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Chicken and Egg? Hentagon, Icosa-Coop, and Two Types of Experience

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Abstract
In an essay with the title Experience and Poverty,1 Walter Benjamin writes about the lack of traditional experience (Erfahrung)—a kind of acquired knowledge—that could be handed down to younger generations through story-telling and hands-on instruction. Benjamin reads this experience as a cipher for modern architecture where one material—steel—stands in for a cultural perspective toward traditions, while glass represents a new virtual existence expressed in a short-term event-based experience—in German the word is Erlebnis—both of which, we think, can be transmitted through contemporary pedagogy. In our paper we argue that effective teaching of beginning-design students requires a hybridization of a material focus and an emphasis on immaterial modes of production.

Disciplines
Architecture | Art Education

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Mikesch Muecke and Peter Evans  
Iowa State University

**Introduction**

In an essay with the title *Experience and Poverty*, 1 Walter Benjamin writes about the lack of traditional experience (Erfahrung)—a kind of acquired knowledge—that could be handed down to younger generations through story-telling and hands-on instruction. Benjamin reads this experience as a cipher for modern architecture where one material—steel—stands in for a cultural perspective toward traditions, while glass represents a new virtual existence expressed in a short-term event-based experience—in German the word is Erlebnis—both of which, we think, can be transmitted through contemporary pedagogy. In our paper we argue that effective teaching of beginning-design students requires a hybridization of a material focus and an emphasis on immaterial modes of production.

Benjamin’s dialectic reading of the two experiences articulates well the differences in the two apparently opposite, yet coordinated, courses we taught in the fall semester of 2013 in the College of Design at Iowa State University. The two courses, Arch 201, an architecture design studio, and its complement Arch 230, a computation-heavy design communications course, are both required in our professional BArch degree. In the history of the department there was never a very close connection between these two courses until recently, when we realized that students might benefit from a more explicit communication across the classes that makes use of the long durée of Erfahrung and the shorter impression of Erlebnis. This realization came about not only because we share an office but also because our research areas tend to overlap. Aside from teaching studios and digital communication courses Pete also takes courses in our Human Computer Interaction program dealing with cognition and augmented reality, while Mikesch usually teaches studios, history/theory seminars and digital fabrication courses, but has also taught Arch 230 several times. In other words, discussing the content and delivery of both courses seemed inevitable, and discussing pedagogical topics and problems now allows us to imagine a different future.

When students enter the first year of the BArch program at Iowa State, after having completed the one-year long Core program shared between the seven different programs in the College of Design, Arch 201 is the first proper architecture studio they encounter. The studio consists of three projects: the first is an introductory precedent study where students understand through physical modeling and drawing that there are buildings, designs, and environments already created by other designers in history that precede their own burgeoning world of architecture; the second project is a team-based full-scale design and construction of a chicken coop (in its first iteration this last fall) where students learn about inhabitation, gravity, wrestling with physical tools, and the translation of two-dimensional drawings into a three-dimensional materiality [see Figure 1]; the second project is a team-based full-scale design and construction of a chicken coop (in its first iteration this last fall) where students learn about inhabitation, gravity, wrestling with physical tools, and the translation of two-dimensional drawings into a three-dimensional materiality [see Figure 1]. The last project is the design of a boat-house through two iterations where each student works individually to develop their ideas. In Arch 230 students are introduced to design communications techniques, including conventional 2D and 3D hand drawing techniques, digital applications such as Sketch-Up, Bonzai, and Revit as well as more advanced...
hybrid modes of manipulating and visualizing architectural designs using augmented reality. Parallel to Arch 201 and Arch 230 the students take a history survey and a building science & technology course. Our goal in this paper is to explore one section/intersection between Arch 201 and Arch 230, namely the design, construction, and visualization of the chicken coop project. We chose to study this project because it requires students to shuttle effectively between both courses by asking them to address inhabitation (at two different scales: chicken and human), the virtual projection of an idea (in German design means 'entwerfen': a throwing forth of an idea into the world), the making of something physical from drawings, and finally its re-presentation through text, drawings, and augmented reality projections that combine representations of physical and virtual presences.

Context

Both of us focus in our research on the sensory aspects of design, and here we mean the multi-sensory exploration of our designed and natural environment that is based on olfactory, auditory, ocular, haptic, and gustatory perception. Through these senses design intersects with cognition and memory. In the 2009 biography about Robert Altman by Mitchell Zuckoff, the director is quoted as saying: "I don't think anybody remembers the truth, the facts. You remember impressions." If we consider what students take away from our courses, what they remember after the semester has ended, individual memory in the form of impressions plays an important role.

From cognitive psychology we know that working memory holds both verbal and visio-spatial information. Beyond that, long-term memory — internalized knowledge — describes comprehension. And here we can differentiate further: hierarchical memory is constructed through a combination of 1. arbitrary things, 2. meaningful relationships, and 3. explanations, moving from the 'what' of declarative knowledge to the 'how' of procedural knowledge [see Figure 2].

We argue that between the immaterial (the internal thought stream of words, images and spaces) and its material expression (external knowledge and physical experience) a hybrid bridge can be built that links both the immaterial and the material modes of production. We believe that this hybrid bridge is critical for today's design-student experience, in that it follows through perceptual analysis, unitization, and on to comprehension 4 while tapping into work modes students are already familiar with, such as conventional drawing and modeling techniques as well as more advanced screen-based augmented-reality applications.

Through a case study that we used as an assignment in both of our courses we explore a project in which students in groups of three or four designed and built working chicken coops. The students employed initially both cognitive and intuitive approaches to learn about the real-world needs of chickens living in urban backyard chicken coops. After several design proposals advanced through small-scale modeling and drawing (both in sketch and hard-line form) the students constructed a full-scale cardboard mock-up where scale (reinforced by ocular, olfactory, auditory, and haptic perception) leads eventually to decisions about construction materials, detailing, and finally full-scale assembly of parts [see Figures 3 and 4].
On one hand the designs are ostensibly about habitation but stretch the students’ material/immaterial toolkit by asking them to explore the difficulty of material joinery, iterative thinking and making, by using saws, hammers, and cordless drills while learning about material resistance, connection and gravity through tactile perception. On the other hand they are about projecting into the future using virtual/digital technologies such as 3D modeling to not only redraw but also draw ideas from what is created digitally. Parallel to this studio work the students created digital models to study optimal orientation of their coops based on environmental factors (sun, wind, exposure) and they modified their designs in the communications course. A one-hour Arch 230 lab component reinforces the joint between both courses by placing the space of instruction physically in the studio which students identify already with designing and physical making.

We might say initially that the studio deals with making while the communications course addresses representation, but the reality is more complex. While the simple dialectical pair of material/immaterial production in both studio and communications courses might look like [Table 1]...

...we prefer for the table above to grow a third column that joins the apparent opposites of material/immaterial realms with hybrid tools of representation and design [Table 2].

However, rather than see the joint between material and immaterial realms as the sole focus of attention we believe that offering students of diverse backgrounds a broad spectrum of learning opportunities provided by the range of tools presented above, will potentially lead to a more comprehensive and effective level of learning. Given the complexity of teaching design to beginning students it seems appropriate to recall the set of principles laid out in the Universal Design for Learning (UDL) initiative that acknowledges three brain networks involved in effective learning. They consist of recognition networks (the ‘what’ of learning), strategic networks (the ‘how’ of learning), and affective networks (the ‘why’ of learning) [see Figure 2].

These three networks can be addressed respectively through curricula that facilitate learning

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### Table 1: Dialectical Pairing of Studio and Communications course

<table>
<thead>
<tr>
<th>Arch 201 Design Studio</th>
<th>Arch 230 Design Communications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Design (poly-sensory coordination)</td>
<td>Computation Design (predominantly visual but also hand-eye coordination)</td>
</tr>
<tr>
<td>Drawings (paper, pencil, charcoal, pen)</td>
<td>Digital Models (using SketchUp, Banzai, Revit)</td>
</tr>
<tr>
<td>Analog Scale and Full-Scale Models (using rulers, knives, cardboard, glue, tape)</td>
<td>Movies (analysis through documentation)</td>
</tr>
<tr>
<td>Analog Full-Scale Models (using hammers, saws, cordless drill, screws, nails, wood, metal)</td>
<td>Graphic Design (digital posters)</td>
</tr>
<tr>
<td></td>
<td>Immersive Technologies (augmented reality)</td>
</tr>
</tbody>
</table>

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### Table 2: Modified table showing additional third column with Material + Immmaterial content.

<table>
<thead>
<tr>
<th>Material</th>
<th>Material + Immaterial</th>
<th>Immaterial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Design (poly-sensory coordination)</td>
<td>Augmented Reality (visual overlay onto physical reality)</td>
<td>Computation Design (predominantly visual but also hand-eye coordination)</td>
</tr>
<tr>
<td>Drawings (paper, pencil, charcoal, pen)</td>
<td>Hybrid Drawings and Collages</td>
<td>Digital Models (using SketchUp, Banzai, Revit)</td>
</tr>
<tr>
<td>Analog Scale and Full-Scale Models (using rulers, knives, cardboard, glue, tape)</td>
<td></td>
<td>Movies (analysis through documentation)</td>
</tr>
<tr>
<td>Analog Full-Scale Models (using hammers, saws, cordless drill, screws, nails, wood, metal)</td>
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</tr>
</tbody>
</table>
through multiple modes of representation, multiple means of action and expression, and multiple means of engagement, combining knowledge, skills, and enthusiasm for learning. Innovative instructors in design studios have been following these principles perhaps intuitively, given the collaborative design environment that encourages learning by iterative doing and collective evaluation. In addition bringing UDL principles consciously into the design curriculum may also create more complex evaluation from the students’ perspective (analagous to cognitive processing), which in turn might allow more resonance and/or more opportunities for some students to gain more profound insights into design processes. Consequently we see UDL principles as a fundamental means to strengthen the multimodal/sensory delivery of design understanding at the beginning student level.

UDL’s holistic and inclusive approach to learning also takes into consideration the phenomenological dimension of perception. In a recent article Alberto Pérez-Gómez makes a case for the inseparability of time and space from a phenomenological perspective, arguing for a perception that involves all senses in a unified whole. His assertion that “meaning is not something merely constructed in the brain but that it “is given in our normal, bodily engagement with things, things that we recognize [...] instantly as the embodiment of an idea, word, or category” resonates potentially with both the physically and the digitally constructed world surrounding us.

The tenor of the article is at times defensive, as if digital technology with its claims of bodily immersion presents a threat to the phenomenological perception of the world through our senses, and yet Pérez-Gómez provides the very logic that allows us to change how we teach our students through both advanced technology.

He admits as much when he describes how in this awareness of that immediacy of perception “reside both the possibilities and the limitations of digitally generated images as potentially contributing, as a form of architecture, to a meaningful lived environment.” While we agree with the author’s assessment of the limitations of conventional architectural representation, i.e. that “architecture is not what appears in a glossy magazine, buildings rendered as 2-D or 3-D instrumental images on the computer screen, or even to a comprehensive set of precise working drawings” Pérez-Gómez fails to address a third possibility that involves generating designs through a hybrid of both conventional architectural perception (dwelling in an environment using all of our senses holistically) and augmented reality where the design works as an overlay of what exists already.

Augmented reality (AR) can be defined as the “fusion of digital information with...the viewer’s real environment.” In Arch 230 Pete started using the mobile app AR Media, in addition to many other digital and physical drawing tools, as an
instrument for students to evaluate a live view of their chicken coop designs in a physical context, such as the backyard of a house in town, or alternatively in their studio environment after the coop had sold in a public auction [see Figure 5]. In this case AR offers a conceptual joint between the material and the immaterial modes of design, allowing students to visualize and evaluate a live version of their project, before, during, and after its transformation into a physical presence. AR could also play a role in the revised version of Bloom’s learning taxonomy by joining so-called lower order skills such as to remember, understand, and apply, with higher order thinking skills, i.e. analyze, evaluate, and create.

Figure 6. Arch 201/230 student Ahmed Al-Othman working with his design in AR Media through a mobile viewing device

In a recent book in which Harry Mallgrave explores the relations between neuroscience and architecture, he unpacks how memory works in our brains. In a chapter on memory he refers to the work of Eric R. Kandel who, in the 1970s, began to “relate memories not to neurons but to neural circuits” which made possible an “understanding that all forms of learning (invariably a process of memory) result in synaptic changes.”

Expanding the students’ toolkit of learning about design using multi-sensory methods that include AR likely reinforces their comprehension of important design concepts in their early design-learning phase, especially with intentional integration and extension into immaterial media at full scale which AR provides. After acquiring initially a how-to experience in a material sense in

Figure 7: Student reading drawings of his group’s Chicken Coop project during the intermediate review while sitting in the project. Different modes of representation overlap.

Figure 8: Full-scale construction of Chicken Coops
studio, students continue to explore further iterations digitally, extending the idea of making into the immaterial realm—with the intention to have them learn modeling and hone their digital communication and representation skills. In this process of shuttling between material and immaterial realms the tools we teach our students become complex instruments that enable fast-track learning.

**Conclusions**

While we are asking fundamentally what we can do to improve the effectiveness of our teaching and the students’ learning, we still have to evaluate if our hybrid approach is effective or not. The proof won’t be noticeable until later in the students’ career. However, we think it is important for beginning designers to develop a project all the way from initial concept to its final built form, including all the in between stages, because traversing this vast terrain of iterative design using many tools parallels the UDL principles of multi-modal learning. When students work iteratively, they learn from what works, and what doesn’t work. They don’t discard their mistakes but make them part of their learning process, part of their memory that affects their design knowledge, and they appear to learn faster than students who only do part of one project, or only work through a single iteration. While we don’t have quantitative data yet we plan to poll students’ experiences through several surveys during the upcoming fall semester when we will teach another iteration of both courses. If this collaboration into the material and immaterial realms proves to be successful we may project it as a pedagogical model for the following semesters, with the proviso that, in consideration of the range of studios and electives offered in the upper semesters, our approach might work only for early education.

In his book *Immaterial Architecture* Jonathan Hill points out the difficulty faced by architects—who struggle to maintain a solid, objective, and respectable profession—to develop an immaterial practice that exhibits qualities such as subjective, unpredictable, porous, and ephemeral. This weakness of immaterial practice, and by extension architecture, is perhaps also a strength in that it requires us as designers of architecture and as educators of future architects “to be fluid, flexible and open to conflicting perceptions and opinions.”

In summary, by the end of the semester the students’ toolkit consisted of conventional drawings done by hand, hybrid drawings that emerged out of a shuttling between analog and digital work, physical models made by hand and/or machine, immaterial thought structures expressed verbally, 2D and 3D digital work that existed only temporarily in pixels on screens, and finally augmented-reality hybrids that closed the loop between analog and digital visualization. This conceptual circle of multi-modal learning now includes both the experience of the long durée (Erfahrung) and the shorter event-based insights (Erlebnis), creating a longer-term knowledge base that makes it possible for students to become better designers.

![Figure 9: Full-scale construction and inhabitation](image)
Notes

3 See Wickens, Christopher, Introduction to Human Factors Engineering (Pearson: 2003).
4 See Norman, Donald, The Design of Everyday Things (Basic Books: 2002).
5 For more information go to the National Center on Universal Design for Learning site at http://www.udlcenter.org, accessed 15 February 2014.
7 Ibid: 462.