

A Transdisciplinary Outsideness:

Propelling Design Education into the Realm of Imagined Futures

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1 ABSTRACT

In our society, traditional education gives the upmost value to information retention, and concentrates on teaching students specific skills that are deemed important in today's world, as opposed to encouraging all kinds of innate capacities—of ways of thinking—that prepare young generations for unforeseen futures. Furthermore, social pressures for high-academic performance and professional success have led students to illegally consume and abuse amphetamine salts-based psycho-stimulants—such as Adderall and Ritalin; these drugs have become trendy, and 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 attain higher performance in test scores. Design education is no different; in my role as a design educator and practitioner I have been concerned with my students' complaints about losing their creative juices once in design school. When confronted with systematic design methodologies, students become handicapped, incapable of embracing their creative capabilities to the fullest because, even when asked to “think outside the box,” there is a limit to the *outsideness* of that box; a limit defined by cultural biases, grades, and social validation. By the same token, the weight to demonstrate “talent,” “creativity,” and “originality,” while also having to conform to social conventions weakens students' innate ability to thrive in a world that is in need—and yet not ready—of independent thinkers, pioneers, and innovators.

In shaping education for the 21st Century, both neuroscience and design[ing] need to become the core of educational systems—neuroscience as the basis to understand and harness human capabilities and design[ing] as the means by which to develop and enact such capacities in everyday life; similar to homeostasis—the ability of systems to regain and maintain a state of balance—design education needs to aim for *heterotopia*, which in scientific terms describes the shift of healthy tissue to “wrong” places causing vivacious activation. In this paper I will discuss a multisensory-implicit approach for teaching and learning: a process of *Transdisciplinary-Outsideness* shaped in a curriculum that integrates Critical Design + Grounded Theory + M2 Research + Design[ing] as a mode of inquiry, serendipitous research, co-participation and co-creation, constructive provocation, and social change, beyond the confinements of practicing Affirmative Design, and those of the classroom space. In order to enhance brain capacities and flexible thinking for resilience, and ultimately nurture students' full potential through thinking and acting, we need to reframe design education as the means by which to naturally, and organically, stimulate all types of intelligences—of cognitive styles; acknowledging intelligences as independent from “what it is known,” and instead understand intelligence as interactive, ever-changing, and adaptive cognitive processes that involve sensory stimuli (information input), brain interactivity (learning), and bodily movements (behaviours/actions).

The current educational paradigm is ill defined—it is a disservice to students' growth both as professionals and as global citizens of the world. We need a radical change in education, a new paradigm that strives for the expansion of minds beyond grades, tests, and drugs. The main goal of a *Transdisciplinary-Outsideness* curriculum is to exercise cognitive flexibility in order to nurture innate capacities by provoking new discourses that challenge the status quo, instead of mending the everyday of today's world.

Keywords

Creative insight, cognitive flexibility, Critical Design, everyday creativity, Grounded Theory, learning through play, Model 2 Research, neuroplasticity.

2 INTRODUCTION

When reflecting on the ways in which information navigates throughout our body in order to action a certain response, one cannot elude the intricate network of microscopic nerve cells that are in constant communication, firing bits of information, which trigger complex bodily changes—the nervous system being one of the most complex and pervasive systems of all; both our biology and our personal experiences define who we are, and who we are to become.¹ New ways of learning that engage both conscious and unconscious processes of top and down functions, and stimulate the bilateral brain—left and right brain equally—are needed in order to create a holistic education for all human populations; an education that ignites “Eureka” moments, fosters “everyday creativity,”² redefines the meaning of being human, and propels the growth of the *self* towards a constant *homeostatic state*—a state of self-regulated equilibrium that adjusts to changing conditions—as opposed to fragmented and unbalanced individuals, limited by a narrow knowledge of particular skills that perpetuate the status quo.

However, the current Information Age puts the highest value on information retention over understanding and thinking. Traditional, non-constructivist, or *existentialist*,³ education focuses on learning a set of skills by delivering information that is then memorized by students. Because of the focus on information retention that can easily become obsolete—such as technology skills—we are depriving our students from developing their natural abilities, those human capacities that have been enhanced through evolutionary processes. This traditional model is based on a pyramid structure of authority and control—the teacher being the authoritative figure who controls the type of knowledge to be learned; the obtained knowledge living outside the student: in books, television, the Internet, and the teacher’s own knowledge; and the teaching style focusing on back cortex functions—temporal and occipital lobes—which are involved in information processing and integration in memory.⁴ This form of education is problematic because even though it stimulates areas of the brain involved in processing information, it disregards other systems also important to learning, such as emotion, reasoning, planning, problem-solving and stimuli perception, all of which are located in the front cortex—frontal and parietal lobes—where information is analysed and applied to new situations. Likewise, this *existentialist* education strives for social homogeneity by teaching social norms and cultural beliefs hence does not engage all types of cognitive styles,⁵ in the sense that students who are more creative, more reflective, or lack a good memory, would not experience optimal learning, and could hardly excel in these learning conditions. Correspondingly, this model is based on a system of punishment and rewards—of extrinsic motivations—where too much reliance on tests and grades is used as assessment tool, without considering the effects of external stressors on the learning process. Because of our survival capabilities, these extrinsic motivators negatively affect the learner because extrinsic motivators are perceived by the learner as a threat, and their minds concentrate on dealing with that threat in order to survive, instead of excel;⁶ this stimulus activates the amygdala, a system in charge of processing emotions, controlling freezing behaviour, and other defensive responses in threatening situations.⁷ On the contrary, when not in a state of immediate threat, our minds can engage fully to explore new ways of doing things, and work collaboratively to help one another.

I have seen this problematic first hand, in my practice as design educator; design education is, in many ways, similar to the existentialist model. Educational models of the 19th and 20th century, developed for an industrial society—such as Bauhaus pedagogy—are still current in many design schools while losing relevance in the

1 Joseph E. LeDoux, *Synaptic Self: How Our Brains Become Who We Are*. Penguin.com, 2003.

2 Ruth Richards, coined the term “everyday creativity”

3 Essentialist education, such as the traditional educational system in USA. Bernard Neville, *Educating Psyche: Emotion, Imagination and the Unconscious in Learning* (Melbourne: Flat Chat Press, 2005).

4 James Ellwood Zull, *The Art Of Changing The Brain: Enriching Teaching By Exploring The Biology Of Learning*. Stylus Publishing, LLC., 2002.

5 Of various cognitive styles, that Kirton describe as innovators, and adaptators; in order to achieve a natural balance, we need to be able to shift from one style to the other, organically, to meet the needs of the situation at hand.

6 Psychology Today, Peter Gray. May/June 2013. “The Enemies of Innovation”, pg. 82, col. right, para 1. Psychologytoday.com

7 Joseph E. LeDoux, *Synaptic Self: How Our Brains Become Who We Are*. Penguin.com, 2003.

ever-changing landscape of a post-industrial world. When looking at vocational education, the learning experience concentrates on narrower, specialized learning systems—such as art and design schools concentrating mostly on the visual cortex. Higher education aims to reteach students some of the capacities they once had, and lost; advisor on education, Ken Robinson, has also discussed this problematic in his book *Out of Our Minds* as a process that “educates” children to “unlearn” capacities, and then tries to make them “relearn” narrower, more specialized, abilities once in adulthood. There is also a constant struggle between what students learn through experience by acting in—and interacting with—the world, and the expectations of what they need to know explicitly, and make visible in their work, in order to get a high grade; Robinson stresses the need for new models of education that consider the learner’s attitudes and aptitudes;⁸ Furthermore, social pressures for high-academic performance and professional success have led students to illegally consume and abuse amphetamine salts-based psycho-stimulants—such as Adderall and Ritalin—which have become trendy 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 test scores. Even more so, pharmaceutical companies have been developing psychotropic drugs to enhance brain function, such as *Neuroflexyn*, marketed in the media as “vitamins for the brain” and fed into the mainstream, pushing to be legalized.⁹ In general, the educational systems previously mentioned are unsuccessful in harnessing the kind of minds that could potentially envision, and build, better futures for the world.

As a way to provide the conditions needed to better our future, transdisciplinary learning environments that embrace intuition, a sense of wandering and reflection, have to be created in order to naturally augment creative insight, and exercise cognitive flexibility in the minds of new generations. An adaptation mechanism that nurtures these 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—known as brain plasticity or neuroplasticity. Numerous brain systems involved in implicit/osmotic learning are automatic, unconscious processes that in many ways determine how we approach, interact, and experience the world. For instance, understanding language involves many unconscious processes such as decoding sounds (phonology), meaning (semantics), grammatical relations (syntax), and knowledge about words (pragmatics). Gigerenzer (2007) refers to gut feeling/intuition/hunt indistinguishably as “a judgment that appears quickly in consciousness, whose underlying reasons we are not fully aware of, and is strong enough to work upon”—[however] intuition is not impulsivity.¹⁰ Seymour Epstein¹¹ contested Freud’s long-lasting theory of the unconscious, and supported a new theory on the *Cognitive Unconscious*, in which he argued that the unconscious records information naturally and fluently. Using the Personality-Cognitive-Experiential Self theory (CEST), Epstein analysed two types of information processing: *Rational* (explicit) and *Experiential* (implicit), where feelings and experiences become predominant in reshaping belief and behaviour. Epstein’s hypothesis is that we think in two different modes and that by cultivating both, we could achieve greater wisdom.¹² This organic process of knowledge production that Epstein refers to—of implicit, *osmotic learning*—needs to be applied to organic ways of teaching and learning, developed to reach an optimal, and lasting, learning experience beyond information absorption and social conformism. Research shows that implicit learning augments creative insight—the Aha! Moment—of *everyday creativity*.¹³ Likewise, creative thinking involves various stages of implicit processes such as preparation, incubation without concentration, and illumination, which are cornerstones to solving wicked problems.¹⁴

Research on creativity and emotions show that emotions and gut feelings are integral to the development of students’ intellect, multiple intelligences, and innate capacities, as well as essential to the production and storage

8 Ken Robinson, *Out of Our Minds: Learning to be Creative*, John Wiley & Sons.

9 Consumer News 247 online, Brain Power: “Is this the Most Powerful Brain Enhancer on The Planet?” <http://goo.gl/0hhuij>; <http://motherboard.vice.com/read/brain-enhancing-smart-drugs-are-going-commercial>.

10 G. Gigerenzer, 2007. Gut Feelings: The Intelligence of the Unconscious. Viking: New York; pg. 16.

11 Seymour Epstein Epstein, S. 1994. “Integration of the Cognitive and the Psychodynamic Unconscious.” *The American Psychologist* 49 (8): 709-724.

12 Seymour Epstein Epstein, S. 1994. “Integration of the Cognitive and the Psychodynamic Unconscious.” *The American Psychologist* 49 (8): 709-724.

13 Ruth Richards, 2007. *Everyday Creativity And New Views Of Human Nature: Psychological, Social, And Spiritual Perspectives*. American Psychological Association.

14 Jonah Lehrer. *Imagine: How Creativity Works*. Houghton Mifflin Harcourt, 2012.

of new knowledge.¹⁵ 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.¹⁶ Researchers at Leiden University in the Netherlands found that focused-attention meditation did not help creativity but open-monitoring meditation perform better in ideation.¹⁷ Scientists have argued that when we pay attention to the world, consciousness is focused, but when we are in a relaxed mode, attention is de-focused and goes inwards for more creative insight. Similarly, when tired, the brain is not able to sustain focused attention, and it is less efficient in remembering learned patterns and connections between ideas and concepts—this state allows for more lateral, divergent, thinking. When less focused, we are able to consider more information, random connections and diverse interpretations hence fostering creative insight and innovation.

Because of the current state of affairs, in shaping education for the 21st century both neuroscience and design[ing] need to become the core of educational systems starting at an early age—neuroscience as the basis to understand human innate capacities, and design[ing] as the means by which to develop and enact such capacities every day in the real world. In particular, design schools have to be frontrunners in re-framing education through a transdisciplinary curriculum, and need to become *transitional-learning spaces*¹⁸—spaces for serendipitous exploration, reflection, and action—that foster the expansion of the self to reach students' full potential beyond a classroom setting into tackling real world issues—in creating what American sociologist and scientist, Herbert Simon, called *preferred situations*. In this paper I will discuss a design-led curriculum that blends Critical Design + Grounded Theory + Mode2 Research and Design[ing] as intertwined modes for creative output. *Transdisciplinary Outsideness* aims to develop open-ended, cognitive-flexible processes that stimulate the whole brain using neuropsychological research as premise. Ultimately, this curriculum acts in tandem with a multisensory space¹⁹ of instruction that boosts optimal learning through play, self-regulation and self-discovery, positive emotions, lateral and serendipitous thinking, and a keen intuition via textures, visual projections, oral narratives, oxygenated air, smells, and kinetic play. Together, both curriculum and learning space create a new interactive pedagogy that can be adapted by educators of all age groups, regardless of specific disciplines, which activates a holistic learning in both inner (learning environment) and outer (real world) spaces of experience.

3 STIMULATING BRAIN CIRCUITS BY DESIGN[ING] TO HARNESS IMAGINATION, TINKERING AND INNOVATION

“...Break the chains of your thought, and you break the chains of your body, too....”

Richard Bach, Jonathan Livingston Seagull, 1970; p.75

In modern society, design[ing] is conceived as the process of constructing meaning through the conception and production of artefacts, systems, and services. The oxford dictionary defines the verb *design* as “decide upon the

¹⁵ Psychology Today, Peter Gray. May/June 2013. “The Enemies of Innovation”, pg. 78-87, May/June 2013. Psychologytoday.com

¹⁶ Ibid.

¹⁷ Colzato, Lorenza S., Ayca Szapora, Justine N. Pannekoek, and Bernhard Hommel. “The impact of physical exercise on convergent and divergent thinking.” *Frontiers in human neuroscience* 7 (2013).

¹⁸ English pediatrician and psychoanalyst Donald Woods Winnicott used the terms transitional phenomenon, potential space, transitional object, and good-enough holding environment, interchangeably to refer to a transitional space (1989). Elizabeth Ellsworth, in her book *Places Of Learning: Media, Architecture, Pedagogy*, describes transitional spaces as places for learning what is that can also teach us what could be; Donald W. Winnicott, *Playing and Reality* (Psychology Press, 1971).

¹⁹ Polo, Niberca. “Osmotic Bubble: Creative Insight by Dint of Synchronized Atmospheres” Thesis dissertation, 2013.

look and functioning of (a building, garment, or other object), by making a detailed drawing of it.”²⁰ But design[ing] goes beyond producing *things*; it is a way of thinking and interacting with the world, and it should entail an innovative way of acting in the world. Furthermore, an important aspect of design[ing] involves the ability to imagine—a powerful force of human nature that propels innovation and discovery since it encourages people to think about the future possibilities, and potentially contests the status quo. Many design methods today use negative reinforcement when mistakes are made, and concentrate on the final outcome as opposed to the creative process, even when the final solution to the problem is yet to become optimal; other times, the process becomes so important that the final product becomes almost invisible, or worthless, which results in a subpart, conventional, and expected result. In any case, this unbalanced relation takes away the value of design[ing] as the act to imagine, in the former, and as a force that propels innovation, in the latter.

In many ways, design education is not different from traditional general education: students act as receptacles of the teachers’ knowledge—a learning experience limited by the teacher’s own knowledge and experience, and by the willingness of the student, if any, to receive such knowledge.²¹ Similarly, some design education models of the *studio-based craftsmanship*, like *learning by doing*, still current today—such as the Bauhaus pedagogy—employ principles of Pavlov’s conditioning and Thorndike’s *Law of Exercise*, failing to consider the learner as an active contributor to the production of new knowledge, and over-concentrating on the acquisition of skills that can easily become obsolete because of the fast-paced technological advances in today’s world. For instance, Walter Gropius, the founder of the Bauhaus School in 1919, believed that the arts were the means by which society could improve human life. His call for a creative revolution fostered ideas of cognitive flexibility and adaptability to new situations. The Bauhaus approach to a constructivist methodology is effective in that students are producing things—it is about making—but deters the learning experience since students are being fed information, and mimic others, instead of producing their own knowledge through perceiving and interpreting the world. Although forward-thinking in its approach, and conceptually relevant today, the practical application of Bauhaus pedagogy falls short in the 21st century because it teaches a set of skills relevant today, as opposed to flexible ways of thinking that can be adapted in various scenarios of unforeseen futures. This model lacks the open-ended, serendipitous exploration that fosters a holistic learning experience through positive emotions, intuition, and wandering. Furthermore, technology is constantly changing and require fast and independent thinkers who can adapt to new conditions, and who are able to absorb and produce new knowledge but pedagogies that arose during the era of industrialization lack adaptation mechanisms to emergent technologies that require in the design landscape, new skillsets and ways of tackling design problems. These limitations restrain students from becoming independent thinkers and innovators, which are attributes of upmost value in this Technological Era.

American journalist, Jonah Lehrer, explains how creative insight—the Aha! moment of creative enlightenment—is a combination of idea incubation, tacit knowledge, relaxation, positive emotions, and *de-focus attention*.²² We need to develop a new kind of mind that helps us manage modern life stressors, restless changes, and external noise by encouraging self-compassion instead of self-criticism and guilt, to harness growth mindset²³ as opposed to fixed mindset; self-regulation is a survival system to manage stressors, and selection and integration of knowledge become the main processes for the production and acquisition of knowledge. These processes have “adaptive value,” meaning that selecting and integrating knowledge is what helps us adapt to new environments and situations. These capacities are part of the tacit knowledge from the collective unconscious; a system that evolution gave us, devoted to navigate the social world. Various contemporary theories of learning and creativity, such as the *Bilateral Brain Theory*, Reber’s 1993 *Transformative Learning*

20 http://www.oxforddictionaries.com/us/definition/english/design#design__10

21 Rivka Oxman, 2003. “Think-Maps: Teaching Design Thinking in Design Education.” *Design Studies* 25 (1): 63e91

22 Jonah Lehrer. *Imagine: How Creativity Works*. Houghton Mifflin Harcourt, 2012.

23 Carol S. Dweck, “Even Geniuses Work Hard. *Educational Leadership* 68, no. 1 (2010) : 16-20.

Theory, and Epstein's 1994 *Cognitive Unconscious Theory*,²⁴ should be adapted to general education, especially to early childhood education, to strengthen the learning experience in educational institutions. These theories converge in the idea that the whole brain is involved in learning, from left-right hemispheres, to levels of awareness and unconsciousness, and higher and lower order systems. Roger Sperry's split-brain (1981), Giacomo Rizzolatti's mirror neurons (1992),²⁵ and Paul McLean's Triune Brain, were studies that revolutionized brain science, and have shed light to the ways brain systems adapt to new conditions through learning. For instance, the theory of right-brain/left-brain dominance—known as the Theory of Lateralization²⁶—is the basis for vocational education. Gazzaniga and Sperry's studies on patients with split-brain surgery (callosotomy)—where the neural fibres that connect left and right hemispheres, called corpus callosum, are removed—have demonstrated the importance for right and left brain consensus²⁷ because, although 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.²⁸

New models that converge education and science, such as *brain-based teaching*, the *neuro-educators* movement, and *Understanding by Design*, aim to integrate scientific research into educational models. *Understanding by Design (UBD)*,²⁹ for instance, is a method for curriculum design that uses research in cognitive psychology and a specific design process as premise to develop teaching and learning strategies for STEM K-12 education. They have develop strategies that takes into account “six facets of understanding: the capacity to explain, interpret, apply, shift perspective, empathize, and self-assess” in order to measure students' understanding of learned material. In terms of the design of class units, UBD is structured in a three-stage design process called “backward design” in which the curriculum designer sets the goals and moves backwards in creating activities, exercises, that help achieve and assess such goals; it assist in developing outcome-based teaching curricula. The problem with the UBD approach is that by concentrating on a set outcome—convergence—the learning experience is already limited by expectations previously set by educational administrators, and instructors. The curricula of the Stanford d.school appropriates the *Design Thinking* practice model at the core of their curricula, based on ideas of *play* to harness positive emotions, and creative thinking. *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. Concentrated on the front cortex (emotions, judgment, witticism, word-play, flexible thinking, amongst others) this type of instruction is a solution-based thinking—as opposed to the scientific problem-based approach—that expands on the development of divergent over convergent thinking.³⁰ However, this systematic approach (define, research, ideation, prototype, choose, implement, learn) although flexible in giving room for iterations and fluid exploration, locks students into looking at problems narrowly, based on learned formulas and behavioural patterns, which hinders the growth of cognitive-flexible minds. As

24 Michael Tovey, “Designing With Both Halves Of The Brain.” *Design Studies* 5, no. 4 (1984): 219-228; Arthur S. Reber, “Implicit Learning And Tacit Knowledge: An Essay On The Cognitive Unconscious.” Oxford University Press, 1996; Samuel Epstein, “Integration of the Cognitive and the Psychodynamic Unconscious.” *The American Psychologist* 49 (8): (1994) 709-724.

25 Mirror neuron systems: connection between sensory organs and motor organs to imitate; sensory motor link for simulation, resonance, imitation, skill building and coordination. Sensory affective light up for attunement, shared emotion, emotional contagion. Systems initially involved evolved to affective resonance.

26 E. W. Taylor, 2001. “Transformative Learning Theory: A Neurobiological Perspective of the Role of Emotions and Unconscious Ways of Knowing.” *International Journal of Lifelong Education* 20 (3 May/June): 218-36.

27 Michael S. Gazzaniga, *Split Brain*. Insta-Tape, 1973.

28 Look up split-brain patients HM, JW, and VP; Michael S. Gazzaniga “The Cognitive Neurosciences.” (1995).

29 <http://rt3region7.ncdpi.wikispaces.net/file/view/Intro+to+UBD+Handouts.pdf>

30 http://www.creativitypost.com/psychology/creativity_and_iq_what_is_divergent_thinking_how_is_it_helped_by_slee. The psychologist J.P. Guilford first invented the terms convergent thinking and divergent thinking back in 1967. Divergent thinking is also loosely called ‘lateral thinking,’ a term coined by the thinking guru Edward De Bono – author of ‘Six Thinking Hats’. – Divergent thinking is the process of generating multiple related ideas for a given topic or solutions to a problem. Divergent thinking occurs in a spontaneous, free-flowing, ‘non-linear’ manner. Convergent thinking, on the other hand, is the ability to apply rules to arrive at a single ‘correct’ solution to a problem such as the answer to an IQ test problem. This process is systematic and linear.

The idea of divergent thinking has become important in the scientific study of creativity because many widely used tests for creativity are measures of individual differences in divergent thinking ability. - See more at:

http://www.creativitypost.com/psychology/creativity_and_iq_what_is_divergent_thinking_how_is_it_helped_by_slee#sthash.HegL8AnU.dpuf

discussed before, the use of traditional assessment tools, such as grades, become a strong extrinsic motivation that negatively affects the learning experience.

The *Transdisciplinary Outsideness* curriculum aims to address the issues aforementioned by implementing design-led research as the foundation of the curriculum where the moments of creative insight derive from first hand experiences, serendipitous exploration, and interactions amongst disciplines and stakeholders—a process that embraces collaboration and co-creation beyond the classroom space. The integration of *Critical Design*³¹ provides a framework that entices creative insight by integrating science as a way to understand *what is*; it is a practice that explores the meaning of being human. Anthony Dunne and Fiona Raby—through their firm Dunne and Raby—disseminated Critical Design as a tool for social change; a form of constructive design research where design practice becomes the core of the research activity. The approach of *Critical Design* varies from technological experimentation³² to provocation,³³ and innovation.³⁴ *Critical Design* is the practice of design[ing] beyond the act of *making* to exploring political, social, and scientific scenarios using design[ing] to provoke, subvert norms, refute, and challenge assumptions. Architect and design researcher Andreas Rumpfhuber explains it: “Any good design contains a certain portion of critique. The main purpose of *Critical Design* is to make the invisible visible by showing us something we didn’t know existed.”³⁵ *Critical Design* is about building new futures by provoking new discourses that challenge the status quo instead of mending the everyday of today’s world by practicing *Affirmative Design*.³⁶ In Affirmative Design, the quest to solve wicked design problems is defined by a mass market, where products are enhanced but the real problems, at the core of societal relations, still persist; it relies on improving an existing design solution since it is grounded on the belief that there is nothing new under the sun, that no design can be created anew. *Affirmative Design* promises solutions that fall short as opposed to addressing social discontents in relation to design as a powerful force for innovation and social change. Critical Design, on the other hand, explores the boundaries that divide design and science, creating fictional narratives—of future scenarios—in both technological and social realms; it strives for social activism and scientific reform;³⁷ critical designers consider themselves moral agents seeking to provoke positive changes in society.

Appropriating *Critical Design* as a pedagogical model in the *Transdisciplinary Outsideness* imbues curricula with a serendipitous exploration that integrates advanced technology, contests conventions, and calls for debate, critical self-reflection, and subversive creation as a fundamental aspect to the learning process; this approach to pedagogy becomes speculative and open-ended, which enables the type of flexible thinking needed to harness creative insight; it embraces a form of reasoning coined by scientist and philosopher Charles Sanders Peirce, called *abductive reasoning*,³⁸ into imagining possibilities of problems that have yet to arise, as opposed to trying to better current situations using minimal enhancements. However, Critical Design needs to push the boundaries of provocation and debate into actionable innovations. In this process, *Transdisciplinary Outsideness* appropriates Critical Design as a way to contest, provoke, and open up new discourses, in conjunction with Grounded + Mode 2 research to let those discourses inform innovations. *Grounded Theory* is the starting point

31 Anthony Dunne and Fiona Raby. “Critical Design FAQ.” Dunne and Raby (2007).

32 Paola Antonelli, *Design and the Elastic Mind*. The Museum of Modern Art, New York, 2008. 101, 112, 42. Look up Typosperma.

33 Ibid. Look up Smoke Eater.

34 Ibid. Look up Eye Candy

35 Trine Vu, “Critical Design As Constructive Provocation.” Design Research Webzine, Mind Design #36 (Danish Center for Design Research, February, 2011).

<http://www.dcdr.dk/uk/Menu/Update/Webzine/Articles/Critical+Design+as+%C2%ADConstructive+Provocation>

36 Malpass, Matthew. “Contextualising critical design: Classification of critical design practices.” In Design Connexity proceedings of EAD conference, vol. 9. 2009.

37 Malpass, Matthew. “Contextualising critical design: Classification of critical design practices.” In Design Connexity proceedings of EAD conference, vol. 9. 2009.

38 For Sanders Peirce “[a]bduction is the process of forming explanatory hypotheses. It is the only logical operation which introduces any new idea’ (CP 5.172); elsewhere he says that abduction encompasses ‘all the operations by which theories and conceptions are engendered’ (CP 5.590). Deduction and induction, then, come into play at the later stage of theory assessment: deduction helps to derive testable consequences from the explanatory hypotheses that abduction has helped us to conceive, and induction finally helps us to reach a verdict on the hypotheses, where the nature of the verdict is dependent on the number of testable consequences that have been verified.”

<http://plato.stanford.edu/entries/abduction/peirce.html>

of the curriculum where, instead of giving a defined problem or hypothesis to students, students explore their surroundings, gather and analyze data in order for the data to define the problem/theory at hand. This methodology uses an inductive approach to data collection and analysis to produce data-based theories of both qualitative and quantitative research; soon after, the theory(ies) derived from this process is(are) tested using induction reasoning to generate “substantive codes”³⁹ which subsequently become the open-ended design problems.

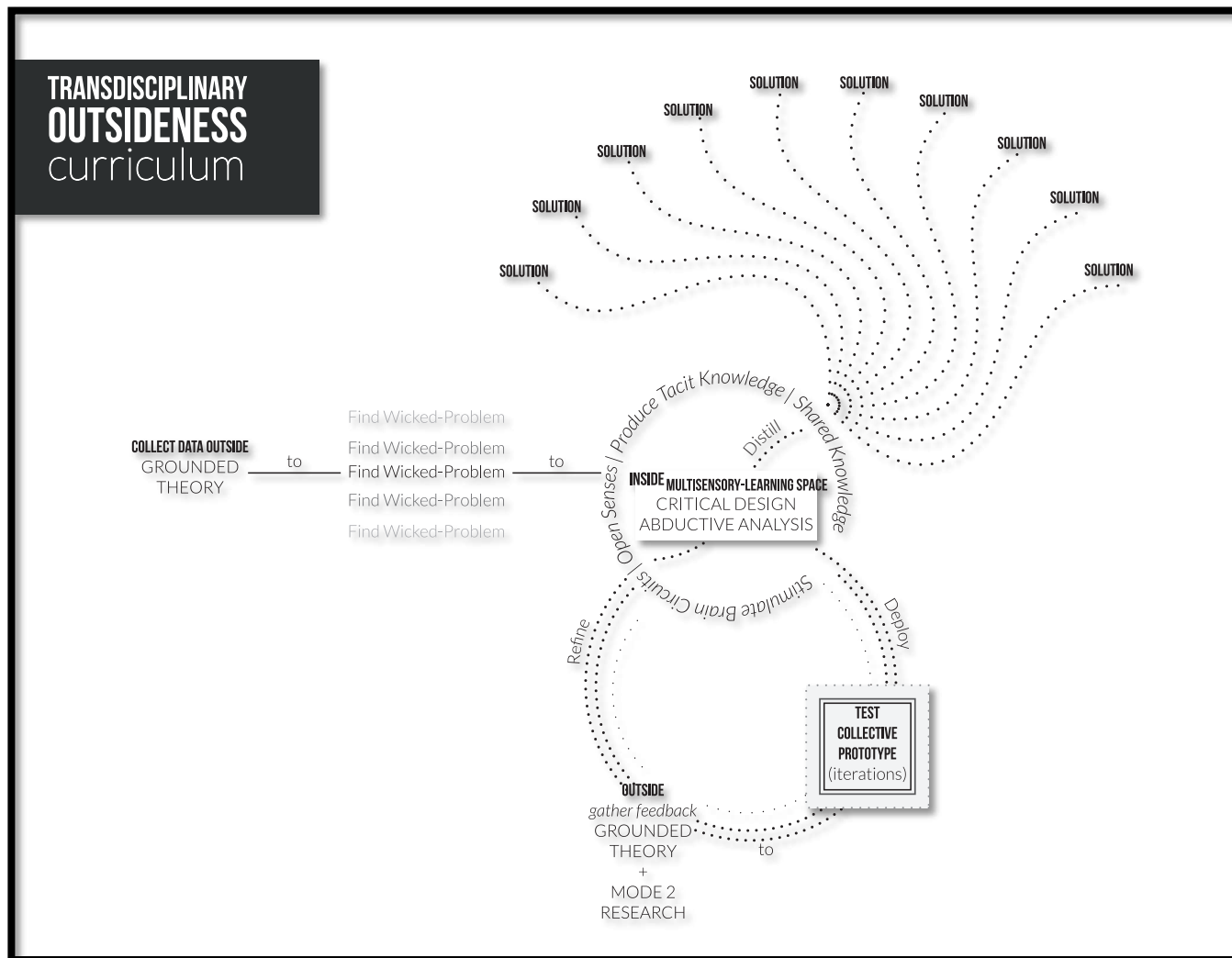


Figure 1. *Transdisciplinary Outsideness* concept map: dynamics amongst implemented theories. ©Polo 2015

Students of a wide array of disciplines—from art and design to science, technology and economics—analyze the design problem(s) through a *Critical Design* lens using abductive analysis, then prototyped, shared—to test with stakeholders, and general public—and, finally, refined; in order to harness a reflective practice, both as individuals and as a collective, Mode 2 methodology is used to gather qualitative data that is not governed by

39 Substantive codes emerge from the process of constantly comparing the data in field notes. Hunterl, Kirsty, Subashini Hariz, Charles Egbu, and John Kelly. "Grounded Theory: Its Diversification and Application Through two Examples from Research Studies on Knowledge and Value Management." *Leading Issues in Business Research Methods* 1 (2011): 22.

paradigms of traditions disciplines of knowledge, as the researcher (the student) imbues in social interactions; Mode 2 research is context-specific, individualistic not generic, problem-focused and interdisciplinary; knowledge is socially distributed, allowing for the tacit knowledge of the collective unconscious to arise and be shared; it also ignites and set a platform for co-creation and participatory design. Students deploy prototypes and gather feedback using Mode 2 research to bring the collected data back to classroom, assess the findings, and apply drawn conclusions to exploring innovative solutions. Also, Mode 2 goes against heterogeneity of knowledge production because it is reflexive and allows for multiple views—free from constrains of value systems and social norms—reconfiguring a problem in various ways, allowing for different cognitive styles to rise to part, and excel. Instructors in this process become moderators, and use *Action Research*⁴⁰ as an assessment tool, which also allows modulating, refining, and re-configuring the ways in which the *Transdisciplinary Outsiness* curriculum engages all participants.

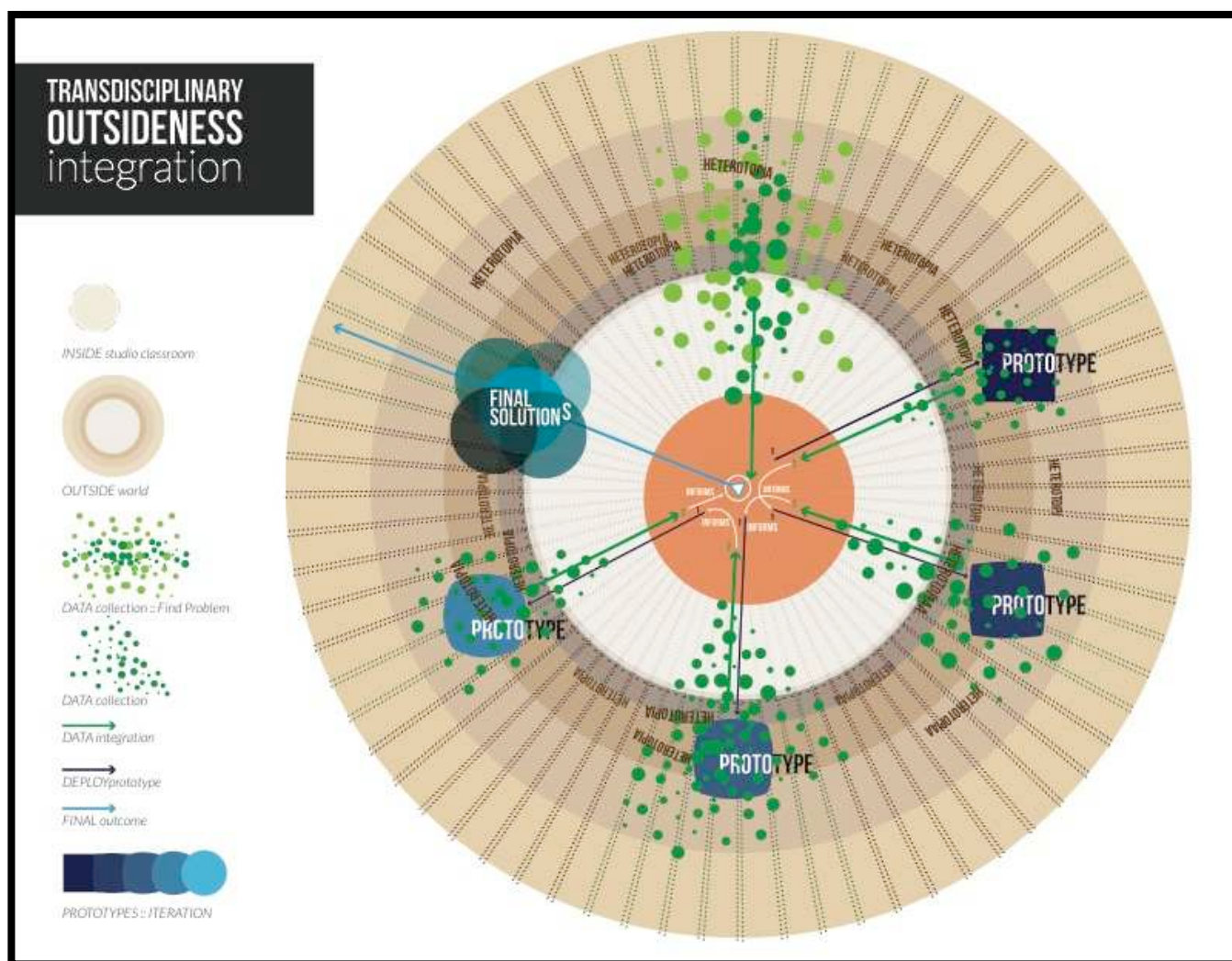


Figure 2, *Transdisciplinary Outsideness* concept map: interactions. ©Polo 2015

40 Ernest T. Stringer, *Action research in education*. Upper Saddle River, NJ: Pearson/Merrill/Prentice Hall, 2004.

4 CONCLUSION

Throughout this paper I argued that we, humans, have the potential to augment our innate creative capacities in an organic way. Similar to learning basic skills like walking and talking, through a process of *osmosis*, knowledge can be integrated unconsciously in order to become tacit knowledge, and automatically brought to consciousness when needed. Since nowadays, most scientists think that the influence of nature versus nurture on brain development is a 50-50% split; our genetic imprint and environmental factors could, at any given moment in life, become triggers that ignite new pattern formation; even our highest mental achievements, our calculus, poetry, or philosophy, come from a brain that evolved these types of skills solely to survive.⁴¹ Our brain looks to the future, makes generalizations about our environment, and develops strategies to enhance our opportunities and minimize dangers so we can survive. It is time to pay attention to social concerns and use the power of design[ing] and the knowledge available on human behavior to build a better society, as opposed to keep perpetuating an over saturated society, of endless production-consumption cycles and white-collar professionals.

During the 1980's and 1990's, the hyper-rationalization of design, and a systematization of the creative process, arose; the problem with the design approach at the time was the regard of the sciences as superior than design, as opposed to acknowledge the richness of the collaboration amongst both disciplines—design and science—where each discipline could bring different ways of thinking to explore and unpack real-world problems. Today, even though higher education is opening up channels for more multi and trans-disciplinary collaborations we are still far from having meaningful collaborations; disciplines are set in their own methods, design and science are still polarized terrains. However, we have arrived to an important moment in history; 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.⁴² Instead of perpetuating the traditional educational system, new ways of learning that stimulate the brain as a whole are needed in order to create a holistic experience that propels the growth of the self, as opposed to fragmented individuals whose lives are limited because they learned a very specific set of skills. This is the time for designers, educators, and scientists to make an impact in the future of our society by collaborating in creating new learning environments, as valuable assets in the creation of a better world. A new breed of *neuro-educators* have been called to the front—those who integrate scientific knowledge into educational systems and pursue a radical change in education, a new paradigm that strives for the expansion of minds beyond grades, tests, and drugs. In order to stay away from artificial manipulation of brain chemistry through the use of psychotropic drugs, *Transdisciplinary Outsideness* is a model that naturally stimulates and harnesses the brain's innate capacities, while empowering students in being active participants, and co-creators, of their learning experience; a learning process sensitive to individual differences, and various cognitive styles.

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