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# Setting a Baby into the Grass: A Biological Model of Interactions between Concrete and Abstract Learning Experiences

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## What the Baby in the Grass Teaches Us

Give a baby its first experience in a grassy lawn and it will roll and frolic in the grass, reveling in its presence against its skin, in its hand. Its fingers will fondle and finesse the blades, press into the mass of roots, break and tear. Learning takes place literally at the fingertips, in the direct experience of the feel of each blade. New connections to the physicality of the world are formed and, in so doing, corresponding new representations of that world are created. Each new contact with the world becomes then an experiment, a test of these representations against each successive direct contact. Concrete experience is thus impressed upon the structure of the mind, burning in synapses and altering nervous circuitry, restructuring the network of our nervous system. Our nervous systems, as characterized by philosopher William James, are "grown to the way in which they have been exercised, just as a sheet of paper or a coat, once creased or folded, tends to fall forever afterward into the same identical folds."[1] Educator Robert Leamnson, following James, believes these basic structures of neural processing are formed in the primary experiences in which college students first engage, inevitably and profoundly patterning the mechanisms of learning for successive educational experiences. If Leamnson's claim has merit, what is broadly called into question is raised by the very fundamental nature of first year education itself: what should be the the foundational learning experience[s] that may form patterns most beneficial to architectural experience and studio education methodologies?

## Learning and Relationships of Process

### *Biological Imperatives for Concrete and Abstract Learning*

In his book, Thinking about Teaching and Learning - Developing Habits of Learning with First Year College and University Students, Leamnson, following the theory of brain-based learning, states that learning involves self-initiated brain changes. These changes occur principally in the ability to detect patterns of experience and make self-correcting approximations through analysis and self-reflection. First experiences are PARADIGMATIC. They establish a biological neurostructure (a pattern) for learning for the rest of one's life. First experiences set in place conditions for the reception of learning. Our brain is the hub of the nervous system and the seat of consciousness but the body is the basis of brain changes. Our nervous systems have their origin in our bodies as our bodies establish a relationship to the physical world.

If concrete experience is biologically formative, should not initial learning experiences be those that best enable self-initiated decision-making consistent with the biological interactivity between body and mind, between, respectively, the concrete and the abstract? Education psychology identifies concrete learning and abstract learning as two opposing yet complimentary and fundamental means for acquiring and acting on knowledge. Concrete learning methods are facilitated by immediate experiential contact in which there is direct engagement through heuristic manipulation and discovery, followed by reflective observation and judgment. Abstract learning involves mental mechanisms and cognitive comprehension utilizing indirect representational cues and symbols in acts of conceptualization, synthesis, and experimentation. Interactive cycling of concrete and abstract modes form the basic staging of learning and pedagogy.

Consider the relationship of concrete and abstract learning at the basic level of a baby's world. Its world is primarily one of sense perceptions and actions. In experiencing the grass, the baby is set to understand something about its place on the grass and the grass itself. Shown only a picture of the grass the baby will not gain any enhancement of understanding. A picture is only a representation of grass and is therefore an abstraction from the grass itself. Placing the baby in the grass provides direct experience of its physical qualities and gives the baby an opportunity to self-correct and learn from experience by making approximations as an adjustment of its mental representation of grass. The baby's relationship to the grass is a form of learning by doing - a heuristic process of trial and reflection - as if feeding on the concrete in a complex interactivity with the abstract in which each mode mutually modifies the other as knowledge and experience develop. The baby becomes wired according to its association to the world in concrete experience.

The Cartesian dualism of mind and body is essentially a relationship between the abstract and the concrete and is manifest in other basic human relationships such as thinking and doing, thought and action, the mind and the hand, and materials and intentions. The successful practice of architecture is itself grounded in the development and expression of abstract content that is experientially based in concrete material physicality. The design process of architect Steven Holl, for example, develops architectural experience as a perceptual synthesis of heightened sensory phenomena and ideational encounters.

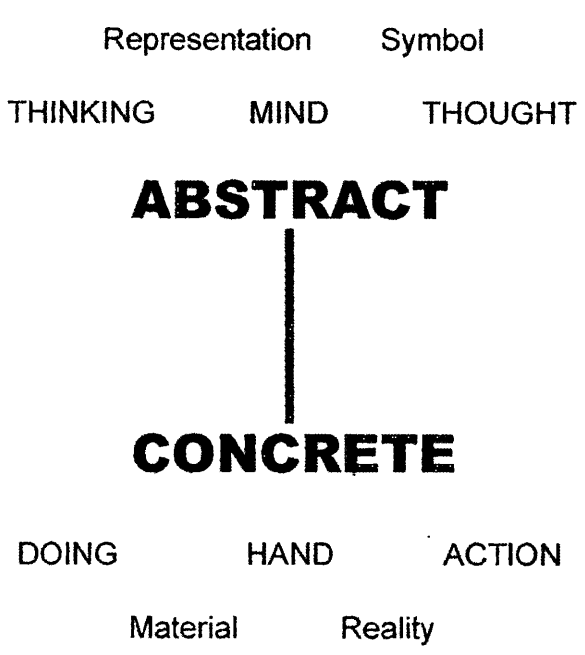


*Fig. 1. Basic Abstract / Concrete Relationship*

First year design pedagogy should tap these basic relationships and cultivate their complex interactions as foundational learning experiences. The intent of this paper is to: 1) discuss the importance of recognizing biological imperatives for learning as identified by education psychology, and 2) model first year design pedagogy on relationships between concrete and abstract processes of learning as a basis for the continued development of design process and maturation beyond first year. In modeling these processes, the intent is to identify and actualize essential and enduring aspects of concrete and abstract learning processes that are both specific and universal functions of foundational education in architecture and design. Therefore, synthesizing the concrete and physical with abstract content necessitates a structural approach that holistically defines transformational interdependence between these elements without reliance on forces outside the model.

**Learning as Structuring Relationships to the World**

At the basis of this pedagogical model is a fundamental premise of psychological theorist Jean Piaget - that children actively and purposefully create their own structure for knowledge as they seek to make sense of the world from their own experiences. Piaget's research principally described four stages in the development of cognition, or thinking.[2] Piaget used the term schemata to describe patterns of operational concepts that come about as the child structures his own characteristic representations of the world. In the initial sensorimotor stage schemata are formed in actions taken while making direct, concrete connection with the world. The infant will develop symbols within the schemata as a way of mediating between its perceptions and the actual objects or events in the environment. In the second "preoperational" stage, roughly from age 2 to 7, children will develop the ability and intentionality to use symbols to let one thing stand for something else, even though they depend on contact with the concrete world. Additionally, children also develop the use of reflection to help them test and think operations through logically in the pre-operational stage. During the third, concrete operational stage, from age 7 to 11, children become able to engage with concepts but depend on relation of the concepts to tangible or concrete situations. In the formal operational stage, Piaget's fourth and final stage of development, children age 11 to 15 are capable of reasoning abstractly about the same concepts through the use of propositional thought using symbolic representations (e.g., words; thoughts; mental images) without requiring constant reference to concrete objects or events. Another way to describe this stage is when they are able to think about thinking.

It is necessary to define what is meant by abstraction. All abstractions are an abstraction of something. The act of abstracting is movement away from the concrete. There must be something as a causal referent of any abstraction. "The only way we can become familiar with symbol systems, abstractions of reality, is to move from known realities to the symbols of them."[3] Childhood development, according to Piaget, demonstrates that the development of the ability to learn is an interdependent relationship between concrete experience and abilities for abstraction. Abstraction does not replace the concrete, it is its compliment. Piaget's ideas are also significant because they stress the idea of developmental relationships, that one act of learning is built upon another as a schemata or structure. The schemata represent an evolving representation of mind/body/environment interactions analogous to a kind of mapping of our nervous systems and neural network on our activities and the world itself.

Drawing on the developmental theories of Piaget, David Kolb expanded experience as a basis of learning into continuous and phased learning cycles. Kolb's process of learning cycles is typically portrayed as revealing one's "learning style" and has been construed into many applications for education theory. Analysis of "learning styles" for architectural education is not the subject of this inquiry. Rather, it is the structure of Kolb's learning cycle diagram that is significant. Basic to Kolb's experiential learning model is that learning is thought of as a process whereby concepts are derived from and continuously modified by experience. Kolb believes that, "Learning is the process whereby knowledge is created through the transformation of experience."[4] The process of experiential learning can be characterized as a four-stage cycle involving four adaptive learning modes - concrete experience, reflective observation, abstract conceptualization, and active experimentation. Movement from stage to stage is a transformation of the other stages.

Kolb's model of experiential learning identifies two separate learning activities: perception and processing. Each of these activities has two conflicting poles. At one end of the perception pole is concrete experience (apprehension, real, human, sensual, intuitive). Experiencing is immersing oneself in the "doing" of a task, usually not reflecting on the task as this time, but carrying it out with intention. At the other end is abstract

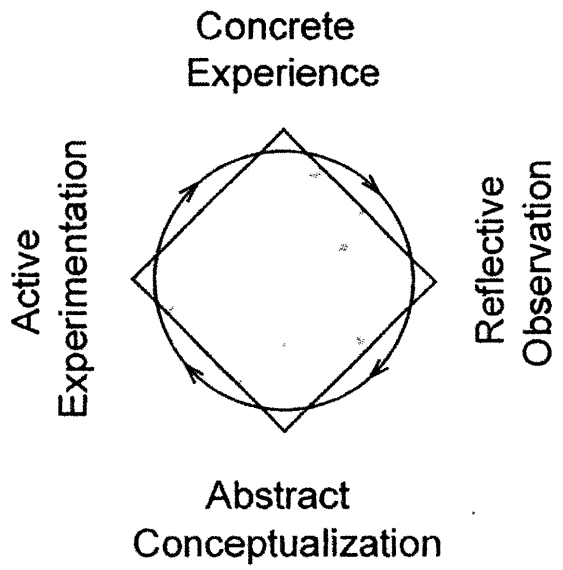


*Fig. 2. David Kolb's Experiential Learning Model*

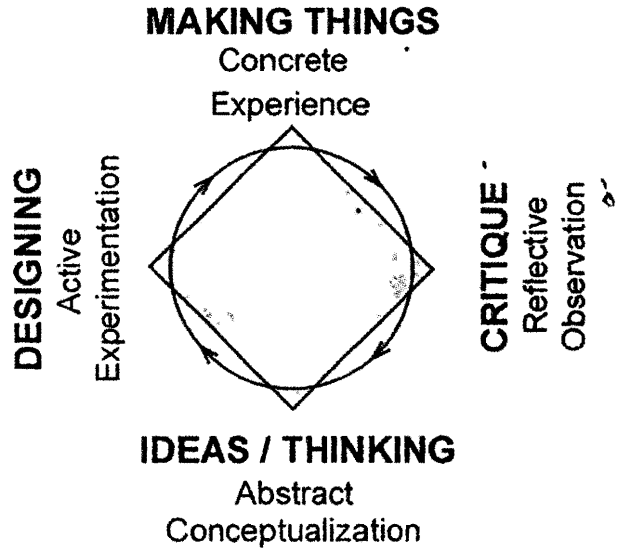


*Fig. 3. Proposal for Pedagogical Structure*

conceptualization (comprehension, representations of experience, mental imagery). Conceptualization involves interpreting the events that have been noticed and understanding the relationships among them. It is at this stage that theory may be particularly helpful for framing and explaining events. For processing, there is reflective observation (intention, reflecting upon past experiences and many views) and active experimentation (extension, testing and utilizing ideas raised by an experience). Reflection involves stepping back from task involvement and critically reviewing what has been done and experienced. Skills involved include attending, noticing differences, and communicating analytic judgments. Experimentation involves taking the new understanding and translates it into predictions about what is likely to happen next or what actions should be taken to refine the way the task is handled. Each of the activities identified make up the four steps in the learning cycle.

Holistic learning occurs when learning experiences cycle through all four of Kolb's dimensions. That is, first experience, then reflect on it, then analyze it, then act on it. In this approach the learner will recognize that some modes in the cycle are easier and/or more productive than others and will be able to identify types of learning that may be more beneficial. This cycling fosters a metacognitive awareness of the learner's own learning processes and helps the student to engage in self-initiated learning.

## Application to Beginning Design Pedagogy

### *A Model for a Way of Working*

A recharacterization of Kolb's experiential learning cycle in terms of typical design studio experiences yields some striking similarities to activities that already and routinely take place in studio education. Design students readily engage in concrete learning experiences in the form of making things and engagement in first-hand material explorations. It could be said that concrete experience is in large part the actual content of design, in that buildings are the environmental surroundings and circumstances of an occupant's everyday life and ordinary state of consciousness of the things around them. Design is also a highly reflective activity, with formal and informal design critique at the center of studio efforts. Reflective activity or design inquiry also takes form as search for sound measures of design. Abstract conceptualization in design occurs within the development of meaningful ideational structure for a design project and typically occurs in the form of discursive thought and conceptual development, and visualization. Representational structures, such as diagrams, drawings, verbal descriptions, material models, and virtual models seek to connect the abstraction of concepts and ideas to the realities of human sentient experience and physical materiality. Active experimentation defines design activity, as concepts and ideas take form as the raw materials of architecture (i.e., configurations of walls, floors, openings, spaces, forms, materials, structure, and construction).

Making and thinking are dialectically paired as complimentary operations. Key to actualizing this structure in the design studio is that each student self-initiates their own operational conditions and build new mental structures. Some will conceptualize and be informed by making; others experiment with making and discover/develop conceptualized thought; still others "receive" conceptualizations primarily through reflective activity (such as critique). Designing always occurs with respect to a varied set of conditions that necessitate varied modes of learning activity. In light of these distinctions, a supportive and integrative pedagogy will allow, fertilize, and propagate methodological interacting in the context of design studio to facilitate a "community of design" in the spirit of challenging design inquiry.

### First Encounter Dynamic: Making and Critique

Many first year design pedagogies typically confront students with abstract tasks such as diagraming, conceptual thinking, visual thinking, representational drawing, and reductive exercises that intend to raise to awareness and understanding of certain basic design elements and principles. Beginning design students have little experiential basis for the specific abstractions of architectural design, discourse, or methods of inquiry. Additionally students typically enter introductory architecture studios with many misrepresentations about design and visual learning, having had their nervous circuitry wired principally through the saturation of media. Overcoming the stilted nature of a student's misconceptions acquired prior to architecture school is a common goal of basic design pedagogy. It is necessary to develop new nervous pathways in students by developing sensitivities for the processes and qualities of the physical world and concrete experience in balance with abstract experience. This needs to be accomplished at the level of individual self-engagement in which everyday human experience is based. Making is an important first step in rewiring our students' nervous pathways. Making things is especially relevant in fostering material and construction sensitivities in design students, who will be, as architects and designers, charged with constructing our sensorial and our conceptual environment.

Abstract and concrete processes are both facilitated and transformed by production (experimentation) and discourse (reflective observation, criticism). The first encounter can structure these relationships through engagement in the concrete experiences of making things, followed in turn by measured engagement in reflective critique of the things made. Engagement in acts of making fosters immersion in concrete experience through direct contact with materials for discovery and manipulation of a material's workable properties in relation to design intentions. Engagement in acts of making has its premise in the notion that making decisions about materials is making decisions about design. Projects that require acts of making necessitate that students employ heuristic investigations and discoveries that are brought to light through ongoing reflective observation and comparative critique. Modes of conceptualization and experimentation are implicit (rather than explicit) in the efforts of working with materials to complete the projects. Workmanship is a constant measure of intentions and is brought into awareness as a fundamental category of design and material qualities. Projects should engage in the concrete experience through direct material encounters and should develop through reflective critique.

### Second Encounter Dynamic - Abstraction to Experimentation

Following immersion in making and critique, the second encounter dynamic engages students in abstract conceptual mechanisms to elucidate and develop a context of thought against which concrete investigations may be balanced. Abstraction may include such issues as diagraming, analysis, visual thinking, drawing conventions, modeling, simulation, scale, context, as well as the use of narrative and metaphor, and the nature of ideation. Engagement in abstract conceptual thought also has its premise in the notion that learning to abstract is learning to design, however, lessons of abstraction are built upon lessons of concrete experience. Projects may focus on processes of theorizing a conceptual approach and developing an experimental proposal in which concrete experience and reflective observation are implicitly engaged as the raw material of abstract thinking.

### Conclusion

> "Thinking is too easy. The mind in its flight rarely meets with resistance. Hence the vital importance for the intellectual of touching concrete objects and of learning discipline in his intercourse with them. Without the check of visible and palpable things, the spirit in its high-flown arrogance would be sheer madness. The body is the tutor and the policeman of the spirit."[5]
> - Ortega y Gasset

It is not the objective of this paper to apply Piaget's developmental stages or Kolb's learning cycle as an exercise of applied science. To the contrary, I am advocating mind-body unity in the classroom that, simply stated, places the direct experience of our physicality in the world as the ground for any abstract, cognitive, or brain-based development of intelligence. For architects and designers, abstract learning must always account for the physicality that is at the heart of their work. Buildings convey ideas. But architectural ideas are conveyed to an experiencing occupant when linked, by necessity, with the perception of a building's material and spatial presences. These physicalities form the ground of abstract ideas and give body to conceptual representations that are otherwise formless. The mere idea of "giving body" to representation describes precisely a more unified relationship of mind and body. Images and representations (ideas) "of mind" originate in sensations of the physical world. This origin does not vanish or drop from significance once the mind forms a representation. In fact, the continual renewal and reconstruction of neural networks is testament to the continual contact of the nervous system with the physical world.

Educational systems that recognize this do so by providing direct experience as ground for cognitive development. Groundless abstract conceptualizing tends to situate design problems as mental structures with at best a weak connectedness to the physicality that must ultimately find resolution in materials and space. As a foundational experience for architectural and design education, exercises that are principally abstract in nature are disassociated from any derivative in human perceptual experience and lead the student to believe that the value of their work (and the built environment) lies principally in its representational content. Its experiential content is devalued and marginalized or forgotten.

The heuristic methodology that often underlies utilization of experience as a basis for learning locates abstract content to that selected and discovered by the student him/herself and, more importantly, puts the student in charge of their own learning (through dialog with self through decision-making,

trial-making, self-critique, material exploration, and process selection). The teacher's role becomes responsive rather than formulaic - partners in design rather than omnipotent masters. This alleviates the teacher from having to deflect students from looking for "what the teacher wants" toward looking for what they can discover, critique, think about, and take action upon. If first educational experiences establish conditions for the reception of learning, then helping students to make their own inquiries sets a pattern that can only reinforce studio education.

Modes of learning analogous to those in Kolb's experiential learning model are already embedded in design studio methods. However, to be optimally effective studio pedagogy must elaborate a structure of learning that allows experiential learning as a basis for abstract learning. Pedagogies of basic design courses that seek to introduce design processes as a universal foundation for success in architectural education must recognize that synthesizing physical reality with abstract content necessitates the integration of concrete (making) and abstract (thinking) learning experiences. Specifically structuring design activities as an intentional cycle gives the beginning design student a foundation of learning in which design experiences are dynamically inter-relational. More explicit engagement in concrete experience as self-initiated learning experiences can ground the complex situation of learning in which students act, observe, challenge, and reflect, allowing them to self-initialize and construct for themselves a dynamic process of learning and doing in which the holistic human experience of buildings can emerge.

## Notes

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2. Piaget, Jean, "Piaget's Theory." Handbook of Child Psychology, Vol 1. P. Mussen, ed., (Wiley, New York, 1983)

3. Holt, John. Learning All the Time. (Addison-Wesley Pubs., New York. 1989) p. 56-7

4. Kolb, David A. Experiential Learning: Experience as the Source of Learning and Development. (Prentice Hall, Englewood Cliffs, NJ, 1984) p. 41

5. Ortega y Gasset, Jose. History as a System. (Norton & Company, New York. 1962) p. 160

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