experts who know about creativity, innovative product development processes and computer supported collaborative

corporative learning, as well as with application domain specialists environment (e.g. aerospace industry) who apply creativity techniques into their working environment (e.g. aerospace industry). As an effect, we faced the challenge of creating a common language that will give designers recommendations about the functionality of the idSpace groupware system. In general, people within a discipline often have trouble communicating their ideas and decisions to other specialists (Borchers, 2001). One of the challenges in groupware system design, which is a multidisciplinary task, is to develop effective techniques for making specialists' knowledge and assumptions more explicit, and easier for the specialists from other disciplines to understand and refer to. In the next sections we present two design patterns about well known creativity techniques. A full list of the available strategies that could be transformed into patterns can be found in the State of the Art in Tools for Creativity (idSpace D2.1, 2009).

### **What are the Flow Design Patterns about creativity techniques**

According to Goodyear (2005) and Hernández Leo et al. (2005) pedagogical strategies that foster collaboration can be described via design patterns. Actually, various pedagogical design patterns have been published. Creativity techniques that foster collaboration can be also described via design patterns and especially via the specific type of design patterns called flow design patterns (FDP). This is due to the fact that creativity techniques (e.g. Six-Hats, SCAMPER, TRIZ, Disney etc.) are considered to be task-oriented. Thus the FDPs can clearly explain the set of tasks that are needed to be performed by people who participate into the creativity process. The term "flow pattern" was originally coined by Hernández Leo et al. (2005) to portray coordination and sequencing of tasks of a (learning) process. Thus, the FDP define the sequence of the tasks that the technique dictates as well as other elements needed for the various tasks, such as the duration of a task, the use of a particular tool for a given task and so on.

The structure of a FDP includes elements such as design problem's description, the related context and a documented solution suggestion for this problem with concrete examples. Table 1 shows in detail the format of a FDP which is similar to the suggestion of CLFP (Collaborative Learning Flow Patterns) by (Hernandez-Leo et. al, 2005). We have chosen this specific format since it is detailed and situated by Hernández Leo et. al, that it is very useful and fully understandable by practitioners which are the final recipients of our FDPs. Since our design patterns are not system patterns we are using a more actor playing description, a description that the FDPs can attribute.

**Table 1. The flow design pattern format**

<b>Element</b>	<b>Explanation</b>
Name	Name of the FDP
Context	Environment type in which the FDP could be

	applied (state an example from a real-world learning activity capable of being structured according to the FDP) as well as the forces that create the problem
Example	One example that states the need of the FDP
Forces	The contradictory considerations that must be taken into account when choosing a solution to a problem.
Problem	Problem to be solved by the FDP
Solution	Description of the proposal by the FDP for solving the problem
Types of Tasks	Types of tasks, together with their sequence, performed by the actors involved in the activity.
Types and structure of Groups	Description of the types of groups of learners identified and how they are related
Consequences	A description of the results, side effects, and trade offs caused by using the pattern
Related Patterns	Other patterns that have some relationship with the pattern; discussion of the differences between the pattern and similar patterns
Examples – Known uses	Examples of real usages of the pattern
References	References that correlate with the pattern
Related Patterns Thumbnails	Thumbnail of the related patterns

### The flow design pattern of the “Six Thinking Hats” technique

**Name:** Six Thinking Hats



#### **Context**

In everyday life (academic, professional, or political), problem solving and/or decision making is often a result of collaboration within a group of people with different thinking and planning styles. Group members contribute according to their personality, inner strengths and thinking styles. Some people think strategically, methodically and with great discipline, trying to foresee possible consequences, while others often “listen to their hearts”. Some people think from a very rational, positive viewpoint, showing resistance to change, while at the same time they don't make creative leaps. Other people are used to a more intuitive approach to problem solving which makes them engage with

passion into new ideas that might not be very realistic based on socio-technical constraints of the context. It is necessary, however, to hear all voices and examine a problem and possible solutions from various perspectives in order to achieve pluralism in depicting the ideal solution.

**Example:** Let's assume that a town council is trying to decide whether or not several local school buildings should be combined into a new one, and what the options are for the use of the old buildings if those become vacant. The decision makers have to analyze all options, critically determine the advantages and disadvantages of the suggested solutions, and do a risk assessment of the outcomes before ending up with creative final solutions.

### **Forces**

Six Thinking Hats creativity method can be used when there are time constraints. The formation of groups (applying a hat) is very easy while at the same time there is no need of specific competencies of the participants. It is also proposed when the need of several different opinions can be heard instead of getting as outcome one and final decision. The complexity of this method is minor since no preparation from the participants is needed.

### **Problem**

How can groups make sure that all possible (practical as well as emotional) perspectives have been examined during a problem solving or a decision making process?

### **Solution**

**Use a technique where you can approach the solution to your problem from different perspectives.**

“Using the Six Thinking Hats technique for looking at a problem, decisions and plans will mix ambition, skill in execution, sensitivity, creativity and good contingency planning.” as de Bono stated (1992),

This technique assists groups in creating a complete and concrete view of the problem to be solved, by considering diverse thinking styles and incorporating multiple views. Groups are able to discuss the full complexity of their decisions, and identify possible drawbacks or benefits which might not, otherwise, be noticed.

### **Types of Tasks**

The collaboration process is broken down into six “Divisions”, each corresponding to a thinking style and represented by a “Thinking Hat”. Members have to perform their thinking within each division. The guidelines for each division are:

- White Hat: be neutral, objective, and unbiased
- Red Hat: be intuitive, emotional, and instinctive
- Black Hat: be pessimistic & judgmental; think of disadvantages
- Yellow Hat: be optimistic, and hopeful; think positively
- Green Hat: be creative, think out-of-the box (new perspectives)
- Blue Hat: manage, coordinate, summarize, facilitate

In the following paragraphs all divisions will be described in detail.

**White Hat:** Members who are working on the problem under the White Hat need to collect data, group those, and interpret information objectively and accurately. The objectives of the White Hat are:

- Exposition of statistical data
- Concentration on actual facts (and not opinions or beliefs)
- Acknowledgement of incomplete or inaccurate knowledge

- Suggestion of solutions that logically result from the data

Questions asked from a White Hat's perspective are:

1. What are known facts, data, and other information on hand?
2. What are the unknown facts, data, and other information on hand?
3. What additional information is needed?
4. What is there to be learned from this procedure?
5. What is the methodology for obtaining the facts and data needed to reach a solution?
6. Based strictly on the data and information collected, what are the possible, logically-derived solutions?

Red Hat: Members who are working on the problem under the Red Hat think with their "heart". They need to use their intuition and instinct to evaluate the situation, its outcomes, and the possible solutions (as those get proposed by the other divisions).

The objectives of the Red Hat are:

- Adoption of intuitive reactions
- Awareness and evaluation of others' feelings
- Promotion of emotional views
- Exposition of implied advantages of different approaches
- Exposition of implied disadvantages of different approaches
- Exposition of contradicting outcomes

Questions asked from a Red Hat's perspective are:

1. What is my initial reaction to a suggestion?
2. How do I feel about a decision I might make?
3. Do I believe I am making the right choice?
4. Does anything inside me tell me there is a better option?

Black Hat: Members who are working on the problem under the Black Hat need to concentrate on the dangers and flaws of each approach, and emphasize the worst case scenarios for any proposed solution. The objectives of the Black Hat are:

- Identification of negative outcomes and their consequences
- Identification of flawed or weakly-supported contingency plans
- Consideration of inadequate resources
- Elimination of pitfalls and non-beneficial ideas

Questions asked from a Black Hat's perspective are:

1. What is a serious flaw of this recommendation?
2. What is a major drawback to this way of thinking?
3. What are the odds of failure?
4. What could be potential worst-case scenarios?
5. Are necessary recovery resources in place?

Yellow Hat: Members who are working on the problem under the Yellow Hat need to bring forward optimistic ideas which may provide opportunities for success. The objectives of this division are:

- Identification of benefits of recommendations
- Evaluation of opportunities within proposed solutions

- Assessment of good-case scenarios
- Assessment of feasibility of recommendations
- Promotion of enthusiasm and motivation

Questions asked from a Yellow Hat's perspective are:

1. What is the best way to approach the issue?
2. What is a reasonable and realistic way to make things work?
3. What are the positive outcomes of each idea?
4. What are the long-term benefits of each action?

Green Hat: Members who are working on the problem under the Green Hat need to vision the problem in a new, open and unrestricted way, in order to generate creative and unusual ideas. The objectives of the Green Hat problem solving approach are:

- Promotion of expanded and elaborate thinking
- Application of extended rules (beyond reality restrictions)
- Envision of creative and non-habitual solutions
- Consideration of new perspectives

Questions asked from a Green Hat's perspective are:

1. What alternative solutions are possible?
2. Could a recommendation be done in another way?
3. What is an unusually unique way of looking at the issue?
4. What would constitute "outside-the-box" thinking in this case?
5. What if...?

Blue Hat: Members who are working on the problem under the Blue Hat need to maintain focus. They act as arbitrators between divisions, directors of the problem solving process, and coordinators of the group. The objectives of the Blue Hat are:

- Maximization of efficiency and effectiveness of thinking
- Facilitation and direction of the thinking process
- Determination of agenda, goals, and responsibilities
- Organization of ideas and recommendations

Questions asked from a Blue Hat's perspective are:

1. What is the best way to define the actual problem?
2. What are the goals?
3. What are the desired outcomes of the solution-seeking process?
4. What is the most effective way of moving forward?
5. What is the optimal way out of the current circumstances?

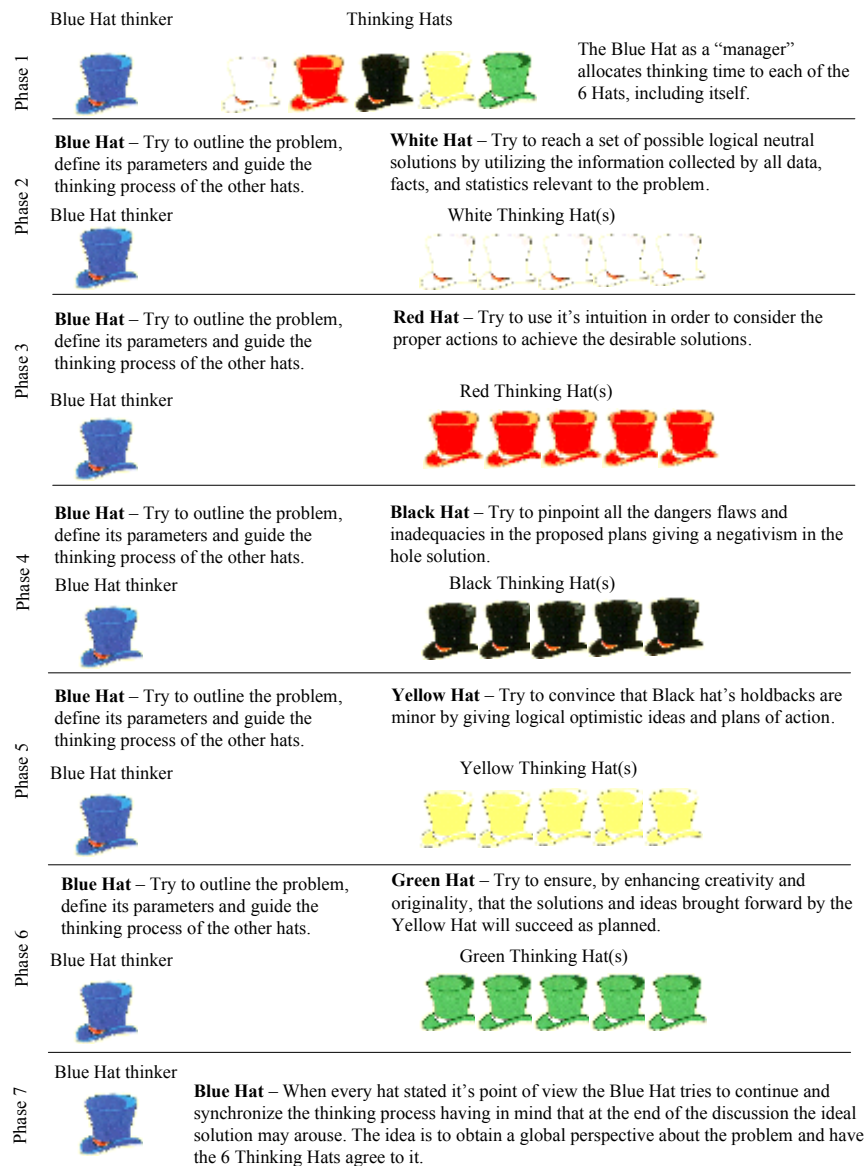
### **Types and structure of Groups**

The Six Thinking Hats technique can be used effectively in practical creativity group meetings, as it provides a way of understanding and accepting different thinking styles that people approach problem solving with.

You can use Six Thinking Hats with other persons or on your own. When it is being used among groups it has the benefit of defusing the disagreements that can happen when people with different thinking styles discuss the same problem. There is not a specific number of participators needed. Of course if there are six (1 blue hat and the other 5 hats)

or eleven (1 blue hat and the other 10 divided into couples for representing the 5 hats) etc. then the division into the Hats groups and the role playing is easier. The role (type of hat) that are given to each participant, even if it doesn't reflect their opinion, is not far beyond simple thinking, since the hat drives thinking to a specific point of view than vague thoughts around the problem.

The proposed – according to de Bono (1992) - order of thinking would transition in the following manner:



Several proposals have been made for changing the specific flow and replacing or excluding types of hats. These alterations of the De Bonos's initial proposed flow are more problem oriented. For example when the problem is Strategic Planning a proposed flow could be: Blue, Yellow, Black, White, Blue, Green, Blue ([http://en.wikipedia.org/wiki/De\\_Bono\\_Hats](http://en.wikipedia.org/wiki/De_Bono_Hats)). Of course these flows need further evaluation.

## **Consequences**

There are several theoretical reasons of why should someone use the Six Thinking Hats technique. The key point that is behind each hat is that the motive that each colored hat gives to the participant of that process is that a hat is a direction to think rather than a label for thinking. By this point the Six Thinking Hats technique encourages parallel thinking as well as full-spectrum thinking. Additionally this technique separates ego from performance ([http://www.mycoted.com/Six\\_Thinking\\_Hats](http://www.mycoted.com/Six_Thinking_Hats))

## **Related Patterns**

- FACILITATOR [1], WELL-CHOSEN RESOURCES [2]

## **Examples**

- MindTools: “Directors of a property company”  
[http://www.mindtools.com/pages/article/newTED\\_07.htm](http://www.mindtools.com/pages/article/newTED_07.htm)
- the MiddleWeb Listserv: “moving to a new city”  
<http://www.middleweb.com/MWLresources/dyckarticle2.html>
- Six Thinking Hats Testimonials:  
[http://www.debonoonline.com/Six\\_Thinking\\_Hats.asp](http://www.debonoonline.com/Six_Thinking_Hats.asp)
- Six Thinking Hats as Applied in Six Sigma by Tata Consultancy Services:  
[http://www.debonoconsulting.com/Six\\_Thinking\\_Hats\\_as\\_Applied\\_in\\_Six\\_Sigma.asp](http://www.debonoconsulting.com/Six_Thinking_Hats_as_Applied_in_Six_Sigma.asp)

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- IQ Matrix: 6 Thinking Hats: Solving Life’s Complex Problems  
<http://blog.iqmatrix.com/mind-map/edward-de-bono-6-thinking-hats-mind-map>
- MindTools: Six Thinking Hats, Looking at a Decision from All Points of View  
[http://www.mindtools.com/pages/article/newTED\\_07.htm](http://www.mindtools.com/pages/article/newTED_07.htm)
- the MiddleWeb Listserv: Turn a Sad Goodbye into a "Problemunity"  
<http://www.middleweb.com/MWLresources/dyckarticle2.html>

## **Related Patterns Thumbnails**

[1] NAME: FACILITATOR

The FACILITATOR is enriching discussions by generating cognitive conflicts. The role of the facilitator is to potentially enhancing the learning outcomes of collaboration.

[2] NAME: WELL-CHOSEN RESOURCES

During a discussion it is essential to guide stakeholders giving them accurate and exact resources in order to produce fruitful ideas.



## The flow design pattern of the “SCAMPER” technique

Name: SCAMPER



### Context

Creative problem solving processes are often characterized by the divergent nature of human thought and action. Divergent thinking involves being able to merge, or combine, unusual ideas. Researchers have acknowledged the importance of recombination of ideas, or previous effective problem solutions, as central to the process of producing a creative and innovative solution to a given problem.

### Example

We can imagine food manufacturers that often produce modifications of their flagship products in order to stimulate new consumers and increase their sales.

### Forces

The use of SCAMPER technique is being used when a pluggable solution to a specific problem is already known. Its outcomes are new solutions for different perspective. This creativity method needs only one participant which doesn't play any roles. It has no complexity, since the only module of it is the answer to one or a number of ready made questions on the already working solution in order to produce a new working outcome.

### Problem

How can we help people to generate new, more complex or complicated ideas (or problem solutions) based on one existing idea or based on several simple ideas or existing solutions?

### Solution

**SCAMPER is a problem solving technique which can be used to spark the creativity of people that try to solve specific problems and helps them reuse existing ideas or effective existing solutions to similar problems.** The main idea behind SCAMPER technique, which has been developed by Bob Eberle (1997), is that everything new is a modification of something that already exists.

Each letter in the acronym SCAMPER represents a different way someone can visualize the components of a problem and how new ideas can be triggered from existing ideas/cases:

S = Substitute

C = Combine

A = Adapt

M = Modify

P = Put to Other Uses

E = Eliminate (or Minify)

R = Rearrange (or Reverse)

### Types of tasks

The SCAMPER technique provides the stakeholders with a set of directed questions in order to direct them coming up with new ideas. These questions should not be posed in normally brainstorming sessions but should be typically used to direct in ways that deliver new ideas. These questions drive the whole discussion between the participants and lead them to minimise the number of out of point proposals as well as the time consumed to bring new ideas upfront.

#### Substitute

Try to imagine the consequences of replacing part of the problem, product or process with something else. Changes can also concern people, things, places, emotions, ideas. New ideas may come up by looking for replacements.

Typical questions:

- How can place, time, materials or people be substituted?
- What can be substituted to make an improvement?
- Swapping two things makes a difference?

#### Combine

Creativity thinking often, in order to reveal new ideas, involves the combination of unrelated ideas, goods, or services. In that case the creation of different products or processes can be achieved by the combination two or more parts of the product or the processes themselves

Typical questions:

- What combinations of components can be made (e.g. materials, features, processes, people, products etc.)?
- Can a synergy being build and where?

#### Adapt

You don't have to "re-invent the wheel" each time you want to solve a problem. The adaptation of an existing idea/solution can be the answer to your dilemma.

Typical questions:

- Can I change a part of the product?
- This change can be done in exchange for what?
- In what degree can the characteristics of a component be changed?

#### Modify

Try to imagine the consequences of increasing or reducing in scale, changing the shape, modifying the attributes of the product. Try to imagine what will bring up the changing of some parts or whole of the current situation. Rearrange the subclasses of it in an unusual way often drives into alternative products/processes.

Typical questions:

- What will occur if a feature or a component will be boosted or on the other hand downgraded?
- What will occur by the modification in the hole or sectional of a process?

#### Put to Other Uses

Imagine how the current product or solution or process can be exploited in other uses, for other purposes. Reuse the existing knowledge to expand the affordances of it. Discover other markets for your product.

Typical questions:

- Are there any other markets that the product can be used in?

- Are there any new potential customers that might be able to use it?

#### Eliminate (or Minify)

Imagine the outcome of a possible elimination – minimization of various clusters of the process or specific parts of the product. Narrow your thoughts by gradually trimming the processes, the ideas, the objects to the way that leads to most important function, to the most substantial part.

Typical questions:

- What will be the outcome of a possible removal of a specific component or part of it?
- Is there any other way(s) beyond the “beaten track” to lead to the desirable solution?

#### Rearrange (or Reverse)

Imagine the side-effects or the result that a possible reverse, a different order, in the way a product is being manufactured or a process is being executed. Picture the outcome from different angles and come up with new ideas.

Typical questions:

- What will happen if the process runs the other way round?
- What can be done to achieve the exact opposite effect?
- What are the sequences of reversing the way it is used?
- What are the sequences of reversing the order it is done?

### **Types and structure of Groups**

SCAMPER can be used either in person (which is not its strength) or in group brainstorming sessions in which there are time constraints and lack of innovative ideas. SCAMPER is actually a checklist of structured questions that promotes innovation and creativity leading stakeholders to think of changes that can be made to an existing idea (sometimes product) to create a new one. These proposed changes can be considered either as direct suggestions or as starting points for lateral and divergent thinking.

### **Consequences**

SCAMPER is ideal for use to identify possible new products. Of course during the brainstorming session many of the ideas that are generated may be unfeasible or may not suit the equipment used by the manufacturer, but some ideas could be good starting points for discussion of new products (<http://www.mycoted.com/SCAMPER>).

### **Related Patterns**

- BRAINSTORMING [3], MIND MAPPING [4]

### **Examples**

One well known example of the application of this technique is the case of MacDonald’s founder Ray Kroc. [<http://www.flatworldknowledge.com/beta-0.1/principles-management/developing-mission-vision-and-/creativity-and-passion>]

We can easily identify many of the ideas he used based on the SCAMPER technique:

- P = Put to other uses: selling restaurants and real estate instead of simply hamburgers
- R=Rearrange: having customers pay before they eat
- E=Eliminate: letting customers serve themselves, avoiding the use of waiters

Another example can be found in the book "Mind performance hacks, Tips & tools for overclocking your brain" from Ron Hale-Evans, O'Reilly, 2006, ISBN 0596101538, 9780596101534, in page 85 when the SCAMPER technique is being used in the traditional card game Rummy (<http://www.pagat.com/rummy/rummy.html>)

One more example can be found in Design and Discovery, Understanding the Design Process in which we can find a case study that students were introduced to the SCAMPER technique by examining an everyday item the water bottles: ([http://www97.intel.com/en/DesignDiscovery/Curriculum/DesignProcess/Session2/S2\\_KeyConcepts.htm](http://www97.intel.com/en/DesignDiscovery/Curriculum/DesignProcess/Session2/S2_KeyConcepts.htm))

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- <http://litemind.com/scamper/>

### **Related Patterns Thumbnails**

#### [3] BRAINSTORMING

BRAINSTORMING is a method of group interaction in both educational and business settings. It is designed to generate a large number of ideas for the solution of a problem.

#### [4] MIND MAPPING

MIND MAPPING is a technique used to represent words, ideas, tasks, or other items linked to and arranged around a central key word or idea. This technique is being used to generate, visualize, structure, and classify ideas, and as an aid in study, organization, problem solving, decision making, and writing.

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