Building on Collaborations

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INTRODUCTION

Interdisciplinary collaboration is an essential catalyst for the realization of common good projects. Entrepreneurial efforts built on mutual respect, shared values, and open dialogue can help form significant partnerships in service of the public interest. While working toward common goals, academic, civic, and professional members of society can produce solutions for the built environment that address a community's needs and introduce incremental innovations in building.

Figure 1: Gita primary school finishing touches

This paper reflects on the collaborative relationship and process between three organizations to design and build a primary school in Uganda. Initiative reCOVER, a design/build program at the University of Virginia, a non-governmental organization Building Tomorrow, Inc. (BT) based in Indianapolis, Indiana, and a professional architecture and engineering firm Arup (The Arup Cause Program) based in London integrated a set of academic and professional objectives in service of realizing a public interest project. Central to this paper is a critical look at the collaborative methods that were established to prepare, develop and manage the design and construction of a primary school building for the community of Gita located in the Wakiso district of Uganda. The project team addressed these important objectives: first, working closely with the community, establish the first ever primary school in the area; second, in collaboration with local building trades, assist in improving the overall quality of building stock while incrementally introducing innovations in building components and construction detailing; and third, consider how this school design could be used in the future to inform other BT primary school buildings throughout Uganda. Equally important to this project was the significant educational experience affected through direct involvement of architecture and engineering students in a year-long process, from planning and

conceptual work, to actual on site construction and community engagement. In their essay "An Architecture of Change," Gámez and Rogers make a very strong argument for a reciprocal relationship between the architecture academia and society.

> Civil society is produced and reproduced through its civic, academic, and professional institutions. The academy plays a particularly important role as a filter for ideas and practices, and architectural education is no exception. Furthermore, education does not exist outside the practices and theories that form the background against which actions, ideas, and knowledge are produced.[1]

Figure 2: Working with the community of Gita

EXPANDING EDUCATION

Architectural education is necessarily adjusting to address an evolving set of societal demands. Today's architectural curricula are becoming more flexible and expansive moving toward design education paradigms and practices that balance sound theoretical principles with applied problem-solving. To a large degree, the new generation of architecture students demands it; the combination of constant ubiquitous streams of information and an extant, unwavering social consciousness, the Millennial generation[2] of architecture students is well-informed, hyper-aware and poised to act on current and imminent global crises. Now, more than ever, a supply of natural and manmade crises is being counteracted by a rejuvenated public demand in the form of hyper social activism – actual and virtual. In light of the mounting domestic and international environmental and political crises affecting (and being affected by) the built environment, academia has been rightly self-critical of the role it will continue to play in preparing future generations of architects. The activism of the 1960s, which focused largely on the establishment and protection of fundamental inalienable human rights for all, has more recently been amplified to a larger scale. A new form of public-interest activism focuses on the wellbeing equally afforded to all global citizens through the health, quality and sustainability of our shared built environments – natural and manmade. Fortunately this form of socio-environmental consciousness is gaining great momentum and becoming more prevalent in mainstream society. Al Gore's award winning book and documentary film *An Inconvenient Truth* as well as Thomas Freidman's book *Hot, Flat, and Crowded – Why We Need a Green Revolution and How It Can Renew America*, amongst many others, have played a significant role in raising public awareness of how decades of neglectful practices of government, industry (including the building industry) and individuals have contributed to the dire and urgent environmental situation we find ourselves in today. In academic and professional architectural circles, Cameron Sinclair and Katie Stohr's *Design Like You Give a Damn: Architectural Responses to Humanitarian Crises*, and Bryan Bell and Katie Wakeford's *Expanding Architecture – Design as Activism* have helped foreground a new role for design in addressing environmental crises through creative, activists solutions for the built environment. In addition to many others, these publications feature the work of Sergio Palleroni, Steve Badanes, and Samuel Mockbee; they also highlight numerous other projects that have been instrumental in helping increase the level of expectation and perception of public-interest architecture realized through academic programs, non-profit[3] organizations, and professional practices. In turn, this has noticeably influenced educators to carefully consider how academic architectural design problems can, not only continue to thoroughly prepare architecture students with sound, foundational design principles and skill sets, but also substantively involve them in instructive projects that apply research and serve the public interest well.

COMMON RECENT HISTORIES

Initiative reCOVER is a design/build program founded in 2007 to assist relief efforts in underserved communities through partnerships with communi-

ty-based organizations. Based on the belief that design and building processes are interdependent, reCOVER promotes collaboration grounded in thoughtful research, substantive dialogue, and direct community involvement. To ensure diverse and effective design development and implementation, faculty and students work to maintain a collaborative design approach and constructive interdisciplinary cooperation. Interdepartmental teaching and research between architecture and engineering is an important component of the program and essential for the initiative's three principal goals: first, to positively affect the design and building of safe, healthy, and sustainable communities around the world through partnerships with non-profit, humanitarian organizations; second, to focus students' attention on real-world and hands-on building projects and experiences in service of a comprehensive architectural education; and third, to work to advance translational research in the areas of building materials, methods, and technologies in the discipline of architecture. The combination of these goals in service of transformational, educational experiences directly influences the structure and content of the courses that are part of the program.

Founded in 2006, BT is an international social-profit organization encouraging philanthropy among young people by raising awareness and funds to build and support educational infrastructure projects for underserved children in sub-Saharan Africa. Under the BT model, donor communities, largely consisting of university campuses, raise the $45,000 needed to construct a primary school and the local community contributes 25,000 hours of unskilled labor to the project. Committees of residents and local leaders are established to oversee the various aspects of planning and construction. To date, BT has built classroom space for over 1,000 children with hopes to double this number in the next year.

A commitment to the environment and the communities in which they work has always been at the heart of the Arup ethos; it defines the approach to their work, clients, partners and colleagues. In 2006, to highlight this commitment to society and to celebrate the 60th anniversary of Arup, the firm launched a new initiative called "The Arup Cause;" created to enable and structure opportunities for their staff to effect positive change in the developing countries, The Arup Cause particularly focused on projects that provided better access to safe water and sanitation. Working with in-country NGO's and local communities, The Arup Cause currently has over 30 projects around the world where it supports a range of project scopes including providing specialized technical design services, project management, communications support, and financial assistance. In its first year The Arup Cause raised over £100,000 to contribute to ongoing projects in regions of the world with the greatest needs and represents a commitment to help 'shape a better world'[4] by bringing about positive change through design services and educational programs.

PREPARING FOR COLLABORATION

In the spring of 2007, reCOVER and BT began planning the design of the primary school building through informal conversations with engineering students involved in the organization's university chapter. Additionally, an engineering course was established by a faculty member in the School of Engineering and Applied Science for the fall of 2008 to conduct research and development in the area of renewable energy and water filtration systems for the eventual design of the primary school. The architectural studio comprised of architecture and engineering students in their final year of undergraduate study was held the spring of 2008. During this semester, an engineer from the Arup office in Cardiff joined the team to assist with the school's structural design. Designing a building on a remote site and for an unfamiliar culture and community challenged everyone on the team to learn as much as possible in order to responsibly inform the design of the school. The unfamiliarity with customs, traditions and local building materials was significantly alleviated by the extensive collective experiences of BT and the Arup Cause program with building and community outreach in the country of Uganda. Other factors that helped inform the design process included a visit by BT in-country director Joseph Kaliisa to the University of Virginia during the fall term of 2007 as well as a site visit to Gita by a group of architecture students and faculty member during the spring term of 2008. During this visit, the building site was carefully studied, a professional site survey was conducted and local resources, building materials and supplies were preliminarily identified. As part of a multi-year partnership between reCOVER, BT, and The Arup Cause, this first building project provided invaluable experiences and information. With compre-

hensive building experience in the region, the Arup engineering consultant provided vital information to ensuring the construction of a sound structural system, the coordination of the architectural design with local engineering skills and abilities, and the integration of the structural and architectural systems. Numerous exchanges over the duration of the project provided architecture and engineering students a set of meaningful experiences with many of the school's beneficiaries, including parents and children. Students experienced the value of working closely with the community and experiencing the Ugandan culture, one distinctly different from their own.

Traditionally, NGOs working on a global scale appeal to students fundraising in support of an array of programs. Many of these programs, though certainly essential to the livelihood of the respective population, are seldom tangible in nature – once students make the investment of time and hand over the funds they've raised, they are unable to visibly see the fruits of their labor. Since its inception, BT's goal has been to not only create the tangible link between a US and Ugandan community, but to also instill the notion that philanthropists who apply lessons learned in an academic setting are just as well-equipped to make a lasting social impact as the financially well-endowed philanthropist. This philosophy is best demonstrated in BT's partnership with initiatives such as reCOVER. Working with a chapter of committed campus leaders raising funds for the construction of a new Gita academy in Uganda, senior level architecture students in reCOVER were an important part of a unified campus approach to tackle what has been dubbed by the World Bank as humanity's largest construction project to date[5] – building enough classrooms to meet the Millennium Development Goal of providing universal primary education to every child worldwide.

BT commitment to bringing the safest, most innovative, and cost-saving school building designs to Uganda is empowered in doing so by the partnership with reCOVER and The Arup Cause. By engaging architecture and engineering students who are still in the classroom themselves, they are able to provide the most meaningful insight necessary in designing a positive learning environment that can be used well into the future. This full-circle approach to the work is central to the goal of not only providing a learning experience for children in Uganda, but also for students in the United States as well.
When it comes to the importance of collaboration between architecture academia, NGOs and professional engineering firms, this relationship needs to go well beyond the traditional corporate partnership.

> By opening design up to collaboration, we arm ourselves with the greatest number of strategies, skills, perspectives, and tools available, and we guarantee that those tools can be freely distributed and adapted by local teams, on the ground.[6]

The potential of creating multidimensional partnerships with long-term value, field-tested, problem solving capabilities, creative thinking and knowledge sharing is substantial. It is critical though to carefully consider local, traditional social structures and skill sets. By recognizing and addressing, at the outset of the process, that there are central issues in managing community-based projects helps synchronize a design team to work toward mutually beneficial outcomes. Time zones, cultural differences, building standards and challenging communications networks all add to a project's complexity; challenges which may be easily overcome in a 'western' context with a design team on site can often cause long delays on sites in remote, rural communities. A big challenge for project teams is to try to minimize these potential construction delays by incorporating adaptive aspects into the design that can be adjusted, altered or all together modified in the field according to cultural or environmental factors. This is a central aspect of the learning experience on the part of all the stakeholders, not only the beneficiaries of the project.

Figure 3: Lifting purlin into place

SITE AND CONSTRUCTION CHALLENGES

Before a shovel meets the ground, BT has an exhaustive assessment protocol that is followed. Included in this protocol is a needs-based assessment of the local area in addition to a feasibility study for the specific plot of land provided. BT invests a significant amount of time thoroughly considering a number of aspects that are important in the construction process including the grade of the land, proximity to a borehole or water source, proximity to a main road, and the condition of the road to be eventually used by delivery vehicles. Unfortunately, most plots evaluated and offered to BT to be considered as potential building sites do not meet these base standards. Sites that pass the preliminary evaluation then go through a series of verifications which BT ultimately must confirm before permission is given to begin construction. Due to the length and unpredictability of this process, it can often take months to approve a specific site for a project team to begin to use as part of an extensive site analysis and design process.

Uganda is primarily comprised of rural communities who rely on subsistence farming to sustain their hand-to-mouth existence. Numerous local communities have suffered greatly in recent years, both from activities of civil war and more recently due to protracted periods of drought. Compounding the strain on these communities is a low primary school completion rate of 54%.[7] Access to vocational training in bricklaying and carpentry, for example, is extremely limited and not economically feasible for most Ugandans. For this reason, a considerable building challenge to overcome in remote, rural communities of the Wakiso district is the availability of skilled masons and carpenters. This in no way discredits the resolve and determination of the Ugandan people to overcome these challenges and improve their quality of life through the built environment. As an example, the construction of the Gita primary school was greatly supported by local volunteers who acquired construction skills on the job from the skilled builders hired to lead the construction, ultimately benefiting all parties involved in this collaboration.

Despite the difficult construction climate BT finds itself operating in, the organization's in-country director and ground staff has created a rigorous set of guidelines that must be followed at each site. Whether it concerns the layout of a construction perimeter or provisions made to save and efficiently store underutilized building materials, BT works diligently to minimize waste. Regulating to the degree that it is possible, it is important to realize that changes in a building culture and mindset that typically resists innovation and change, is a gradual process. Frequently reoccurring power outages, lack of electrical service altogether, or exorbitant rental fees for electrical generators further add complications to work flow and precision of construction at these remote construction sites. This requires creative thinking on everyone's part to adjust construction details to meet baseline safety specifications and performance. Other daily challenges faced by construction crews can be as straightforward as trying to overcome high heat and humidity levels or as complicated, and potentially dangerous, as managing and lifting large, cumbersome or heavy building components without crane and rigging equipment.

Figure 4: Timber trusses ready for final installation

These site and logistical factors have directly influenced the overall design of the building; spans and heights have been determined based on the general use of hand tools and safe lifting distances for small groups of construction workers and volunteers. Lightweight construction of reasonably small, repetitive building components (i.e. 14 identical wooden roof trusses) or location of the building on the site to minimize the amount of cut and fill (which was completed with small shovels, pickaxes and pans) were carefully considered throughout the

design process. Managing the building sequence as a set of small projects with daily or weekly goals proved to be an effective onsite construction strategy. These smaller and more manageable mini-projects also helped overall crew morale as they were able to accomplish discrete goals on a more frequent basis. Volunteer cooks prepared meals throughout the day for construction crews, an important social component on the building site.

INCREMENTAL IMPROVEMNTS IN BUILDING TECHNOLOGY

Significant technological improvements are being made in the area of construction methods, materials, and building components and have had a substantial effect on the quality of construction in the region. For example a move from using locally fired bricks, which can be somewhat brittle and susceptible to cracking and splitting, to the use of "interlocking stabilized soil blocks" or bricks (ISSB) have improved stability and precision of load bearing, masonry wall construction. ISSB building components are more stable bricks made with the use of a hand press and air dried; this process avoids the use of stacked-brick kilns. In turn, this new building unit reduces the quantity of raw materials required such as cement (less mortar is required in the brick laying process) and the detrimental impact on the environment. Since the process does not require a kiln to fire the bricks, a large amount of wood (usually harvested from the environs) is spared. The bricks can also be made on site avoiding transportation costs, fuel consumption, and material damage – the result is a site-made building product with greater integrity, accuracy, and durability. Additionally, once the new technology has been effectively demonstrated, acceptance becomes more widespread; the ISSB press can then be left with the local community after the building is completed so that they can use their new skills to set up a cooperative business to make brick and block for nearby communities. This further supports new entrepreneurial ventures and generates new income streams for the community. Although this versatile building product was not used on the school for the community of Gita, it has influenced the process going forward and subsequent school building designs. This iterative process of demonstrating and acquiring new building skills has also helped local communities to collaborate with each other by exchanging ideas and advancing building methods and material applications.

A number of site strategies were employed to make the design a more effective building process and improve the overall environmental performance of the classroom spaces. As mentioned above, an optimal placement of the building on the site accounted for the existing topographic conditions and resulted in the least amount of overall cut and fill required for the foundation and terraces. Additionally, the orientation of the building was studied to minimize the amount of solar exposure specifically during class times. This optimization was achieved by orienting the building 31° from north and introducing a 45° rotation in the brick pattern constituting the majority of the walls of the west-facing façade of the building. Also billed as a cost-cutting measure, the introduction of the rotated brick pattern was initially met with great skepticism by the general contractor and masons. Today, the technique has been viewed as an effective way to increase natural ventilation and reduce direct thermal loading and glare in a classroom. This simple example has, in many ways, introduced an innovation into the local building community which otherwise may not have existed, or been as widely accepted as it has become now.

Terraced land around the school building has been slated for future cultivation. The tropical climate of the region, two annual harvest cycles, rich soil and access to water will make this possible. After the Gita primary school opens, the NGO hopes to work with local community leaders to lead extra-curricular agriculture classes on the terraced, three-acre site. The purpose of these classes will be two-fold; first, to provide new skills and techniques that can be useful for students whose families are subsistence farmers, and second, to help form a vocational training program for students who may not pursue continued education. While currently in the early stages of planning, this productive landscape component of the school has been carefully considered throughout the design process and has influenced the placement and orientation of the building relative to the future agricultural plots.

At the same time, there were aspects of the design that were the cause of significant construction delays and confusion between the general contractor and the project team. The most poignant example is that of the roof's truss system made from eucalyptus wood. Despite detailed drawings, "how-to" diagrams, and assumptions made by the project team, the assembly of the structural building components

were not mutually understood when the construction began. The result was a series of inconsistencies in the overall quality and precision of the wooden trusses and a deviation from the technical specifications of the design. A lesson learned was that even with concerted oversight, the precision and accuracy with which such a system is represented in the construction document set may not necessarily ensure the same level of accuracy in the construction of the final product. The challenge, therefore, is to strike a careful balance between extending the capabilities of local building practices and component detailing while ensuring the sound construction of pragmatic and well-integrated design solutions into the community. The NGO's in-country director played a critical role in helping manage more technical construction details throughout the building process; by working closely and supporting the community leaders and stakeholders, the in-country director sustained a constructive, professional dynamic and in so doing helped maintain a focus on the collective goal. Direct, daily involvement of the local community in the construction, management and decision-making process was an essential component for realizing this project.

Figure 5: View of primary school from southeast

GOING FORWARD

With every project completed, the collective experiences of reCOVER, BT, and The Arup Cause have helped bring a new awareness to this process. Understanding how to better manage resources and overcome limitations to support local construction teams on the ground were invaluable lessons. The challenge for future projects will be how to more effectively communicate with the beneficiary community and manage these factors as an integral part of the design process without limiting ingenuity and innovation. Along with the community, the design team which comprised of architecture and engineering students, faculty, and professional architects and engineers gained a great deal of experience from negotiating the constraints placed on the scope of the overall design. Overall budget, readily available equipment, tools and materials, local construction capacity and skill sets, cultural customs and traditions, and a host of other geographic-specific characteristics profoundly affected the design process and outcome. These key factors will continue to have a strong influence on future projects; the extent to which all partners involved in the process are able to synthesize these influences as part of an overall objective will factor into the continued effectiveness and success of such initiatives.

ENDNOTES

1. José L. S. Gámez and Susan Rogers, "An Architecture of Change" in *Expanding Architecture: Design as Activism*, Edited by Bryan Bell and Katie Wakeford, (New York, Metropolis Books, 2008) p.23
2. "Millennials exhibit distinct learning preferences identified by Oblinger (2003) and Brown (2000) such as preferring teamwork, experiential activities, structure, and the use of technology." By Diana Jonas-Dwyer and Romana Pospisil, "The Millennial Effect: Implications for Academic Development," "Millennials exhibit distinct learning preferences identified by Oblinger (2003) and Brown (2000) such as preferring teamwork, experiential activities, structure, and the use of technology."
3. "Nonprofit should be nonexistent — the term, not the type of organization. The time is right to insist on a term that focuses on the investment, risk taking, and entrepreneurial imagination that have always been so essential to organizations that serve the social good. 'Social-profit organizations' is a term that can better capture the contribution made by entities that have too long been known as charities or nonprofit groups." For an elaboration on the term "social-profit" and its proposed replacement of the term "non-profit" see Claire Gaudiani's article "Let's Put the Word 'Nonprofit' Out of Business" in "The Chronicle of Philanthropy," July 26, 2007
4. "We shape a better world" corporate identity derived from the values presented in the "*The Key Speech,"* delivered by Sir Ove Arup on July 9, 1970 at a meeting in Winchester to his partners from the practices around the world. In the speech, Sir Ove Arup set out a

series of goals and talked of the spirit of the firm going forward.

5. Serge Theunynck, "Education Notes," The World Bank, August 2003 (This note series is intended to summarize lessons learned and key policy findings on the World Bank's work in education. The views expressed in these notes are those of the authors and do not necessarily reflect the views of the World Bank.)

6. Cameron Sinclair, "Open-Source Humanitarian Design" in *World Changing – A User's Guide for the 21st Century*, Edited by Alex Steffen, (New York, Abrams, 2006) p.216

7. The World Bank Group 2005 Data Profile Report Online(http://ddpext.worldbank.org/ext/ddpreports/ViewSharedReport?&CF=&REPORT_ID=9147&REQUEST_TYPE=VIEWADVANCED)