Adaptive Re-Use: The Architecture of Re-Purposing Existing Objects

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Abstract

This paper addresses the problem of homelessness and affordable housing and how students can become involved in this international and national problem within their studio and laboratory courses. It also addresses sustainability and, in particular, the repurposing of existing objects that has recently gained popular attention in the design community with projects involving shipping containers and other existing or found objects as innovative options for living and work environments.

Specifically, this article delves into the reuse and design of aging trains to develop housing and work environments in a specific community. This paper examines this topic within the framework of the literature that speaks to repurposing and adaptive re-use in the design field and places this project within the continuum of that context, meanwhile exploring the question of how to develop a suitable proof of concept that can leverage this into a studio or capstone project as well as a community-based learning experience. Conclusions and an assessment of the value of this approach to solving the above noted problems will be reached based upon these various sources.

Also of unique consideration is an examination of the value of student service-learning assistants that can be used to jump start these projects. Students in these positions are exposed to learning about the value of service and community engagement and a rich data source of these students will be tapped to examine the value of these assistants in this context.

Introduction

Adaptive reuse in the architectural field has typically meant taking an existing warehouse, for example, and redesigning it into another building type, such as a restaurant or a high-end condominium. However, over the past several years, we have seen a rise in architects (and other professions (e.g., doctors, dentists)) engaged in service or community-engaged activities and moving their client base beyond the wealthy few in the suburbs to those in dire need of shelter, medicine, and overall care. Specific examples of this include Habitat for Humanity, Architects for Humanity, Doctors and Engineers without Borders. Some of these, particularly in the design field, fuel the notion of using "found objects" for not only art, but architecture and engineering. Hence adaptive reuse becomes more than repurposing existing architecture as mentioned above. Instead it becomes more about repurposing objects that did not originally function as architecture or places of shelter.

The adaptive reuse approach to architecture exemplifies the creative play of children: making forts out of blankets and household objects, for example - re-purposing objects for shelter at a creative level. As renowned designer Kalkin notes, in reference to using steel shipping containers for housing: "...it's like a child playing with blocks. Containers are these enigmatic found

objects. Each one has a different story to tell." (p 22)[8]

The advantages of this type of playful architecture are that it is typically inexpensive, allows for consumer customization, addresses energy waste and sustainability concerns, and is therefore compelling on several levels. This paper will explore this approach to architecture within the context of education and will therefore set the stage for the creation of student-based projects built upon this theoretical framework.

Literature Review

The following review of the literature focuses specifically upon adaptive reuse with respect to architecture. It unfolds within several subsections that are primarily based upon the object of re-use, as this often sets the stage for sub-groupings within this field. They are as follows:

Container Architecture

It should first be restated that, unlike other architectural areas of study, adaptive reuse is not necessarily a product of other architecture. This is recognized within the literature with respect to the re-use of intermodal shipping containers for a variety of building projects. For as stated in one of the prominent resources on this subject: "It [shipping container architecture] does not properly come from architecture: it is made possible by container surpluses created by imbalances in global trade." (p 6)[8]. In other words, this is an architecture that speaks to the excesses of "things" on our planet (there are over 100 million shipping containers in circulation) (p 15)[8] and the sensible movement to make use of these items rather than send them to a landfill site. In this context adaptive reuse is a movement to "upgrade global detritus" (p 6)[8] and to examine our leftovers or garbage "with fresh eyes in order to find its highest and best use" (p 6)[8].

Container Architecture[7] by Jure Kotnik is one of the frequently cited sources of information in this field. Originating from the 1950's, today's shipping container began its adventure into architecture through exploratory makeshift sheds or shops while others were created as more sculptural, statement pieces. The surplus of these containers pushed its design and repurposing evolution to move quickly. Sending an empty container back to be reused costs $900 (p 16)[7], therefore it is often more economical for companies to purchase a new one. The growing knowledge of this abundance problem has helped shape the re-use of these structures into buildings. By 1990, for example, James Palibroda submitted a patent application with the United States government to use insulated shipping containers as substrates for containerized transportable housing[3]. This indicates that it took only forty years to separate the birth of the modern shipping container and the need to redefine its use.

According to Kotnik, reusing the shipping container as housing is simple. "They are prefabricated, mass-produced, cheap, and mobile" (p 14)[7]. However, this has both pros and cons. Benefits include modularity; remodeling can simply mean the addition of more containers. This gives each home/office the ability to grow organically with its inhabitants. Another perk is physical strength: "The sturdiness of the container's outer shell resists any on-site manipulation and withstands the worst of weather conditions: the cold and the heat, as well as salty water, high winds, downpours, and other inconveniences" (p 14)[7].

Additionally, the negative aspects are addressed. The container requires sound-proofing and in areas of extreme climates, special attention to insulation methods is required. Psychologically, Kotnik recognized that the general public is unsure of viewing the container as a way of building homes. He states, "Their breakthrough into mainstream could thus largely be aided by famous designers and architects" (p19)[7]. Otherwise, container homes could be viewed with some skepticism and lacking in social stature, sometimes with cultural adversity to living within a steel box that is rusty, dirty, claustrophobic, and inappropriate in scale and dimension. As noted architect Kalkin states, it is the process of "transforming a commodity into poetry, the vulgar into the sublime" (p 22-1)[8] that is the challenge of this type of architectural problem.

Containers have been used as homes and offices to great success (see Figures 1, 2 and 3). Yet the creation and development of these have not come without their particular challenges. As noted by Ohtake[9], the lack of public support for this type of construction has kept the future of the container home in limbo. Building codes are also often the single largest challenge of using containers as a substrate. Yet he continues in a more positive tone by stating: "As more designers push container architecture from fad to legitimate building system, it's possible that one day they will be seen not only as units for shipping but also as containers for living" (p 81)[9].

Figure 1: Shipping Container House[9]

Figure 2: Shipping Container-Based House[8]

The office structure at Buoys Wharf in East London serves as an excellent example of containers used as a low-cost alternative for self-employed individuals or businesses in need of inexpensive start-up space. Urban Space Management assembled this solution on the Thames River. One scholar, in discussing this project, states: "For a business, the cost of renting workspace can be one of the largest expenses after employees' salaries" (p 78).[10] This particular live/work system explores the versatility of the container. The front section looks like a puzzle of containers, all arranged at different depths and right angles. The rear is simply stacked containers, four high. A container turned on end creates a stairwell for the structure and private patios are provided with existing doors. Completed in 2003, this creative approach to stacking and repositioning the containers has effectively provided housing, shops, and workshops at very low cost (p 79).[10]

Figure 3: Containers as Offices[10]

Earth Ships

The discussion of these different types of "found object architecture" would be remiss to not mention that this approach toward creating architecture has been around for quite some time.

Prime examples of this are the "earth ships' created by graduate architect Michael Reynolds. Born out of the counter culture movement of the 1960's and 1970's this approach to architecture ran in opposition to the track homes of this era and espoused an approach to architecture that signaled the green architectural movement that is so prevalent today. Reynolds' "earth ships" were dwellings made of rammed earth and tires that the architect had been perfecting in and around Taos for 20 years. His goal was to be independent of the conventional power grid by using sculpted earth, tire walls and the sun, which also powered photovoltaic cells that provided electricity. Rather than conventional plumbing, there were also catch-water roof systems to harvest and filter runoff from snow and rain. Used water from bathtubs and sinks were piped into planters where flowers and vegetables grew. There were no sewers, only solar toilets, an invention of Reynolds that reduced human waste to dust, dust that may even be good for something, he said."[2] These structures relied more upon repurposed objects than container architecture, however the spirit remained the same - creating shelter from objects that typically are not considered to be architecture-worthy.

Re-Purposed Train Architecture

All of these approaches to architecture are what fuelled the current project at IUPUI. Set within the Midwest area of the USA, far from shipping ports, the authors concluded that aging trains might be a more suitable starting point for this type of architectural project in this area of the country.

In looking for precedents and historical references on the use of trains as shelter, the Airstream Project[1] surfaced as a suitable example on which to base our educational project. This particular project (see Figure 4) relates directly to our desire to repurpose train cars as it explores the use of creative solutions applied within an interior arched environment and, for the most part, Amtrak train cars (found readily within the Midwest area) and Airstream design share the same overall shape and exterior material. A new trend in remodeling Airstream trailers that was launched by this project provided opportunity to consider self-contained offices, retail spaces, and apartments within these environments (see Figure 4).

Figure 4: The Airstream Project[1]

This particular project was centered on the design and remodel of the 1968 Airstream

Ambassador for a private client, including design and fabrication of all cabinetry and built-in furniture, including pocket doors, curved cabinet doors, and an automated futon. It explored the ideas of creating an efficient space within a small footprint, ideas that fuel and support the current interest in smaller houses and smaller carbon footprints.

Another example of trailer/Airstream renovation comes from Andrea Stavropoulos, a landscape architect from central California. Andrea purchased a 1959 travel trailer and converted it to a live/work space (see Figure 5). He writes about his experience as follows: "My obsession with mobility, modularity, and affordability began long before the Airstream and has since extended beyond" (p 6)[11]. This also supports the notion of repurposing train cars which, as previously noted, have a similar shape and structure to Airstream trailers.

Figure 5: Repurposed Travel Trailer[11]

Summary of Literature Review

This brief overview of repurposing objects into shelter speaks to infinite possibilities for the adaptive reuse of the artifacts of industrial capitalism: shipping containers, trains and a vast array of other objects (e.g., earth ships) that continue to fill our country with too many things. In order to approach architecture within a sustainable model for the future it only makes sense to place these types of design problems into our students' studio projects and have them face the dilemma of what to do with this excess of material that would otherwise be destined to the nearest landfill.

It is these types of houses that are now finding a market within the hip and affluent segments of our society in contrast and in response to the endless sea of track homes and vanilla suburbs. Using shipping containers and trains as the building blocks of architecture "unleashes a set of cultural associations and chain of meanings that have as much to do with consumer society, the

haves and the have-nots and global commerce..."(p 10)[8] and are "a practical solution and a social commentary on the growing world housing crises..."(p 10)[8].

As shipping containers were, and continue to be, tied into global transportation their use naturally spun off into disaster reconstruction and the need for immediate solutions to shelter. As a result, container architecture runs the gamut of fashionable, trendy solutions to housing to more utilitarian solutions for disasters and housing shortages. This approach to shelter crosses many boundaries and economic groups and hence strikes a chord with many. Who wouldn't want something that can look appealing, is affordable and is kind to the planet (see previous figures)?

The downside of this, as previously mentioned, is often the preconceived and sometimes cultural adversity to living within steel boxes and old trains; they can be dirty, claustrophobic, and inappropriate in scale. Yet these are indeed the challenges that call for a unique approach to solving architectural problems and are a perfect place to begin a studio project in architecture and/or interior design. They make interesting problems in that the students are engaged in the design of a dwelling but also engaged in issues of sustainability, social commentary and repurposing. These become highly creative, intellectual and innovative exercises, allowing them to explore the boundaries of the context for what people think of as a house or a building, transporting the design of houses and office buildings into a new paradigm.

Methodology

In moving these concepts into a class project, the authors first recognized the necessity of treating this as a real versus a fictitious project. Fortunately, given the current economic climate in the US, the idea of developing design concepts related to affordable housing was appealing.

To begin with, a student Service Learning Assistant was hired to start this project. This helped to embed the project at the student level and to expose at least one student to the background development (initially, research) of this type of project. Service Learning Assistants are students at our institution who are supported by Service Learning Assistant (SLA) Scholarships and who have been selected by faculty or professional staff to support community engaged faculty work in teaching, research and service. "SLAs may assist their faculty/staff mentor:

- in the design/implementation of a service learning class,
- conducting a community engaged research project,
- supporting capacity building for the expansion of service learning within a campus department or unit, or
- implementing a professional service project in and with the community."[6]

Service Learning Assistants

As noted in the previous section, Service Learning Assistants play a vital role in the development of these types of community-based projects and have proven to be a real boon to the faculty trying to organize and develop these projects.

To validate this worth, data retrieved from the Center for Service and Learning on our campus allows us to assess the real value of the SLA experience. This data is retrieved from two surveys, one known as the Civic Mindedness Survey that assesses (pre and post) the impact of students' Service Learning Assistantship work on their continued growth and development as an active member of society. It consists entirely of closed questions, typically on a 7 point Likert scale. The other survey, known as the Civic Minded Graduate Reflection Prompt, assesses how the SLA experience has influenced students' learning and development, and their attitudes towards their education and service learning. It also consists of closed questions.

It should also be noted that the more recent respondents to these surveys have used a new survey methodology to account for 'response shift bias' (Howard & Dailey, 1979)[4], which basically asks them to take a survey, then immediately afterwards take it again. These surveys have helped our institution tremendously when assessing the growth of these students with respect to service learning and civic engagement.

Figure 6, in graphic form, illustrates the average ratings relative to a population of 85 participants taken from all of the SLA's at IUPUI. These, it should be noted, are faculty ratings (using a Civic Minded Graduate rubric) of the students based upon a written reflection that each SLA composes at the end of their SLA session. This is a good indication and validation of the necessity of offering these types of experiences to our students.
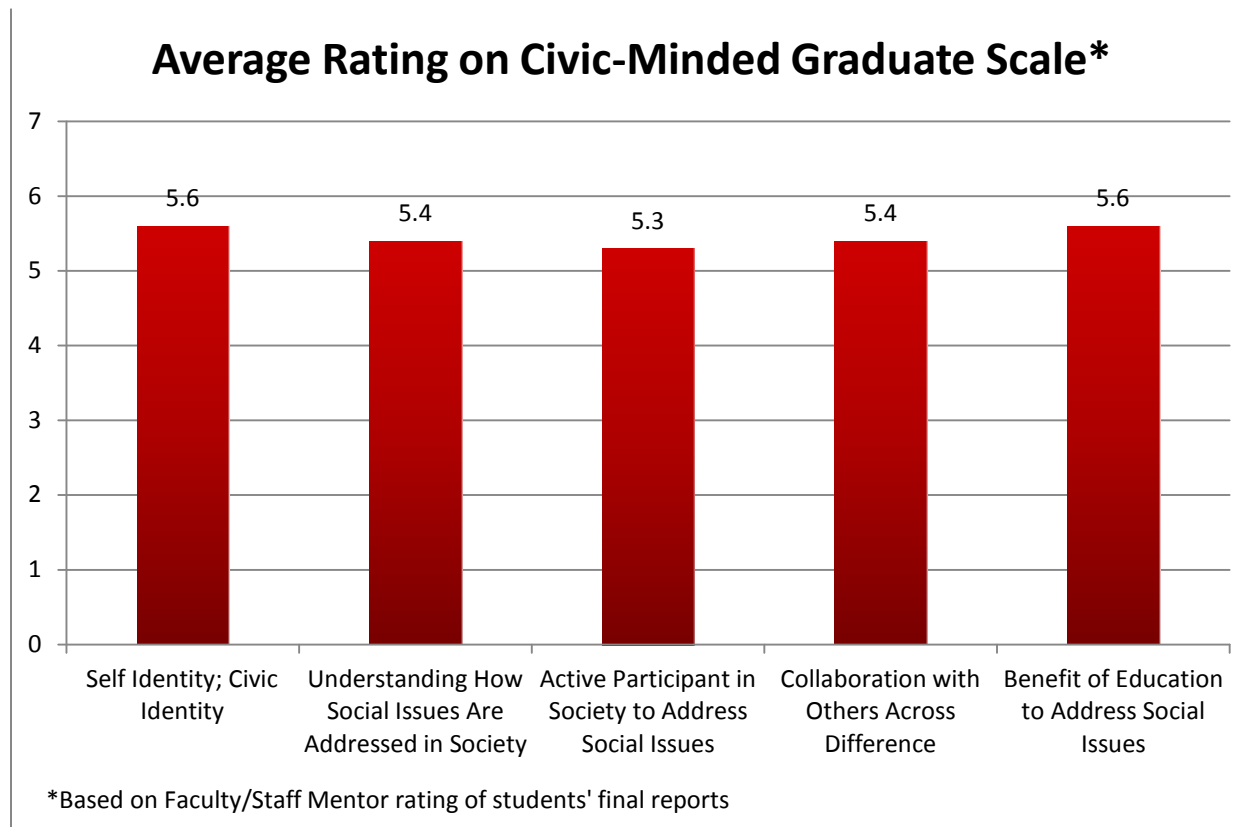

Figure 6: Data from Civic Minded Graduate Survey[5]

More specific qualitative examples of student comments taken from these reports include the following, reaffirming the value of these experiences and how they have been transformative:

Student One: "The understanding of how design can raise the quality of life in a community, and how appreciation of other cultures allows one [to] help them, has deepened my regard for these experiences."[5]

Student Two: "This learning matters because it brought a great change in my life."[5]

Student Three: "In the future I plan to remain involved in organizations and activities that are concerned with social advocacy. I also plan on being a part of professional organizations that will promote social advocacy."[5]

Student Four: "Interior designers should be aware of the impact of such political and social processes on their practices and should implement changes in designed environments that support improved social conditions in order to meet the basic needs and life safety of people."[5]

All of the above statements are part of a larger narrative submitted by the students. In realizing that this might shortchange the reader, the following has been included and is the personal testimonial of one of this paper's co-authors and student Service Learning Assistant (SLA) who was part of this project from its inception. Her involvement took her directly into the community in order to lay the foundation of this project that was looking at the re-purposing of trains. The following is a large part of her reflective narrative submitted at the end of her experience as an SLA with respect to this project:

"As a service-learning assistant, working with a local community is crucial in developing a new perspective and the correlation of applied knowledge. Prior to meeting the communities interested in adaptive re-use, my research was abstract. I was compiling resources and developing a common knowledge of container architecture. However, after meeting with IUPUI's Solution Center, a sense of reality began to cultivate. No longer was I merely gathering information, I was asked to explain it and expand on available literature. In preparation for the first community meeting, I traveled to the town. Simple observations developed my connection with adaptive re-use and those who would be utilizing it.

From these experiences, I felt a personal connection to this project and began to see Interior Design in a completely new light. Prior to my research, I did not feel passionate about my career options upon graduating. This semester gave me a new direction and a new perspective. As an Interior Designer, I plan to work with my community on non-profit projects and neighborhood revitalization through the process of adaptive re-use. I believe this is the future of design: solving problems by utilizing local resources in new and creative ways."

These comments by the student SLA are indicative of the transformative power of engaging students in community-based projects that delve into service learning and reflection. As noted in her comments, these activities take the abstract notion of designing something into reality. Coupling this with adaptive re-use also exposes these students to the necessity of becoming the stewards of our future environments and to ensure that the planet's resources are not being insensitively managed. Having students create new objects out of existing ones forces them to creatively solve problems that do not rely on creating more physical objects.

Project Development

The authors have all been involved in community engaged and service learning projects of some type so the transition to this type of studio project was not difficult. The projects are intended to last an entire semester and the greatest number of students involved in these projects would be 18, at the most. Students typically work individually but, on occasion, have worked in teams of two to three persons. Assessment of the success of these projects is typically retrieved from end of semester student evaluations. As we continue to develop more community-based projects we intend to create more assessment tools for each specific project. We already have a questionnaire developed that targets our community partners. Data collection from these surveys will occur at the end of next term.

In at least one case the professor provided students with a pre-flection paper that made students confront the notion of what service learning means to them prior to hearing about the semester project and what community engagement or service learning means. This assignment is completed on the first day of class to gauge the level of understanding of the students in these types of projects. Typical comments from students have been similar to the following examples:

Student One: "…we will be learning this information and these skills in a professional environment that mirrors that of a realistic work setting…"

Student Two: "…assisting another community, as well as being able to take our knowledge gained from this class to continually better our community and others."

Student Three: "…provided a service for an outside person or organization, and learning through a hands-on teaching style.

All of these speak to an initial understanding (pre-project) of working on a project that involves an external partner or client and that the learning that will take place will be similar to what they will experience as graduates. Additionally, the project will serve in helping others. At the end of the term all students also completed a post-survey, much like the SLA's had done, and, in fact, the survey questions were taken from those found in the SLA Civic Mindedness survey.

This pedagogical approach takes the design experience out of their personal desires to add more personal pieces to their portfolios and places them within the context of creating design objects (in this case shelter) to help others. These pre-flection assignments (shown immediately above) are then used to stimulate discussion about what it means to work on a service learning project as well as often expanding into discussions about what it means to be professional and, as well, what it means to place design objects (buildings) into a community that may already have enough of them.

Summary and Recommendations for the Future

In moving forward with this project connections have already been made with the community stake holders and special classrooms have been booked that will facilitate videoconferencing. Students are also encouraged to work from different locations in the community (Starbucks, libraries, etc.) so that they can work in the field and connect to the class remotely. With the advent of more user friendly versions of the software (Adobe Connect and MOVI) it is assumed, through a trial completed next term, that this project will allow for interpersonal communication regardless of where the client or student will be. There appears to be little necessity to have students always come to the designated classroom to attend class. We are

hoping that this will enable us to offer these types of experiences to other students who are not physically housed at IUPUI, or, perhaps, secondary students who may also want to join the project.

It should also be noted that our research did not turn up any current projects with shipping containers (or trains for that matter) that delved into the viability of these types of sturdy structures with respect to areas prone to tornados. As well, in moving forward, one should also be cautious of realizing that these seemingly virtuous activities do not necessarily lead to better design. What they do allow for is a larger community of designers to weigh in on the impact of the final product and it is hoped, that through increased community liaison, that our students will become more attached to the notion of how design can help others and the problems that this world currently faces and will continue to do so in the future.

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