A Phenomenological Approach to Engage Students in Learning Urban Ecology

Samuel Hammer*
Boston University, Boston, USA

Abstract

Urban ecology is a complex interaction of humans, the built environment, and nature. The challenge is to teach this complexity effectively, no matter which students we are addressing in a university setting. How can we help students face challenges to learning this difficult material within constraints of time, physical conditions, and conceptual difficulty? A meaningful study of urban ecology should take students out of their comfort zone to engage with questions of complexity. Methodologies such as observation, contemplation, and serious play encourage critical thinking and help students tackle complex concepts that require abstract reasoning. These behaviors structure and guide an aesthetic experience that subsequently informs the cognitive-rational science of urban ecology. Observation in its many forms sets the stage for all further learning activities. Reflection allows students to develop ideas about their own learning and consider new perspectives. Serious play, which includes in-class model-building, excites students to work in a hands-on, collaborative environment. Finally, social media provide a tight focus for communication, encouraging students to "instantly" share their discoveries in a visual context while using the vocabulary of science. These methodologies and the abstract reasoning they generate can be carried forward for use in subsequent projects, in which student innovation and designing-outside-the-program are rewarded.

Keywords: Ecology, abstraction, complexity, phenomenology

Introduction

Urban ecology goes beyond the complicated interaction of nature and the built environment. The city itself is analogous to an ecological system (Alberti et al., 2003). As an interactive ecological system, the city and its urbanized region display numerous features that engender complexity (Jacobs, 1961). The first step in relating this complexity to students is to break down the components that define urban ecological complexity. These can be summarized as:

1) The ecology of soils, water, and biota of that exist within the city and comprise its non-human ecology
2) The effect of the city on the natural ecological, biogeochemical, and climatic patterns within and beyond its borders
3) Temporally- and spatially-related social phenomena that are analogous to natural processes, for example neighborhood succession, which involves physical and compositional changes

*Corresponding Author: Samuel Hammer, email: cladonia@bu.edu

4) Human ecology, which involves diverse people and activities, for example economies of scale, transportation, production, learning and commerce
5) The health and resiliency of the urban ecosystem as related to human welfare, economic resiliency, and resiliency in the face of climate change and natural disasters.

These issues comprise the cognitive-rational narrative of urban ecology. They are the basis of an interdisciplinary model, which because of its complexity presents a daunting conceptual menu for students. How can we help university students "digest" these ideas within the space of a semester or two? How can we engage them in learning complex systems? How can we help our students, both undergraduates and graduates, to sharpen their long-term skills in abstract reasoning? A phenomenological approach, which emphasizes students' mutual interrelationship with their environment (Bogner, 1985), may provide an answer. Because phenomenology explains meaning through an individual's self-experiences it is radically subjective (Selvi, 2008) and therefore difficult to assess from an educational perspective. Its methodology is also difficult to circumscribe. In spite of its limitations, phenomenology may provide a useful framework for grappling with complex systems. In this paper I discuss my rationale and strategies for teaching complexity, which use a phenomenological approach to take students beyond the cognitive-rational narrative of urban ecology.

From abstract to articulate

The external signals that we perceive from our surroundings are abundant and abstract (Hammer, 2012; 2014). At all stages of cognitive development, from infancy into adulthood, we require a problem-solving algorithm that enables us to make sense of these signals. We make sense of these signals through abstract reasoning, which includes activities such as making connections, perceiving patterns, and discerning processes. All of these fit within a phenomenological approach. Students enter the university equipped with the ability to perform these activities. In fact, abstract reasoning and its supporting phenomenological behaviors cannot be taught. Instead, these activities are promoted through the behaviors of observation, contemplation, and play, behaviors that we can encourage in our students. Through these behaviors students apply a personal aesthetic, a kind of intellectual scaffolding that involves multiple ways of thinking and feeling, in order to address problems in urban ecology. One's personal aesthetic thus goes beyond conventional definitions such as "taste." Rather, an aesthetic can be interpreted as a critical methodology, a suite of behaviors for problem-solving that transcends disciplines (Yanchar et al., 2005). The goal of abstract reasoning and the aesthetic that supports it is to translate abstract signals into the articulation of a product or model (Boal 2006). For students to build meaningful models of urban ecology they must translate the signals they perceive into a cognitive-rational narrative. How do we make them aware of their own perceptions?

Scientist-artist behaviors and urban ecology

Leaving the comfort zone: A methodology of discovery

Problem solving requires negotiating unknown, often difficult conceptual terrain (see Chimero, 2012). For most people, entering the unknown is concomitant with leaving one's comfort zone. It requires a mode of discovery, a process. Problem-solving professionals such as planners, designers, scientists, and artists use process to identify and grapple with problems. Their process can be considered as phenomenological in that it is open-ended and iterative (Mackey, 2001). It includes constant dialogue with the environment. And it results both in a model *and* a newly evolved process. As we approach new problems that will impact the future, for example urban resiliency, our collaborative-interdisciplinary activities show that much more is required of us than expertise alone. Complex questions that surround urban ecology, diversity, and resiliency require abstract thinking and the ability to act on that thinking. So teaching our students the "subject" of urban ecology is perhaps less a matter of teaching "facts and figures" than it is encouraging modes of behavior and thinking. To this end it is essential that students encounter urban ecology in all its complexity through their own experiential lens (Jacobs, 2012).

Experience requires action, and this is the first challenge to students' comfort zone. For example, in an exercise in which students studied water in the context of our city (Boston, USA), they were asked to take a self-guided field trip to the Charles River Dam. The dam is significant in that it separates a former tidewater river from the ocean. It is the only structure that protects inner Boston from flooding. The several-meter-high dam is susceptible to overflow in a combination of rising sea levels, high tide, and a potential storm surge. For my urban ecology class undergraduate students were required to take two forms of public transportation and to walk about a kilometer to reach the site. Leaving campus and using public transportation was uncomfortable for my students, many of whom use taxis several times a week, and I heard plenty of complaints about the inconvenience. Moving outside their comfort zone challenged the students, but it may have nudged them into looking at things differently. As assigned, I received twitter posts from every student describing the experience. Some of their responses:

"The dam is intricate."

"The dam looks strong and sturdy."

"The dam is smaller than I expected."

"The water level is already so high it can barely take any more."

"I saw a different side of Boston on this trip! Truly opened my eyes."

Fig. 1: Students Discover Boston on Foot
Source: Author

Observing: The first step takes many forms

If we consider urban ecology as a set of problems that need to be addressed, then the first step is to identify the components of the environment. These components include the natural, human, and built environment of the city. Simple observation is the key to this activity. It can be done in innumerable ways—visually (with or without the aid of tools like a microscope), aurally (the sounds and noises we hear are central to the urban environment: Sharma et al., 2014), or using any of the senses.

For example, I sent my undergraduates to a nature preserve a few blocks from campus. The preserve features a pond with no outlet, the remnant of a glacial landscape that existed ca. 8000 years ago. The pond and its surroundings are lovely in themselves but I wanted students to pursue a goal in their walk. I asked them to read a short essay about movement and to consider movement in a variety of contexts. For example I asked them to compare the movement of glaciers to the movement of the surface of the pond. They were asked to record as many kinds of movement as they perceived and to post a photo or video with comments about their observations to our flickr site. Students reported seen and unseen movement: Leaves in the wind, swimming water birds, plate tectonics, even the movement of nutrients during plant metabolism. They did a good job and engaged in the serenity of a special urban space. In fact, students did this work for me while I was in Colombo at the last ICCPP conference!

In a more rigorous but still open-ended exercise, I asked my graduate students in Design Research Methods (Boston Architectural College) to situate themselves in an urban setting and observe everything they could, taking extensive notes, sketches, photographs, and video documentation. They compared their unaided observations (notes and sketches) with their photos and videos, and reported the difference in the quality of these different kinds of observations. The process of observation itself is more important than what students observed. Later in the course I asked them to return to the spot and note which aspect of their urban corner they would set out to improve. Their design questions came only at the end of a course in which they observed, reflected, questioned, and played in a variety of settings.

In other settings, both graduate and undergraduate, I promote the use of microscopes. The microscope reveals structural characteristics, for example of soil, that are useful to understanding urban ecology. I ask my students to collect soil samples during a field trip and in a subsequent laboratory, students examine the soil they collected. We discern biotic and abiotic features in the soil as well as differences in the texture and composition of soils from various sites. Our observations give us an opportunity to discuss related ecological features such as water, plants, and microorganisms to questions of land use and the urban built environment. The microscopy exercise also provides students with the notion that urban ecology transpires at many scales and in many spatial and temporal dimensions. The fact that they collected the samples themselves allows them to experience urban ecology in an immediate, personal fashion. Their discoveries under the microscope help them build a narrative of ecology previously unknown and probably unsuspected to them.

Our students are digital natives (Jones et al., 2009), so they can be encouraged to use laptops and other devices to observe, either passively (observing what’s on the screen) or actively (by taking photos, videos, and sound recordings). When I introduced undergraduate laboratories that were 100% computer-based I was happily surprised with student engagement. This was a first in my 20+ years of teaching that students stayed focused for the entire lab period. The material they engaged with on their devices provided an atmosphere where they could focus and move through the activities, tweeting me feedback as they proceeded. It is worth noting that as I continued a series of computer-based laboratories I designed, students sustained their interest and engagement for the whole semester. Perhaps this is because students, especially undergraduates, find the computer-based environment non-threatening and easier to frame around a concept than a field trip on a cold day. There are simply less “moving parts” and the environment is friendlier to them. But does this translate to other parts of the world? In Boston I teach in a cold climate that is inhospitable to outdoor activities most of the school year. Conceivably the heat and humidity in Sri Lanka comprise an analogous situation in terms of outdoor activities. Would urban ecology students in the tropics benefit from more computer-based labs?

Fig. 2: Students Observed and Analyzed Urban Space Using Images on their Computers
Source: Author

Reflecting: Finding connections and developing hypotheses

Observation by itself can be a passive behavior. As students gain fluency with the difficult concepts of urban ecology, our goal is to encourage less passivity and more action. How can we increase abstract reasoning as well as independent thinking? Reflection and contemplation encourage students to look inward toward their own process of reasoning, in order to reach higher-level cognitive behaviors (Bloom et al., 1956). Reflection is the next step in increasing engagement with complex models of urban ecology. Scientists and artists use observation to fuel reflection, a mode of thinking that permits interpretation of complex situations and the development of hypotheses (Ash & Clayton 2004). Students can be encouraged to do the same. In the guided reflection exercises I developed students work toward an enhanced awareness of the urban environment and concomitantly enrich self-awareness because they reflect on *how* they observe. Here a phenomenological approach leads to met cognition (understanding how we know), which is central to critical thinking as well as learning in a design context (Edelson, 2009). A signal feature of the process of reflection is that is slows students down. Although they crave self-determination of open-ended exercises in observation and reflections, students might prefer to perform the rote tasks they need to fulfill during a lab, preferably as fast as possible. So reflection is another process that may take students out of their comfort zone.

In the introduction to both my graduate and undergraduate courses I ask students to evaluate why they choose a certain image over another. This starts the process of self-evaluation that highlights, among other things, the aesthetic biases that students bring with them. We all share this trait and as educators, reading students’ responses about their visual preferences can also force us to explore our own ways of thinking and teaching. Using replicates of Paleolithic hand-held tools I ask students to read an essay on the tools (as well as to handle them) and to evaluate the concepts of “subjective” and “objective.” It’s amazing to read responses that report as “subjective” terms like “elegant,” “beautiful,” and “balanced.” By contrast, supposed dates, tool uses, and other “facts,” though highly speculative, are reported by the students to be “objective.” What does this tell us about the way students might interpret their larger environment? Or how they would evaluate urban ecological problems? Must there be a gap between perceptions of beauty and utility? Contemplative learning in a phenomenological framework addresses these questions.

Aesthetics, an algorithm for problem solving and abstract reasoning, is the diaphanous fiber that connects science and art, subjective and objective. Reflecting on their own aesthetic students connect the abstract signals they perceive in their environment with the cognitive-rational science of urban ecology. One of my course goals is to help students make connections between seemingly unrelated objects or phenomena. For example, I ask them to compare a lego brick structure with a Chinese scholar’s rock. As students work through perceived connections between objects, or as they struggle to find a connection the professor suggested, they sharpen their cognitive skills. If we can promote this behavior, for example by hinting at unexpected or seemingly out of context terms such as permeability, variation, and evolution, then we can help students connect the visible “real” world with its underlying ecologies.

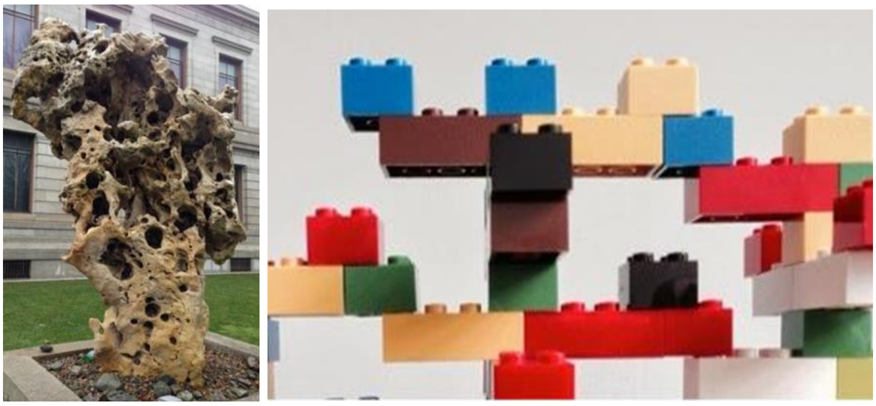

Fig. 3: Students compare unrelated objects to explore concepts such as permeability, variation, and the evolution of form.
Source: Author

Serious play: New frontiers in learning

After decades of teaching traditional laboratories I realized that in many ways, they didn’t work. While laboratories are intended to provide first-hand experience for students, perhaps replicating iconic work of past scientists, the result is something much different. Student laboratories, especially for undergraduates, seemed to feel increasingly rote, with students going through a cookbook-style sequence of activities and plugging in numbers for an analytic graph that held little meaning for them. At the surface, we could say that these labs involved abstract reasoning but in fact, students employed little or no abstract reasoning. They just wanted to get the lab finished. The fact that students rushed through labs demonstrated the lack of meaning in these exercises. I had to make a change.

During a serendipitous trip to Sri Lanka in 2013 I was introduced to a world quite different from my own, a world that required deep observation and reflection to even begin to understand. As I traveled, and immediately after I returned, I started to design a series of new laboratories that would promote observation and reflection. But what about play?

Part of my realization was that I could no longer expect students to perform the old lab exercises we had always offered. Starting with my creative and somewhat malleable graduate students in Sustainable Design (most of whom enter the program as non-designers) I began to introduce activities that would challenge students with open-ended, serious play in which they set the parameters. I asked the students to build “complex” structures that represented urban landscapes. The results were impressive. Tired, overworked graduate students were sparked to spend hours building with Zometool toys. I found a muffled group of stressed-out students suddenly come to life, creating structures, making noise, laughing and conversing. When they finished building their models of complexity they happily shared with the group the parameters, “rules,” and goals of their projects. Would it work with my undergraduates?

I started slowly with my undergraduates, who are more conservative than my design graduate students. Instead of asking them to “have fun” with building tools I asked them initially to explore the behaviors of water. I provided students with rudimentary tools: Water, salt, sand, clay, string, sponges, and *Azolla*, a water fern that we have to order specially, but which happens to be common to freshwater environments in Sri Lanka. Students engaged with enthusiasm and a sense of discovery. Some demonstrated the surface tension of water. Others found evidence of mass flow. One student poured fresh water on top of a saturated solution of saltwater and demonstrated (in a beaker) the characteristics of an aquifer in a saline environment. All of their discoveries have a direct bearing on urban ecological systems and all of them were self-generated. My only rule was, “Play.” Their play was subsequently translated to scientific narrative in the tweets my students sent me.

Fig. 4: Student tweets on the characteristics of water, following a serious play session.
Source: Author

Many authors discuss the role of play in learning, creating, and innovation (Zimmerman, 2003; Bateson & Martin, 2013). But even after our water experiment I was still skeptical. "Play" is something my undergraduate students left behind as they took on the mantle of young adulthood, honing their academic achievements in high-impact educational environments as they prepared for university. Common wisdom refutes play. But common sense recognizes its importance. Would I be able to persuade them to pick up the Zometool sets and work with them? My apprehensions were unfounded. Students engaged in intensive, goal-oriented collaborative play to construct oversize 3-D models. They began by strategizing and sketching their models. As the models grew students adjusted their designs. They experimented with unexpected shapes, movement, and connections that resulted in their particular structures. Finally, they presented their structures and like my graduate students, reported on the process of building, the role each of them played, and the outcome of their work. Students' model building behavior helped them comprehend the subject matter, experiment with scale, and understand functionality. Quite literally, students engaged in modeling complexity, a goal worthy of any urban ecology course.

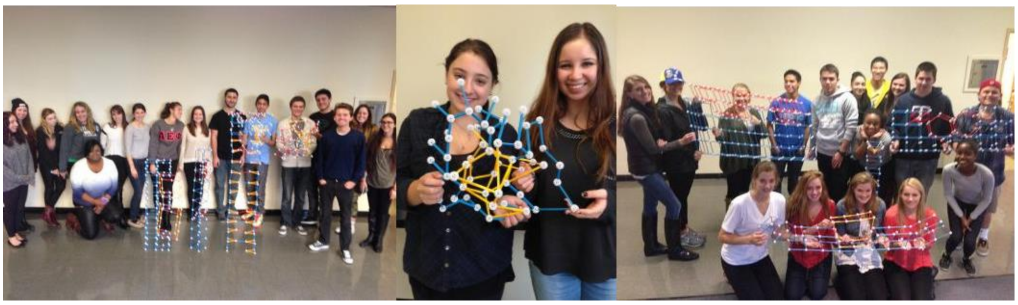

Fig. 5: Students show off their models of complex systems
Source: Author

Conclusion

A phenomenological approach to learning provides great opportunities. But there are limitations as well. For example, how can we assess student achievement in open-ended exercises? Where are the results that presumably make them qualified to work in professional settings? Can we predict how they will do on exams? While student achievement under a phenomenological approach is hard to predict, so are the urban ecology problems they will face in a decade or two. In my estimation, we cannot teach students solutions to the problems they will face. We can however provide the tools for problem-solving behaviors. Urban ecology is an interdisciplinary science and solving its problems require a trans-disciplinary approach undertaken at a range of scales from microscopic to global. Standing on its own, no single disciplinary "content" that we offer will take our students where they need to go. The world they face is unpredictable, random, and abstract, just like the many signals they perceive in their environment. The tools they will need to face the future go beyond technology, beyond our books, beyond the disciplines we have struggled to master (and which we naturally but perhaps misguidedly want to pass down). Our students face a world that requires real-time human agency. They will need to ask critical questions, to think and act quickly, collaboratively, and creatively. Our job is to help them develop their innate ability to connect disparate ideas. As they make these connections, they expand their horizons through interdisciplinary work. Helping our students approach and solve problems through abstract reasoning is our contribution to their future.

References

Alberti, M., Marzluff, J.M., Shulenberger, E.C., Bradley, G., Ryan, C., & ZumBrunnen, C. (2003) 'Integrating humans into ecology: Opportunities and challenges for studying urban ecosystems'. BioScience, Vol. 53, no. 12, pp. 1169-1179.

Ash, S. L. & Clayton, P.H. (2004) 'The articulated learning: An approach to guided reflection and assessment'. Innovative Higher Education, Vol. 29, pp. 137-154.

Bateson, P., & P. Martin (2013) *Play, playfulness, creativity and innovation*. Cambridge, UK: Cambridge University Press.

Bloom, B. S., Engelhart, M. D., Furst, E. J., & Krathwohl, D. R. (1956) *Taxonomy of educational objectives: The classification of educational goals. Handbook I: Cognitive domain*. New York: David McKay Company.

Boal, A. (2006) *The aesthetics of the oppressed*, London and New York: Routledge.

Bogner, B. (1985) 'A phenomenological approach to architecture and its teaching in the design studio', in *Dwelling, Place and Environment*, Seaman, D. & Mugerauer, R., Eds. Springer Netherlands. pp. 183-197.

Chimero, F. (2012) *The shape of design*, Minneapolis, MN: Shapco. Creative Commons Attribution.

Edelson, D.C. (2002) 'Design research: What we learn when we engage in design'. Journal of the Learning Sciences, Vol. 11, pp. 105-121.

Hammer, S. (2012) 'From abstract to articulate: Science, problems solving, and aesthetics'. Community College Humanities Review Vol. 32, pp. 6-15.

Hammer, S. (2014) 'Hacking design learning: Exploratory play with purpose'. ARCADE Magazine Vol. 32.1, (unpaginated). http://arcadenw.org/blog/hacking-design-learning-exploratory-play-with-purpose.

Jacobs, J. (1961) *The death and life of great American cities*, New York: Random House.

Jacobs, J.M. (2012) 'Urban geographies I: Still thinking cities rationally'. Progress in Human Geography, Vol. 36, pp. 412-422.

Jones, C., Ramanau, R., Cross, S., & Healing, G. (2009) 'Net generation or digital natives: Is there a distinct new generation entering university?'. Computers and Education, Vol. 54, pp. 722-632.

Mackey, J. Linn. (2001) 'Another approach to interdisciplinary studies'. Issues in integrative studies Vol. 19, pp. 59-70.

Selvi, K. (2008) 'Phenomenological approach in education'. Analecta Husserliana, Vol. 95, pp. 39-51.

Sharma, A., Bodhe, L.E., & Schimak, G. (2014) 'Development of a traffic noise prediction model for an urban environment'. Noise and Health, Vol. 16: pp. 63-67.

Yanchar, S., Gantt, E. E., & Clay, S. L. (2005) 'On the nature of a critical methodology'. Theory Psychology, Vol. 15, pp. 27-50.

Zimmerman, E. (2003) 'Play as research: the iterative design process', in Design research: Methods and perspectives, Cambridge, Massachusetts: MIT Press.