The Physical Context of Creativity

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Creative processes are complex and consist of sub-processes, e.g. value creation, scaffolding, imagination and materialization. Creativity takes place in a physical context, i.e. in a confined space. Such space restricts and enables the free flow of sensory experiences and proximity of other people. The confinements may make certain sensory experiences available, e.g. vision of source material, sight and sound (including noise). This framing allows certain cognitive processes and restricts others. This may induce emotions that, in turn, facilitate or reduce the enhancement of creativity. Physical space affects the well-being of people, the channels of information, the availability of knowledge tools and sets the stage for coherence and continuity, which may contribute to competitive advantages.

Introduction

Creativity

A creative individual is somebody who actively seeks new knowledge, who is motivated by curiosity and who wants to achieve something. Creative individuals are also able to sustain ambiguity and stay in a state of ‘indecision’ for longer than others, and may show a risk-taking attitude. While these characteristics may be true, they should not be exaggerated. Csikzentmihaly’s (1996) interviews with over 100 people, especially selected for achievements at Nobel Prize level, indicate that lifestyle and being in the right place at the right time play a major role in creativity. To know when and where the right time and place indicates that factors outside the creative individual are at play. This means the creative person must match with the field of experts and the domain of knowledge.

Wallas (1926) introduced a phase model, which has been used and referred to as an anchor point of creativity ever since (Csikszentmihaly & Sawyer, 1995). The model serves as a good guideline for how a creative process may consist of different phases. In the phase model, the first phase is preparation, the second is incubation followed by insight and lastly, elaboration and evaluation. We will inspect these, before describing relations between the creative processes and the spatial dimensions.

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The Preparation Stage

The general issue of this stage is to facilitate data and information for the process. Such situations differ, as both a single individual as well as a team may conduct the preparation. Space for organizing the information and easy retrieval is essential. It is vital for team members to exchange frameworks, to set the common goals and stage the remaining process. The spatial arrangement must support as much information flow and absorption as possible to each member. The tools, like personal computers, bulletin boards and general access to information are important both for individuals and for teams. Communal space seems important for teams. Sometimes a private space is essential for analysis, both by individuals and team members. The length of this phase can vary – depending on when the team reaches a barrier, fatigue or leaves the assignment.

The Incubation Stage

In the incubation stage, the cognitive processes seem to be essentially a personal or private affair. Incubation can happen when people change to other assignments or simply relax from a previous one, but the cognitive process of problem solving goes on implicitly. The literature on incubation only refers to individual cognitive processes, (Dorfman, Shames & Kihlstrom, 1997). Despite this, it seems likely that ‘distributed cognition’ happens because perceptual clues are shared among team members (Hutchins, 1995). In such cases, the team members need a medium of communication e.g. a bulletin board (Reddy, 2002) or any other cognitive artefact (Gedenryd, 1998). Some creative people are best left to themselves in the incubation stage, while others seek company. Incubation is an implicit cognitive process, but perceptual clues may facilitate the process. Staying in the room where all the information from the preparation stage is kept may facilitate such implicit perception as a process of ‘priming’.

The Insight Stage

Insight (or illumination) is a ‘flash’ that occurs when the winning concept cuts across the barriers of consciousness. Accounts of insights are often reported as idiosyncratic, and it may not matter much where it takes place (Hadamard, 1945).

Elaboration and Evaluation

We shall compare the results with the goals of the preparation stage where the value creation is at the centre. In this context, thorough analysis and evaluation are necessary in order to see if the desired goals and values are met. Contextually, this stage must resemble the preparation stage, as the operations are similar. While the preparation stage starts with a briefing, the elaboration and evaluation stages end with a debriefing and implementation. While we can assume how space may increase creativity, there are no aspects of this in the theories.

Spatial Concepts

Concepts of space are often thought of in ‘vernacular’ terms, because of the difficulty of their articulation (Hillier, 1996). Even architects have only recently developed a scientific language for space (Hillier, 1996). The most basic concept when dealing with space must be that of place. The position and extent of the place must be established before the particulars of space matter (Nordberg-Schulz, 1970). ‘Place’ refers to the physical extent or territoriality, whether in the home or at work. The ‘dwelling’, signifying the locus one returns to, is important, as this is the foundation for an identity within the whole organization. Space is the ‘built environment’ and includes shelter, confinement and protection (Lawrence & Low, 1990, p. 454).

‘Built form’ also refers to specific elements (e.g. doors, windows, roofs, floors and chimneys) as well as sub-divisions of buildings (e.g. rooms, arrangements and connections) referred as ‘configurations’ (Hillier, 1996, p. 33). There are several concepts of space (Nordberg-Schulz, 1970). Although the concepts of physical, perceptual and phenomenological space differ analytically, in most situations these concepts must be seen in relation. Architects and builders create the physical space, but the space we use is founded on what we perceive. Physical space is the foundation of the perceived space that affords opportunities for our activities. Physical space is the objective and the perceived space is the subjective aspects of the same space. Other variables are paths, connecting spaces or spaces naturally leading to movement or in a certain direction. Paths guide much automatic behaviour (Bargh & Barndollar, 1996), since we usually follow them without effort or conscious decisions, which is an important aspect of how space directs behaviour. The density of the place can be important as it means that people move closer to or further away from each other, the so-called ‘proxemics’ dimension (Hall, 1968). Density is usually not a homogenous phenomenon.
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density may result in more intense interaction, e.g. when people brainstorm. On the other hand, when people get too close, the space becomes crowded (Baldassare, 1978).

Norberg-Schulz (1970, p. 17) defines space as ‘a relatively stable system of schemata’, where these schemata can be logical, pragmatic, perceptual, cognitive, emotional or existential. A number of spatial dimensions are important. One is configuration, which has a quantitative aspect and can be defined formally:

If we define spatial relations as existing when there is any type of link-say adjacency or permeability-between two spaces, then configuration exists when relations between two spaces are changed according to how we relate one or other or both to at least one other space. (Hillier, 1996, p. 33, 96ff).

When we consider two adjacent rooms and a situation where a person comes from the outside and enters one of the adjacent rooms, it becomes clear why configuration matters. If you have to pass through one to get to the other, the configuration is asymmetrical. This means that it is possible to grade rooms according to access. Some rooms are accessible from outside and allow strangers to enter. Others require more doors and are restricted to privacy. The issue is both practical and cultural. Few cultures allow a stranger coming from outside to enter the intimate rooms of a home or a shop. Buildings in most of the world have graded accessibility to rooms, marking the level of intimacy from the outside. Typically, there will be a communal space that strangers are invited into first, which is also the room that provides access to most of the other rooms in the house. This quantitative aspect is measured by the simple means of a j-graph and shown as simple branch or network models (Hillier, 1996, pp. 35, 99). The configurations can be characterized as form, e.g. centralized, linear, radial, clustered and grid (Ching, 1996, p. 57), which all offer a variety of usages.

The other important characteristic is qualitative. This is more complex, and this is where the real challenge is. Many experiences and emotions are attributed to space (Baldassare, 1978). Particularly relevant for our purpose is the connection made between space and imagination. Aristotle made use of the spatial term topos (Nordberg-Schulz, 1970), which is similar in meaning to Newell and Simons’ (1972) term ‘problem space’, meaning a discourse. Physical space is correlated with cognitive space. This is a metaphorical relation, where the physical space gives form to cognition. Our objective is to identify what qualities in the outer space feed into an effective inner creative process.

Embodied Cognition and Creativity

Creative processes are mental, and have been the object of research among the early cognitive scientists, e.g. Newell and Simon (1973). The aim of that research was to develop a metaphor resembling a computer image of the brain. Although this research was successful for many years, criticism has recently emerged claiming that the research programme ignored context (Clark, 1997; Haugeland, 1995; Hurley, 1998). In contrast, their view assumes that cognition and emotion integrate body and mind, and that it cannot be regarded as an activity apart from the physical reality and body of the thinking and feeling subject. Much cognitive activity is ‘situated’, that is, it happens ‘online’ when challenges are met and action is required. This does not mean that planning and reflection are not happening or that they are not very important. It means that even when the best planning has been conducted, the reality of the situation is a direct force that must be accommodated in real time and with complex feedback. Hurley (1998) uses the following metaphor:

the circus performer who puts the handle of a dagger in her mouth, tips her head back, balances a sword by its point on the point of the dagger, and with the whole kit balanced above her head magisterially climbs a ladder, swings her legs over the top rung, and climbs back down the other side of the ladder. Each move she makes is both the source of and exquisitely dependent on multiple internal and external channels of sensory and motor-signal feedback, the complex calibrations of which have been honed by years of practice. An only slightly less intricate structure of dynamic feedback relations knits the nervous system of a normally active organism into its environment. (Hurley, 1998, p. 2)

Much cognitive work is ‘situated’, once we are there, we must act out the plan and make all kinds of situational adaptations as problems occur. Often, things happen so fast that only automatic responses (Bargh & Barndollar, 1996) and emotions (LeDoux, 1998) are fast enough. Creativity is a process that brings new knowledge, that is, previously unrelated elements of knowledge that are synthesized bring new insight through a mental process. There seem to be four sub-processes, ‘layered’ into each other, which connect with each other
in a variety of ways. Each of these processes goes through the four phases of the Wallas model, but not equally strong. They run partly simultaneously and partly one of the processes dominates, according to which phase of the Wallas model we are in. The processes are:

- value creation processes;
- scaffolding;
- imagination processes;
- materialization processes.

Value Creation Processes

Value creation penetrates the whole process as the goal of creative endeavour. A critical element of innovation in business companies (Christensen, 1997) is that the process takes place in close co-operation with the value chains of the company. An innovation is a reconfiguration of value chains and if innovations are detached, i.e. done independently of implementation, implementation may jeopardize the innovation and no new value or exploitation will be realized.

Scaffolding

‘Scaffolding’ means that a creative process is designed within a context of space, tools, people and information. This usually takes place at the beginning of the creative processes in order to support the subsequent processes. Any cognitive process goes on within a mediating cultural and physical context. Cognitive processes are ‘embodied, environmentally embedded’ (Clark, 2001 p. 140). Humans move around in the ‘creative space’ much like we move around in a landscape. When this happens, a ‘perceptual rehearsal’ is performed (Ippolitto & Tweeney, 1995). This supports the process of imagination, which accommodates changes in concepts and adopts new ones. In this process, people perceive sensory impressions. Furthermore, the scaffolded environment becomes a part of the creative brain, and an implicit factor that we only question where we detect problems. Problems of sub-optimal environments may be experienced only as symptoms and as emotions can that impair the creative output.

Haugeland (1995, p. 236) specifically asks whether the context embodies the information and knowledge created in cognitive tools and processes of a laboratory. Any studio or laboratory scaffolds its specific activities to match their ways of creative working (Kelley, 2001). The first spatial issue is that of shape or configuration. The basic configurations are; centralized, linear, radial, clustered and grid (Ching, 1996). At a very general level, the activity that takes place must be facilitated by the floor plan. Long corridors facilitate a hierarchical organization with people in separated rooms, whereas a flat structure is afforded by open space where people interact at many levels. For instance, people meet when their paths cross. A forum or meeting place enables many people to interact simultaneously. Narrow paths that only allow sequential passages reduce interaction (Sundstrom, Herbert & Brown, 1982). The linear space may appear tidy and well-ordered, but it is difficult for a group of people to assemble to discuss preparations or feed new information into the system. This is best done when a circular structure can be realized. Often, meeting rooms or lecture theatres are used in sharing information. But these are usually intended to communicate the ideas from one person to an audience, not the audience sharing information. Thus a centralized or radial shape seems more appropriate, in the sense that communal space can be realized at the centre of the creative space. Often there will be a centre, where communal tools may be placed, e.g. storage of vital information, earlier successes, etc. In situations where multiple disciplines work together, the need for a central location and information system may be vital. IDEO Product Development (Kelley, 2001) has such facilities.

More advanced forms, such as clusters or grids, may improve the space, allowing special attention to be given to the specific requirements of tools, e.g. visual or prototyping. A creative space should allow the peculiarities of the present disciplines to deal with the particulars, while enabling communal space for intensive exchanges and collaboration. The design studio is a good model, as many designers like to design their workspace. Symmetries are often preferred for aesthetical reasons, but often functionality and variation is facilitated by asymmetry. An asymmetric space may also be more challenging and present an exciting atmosphere.

When two planes are vertically in parallel, they can provide different configurations and allow paths to include both horizontal and vertical movements (Ching, 1996, p. 143). A grid structure can thus be obtained and allow both effectiveness and flexibility. A good creative space seems to contain challenges to the inhabitants and a part of its use. At first sight, the studio of the Finnish architect Alvar Aalto seems to be quite simple, but in reality it is not (Ching, 1996, p. 138). The space is basically L-shaped, which promotes functionality. The Finnish architect Aalto brings the outdoor area into the picture with an amphitheatre for lec-
Imagination

In the creative processes the imaginative is sought, that which did not exist before. Real imagination is concerned with new insights. In a creative process, imagination may be intense, but with short duration. The concept imagination (Brann, 1991; Johnson, 1987) stands for the integration of knowledge into coherent and unified representations over time. These should be in the form of ‘schemata’ that mediate between abstract concepts, contents of sensory experiences and the creative, free, open-ended activities by which we achieve new ways of experiencing and accommodating the exiting structure of knowledge to integrate new knowledge. This is obvious if the outcome is a physical object, but even a service or system must be documented e.g. using visual and verbal descriptions (Horn, 1998).

Imagination is the representation of what does not yet exist. To imagine is to envision or create. Imagination is a dramatic human capability and a way for changes (Brann, 1991, p. 23ff). Imagination, as the word’s etymological origin suggests, is having a picture in the ‘mind’s eye’. Some of the definitions include ‘to abstract or extract from multiple ideas and compound them into one’ or ‘the human capability to find analogies’. Lakoff and Johnson (1999) bring metaphors – cross-domain mappings – to the foreground of imagination. According to them, creativity is the recombination of existing elements of knowledge or symbolic representations. Herbert Simon’s (1996, p. 111) definition of design raises the issue of imagination. He distinguished between the logics of ‘what ought to be’ in contrast to ‘what there is’. Filling this gap is the role of design and, according to Simon, the solution is heuristic research, which is equal to imagining.

The history of creative processes has explained how their creative thinking was visual (Feynmann, 1985; Hadamard, 1945). Crick and Watson (Gick & Lockhart, 1995, p. 214) similarly ‘saw’ the double helix of DNA after their own and others’ constant remodel-

Materialization

Finally, the materialization process transforms concepts into material objects. Concepts must be made to sensory experiences. A doctrine held high in the IDEO Product Development company is ‘rush to prototypes’ (Kelley, 2001). It means whenever possible an idea or concept should be materialized. This is in accordance with the embodied cognitive theory (Clark, 1997). The idea of ‘wideware’ is that the environment facilitates a cognitive process, where space, surfaces, objects (artefacts) are part of the apparatus and interact with the biological brain in a concerted way. Some cognitive processes are sometimes only possible when externalized. The lack of visual clues reduces the memory, although memory techniques may facilitate it. Brann (1991, p. 282ff) claims that memory is facilitated by using space – and by internalizing experiences in a spatial-temporal setting. Memory is sometimes facilitated by the impressions of a particular place. This could be due to different sensory impressions. Many people, when they forget something head back to the last place they could remember what it was about. We can generalize from this and use the environment systematically to stimulate memory creativity. A simple way of materializing is sketching and using diagrammatic methods, visual models and tangible objects. Therefore, availability of tools for prototyping and models is important. Some companies rent design studios for the purpose of immediate availability of workshop facilities.

While it was not Newell and Simon’s (1973) intention to connect workspace and problem space, we make the connection because the two are natural extensions of each other when we consider embodied and embedded cognition. In particular, when we consider space for design work and research laboratories, this makes sense. Creative people externalize the mental constructs in order to work better with them. Other studies (Kirsh, 1995, 2001) also account for the importance of physical space
in work processes. In the end, value creation must be material to be implemented in production, whether products or services.

Table 1 shows how the concepts of spatial embodiment and creativity processes work together.

**A Case**

A big pharmaceutical company was in a process of developing new devices for their hormones. Having been one of the leaders in the field, the company decided that in order to improve their competitiveness, they had to integrate syringes for delivery of this particular hormone, aimed at the growth of children. The process they were aiming for was to follow a ‘Wallas-type’ creative process (Wallas, 1926). Early explorations led to the idea that since the new product was not strongly connected to the existing (pharmaceutical) product lines, there was no particular reason to expect that the development would benefit from proximity to the pharmaceutical research, and it was decided that the development team find their own space. Available space in the company is ordinary linear office space. Small rectangular offices were located in a sequential fashion like a typical office or hospital building. It was evident that walls could be put down and offices combined to form larger rectangular shapes. This was not found to be very attractive since the development team, consisting of engineers, product designers, a marketing and brand expert and a user research expert wanted a centre of gravity where the project was physically anchored. Instead, a design studio was commissioned on a part time (one to two days a week) basis to serve the space. The vicinity of the city centre, with easy access to city life and nice panoramic views may influence the process as well as the variation of changing spaces for one or two days a week. It is difficult to isolate the affect of place versus space, but we assume space is the most important factor.

The studio consists of one big room and several workshops located in a ‘clustered’ fashion. The big room is at the centre of the design studio and paths go in radial manners out from this central location. Since the studio could only be used one to two days per week on a regular basis it was not possible to make fixed installations. Everything had to be flexible to allow other applications. The centre consists of two large tables with drawing facilities and computers. The space is large compared to the limited number of people and crowding is not an issue. The colours are light and the walls and floor filled with objects and models.

In the preparation phase, the space was furnished with a bulletin boards, flat tabletops, drawers and filing cabinets for localization of specification, progress reports and sketches. Computers with CAD were present in the studio, as were metal and wood workshops.

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very close to the main location. Competing products and other relevant props were displayed on shelves surrounding the room. The work in this phase consisted of a lot of brainstorming. The individual participants prepared themselves, mainly at their own workspace home in the company. Asked why, the answer was that this was routine work, and for that purpose the existing structure served well.

The incubation phase was not experienced as a real transition. The studio space provided tranquility and this was supported by sufficient space and light colours, availability of many objects, both familiar and strange. The view to outside where people would pass, sit for drinks in the sun provided a continual variation of view, very different from the one at the company site. Incubation just happened between weeks of intensive collaboration. It must be stated that this innovation is above all incremental. Novelty is needed and patentability is an important issue, still the process was incremental.

Insights were explained to happen in communal sessions, where well-prepared experts presented their revised studies for the others. The close vicinity of the wood and metal workshops enabled the innovators to jump to simple models to explain the principles. The recordings of previous sessions were always present, easy to access and the bulletin board and tables displayed previous attempts.

According to the company and the designers who manage the studio the process is very successful and the collaboration has lasted for several years. This gives an accumulation of recorded material and experience which itself is useful. It seems that the changing place may be a factor, since isolation from disturbances may be a factor. The inconvenience of bringing information from the company to the studio goes in a contrary direction. Most of the effects should be due to the spatial issues. Only seating arrangements have been changed during sessions. Private space for contemplation and concentration is available and frequently used.

Conclusions

A limitation in this study is the lack of comparative situations. Csikszentmihalyi (1996) raised this as a general issue in creative studies. An experiment could be set up where two teams are given similar assignments but different spatial conditions. This means that the case is only an example of how some companies deliberately use physical space as a toll in their creative pursuits. In this paper, we have discussed the spatial requirements during different stages of creative processes. The article suggests that there are differences in the requirements between the stages. The preparation and elaboration stages typically require a combination of communal and private space. The incubation and insights stages probably require more private space. For example, useful information presented in the nature of objects, artifacts, tables, images, tabletops etc. can facilitate the process at an implicit level.

References


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