

PERTINENCE OF A NEUROSCIENCE CONSTRUCTION INDUSTRY CLASS IN ORDER TO RAISE GLOBAL CRISIS AWARENESS

ENRIQUE VILLACIS TAPIA¹ and CYNTHIA AYARZA²

*¹School of Architecture, Design and Arts/Pontifical Catholic University of Ecuador, Quito,
Ecuador*

²Ensusitio, Quito, Ecuador

In contemporary architecture, engineering, and construction related fields of study, education must prepare future professionals for a world dealing with global warming, political, economic, and energy crisis among others. Within academia, it is always difficult to motivate students to think beyond construction as a mere product and just their own financial benefits. The current studies within the neuroscience state that motivation and a constant state of criticism empower the student in order to be ready for the dramatic future scenario. The practical workshop Con lo que hay- (with what is available), dictated by Ensusitio- at the School of Architecture of the Catholic University in Quito, PUCE-FADA, its program and its strategies will be analyzed through the lenses of the neuroscience perspective on education. This study examines the pertinence of an interdisciplinary -reality based- program in order to make construction industry students aware of our current reality and eminent global crisis.

Keywords: Education, Climate change, Empowerment, Environmental crisis, Economic despair.

1 INTRODUCTION

This study evaluates the pertinence of an education based on neuroscientific principles in order to motivate future professionals to be conscious about the global contemporary and future crisis. As Noam Chomsky said: “We can’t overlook the fact that we’re at a moment of human history that is entirely unique. For the first time in human history, the choices we make influence the survival of the species. That has not been true in the past. It is very definitely true now” (Barsamian and Chomsky 2017). Most of the environment where students develop is a comfort zone that is not aware nor in contact with this reality. Neuroscience states that a multidisciplinary and holistic approach to these topics might create a better understanding and the sense of urge in order to act rather than just study these difficult times. Based on this crisis environment and neuroscience as a theory we study how a “hands on” course is pertinent to the development of a more conscious professional. First, we describe the current crisis environment, leading to consider how neuroscience can develop a better action-fueled understanding. Finally, we analyze a specific course Taller Con lo que Hay (CLQH), and how it contributes to this crisis environment by applying neuroscientific principles. The purpose of this study is to analyze the possibility of incorporating neuroscientific strategies in the construction industry academics in order to raise

awareness about global crisis. It would be important to measure the impact on students and professionals but that is what will come in further studies with time and experience.

2 GLOBAL CRISIS

Energy crisis: “The analysis carried out by the US Energy Information Administration (EIA) estimates that, by 2030, global energy consumption will have grown by over 70%” (Foruzanmehr 2008). Considering production, operation, and demolition, the construction industry consumes over 40% of the energy used in society (Berge 2000). One of the most important challenges is to choose carefully the material for the building since we can reduce its operational energy (Berge 2000). Other than the ecological footprint and the monetary cost, our future environment needs to use what would be available closer to the building site.

Climate change: The construction industry produces, 40% of water pollution, 23% of air pollution, 50% of greenhouse gas production, and 40% of solid waste. In addition, it uses 50% of water globally and 45% of world energy (Dixon 2010). Taking in account that the Intergovernment Panel on Climate Change, summoned by the United Nations, reports “if greenhouse gas emissions continue at the current rate, the atmosphere will warm up by as much as 2.7 degrees Fahrenheit above preindustrial levels by 2040, inundating coastlines and intensifying droughts and poverty.” (Davenport 2018). Results are evident, “June 2019 was the hottest ever, according to a report from the National Oceanic and Atmospheric Administration -- and it was the overall hottest first half of the year in South America, Mexico, New Zealand, Madagascar and other parts of southern Africa.” (Keneally and Sandell 2019)

Economic despair: At least 80% of the world’s buildings are informal, they are built without architects or engineers, these constructions “circumscribe in a context and uses the available resources, it has a self-construction or community construction process because it deals with traditional technologies. All the popular architecture is a response for concrete necessities and values from the local way of life, economies which they belong to” (Vellinga *et al.* 2008). If popular buildings are mostly conscious of their environment, this means that constructions built by professionals are the ones that are contaminating the most. The world poverty based on the UN projections and from that amount of people 70-80% live in informal buildings, 1 in every 4 persons who live in urban areas live in informal spaces which means that our professionals are applying their skills in only the 20% of the market. A market that contaminates the most, consumes most of the world energy, and brings economic despair.

The energy crisis, climate change, and economic despair are in a close relationship, “the climate change predictions and the necessity of reducing the carbon dioxide is vital, for each bag of cement that has been produced, 1 ½ bags of cement of residual carbon dioxide has been produced” (May and Reid 2011). Our students most likely will be facing this reality. It is very difficult to let them know about this by books and numbers, a taste of reality is needed as a wakeup call. Are the professionals we train capable to adapt to this future?

3 NEUROSCIENCE AND CRISIS AWARENESS

As stated in Webster (2019), neuroscience is part of the life sciences involving the physiology, anatomy, molecular biology, and biochemistry of nerves and nervous tissue, always focused on their link to behavior and how they learn.

3.1 Neuroscience and Education

Neuro-Education, an emerging discipline, tries to combine some fields of neuroscience: psychology, cognitive science, and education in order to create a broader understanding of how we achieve knowledge and how we manage information, so we can develop more effective teaching methods. Neuroscience states that knowledge is better acquired when emotion arrives, with a multidisciplinary approach kinesthetically and in environments with no stress.

Real-life application brings emotion stakes: It is suggested that emotional processes are required for the knowledge and skills previously acquired in school to reassign to real life and novel circumstances (Immordino and Damasio 2007). It is not only the quantity of information we received in the classroom, but the adequate way we apply it in the real world that makes that information becomes knowledge, and that emotion brings the critical knowledge that deals with the common good. In addition, emotional thoughts gain significance through the application of rational evidence and critical knowledge and likewise, rational evidence can be forced upon kinds of emotional thought to produce a moral decision making that overtakes notions of good and evil (Greene *et al.* 2004, Greene *et al.* 2001, Haidt 2001).

The body, a kinesthetic and multidisciplinary approach: The body, a kinesthetic, and multidisciplinary approach: Neurobiological and psychophysiological research establishes these relationships between the body, emotion, and cognition. The induction of emotion causes mental changes and physiological effects. Likewise, feelings of emotion rely on the somatosensory (happiness, fear, anger, or sadness) systems of the brain (Immordino and Damasio 2007). If emotions are directly related to the body experience, then the more we create that experience with a multidisciplinary body engagement during the process then the cognitive process will be more effective.

The stakes, and motivation: Motivation should be understood not only as a short (visceral desire) but as a long term (university or professional goals) approach. In addition, dopamine, which is associated with pleasure can be stimulated by making remember the experience of learning as something positive, for example, a good studying environment (Howard-Jones 2014). Meaning that motivation deals more than with awards but with personal and visceral needs, asking what do you want to learn? And this also raises the stakes for the students, the risks that a controlled real-life experience needs.

3.2 Neuroscience and Climate Change

Neuroscience with its holistic approach helps to build a more complex and effective consciousness about the reality of the crisis by incorporating: emotion, multidisciplinary studies, and motivation for survival. In order to understand the moral cognition and its measures three levels of analysis, most interact the psychological level (the nature of relevant psychological states, their developmental origins, and their cultural and evolutionary history); the cognitive level (the pertinent information-processing mechanisms); and the neural level (the brain mechanisms). (Grasso 2012)

A multidisciplinary approach, multiple cognitive systems: Grasso (2012) states that moral judgments are produced by the interaction between multiple cognitive systems. This means that the decision-making process deals with a reflexive rational process based on affection and emotion controlled by a cognitive system.

Motivation and a sense of urgency: Climate change is not a personal moral dilemma (harms a particular person) but an impersonal one (harm to undefined victims), it demands to divert some pre-existing threat onto different victims rather than producing the harm oneself,

(Greene *et al.* 2004, Grasso 2012). We should jump from personal moral dilemma to an interpersonal one: I hurt you, and at the same time, my good action has a positive impact on you.

4 THE “CON LO QUE HAY-CLQH” (WITH WHAT IS AVAILABLE) WORKSHOP

CLQH, (with what is available), is an academic workshop established and taught by Ensusitio in different universities within the Architecture field, its main branch at the Pontifical Catholic University of Ecuador in Quito at the School of Architecture, Design, and Art (PUCE-FADA). It is a hands-on experience where academic knowledge is applied in a specific community. Based on a participatory design process a real community need is developed by a consensus design process and community construction. The general timeline of the course is four months, although students know what the workshop is about they don't know the specifics about which technology or the community where it will be applied.

- What would the group like to be involved in during the semester? The students as a group and in consensus take the lead on what they would like to make an emphasis on: technological, ancestral, etc. Where does the group want to apply its time and expertise? They choose to work where the architects don't usually work, poor and rural communities, because of liberty and to make their experience worth the best: the common good. This creates the sense of empowerment.
- Participatory design: measuring expectations from both the community and the students, we are not professionals, and time and resources are what are available. Involving also the fundraising process.
- Community building process: both students and the community and professors share the responsibility of building the project with our hands.
- Empowerment: the students know two basic ideas from the course: you build what you design, and architects should go where architects are most needed; based on this, they lead the process.

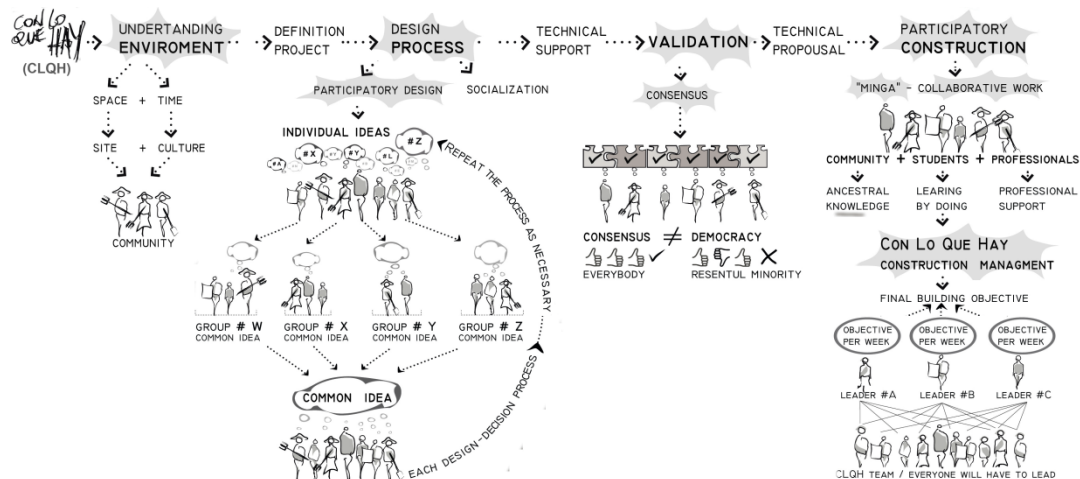


Figure 1. Con lo Que Hay CLQH flow chart (Ensusitio 2018).

- Reality: whatever students choose to work during the academic period it is going to be built in collaboration with the community they choose to work with.

- Hands on: the students work side by side with communities, building and experiencing reality first hand, not only in the field but also in workshop and fundraising.

5 CONSTRUCTION IS MORE THAN BUILDING BUILDINGS, THE CLQH WORKSHOP AND NEUROSCIENCE AND GLOBAL CRISIS

Here we evaluate these three points:

- Empowerment: the stakes and the sense of consequence. Whatever the course chooses to build during the process is going to produce an impact to the chosen community; this impact in this small experience can be related to crisis awareness whenever the student will build projects during their professional life.
- Real life brings the emotion of building something that the team designed, which brings motivation as well as risks. This might be seen as a contra to which neuroscience states: creating a non-stress environment, but this stress is different, not related with a grade but with the emotion of building their own responsible reality. Moreover when students evaluate the use of certain materials they get to feel first-hand the impact in their economy and especially in both cultural and physical environment of the community.
- Hands on: when the whole team has to psychically build the project all of the senses are included, the body as a whole is included and the knowledge has to be multidisciplinary in order to be able to be build. Sharing this process with communities makes the construction process human again bringing consciousness to the impacts of construction.

6 CONCLUSIONS

The CLQH workshop uses interdisciplinary hands on and real-life approach, it relates directly with reality creating empowerment and the sense of urgency of action within crisis environments. These factors are in close relationship on what neuroscience brings to the table: being multidisciplinary and holistic; strategies also use to create powerful global crisis awareness, not from studies but from real life. This course may be a powerful tool to empower future professionals in order to create awareness and cultivate actions about crisis.

7 RECOMMENDATIONS AND FUTURE RESEARCH

It is important to present results of the impact but at this point it is not yet possible, we are presenting our efforts to face global crisis using experimental process in order to try to achieve better outcomes for future generations. The impact on students and professionals will come in further studies with an evaluation over time.

References

- Barsamian, D., and Chomsky, N., *Global Discontents: Conversations on the Rising Threats to Democracy*, Company, H. H., (ed.) N.Y.: Metropolitan Books, 2017.
- Berge, B., *The Ecology of Building Materials*, Oxford: Architectural Press, Elsevier, 2000.
- Davenport, C., *Major Climate Report Describes a Strong Risk of Crisis as Early as 2040*, 2018. Retrieved from <https://www.nytimes.com/2018/10/07/climate/ipcc-climate-report-2040.html> on July 2019.
- Dixon, W., *The Impacts of Construction and the Built Environment, Briefing Notes*, Willmott-dixon Group, 2010.
- Ensusitio, *Decision Comunidad y Trabajo*, Quito, Ecuador. 2018.
- Foruzanmehr, A., *Towards New Approaches for Integrating Vernacular Passive-Cooling Systems Into Modern Buildings in Warm-Dry Climates of Iran*. London: Windsor, 2008.

- Grasso, M., *Climate Ethics: With A Little Help from Moral Cognitive Neuroscience*, Environmental Politics, 377-393, October 2012.
- Greene, J. D., Nystrom, L. E., Engell, A. D., Darley, J. M., and Cohen, J. D., *The Neural Bases of Cognitive Conflict and Control in Moral Judgment*. Neuron, 44(2), 389-400, October, 2004.
- Greene, J. D., Sommerville, R. B., Nystrom, L. E., Darley, J. M., and Cohen, J. D., *An fMRI investigation of Emotional Engagement in Moral Judgment*, Science, 293(5537), 2105-2108, September, 2001.
- Haidt, J. *The Emotional Dog and Its Rational Tail: A Social Intuitionist Approach to Moral Judgment*, Psychological Review, 108(4), 814-834, 2001.
- Howard-Jones, P. A., *Neuroscience and Education: Myths and Messages*, Nature Reviews Neuroscience, 15, 817-824, October, 2014.
- Immordino, M. H., and Damasio, A., *We Feel, Therefore We Learn: The Relevance of Affective and Social Neuroscience to Education*, Mind Brain and Education, 1(1), 3-10, March, 2007.
- Keneally, M., and Sandell, C., *These 5 Statistics Show Why We're Experiencing Historically Hot Weather*. Retrieved from <https://abcnews.go.com/US/statistics-show-experiencing-historically-hot-weather/story?id=64438226> on August, 2019.
- May, J., and Reid, A., *Casas Hechas A Mano Y Otros Edificios Tradicionales: Arquitectura Popular*, Art Blume, S.L., 2011.
- Vellinga, M., Paul, O., and Bridge, A., *Atlas of Vernacular Architecture of the World*, Routledge, 2008.
- Webster, M., *Neuroscience*. Retrieved from <https://www.merriam-webster.com/dictionary/neuroscience>, on Sept 9, 2019.