Osmotic Bubble:

CREATIVE INSIGHT BY DINT OF SYNCHRONIZED ATMOSPHERES

By Gigi Polo

IN A WORLD OF RAPID CHANGE, TECHNOLOGICAL GADGETS AND GLOBAL INFORMATION FLOWS MEDIATE SOCIAL RELATIONS AMONGST HUMANS. The immediacy of live feeds around the world and the connectedness of the citizens of the world make it challenging to keep up with a restless landscape. Because of these changes of how we, as humans, interact with one another and our world, the generations to come need to learn flexible ways of thinking that enable them to organically, and creatively, adapt to ever-changing, unforeseen, conditions; ways of thinking that strive to foster design-able, resilient minds. Creative capabilities are part of the blueprint of human evolution; we need to harness the extraordinary capacities we have to be innovators. Designer and educator Victor Papanek described design[ing] as a ubiquitous activity of everyday life, and saw a designer in every human being.

An adaptation mechanism that nurtures new ways of thinking—and helps us survive in changing conditions when encountering new situations—is the ability of the human brain to rewire itself through experience; a process known as brain plasticity or neuroplasticity. This concept of "re-wiring" the brain in a neural level is the foundation of learning and memory; learning could not be possible if the brain was fixed at birth. However, in the midst of the 21st Century, education is still concerned with the transmission of information, giving the most value to information retention.

Creative capacities are lost when children, in the process of being educated both in the home and at school, are encouraged to memorize over thinking, to mimick and to follow directions over searching for their own answers. In adulthood, vocational education aims to re-teach students some of the capacities they once had, and lost. Society's obsession in giving value to certain talents instead of encouraging all kinds of innate capacities hinders the learning

experience in educational institutions. This disruption in educational systems is what Ken Robinson discuses in his book *The Element* as a process that "educates" children to "unlearn" capacities, and then tries to make them "relearn" narrower, more specialized abilities once in adulthood; instead, we are in need of new models of education that considers the learner's attitudes and aptitudes. British design researcher, Nigel Cross, argues that Design cannot be reduced to vocational education and should, ultimately, become part of all forms of education, next to the sciences and the humanities, as opposed to being subservient to other disciplines. In support of his view, studies conducted in Japanese, Hungarian, and Netherland schools have shown that when exposed to visual and performing arts, the brain tends to create more and stronger neural connections, enhancing divergent thinking, creativity, and problem-solving in real-world situations. In order to enhance brain capacities and flexible thinking, and ultimately achieve one's full potential through thinking and acting, neuroscience, cognitive neuroscience, and design[ing] need to become the core of educational systems: neuroscience as the basis to understanding human capacities, and design[ing] as the means by which to practice and develop such innate capacities. We need to expand our understanding of the learning brain: how it thinks, produces, stores, and retrieves knowledge.

Education is based on systems of bribes and extrinsic rewards, which sometimes are based on mistaken ideas about motivation; these include grades, gold stars, scholarships, and praise. Power relations of extrinsic motivations lower performance because they subdue intrinsic motivation, and personal drive. Alfie Kohn, in his book *Punishment by Rewards* discusses the idea that in offering an extrinsic reward, the chances for learning to occur diminish. In order to avoid narrowness and homogeneity in educational systems, education has to embrace a holistic approach that primers next generation of thinkers, creators, pioneers, and innovators—citizens able to envision, and build, better futures for humanity; in creating what American sociologist and scientist, Herbert Simon, called preferred situations.

Intrinsic motivation and personal satisfaction, over extrinsic rewards such as money, grades, and other forms of social validation, is what Kelly McGonigal, PhD and author of T*he Willpower Instinct*, calls willpower, grit, and resilience. Exploration and play are basic triggers of intrinsic motivation that should be embraced in education; instead of fear of being tested or graded, self-knowledge, sense of autonomy and achievement, an a purpose in life, are the best motivators. The nucleus accumbens—located in the basal forebrain—is an important structure involved in pleasure, including laughter, reinforcement learning, and reward; it is also involved in fear, aggression, addiction, and impulsivity when negative emotions arise.

In the learning process, teachers need to transform from "depositor, prescriber, domesticator" to moderators, advisors, collaborators, and move away from an education that perpetuates social conformity, and power relations evident in both public and private life. The role of educators must be to nurture innate capacities that

keep developing through life as opposed to educating us out of our capacities through general education in order to re-educate us later in life, in fragmented chunks, through vocational education— teachers need to strive to become a new breed of neuro-designer-educators. Furthermore, we need to rethink education for the 21st Century as the means by which to stimulate all types of intelligences—of cognitive styles—to enhance innate capabilities for resilience; acknowledging intelligences as independent from "what it is known;" as interactive, ever-changing, and adaptive cognitive processes that involve sensory stimuli (information input), brain interactivity (learning), and bodily movements (behaviors/actions). In addition, education needs to embrace design[ing] (design ability) as an innate form of intelligence. Imagination, creativity and independent thinking have to become the academic backbone that uses design[ing] as a way to stimulate brain circuits engaged in learning.

This project aims to re-think general education through the lens of neuroscience and cognitive science as a way to develop new, open-ended, cognitive-flexible processes that propel students' creative capacities in everyday life. Organic ways of absorbing and processing knowledge—osmotic learning— facilitate creative insight, the Aha! moments, of everyday creativity through self-discovery and serendipitous thinking; osmotic learning harness design-able, resilient minds. My proposition is to create a transitional-learning space—the Osmotic Bubble—that enables osmotic learning by dint of adapting an amalgam of practices from progressive education, Design Thinking, and Critical Design, in combination with multisensory stimuli. Sensory input, emotions, memory, automatic systems, and left-right brain functions are some of the brain circuits that I have taken into account; the sensory cortex receives first input from the outside world in form of vision, hearing, touch, position, smells, and taste.

I see transitional-learning spaces as places for play, creative insight, and self-discovery, driven by inner processes—like intuition, willpower, and positive emotion—that take us closer to becoming part of the world ecologies by achieving balance with our natural, social, and material world. It is import to clarify that in this context, us means the human race, the citizens of the world. The Osmotic Bubble could potentially provide conditions that enhance the brain's innate capacities through a new form of pedagogy that takes into account both curricula and the built space of instruction. The image in figure 1 is a concept map that visually explains the elements involved in achieving the goals of my project.

A New Paradigm Shift for Education: NATURE+DESIGN[ING]= RESILIENT MINDS

Traditional, non-constructivist, education—called by some existentialist —focuses on teaching a set of skills by delivering information that is then memorized by students. Because of the over-focus on information that can easily become obsolete—such as technical skills—we are depriving our students from developing their natural abilities, the human capacities that have been enhanced through evolutionary

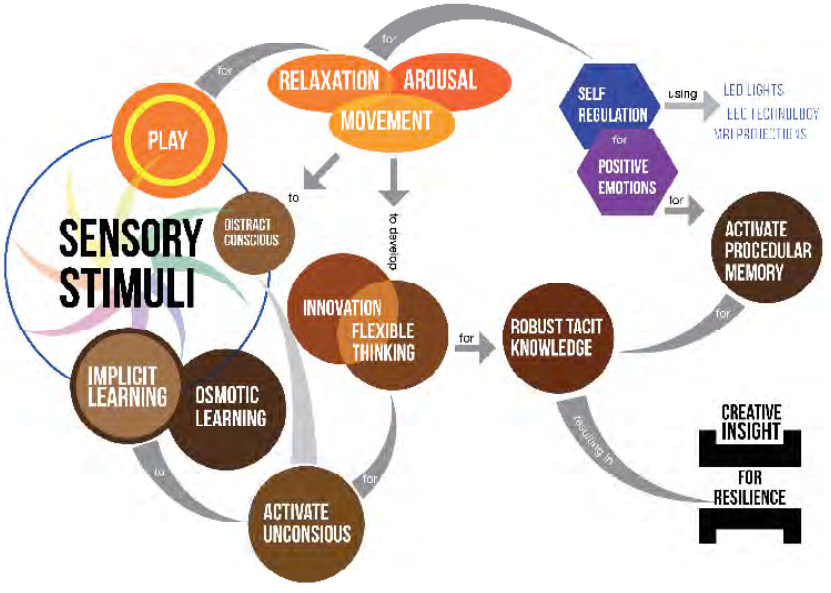

Figure 1: Osmotic Bubble approach.

processes. The current state of the so called "Information Age" puts the highest value on information retention over understanding and thinking; it is based on a pyramid structure of authority and control—the teacher as the authoritative figure who controls the type of knowledge to be learned. Also, the obtained knowledge lives outside the student: in books, television, the Internet, and the teacher's own knowledge—an ill-defined interaction that weakens students' self-confidence.

This type of teaching focuses on back cortex functions—temporal and occipital lobes—which are involved in information processing and integration in memory circuits. This approach is problematic because it stimulates areas of the brain involved in processing information disregarding other systems also important to learning, such as emotion, reasoning, planning and problem-solving and stimuli perception, located in the front cortex—frontal and parietal lobes. In the frontal cortex information is analyzed, and applied to new situations. Also, an existentialist education does not engage all types of cognitive styles, in the sense that students who are more creative, more reflective, or lack a good memory, would not experience an optimal learning experience.

Conversely, constructivist, non-essentialist, models of progressive education, allow students to be in control of their learning experience and of the type of knowledge they acquire; it enables students to develop capacities that encourage them to design their own life as global citizens of society; it is democratic, and encourages students to break free from habits into creative thinking and emotional regulation. In these systems the teacher is a moderator that interjects from time to time when questions arise but cannot impose their knowledge, and the

learned knowledge comes from real-life experiences. To a certain extent, progressive education—especially the student-centered instruction of learning through guided play used in Montessori School and City and Country, and John Dewey's Laboratory of learning from real-world experience—aims to involve both the back and front cortex: students strengthen their capacities in analyzing, processing and understanding, in a relaxed environment that promotes positive emotions through play. Still, these models are not deeply tapping on other brain systems involved in optimal learning, such as the sensory (sensing stimuli) and the motor cortex (moving and acting).

Some contemporary models of design schools, such as the curricula of the Stanford d.school and M.I.T Lab, illustrate the process of re-learning capacities, in the ways in which the Design Thinking model is at the core of instruction. Design Thinking is a problem-solving method that encourages collaboration amongst disciplines outside design, as a way to propel robust ties between designers, consumers, and services. By concentrating on the front cortex, this type of instruction is a solution-based thinking that expands on developing divergent over convergent thinking. However, this systematic approach, of "define, research, ideation, prototype, choose, implement, learn," although open to iterations and exploration, locks students into looking at problems narrowly, based on learned formulas and behavioral patterns, which hinders cognitive flexibility—the ability to see, and adapt, to situations in multiple ways.

Contemporary learning theories, such as the Bilateral Brain, Reber's 1993 Transformative Learning Theory, and Epstein's 1994 Cognitive Unconscious Theory, have shown that unconscious cognitive processes are more robust and resilient than explicit cognitive processes because they resist neurological and psychological injuries that affect conscious processes. The robustness of implicit cognition is stimulated by the environment, and is highly efficient in that it requires fewer attentional resources and awareness.

New educational models based on scientific discoveries—such as brain-based teaching, the neuro-educators movement, and Understanding by Design—are gaining recognition in curricula. For instance, Understanding by Design has a template called Neurological Lesson Planner where executive functions are listed and promoted (making judgment, supporting opinion, analyzing source validity) as a way to activate higher cognitive levels.

In order to approach problems creatively, situations need to be reframed; creative thinking is about seeing the problem anew, unlearn what we belief as true, in order to retrieve different types of tacit knowledge stored in memory circuits. The 2000 Nobel prize winner, Eric Kandel, in his book *The Age of Insight* (2012), argues that, in order for creative insight to happen, the brain needs to integrate information unconsciously, at certain rates, in specific parts of the brain. Subsequently, the Aha! moment is the result of right/left brain consensus, when in a process of conscious and unconscious feedback loops—in of

transitional spaces—what psychologist D. W. Winnicott refers to as inner (unconscious) and outer (conscious) space.

Also, Gazzaniga and Sperry's studies on patients with split-brain surgery (calloscotomy) —when the neural fibers that connect left-and right hemispheres, called corpus callosum, are removed—have demonstrated the importance for right and left brain consensus; that even though each hemisphere has specific functions, they need to be in constant communication in order to function efficiently, and be able to perceive and act in the world. The amygdala—in charge of processing emotion—is also involved in implicit processes, including learning, and the "working memory;" feelings of fear of failure dismisses creative insight.

Psychologist Barbara Fredrickson, of the University of North Carolina at Chapel Hill, says that positive emotions expand our way of thinking and learning, enhancing information retention and creative thinking, while negative emotions reduce the foremost mentioned due to an extreme focus on external stimuli, such as being evaluated, or being afraid of the consequences of failure. In studies of creativity, conducted by psychologist and educator, Teresa Amabile, participants who didn't know were being tested, proved to be more creative since they were playing instead of being concerned with external judgment or rewards. From studies of hypnosis and yoga, German psychiatrist, Johannes Schultz, developed during the 1920's a system of self-induced states called autogenic training, which is based on repeatedly practicing control over bodily functions, such as heartbeat; after daily practice during several weeks, the result was a gained ability to go into deep relaxation state at will. Autogenic training is similar to concepts of self-regulation using bio-feedback, and self-submerged therapy. Researchers at Leiden University in the Netherlands found that focused-attention meditation did not help creativity but open-monitoring meditation perform better in ideation.

American journalist Jonah Lehrer explains creative insight—those Aha! moments of creative enlightenment—as a combination of idea incubation, tacit knowledge, relaxation, positive emotions, and de-focus—below consciousness—attention. EEG technology can be used to trace the moment of insight eight seconds before it happens, which has been found to be the moment when the brain reaches alpha waves. When in alpha waves, the attention goes inwards, allowing the person to access tacit knowledge stored in the long-term memory and retrieve collected content; when too focused, the attention goes outwards, and the mind concentrates too much on finding the correct solution to win an external reward, rather than exploring possibilities without external stressors.

The Osmotic Bubble: A TRANSITIONAL-LEARNING SPACE FOR SERENDIPITOUS THINKING

Using the idea of a bubble-like structure as a new classroom space, the Osmotic Bubble is envisioned as a multisensory, shared, space that enables retreat from the constant, outside, information overflow of modern life. In developing the Osmotic Bubble, I seek

to deliver an implicit learning experience of unconscious absorption and knowledge production—osmotic learning—through play, positive emotions, self-regulation, and sensory stimuli as a way to reach optimal learning. Consequently, osmotic learning will enable the production, absorption, and retrieval of tacit—unspoken, implicit—knowledge, which has been proven to be more resilient than explicit knowledge. The desire outcome is a new pedagogy—in the form of curricula, and a multisensory built-space of instruction—that harness innate capacities, and propels creative insight, using design[ing] to stimulate the whole brain for self-regulation, positive emotions, and intuition; a pedagogy that educators of all age groups, regardless of specific disciplines, can adapt to their instruction in order to enhance human innate capacities. "Enhanced capacities of creative insight" are measured by the amount and quality of creative insight shown in the work that students produce.

In a pilot study that I conducted with a small sample of 17 sophomores in an art and design school, results showed that certain students, because of their specific cognitive style (right-left hemisphericity) were influenced by implicit (indirect) instruction more than the traditional, explicit instruction. Since assessment of the effectiveness of implicit learning in terms of acquired-tacit knowledge is difficult to make explicit, I used a battery of psychological self-report tests: Zenheusern's hemisphericity, Higgin's self-regulation, and Runco's divergent thinking figures. I invited two design practitioners and educators to analyze the work produced during an in-class exercise, as a way to assess the quality of the productions created before (baseline) and after (priming) to different teaching styles: implicit learning, and traditional (explicit) instruction. Results showed that implicit instruction has an effect in certain cognitive styles. An interesting pattern arose from the data, in terms of faculty assessment, with a high level of disagreement in most ratings. However, further research is needed in order to get conclusive evidence.

I SEE TRANSITIONAL-LEARNING SPACES AS PLACES FOR PLAY, CREATIVE INSIGHT, AND SELF-DISCOVERY, DRIVEN BY INNER PROCESSES—LIKE INTUITION, WILLPOWER, AND POSITIVE EMOTION—THAT TAKE US CLOSER TO BECOMING PART OF THE WORLD ECOLOGIES BY ACHIEVING BALANCE WITH OUR NATURAL, SOCIAL, AND MATERIAL WORLD.

Although participants of current experiments are design students, in a larger scale, I believe that the indirect, osmotic learning, would be most effective at an early age—between 3 and 4 years old—when children have yet to learn cultural beliefs, and instead strive on self-belief. I have started research with design students because of accessibility, and also because creative personalities have many similarities to children's personalities: they have a fertile imagination, are impulsive, risk-takers, and dreamers.

The major objective of my study is to re-shape the learning experience in two levels:

1. Content: to deconstruct the creative process by developing game-like exercises that combine physical movements in space while mentally tackling everyday-design problems in order to connect the least evolved, instinctual—Reptilian—brain linked to motor skills, which works in an unconscious level, with the more evolved, rational—Neocortex—brain, which acts in a conscious level; what we could compare to the brainstorming and mapping part of the creative process. Exquisite Corpse exercise of hand-drawn sketching and pictorial mindmaps will allow students to share pre-verbal ideas while prototyping and testing will be a process of individual, introspective, exploration. The idea of "thinking by moving" is discussed by author Ken Robinson in his book *The Element*, in which he shared the story of British ballerina, dancer, actor, and theatre director, Gillian Lin. At age 8, during the 1930s, Gillian was thought to have a learning disability but instead she just had a different approach to learning: she needed to "move to think;" she is the renowned choreographer of Cats and Phantom of the Opera.

2. Form: Redesigning the traditional studio-classroom setting into a transitional space—the in-between, exploratory, space of inner/unconscious and outer/conscious self, that enables students to augment brain capacities and develop cognitive flexibility hence maximizing Aha! moments of creative insight. An important

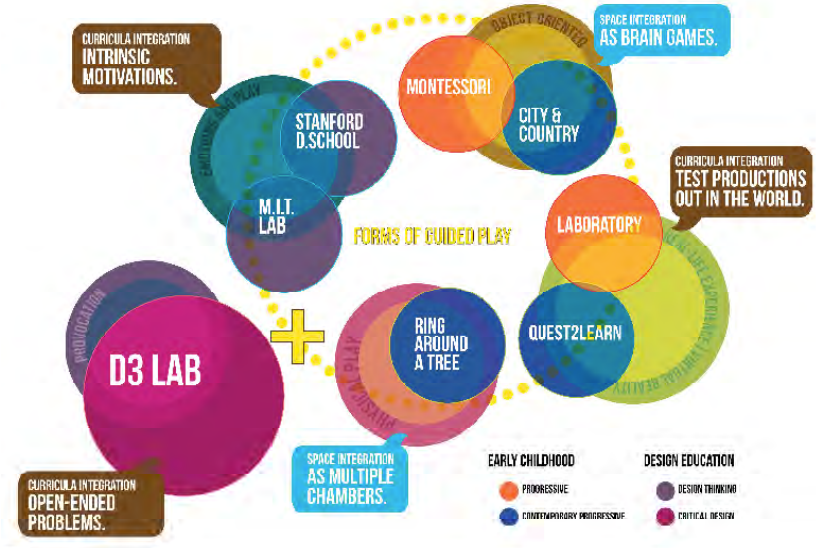

Figure 2: Analysis of educational models applied to the Osmotic Bubble.

aspect of these two components—the act of play in a relaxing atmosphere—is the ability to engage the Limbic System—also known as the primitive, Mammalian or MidBrain, responsible for processing emotions, as a way to contrive homeostatic emotions—attention-demanding feelings that motivate behavior and maintain the body's internal state—modulated by the ventral anterior cingulate cortex. Neurofeedback technologies, which are real time, self-regulation systems (i.e., wireless electroencephalography or EEG) will be used to track electrical activity in students' brains as a way to both collect neural field potential data and provide feedback for self-regulating the environment of the Osmotic Bubble space (e.g., change of light intensity and wavelength, temperature, sound, etc.)

The concept map shown above (figure 2) serves as a visual representation of the different practices that I have integrated from other educational models in the conceptual development of the Osmotic Bubble.

The educational models mapped above, although effective in engaging students with intrinsic motivations, use classroom spaces as containers with no agency, as opposed to acknowledging the space of instruction as a mediator of the learning experience; spaces where the interactions of students with—instead of in—the space, and amongst themselves, becomes an igniting element to achieve one's full potential. In transforming the traditional classroom into space with agency while deconstructing the design process through forms of play inside a space that propels self-discovery and serendipitous thinking.

Drawing inspiration from the structure of interlocked, translucent, and temporal soap bubbles—the structure of the

Osmotic Bubble is created by multiple, interconnected, chambers of various sizes, which I refer to as synchronized atmospheres, constructed in an array of translucent materials that provide various stimuli—textures, smells, augmented or canceled sound—and enable visual projections on the walls; it is a multisensory, shared, space of retreat from the constant, outside, information overflow of modern life. Chambers are semi-transparent circles, created using specific bendable materials that provide texture, detach scent, and modulate sound. I have envisioned the Osmotic Bubble as a modular structure, easy to assemble and dismantled, that can be stored, laid flat, to be transported, relocated and assembled again in a new location. Two hundred chambers will be designed with brain games printed on surfaces, and specific physical qualities; because of its modularity, the Osmotic Bubble could be made of different amounts of chambers depending on the amount, and age, of students participating, and space availability, between twelve and two hundred chambers.

By means of integrating multi-sensory elements, different kinds of perceiving and experiencing the space will develop various ways of knowing and help produced different types of knowledge that speak to an array of cognitive styles and personalities. The aim of the space is to stimulate students' whole brain—left and right brain equally, in both conscious and unconscious levels—in order to augment their innovative thinking. The space will engage students in both implicit (through the stimuli) and explicit (through the curricula) learning.

In combination with psychological assessment, and the use of computerized motion tracker devise, patterns of movements can be analyzed to find the level of engagement and interaction students engage in when in the space; how much collaboration happens intuitively; how much time students spend solving situations in isolation. Motion tracking will help make adjustments to the Osmotic Bubble, both in terms of the space and the curricula. Ideally this new pedagogy will be used in all levels of everyday instruction, on both general and vocational education. Also, in stage three of the project, Ruth Richards' Lifetime Creative Scales (LCS) will measure students' capacity for everyday creativity, once acting outside of the Osmotic Bubble.

Creating Preferred Situations: IMAGINING A FUTURE OF ENDLESS POSSIBILITIES

Neuroeducation is a contemporary teaching and learning theory that uses as premise research from neuroscience, and psychology at the core of instruction. President Obama's BRAIN initiative (acronym for Brain Research for Advancing Innovative Neurotechnologies) opens up new possibilities, not only for scientists in the quest of answers but also for educators in general. In the words of president Obama: …there is this enormous mystery waiting to be unlocked, and the BRAIN initiative will change that by giving scientists the tools they need to get a dynamic picture of the brain in action and better understand how we think and how we learn and how we remember. And that knowledge could be—will be—transformative." The president

proposed 100million dollars for what he called “the next great American project.” This is the time for design to make itself present and reassure the profession as one as valuable as the sciences, as a valuable asset in the creation of a better world.

The Learning and the Brain Society embraces collaboration amongst neuroscientists and educators—and calls both disciplines to join forces in the quest for better education practices; the neuro-educators have been called to the front. Today, the social pressures for high-academic performance, and professional success have led to the illegal consumption and abuse of amphetamine salts-based psycho-stimulants. These medications, currently used to treat attention deficit hyperactivity disorder (ADHD) and narcolepsy—such as Adderall and Ritalin—are highly consumed amongst college students looking to gain focused attention, work long hours, and retain more information for short periods of time in order to have higher performance in tests.
We need a radical change in education, a new paradigm that strives for the expansion of minds beyond grades, tests, and drugs. The Osmotic Bubble is not aiming to be an instrumental intervention to change behavior and capabilities by affecting the brain’s built systems but instead, it is a model for spaces of instruction that harness the brain’s innate capacities, while empowering students in being active participants, and co-creators, of their learning experience; a space sensitive to individual differences, and various cognitive styles. In order to stay away from artificial manipulation of brain chemistry through the use psychotropic drugs, the Osmotic Bubble stimulates the brain natural chemistry through a multisensory experience. I hope that the Osmotic Bubble permeates traditional systems, and becomes a ubiquitous and pervasive form of teaching and learning.