

New perception of virtual environments, Enhancement of creativity

Increasing dimension of design starting point

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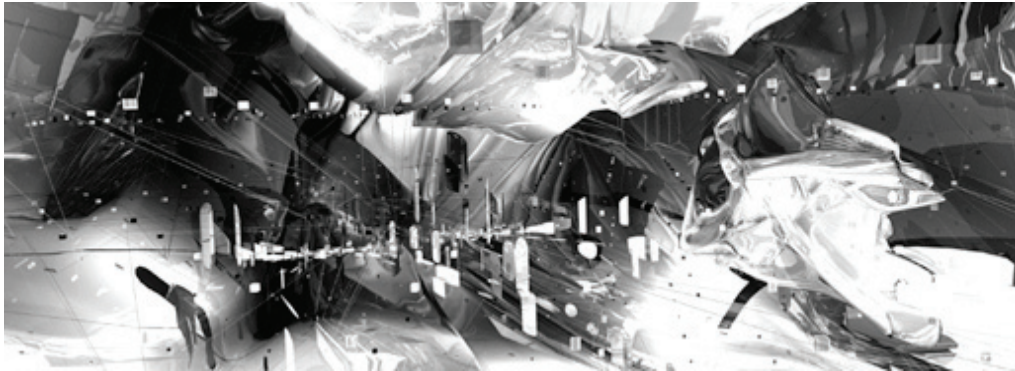
Abstract. *The digital era allows for a new domain of architectural experience. Within a virtual environment designs can be created that go beyond the mere accommodation of literal functions, and that affect and contribute to the human experience by dynamically interacting with and affecting the inhabitants' life. A key point in "creativity", considering different disciplines, is the role of previously gained experiences, which cause the emerging of intuition. Accentuating the role of new experiences in enhancing the intuition, by designing in an imaginary world, stands to be an interesting move. Detached from the real one in sense of time and matter, the imaginary world enables the designer to cross the borderline of reality. The hypothesis underlying this ongoing research, from a cognitive point of view, is that the extensiveness of experiences gained by exploring unconventional virtual environments relates positively to both creative performance (enhancing interactivity, lateral thinking, idea generation, etc) and creativity-supporting cognitive processes (retrieval of unconventional knowledge, recruitment of ideas from unconfined virtual environments for creative idea expansion). Practically, the authors propose starting the design from a point cloud in a virtual environment that can be manipulated by the designer immersing in this environment.*

Keywords. *Virtual Environment, Experience, Enhancing creativity, Point cloud*

INTRODUCTION

Many architects confess that, very gradually and unconsciously they stock in some conventional design approaches, because slowly confinements in construction and conventional stereotypes are imposed on them, dominate them and prevent them to think innovatively. Now, it is seemingly logical that if you have a chance to see and explore some innovative

notions in virtual environments, totally free of any limitation, this causes a conceptual expansion, since irrelevant pictures are added to old design approaches. This can reverse the process. The confinement, mediocrity, stereotypes ... may diminish gradually; helping designers to expand their conceptual boundaries and thus eventually help them to enhance their creativity.



*Picture 1
Courtesy of Marcos
Novak-V4D_Visio4D*



*Picture 2
Courtesy of Marcos Novak-
V4D_Visio4D 1*

Creativity, however, is a vague term, and its definition totally pertains to the context of study and the discipline. As far back as 1959, Taylor surveyed about 100 definitions in his attempt to clarify the creative process (Taylor 1959). The definitions vary significantly by their content and complexity. Nevertheless, there are two commonly “universal” attributes of creativity: novelty and appropriateness. For the purpose of this paper, we will consider creativity as a cognitive process that generates new concepts, which are novel and unconventional.

This study accentuates the experience. Identifying its way of operation and pointing out its existence and relevance. Experiences indirectly affect creativity. The larger the inventory of experiences, the more and better combinations of ideas are possible.

Being in varied or diverse environments can train individuals to encode information in multiple ways, building a myriad of associations between concepts. For example, bilinguals, who have been exposed to two languages, are more creative than monolinguals (Nemeth & Kwan, 1987; Simonton, 1999). Creativity is found at relatively high rates for individuals who are first or second generation immigrants and for individuals who are ethnically diverse or ethnically marginalized (Lambert, Tucker, & d’Anglejan, 1973; Simonton, 1997, 1999). At the group level, creativity is facilitated within collaborative groups that contain diverse members (Guimerà, et al., 2005; Levine & Moreland, 2004) and in groups in which heterogeneous opinions are expressed (Nemeth & Wachtler, 1983; Simonton, 2003). Even at the societal level, creativity increases after civilizations open themselves to outside influences and when geographic areas are politically fragmented and relatively diverse (Simonton, 1997).

In this article, we define the Virtual Environment as a real-time interactive and fully immersive virtual 3d environment. This stands in contrast to the definition of Virtual Reality, which is somehow an imitation of the physical world (e.g., flight simulation). Also emphasizing the unconventional virtual environments within which an emergent spatial pattern can dynamically evolve in time with respect to user interactions, are a variety of spatially intriguing concepts such as: Multiple dimensions,

Dematerialization, Infinite depth, Continuous change, Multiple scales, etc., which can be experimented with (picture 1 & 2).

The research presented in this paper focuses on the relationship between experiencing virtual environments and creativity and is expected to answer the following questions:

- a. What types of virtual environments are needed for enhancing creative performance?
- b. How does exploring a virtual environment benefit creativity?
- c. How does the brain perceive such immersive environments? (Does it use a reductionist point of view or is it an emergent phenomenon?)
- d. Can the mathematical term of topology be applicable in the visual perception of an environment? (Can the brain define certain characteristics of space even when the space deforms?)

As an overview of the major speculations in this paper, we are seeking to prove that:

- a. Exploring a virtual environment enhances creative performance and creativity-supporting cognitive processes (e.g., recruitment of different ideas and retrieval of unconventional knowledge);
- b. The connection between experiencing virtual environments and creativity is most apparent when individuals have had the experience of deeply “immersing” themselves in the virtual environment and “interacting” with the environment;
- c. Adapting and opening themselves to new experiences and actively interacting with and comparing the differences they encounter between unconventional environments and the physical world can boost the benefits of these experiences;
- d. A weaker relationship between experiencing virtual environments and creativity emerges in contexts where one is confined to limitations of the physical world, such as: construction limitations, material limitations, etc.

WHAT IS CREATIVITY?

Creativity is typically defined as the process of bringing into being something that is both novel and useful (Sawyer, 2006; Sternberg & O’Hara, 1999; see also Amabile, 1996). The creative process is often a mysterious phenomenon, with sudden insights seeming to work at an unconscious and inaccessible level (Schooler & Melcher, 1994). The magical “aha” moment of discovery, the point at which an idea leaps into consciousness, is part of what makes creativity seem sudden, without logic, and elusive (Leung et al., 2008).

Because of its apparent unpredictability and elusiveness, creativity may seem difficult to study scientifically and systematically. However, psychology based literature now can provide a wealth of evidence depicting the psychological factors that facilitate creativity; elements of personality, affect, cognition, and motivation can either facilitate or impair creativity (see Amabile, 1996; Csikszentmihalyi, 1996; Sawyer, 2006). For example, personality studies have demonstrated that creative people tend to be nonconforming, independent, intrinsically motivated, open to new experiences, and risk seeking (for reviews, see Simonton, 2000, 2003). Large-scale studies and meta-analyses have found that intelligence, tolerance of ambiguity, self-confidence, and cognitive flexibility also tend to be found in creative people (Feist, 1998; MacKinnon, 1978). Now, it seems logical that if we consider an approach from the other side of the spectrum - we push designers to encounter new experiences - we can enhance their thresholds of ambiguity, self-confidence, cognitive flexibility, etc. It has been proven that a number of contextual factors related to motivation, cognition, and affect facilitate creativity. Individuals who pursue tasks for intrinsic rather than extrinsic purposes show enhanced creativity (Amabile, 1985, 1996; Amabile, Hennessey, & Grossman, 1986; Eisenberger & Cameron, 1996; Hennessey & Amabile, 1998). Especially in design we consider it largely intrinsic rather than

extrinsic. A distant future focus, compared to a near future focus, has been shown to lead to more creative negotiation outcomes (Okhuysen, Galinsky & Uptigrove, 2003) and to enhanced creative insight (Förster, Friedman & Liberman, 2004). Focusing on potential gains rather than losses increases the accessibility of unconventional ideas and thus enhances fluency in generating creative ideas (Friedman & Förster, 2001; Lam & Chiu, 2002). Finally, creativity seems to flourish when people are in positive or neutral affective states rather than negative affective states (Amabile et al., 2005; Fredrickson, 2001; Fong, 2006).

TYPES OF CREATIVITY

There are two main types of creativity (Boden, 1990): 1) improbabilist that assumes that nothing has to be created de novo but existing elements are brought into a distinctive relation to each other by establishing new connections among them. This is the current definition of creativity in architecture, indeed this is not a defined accepted definition of creativity, however informally this is the way creative architects follow. 2) impossibilist – a deeper type that is based on transformation of conceptual spaces. The difference between these types is determined by the mode of creative thinking. Improbabilist creativity stipulates thinking in the associative mode, adherence to rules, logic, and boundaries of the current conceptual (mental) space that is a conceptual packet or network built up for purposes of local understanding and action (Fauconnier, 1985). If we extrapolate this definition to architecture, obeying conventional rules and the role of confinements in architecture in terms of material, technology, even perception of new spaces become clear. Impossibilist creativity is subject to the bisociative mode, in which the conceptual space is transformed, frequently regardless of existing rules and disciplinary boundaries (Koestler, 1967). As Boden puts it in “Creativity and unpredictability,” a theory of creativity is to be a theory about the exploration, mapping, and transformation of conceptual spaces

(Boden, 1995). It is presumed that a product of impossibilist creativity cannot be generated without transformation of the corresponding conceptual space. The first step here for creativity in design is enhancing the perception of space. Since we are used to the environment around us in term of scale, depth, dimension, etc., changing the characteristics of the conventional environment around us would be the right choice for transformation of the corresponding conceptual space.

THE CREATIVE COGNITION APPROACH

Recently, a scientific approach to studying creativity—the creative cognition approach—was proposed for understanding and specifying the cognitive processes that produce creative ideas (Amabile, 1996; Bink & Marsh, 2000; Finke, Ward, & Smith, 1992; Runco & Chand, 1995; Wan & Chiu, 2002). The central argument of this approach is that creative processes are not much different from those cognitive processes that produce our everyday mundane activities.

Every person has the potential to become creative as long as he or she effectively utilizes ordinary cognitive processes to produce extraordinary creative outcomes (Finke et al., 1992; Ward, Smith & Vaid, 1997; Weisberg, 1993). Specifically, the creative cognition approach identifies two kinds of cognitive processes implicated in creative thinking—generative processes and exploratory processes (Finke et al., 1992). First, people actively retrieve or seek out relevant information to generate candidate ideas with differing creative potential (the generative processes). Next, they survey these candidate ideas to determine which ones should receive further processing, such as modification, elaboration, and transformation (the explorative processes), (Leung et al., 2008). One strategy that makes effective use of generative processes is conceptual expansion, which takes place when attributes of seemingly irrelevant concepts are added to an existing concept to extend its conceptual boundary (Hampton, 1987; Wan & Chiu, 2002; Ward et al., 2002, Ward, et al., 1997).

EXPERIENCING UNCONVENTIONAL VIRTUAL ENVIRONMENTS AND THE ROLE OF CREATIVITY

As mentioned before, defining the term creativity is a hard task. Every designer has the bias that he/she is creative. There is no objective measurement or measurement tool to evaluate creativity. However, it seems obvious that the learned routines and conventional knowledge of the discipline may limit his or her creative conceptual expansion. Prior knowledge and highly accessible exemplars are a major constraint on imagination and creative conceptual expansion (Ward, 1994). For instance, when people generate exemplars in a novel conceptual domain (e.g., animals on the planet Mars), even the most creative examples resemble highly accessible exemplars (e.g., animals on Earth with eyes and legs or known science fiction exemplars) (see Kray, Galinsky & Wong, 2006; Rubin & Kontis, 1983; Ward, 1994; Ward et al., 2002). It happens exactly within the design process as well. Thinking out of the box could become an impossible task. To overcome these constraints, experiencing virtual environments can be a solution. When individuals encounter an unconventional virtual environment, they may experience shock, anxious feelings and disorientation in the absence of spatial perception, scale, depth, material, etc., which are generally all conventional norms. People typically take these familiar things for granted and, thus, can suddenly become lost and inaccessible when immersed in a virtual environment (Picture 3 & 4).

Although this shock has its dark side, once the initial, difficult adaptation stages have passed, it can

also provide a great opportunity for acquiring new perspectives to approaching various tasks and learning new ways of thinking. Whereas old, conventional design approaches may constrain creativity, the experience of virtual environments may foster the creative expansion of ideas. Thus, we hypothesize that virtual environment experiences can contribute to creative expansion in at least four ways:

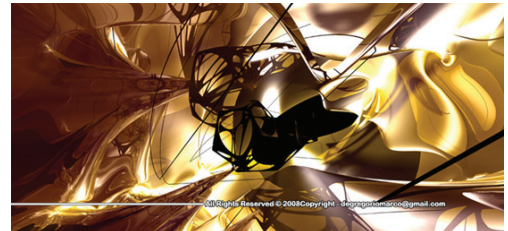
First, architects learn new ideas and concepts from exploring and designing in these environments. Through these experiences, people are also exposed to a range of behavioral and cognitive scripts for situations and problems. These new ideas, concepts, and scripts can be the inputs for the creative expansion processes because the more new ideas people have, the more likely they are to come up with novel combinations (Weisberg, 1999).

Second, although architecture pedagogy established conceptions and conventions provide the architect with structured and routine responses to the design, these cognitive structures may be destabilized as people acquire alternative conceptions through their experiences in another environment, in terms of new perception and cognition and interaction with it, particularly as people adapt their own thoughts and behaviors to the new environment. Immersing in multiple virtual environments may even lead individuals to access unconventional knowledge when back in the physical world (Picture 5,6).

Third, having acquired and successfully applied incongruent ideas from these new experiences, designers may show an increase in psychological readiness to recruit and seek out ideas from diverse sources and use them as inputs in the creative process,

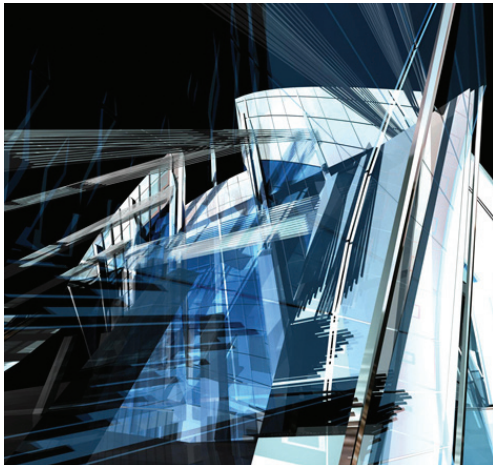
Picture 3
Unconventional virtual environment, courtesy of Marco De Gregorio

Picture 4
Unconventional virtual environment, courtesy of Marco De Gregorio



allowing for continued exposure to a wide range of new ideas, norms, and practices.

Fourth, it is obvious that implementing formal shapes, characteristics, etc., directly in the physical world is not the purpose, however, incongruent concepts provoke exploration into their interrelations, the process of implementing incongruent ideas may lead to greater cognitive complexity, this challenge finally help them to think out of the box. Higher creativity is most likely when the two concepts involved in conceptual expansion are not normally seen as overlapping with each other, where seemingly non-overlapping concepts sometimes are associated with two distinct worlds (Hampton, 1987; Wan & Chiu, 2002). In short, the experience of virtual environments may foster creativity by (a) providing direct access to novel ideas and concepts in (unconventional) virtual environments, (b) creating the ability to see multiple underlying functions behind the same form, (c) destabilizing conventional knowledge structures (design approach), thereby increasing the accessibility of normally inaccessible knowledge, (d) creating a psychological readiness to recruit ideas from unfamiliar sources and places, and (e) supporting synthesis of seemingly incompatible ideas from another environment.



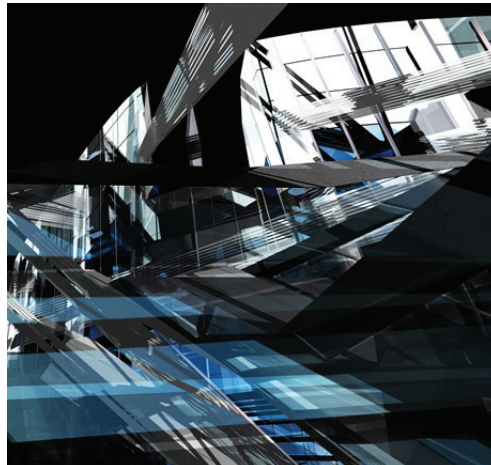
REAL IMPLEMENTATION IN PRACTICE:

Thinking “out of the box” from out of the box:

Kas Oosterhuis (2011) denotes it in his book “Toward a new kind of building” as: inclusion and exclusion. To start a design process with plan and section in an exclusive approach is so poor. It excludes thousands of possibilities, and so the designer will never be able to consider these possibilities. The Flatland-based designer will never touch upon the rich world of complexity. Space-landers can observe the flat-landers without any problem and flat-landers can see line-landers and line-landers can easily internalize the life of point-landers (Oosterhuis, 2011). Starting with a point cloud is a first solution to get rid of old conventional methods and aiming for inclusion.

Kas Oosterhuis (2011) defines his approach and definition of the point cloud in this way:

My personal design universe consists of an interacting population of groups of points in space, wirelessly connected by force fields that are aware of themselves, communicating with their immediate neighbors... My design universe includes interacting point clouds, in which each point behaves as if it is in the center of the world, even though it is just ‘somewhere’, as our Earth is



*Picture 5
by authors: Screenshot – new
cognitive perception of virtual
environments*

*Picture 5
by authors: Screenshot – new
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environments*

just somewhere in the Milky way... Each point is an actor, always busy measuring and adjusting its position in relation to its peers. Each point is an actuator, triggering the execution of its internal program. Each point is a receiver, processor and a sender in one. Each point of my personal design point cloud displays behavior, it has character and style. Each point of the point cloud is a microscopic instrument to be played, a game to be unfolded.

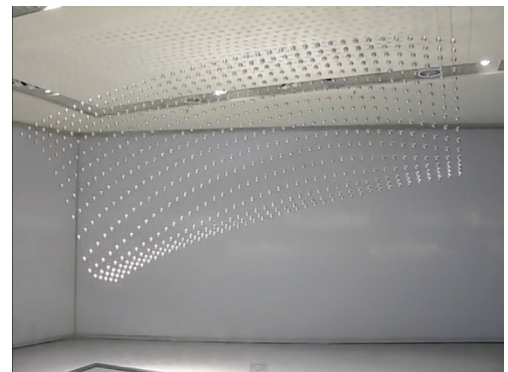
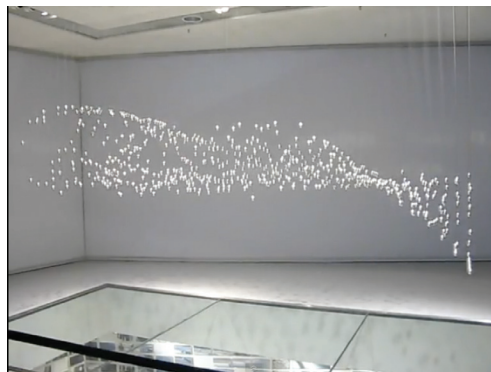
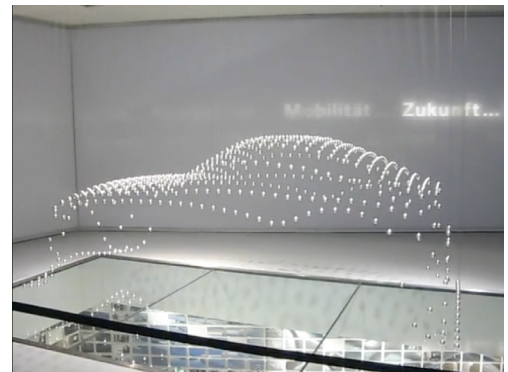
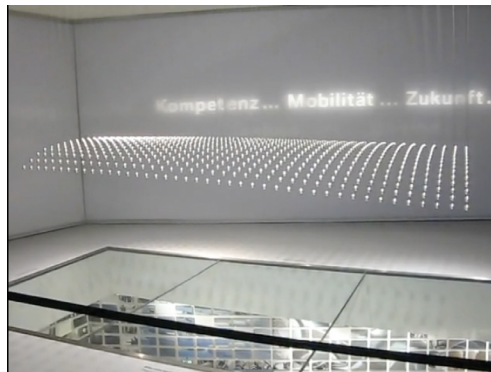
Adding extra dimension to the “starting point” is the point. Starting with a cloud of points floating in endless space and establishing a behavioral relation between those points as birds in the swarm is a proper method (pictures 5: Kinetic Sculpture, BMW

Museum Munich 2008). Implementing a point cloud in a 2d interface helps a lot, even though it is still confined. Starting to manipulate a point cloud in an immersive 3d virtual environment is starting from a progressive point, since it is already out of the box. Now thinking out of the box from out of the box becomes possible. Experiments in this scope of action have already been started and, as mentioned before, this is an ongoing project.

CONCLUSION

The speculations reviewed in this paper demonstrate that virtual environment experiences predict both creative outcomes and creative processes. Virtual environment experiences are positively related to the conceptual boundary in design that

Picture 5
Kinetic Sculpture, BMW
Museum Munich 2008



requires insight into producing creative ideas without being confined to the widely known. It also predicts creativity supporting processes such as the tendency to access unconventional knowledge from memory and to recruit ideas from new experiences for creative idea expansion. Moreover, it is conspicuous that the relationship between virtual environment experience and creativity is stronger when people adapt and are open to these new experiences. Also, the authors argue that implementing a virtual environment as a starting point for design is a solution that adds an extra dimension to the design process and make it inclusive instead of exclusive.

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