



Home Experiments: EarthBag Construction as Teaching Tool in Rwanda

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Yutaka Sho is a partner of GA Collaborative, a US-based design firm that works with non-profit, municipal and academic partners. In Rwanda GAC is building a village of 50 homes with an association of builders and architecture students. She has researched and practiced in Bangladesh, Japan, Lebanon, Turkey and Uganda. She received a bachelor's degree in landscape architecture from Rhode Island School of Design and a master's degree in architecture from Graduate School of Design at Harvard. Sho is an assistant professor of architecture at Syracuse University in New York.

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This paper investigates the meanings of *home* and *field* in architectural and engineering designs in international development. Academic research in the humanities and science disciplines tends to situate the home and the field opposite of research activities. The home is a stable and controlled laboratory for analyses and theorization while the field is where raw data and observations are collected. For architecture and engineering disciplines (or design disciplines in general), however, the separation is not as clear. For design, the field usually means job sites where designs are built but also where ideas are tested, verified, improved, and either brought back to inform the work at home/ studio or new designs are improvised according to the field conditions. The field-work permeates home as well. At home /studio at design firms or universities, radical innovations in structures, forms, theories, materials and their applications are rigorously tested, data is collected, effects are critiqued and designs are advanced. For design disciplines, the home and the field overlap.

As western design expands its global reach, the disciplines face new challenges. In Rwanda, on which this paper will focus, 40% of the federal budget comes from international aid and development projects depend on the state of foreign affairs. Under such precarity, design disciplines often struggle to integrate local participants as primary project drivers. Design and construction knowledge, experience and jobs could leave with the foreigners who brought them. In these global projects, the West receives praise in case of success while risks befall on the locals in case of failure. “Home” in this context is found in the West where designers manage projects in the distant field of developing countries. The unique overlap between the home and the field of design disciplines are undermined by the global political and economic hierarchy.

In nations like Rwanda where a significant part of construction projects are supported by foreign aid, home gains yet another meaning for local residents. The domestic space of home becomes contested by global development ideals such as those crystallized in the UN’s Millennium Development Goals, the local powers’ competition over foreign aid, and residents’ aspirations for better lives. The idea of home is especially conflicted since the 1994 genocide when more than two million people returned from exile to destroyed houses. For newly- minted design disciplines in Rwanda, home is an uncharted field in which ideas of development and the memories of the past violence struggle to cohabit.

In this paper I examine trans-cultural construction projects as the framework for architectural and engineering experiments. GA Collaborative or GAC, the nonprofit design firm I co-founded, used the construction of a prototype home in Rwanda as an educational opportunity for local design students and for western designers. In the West where property owners have more

autonomy, residential projects are often the site of experimentation for designers. The home's private nature grants freedom from cultural norms and its modest scale allows radical innovations. But in a low-tech, low-income setting where people build their own houses, such as in rural Rwanda, the skilled labor, resources and experience required for such experiments are difficult to find. Yet without the experimentation in affordable home construction, any meaningful sustainable development is unattainable. And without local designers' involvement, the knowledge will be lost when foreign designers depart. Students at University of Rwanda are trying to change this trend.¹ UoR hosts the nation's only architecture department and the most prominent engineering school. Determined to rebuild their country and wrestling with pressure to develop, students re-define and re-justify their roles daily. Using my teaching experience at UoR in 2011 and GAC's prototype housing construction with UoR students in 2013, I critically examine our work to investigate an alternative model of engagement between western designers and local stakeholders.

Field-Work

Study abroad courses have been part of western education for centuries. With increased communication and awareness of environmental deterioration, the need to understand resource-deprived areas of the world is felt more urgently today. Research studios offered by universities and internships with transnational and charity organizations are only a few of the opportunities offered to western students. They face the same challenge as international development projects. Curricula are often structured to collect data in peripheral locations in contrast to a centralized studio common to the intellectual environments of the West. Findings are compiled and presented at expert conferences miles away from the field. Most studios do not build, and their audiences are understood to be their western colleagues.

This binary of field and home in design has been under scrutiny.² Clear demarcation of the field (often in developing countries) from home (often in the West) assumes the intellectual dominance of the latter over the former. As geographer Jennifer Hyndman states, however, "this separation is untenable when cultures come to occupy the same spaces," such as in cross-cultural construction projects.³ Western humanities researchers have been wrestling with their outsider status and the gap between their academic gaze over the research subject. Humanities researchers disclose their background before the research begins as a necessary measure for ensuring transparency of biases. Although the global reach of western designs has been celebrated for some time, architects and engineers have been slow to deal with such a cultural dilemma. Design disciplines often neglect to situate themselves and their biases in the context of the field and assume that design is a universal language. It is not in the designers' habit to contemplate that, while their knowledge may be factually true, it may not be appropriate in the field.

Research studios in non-western countries have become regular offerings of western universities. Notable are ETH Studio Basel headed by Herzog and de Meuron, Goldsmiths University's Forensic Architecture by Eyal Weizman, Harvard Projects on the City by Rem Koolhaas, Earth Institute with GSAPP at Columbia University, and numerous other one-off programs.

Perhaps the best known, Koolhaas' and Harvard's research in Lagos, Nigeria has received objections from outside of the design disciplines equal to praises from within. One often cited contribution to the disciplines is that the project opened the doors to geographic areas outside of conventional western tenets of the time, in 2001. While it is certainly a necessary change, it elucidates western discourse more than African discourse for which the issues have been urgent all along. Critics argue that historical, economic and political palimpsests, their present and possible impact, and basic scholarly research on those topics have been systematically ignored by the Harvard team.⁴ The research focuses less on Lagos and is more about how Koolhaas observes and speculates about it, indicated by his reflective voice-over that permeates the film "Koolhaas: Lagos Wide and Close."⁵

Those of us whose home and field are separated by geographical, cultural and political distance face the same challenge. The Lagos research by Harvard team teaches us that the distance itself needs to be critically examined. The purpose is not to eliminate it. Rather, distance and difference between home and field should be used as a tool to create work rooted in connectivity between the two. This is where my teaching goals and methods in Rwanda originated. I worked with Rwandan students to document spaces where global development pressure, local desires for equity, and everyday routines met. In image and text, students engaged with political, economic and cultural forces that shaped their built environment.

The Rwanda Picture Project

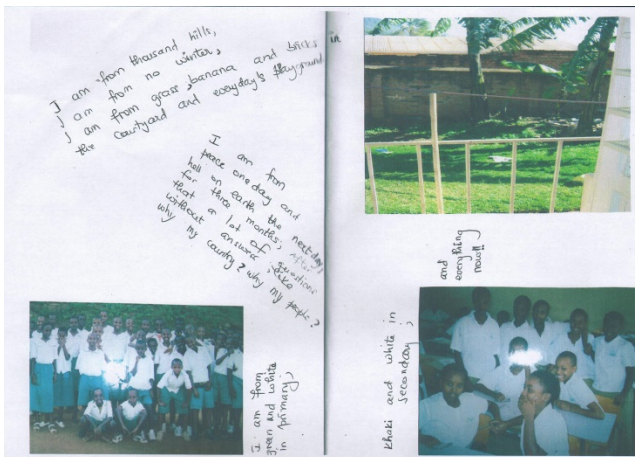
In 2011, I taught an architectural theory course and a design studio at University of Rwanda, the young and only architecture program in Rwanda. Expecting to reinvent the country, UoR tries to customize the architectural education based on the cultures of the industrialized countries, in the language of the global economy - English. There is no doubt that the faculty at the architecture department aspires to be diverse in their approach. Yet colonial power relations persist in the learning environment. During my tenure most of the faculty was westerners, and most of them high-ranking including the head of the department. Each faculty member sought an alternative curriculum and my theory course was likewise an attempt to bring forth students' voices in shaping of spatial thoughts.



“13 WAYS OF LOOKING AT FIRED BRICK”

By Murama Jacques

When looking at KHI square you see a brick
 a brick is not broken, a brick is brown
 a brown is Rwanda soil, Rwanda product
 product produced by browned head
 brown brick has lost his source, is on black ground,
 black imported from abroad
 black paving is not my preference, but happened many
 years ago
 brick is never black, black is not soil, is not good
 black is hot, brick is cool
 between black and brick is green, green is respected
 and restricted,
 is interesting but inaccessible, serves less than black
 only allowed trees have access into green
 green its self is not selective, is selected to be selective
 green is home of smallest organisms, green is not my
 home
 brick is my home, my home is brown
 brown as my ANDAZI
 ANDAZI is my strengthener, my food
 brick is fired, andazi is fired
 through fire I eat, I live
 brick is never hot or cold, brick is good provider



“I am from”

By Gwiza Flavia

I am from thousand hills,
 I am from no winter,
 I am from grass, banana and bricks in the countries
 and everyday's playground
 I am from
 peace one day and
 hell on earth the next day,
 for three months; after
 that a lot of questions
 without answers, like
 why my country? why my people?
 I am from
 green and white
 in primary;

khaki and white in secondary;

and everything now!!

Figures 1 & 2

We began with the students taking photographs of the everyday Rwandan environment such as homes, streets, new high-rises and roundabouts. They then depicted the photographs in free-form text in English - a third or fourth language for most students (Figure 1 & 2).⁶ The curriculum was adopted from the Photography and Literacy (PAL) Project by Stephen Mahan and Michael Burkard, a photographer and a poet respectively, originally created to give voices to inner city immigrant students in upstate New York. While drawing and writing may intimidate students, the ease of pressing the button on the camera and composing grammar-free text liberated them. Rwandan students' work shows their homes, families and domestic objects; students embraced and reflected on the nature of their living spaces, and how they negotiated the ideal development model with the West. The exercise was followed by theory readings mostly from the West about spatial relationships such as corridors to rooms, details to whole, and private and public.⁷ Western architectural theory, although ignorant of Rwandan realities, helped frame our discussions about what unique factors may have caused spatial manifestations in Rwanda differently than those in the West. The aim was to picture and to write about design agency for a Rwanda borne of connectivity with the West, not in its shadow or in isolation.⁸

The theory course was a critique of Western preconceptions of African spaces and vice versa. The PAL technique helped westerners to think with Rwandans about how the western media portray Rwanda and Africa in general. It gave Rwandan students a rare opportunity to question, however quietly in a country that censors speech, the ideology of development armature in post-conflict Rwanda. The student work that came out of it resisted simplification and the reduction of their motivations and creativities for their built environment. It drew a complex relational diagram of social practices, political histories, cultural instincts, landscape, buildings, material nature and students themselves.

In our prototype construction in 2013, we learned from Rwandan students and encouraged various forces to manifest in our modest home. Student interns were drawn to the government's call for development as well as toward the voices of rural people to whom they belong. The cost of imported materials controlled the design; the urgency of environmental sustainability was linked with sustenance farming; pervasive local favoritism confronted the villagers' aspiration for equity; and they all intertwined in our small house. When we introduced the innovatively engineered EarthBag construction, it became an outlet for the above forces to materialize. The context for our project, however, was regulated by Rwanda's ambitious housing policies.

Housing in Rwanda

The Kigali City Masterplan was a collaborative effort between US-based companies including OZ Architecture and Engineers Without Borders.⁹ Surbana from Singapore developed it and Rwanda's Ministry of Infrastructure is implementing it. The award winning plan was funded by the African Development Corporation and the World Bank. As part of Vision 2020, Rwanda's

official development guideline that reaches all areas of life, the masterplan has been radically altering the Rwandan built and natural environment since 2008. Housing policies are closely controlled by Vision 2020.

The streets of Kiyovu, near the city center in the capital city Kigali, wind between well-tended trees and tall concrete walls. On the gates are names of NGOs from “developed” countries in the East and the West, and their large estates stand in place of overcrowded self-built settlements that were cleared according to the masterplan. Land owners were able to move to new government funded villages. The landless, however, were left with little choice but to rent further away from familiar neighborhoods and amenities. This is a result of a housing policy called *imidugudu* or villagization in which the Rwandan government relocates all of its twelve million citizens to planned settlements. Despite the government’s effort to supply infrastructure, which is the main argument for consolidated settlements, most planned villages lack water, electricity, sewer and reliable bus service years after the project’s implementation.

Many UoR students live in boarding houses in self-built neighborhoods near the university. They live in rooms big enough for a bed, and share latrines, bath and kitchen. Walls are made of sun-dried adobe blocks which were recently outlawed for their erosion-prone nature. Kiln-dried bricks are expensive, however, due to the cost and scarcity of firewood. Between tightly packed houses, unpaved steep paths double as run-off gutters that alter their course after each rain. Despite their small size and high density, single room rental units are necessary not only for students and migrant workers in urban areas but also in rural villages. Without the means to build a home for the new family, low-income men cannot marry in Rwanda. While single women may live with families as domestic help, single men live in boarding houses. Another problem with the government villagization projects is that they do not provide options that respond to the trends in economy and design.

EarthBags

Eternally Solar in South Africa modified polypropylene bags for EarthBag wall construction and has been implementing them in low-cost houses ever since. We invited their affiliate contractor EarthKhaya to lead the workshop for the residents of the Masoro village, about 20 km north of Kigali. EarthBag’s simplicity – stuff, stack and tamp the bags - enabled unskilled villagers to participate in the construction of a prototype house for their own future homes. The project aimed to assist villagers and UoR students to take a step toward taking control of their built environment.

Eternally Solar adapted an old military bunker construction technique by introducing two simple stitch lines, dividing 30cm-wide polypropylene bags into three equal tubes. The outer tubes are stuffed with the sifted site soil, and the soil is placed from the outside on top of the middle once

the bag is laid. The ridge in the middle connects the overlapping top and bottom bags, eliminating the need for barbed wire used for the previous type. Unlike Hydraform, the blocks of mixed mud and cement used in government housing, EarthBags do not require machines that consume fuel. Cement, gravel and steel reinforcement is necessary only at the foundation, sills, lintels and wall tops where roof rafters rest. Rafters are tied around the top layers of bags with hoop iron.

If protected from UV light by plaster, polypropylene is proven to last over fifty years.¹⁰ A product of petrochemical waste, polypropylene is strong and light weight and used for carrying vegetables and charcoal everywhere in Africa. For Rwandan projects it is available in neighboring Uganda whose border is an hour's drive from Kigali. EarthBag walls are water, fire, termite and bullet proof.¹¹ It has superior thermal and acoustical insulation quality. After the finish is applied they appear exactly as masonry walls, celebrated for its performance and its "developed" look in Rwanda. The technique does not require builders to read or write, and just a basic understanding of geometry is needed. The cost is in intensive labor but not in large tools or in materials. Made of industrial waste but avoiding the stigma of the "poor's material," they offer an alternative solution for environmental, economic and social sustainability in resource deprived areas.

Student Interface

Student interns were able to relate to the Masoro villagers in ways that we never could, and they quickly became the real face of the project. Of four interns, only one of them had building experience. But each developed their own expertise in the field during fact finding, sub-contractor coordination, worker training and negotiation with local powers. Our EarthBag home project offered learning opportunities for them in at least three ways, though they often overlapped: structurally; socially; and by transforming otherwise autonomous design disciplines.

First, students mastered the structural understanding of EarthBags and general building process. When introducing new construction techniques such as this one, they require peer-review, improvement and dissemination by the entire building sector. It is not enough to solve local economic and structural shortcomings but should be made available to a wider audience to benefit the nation and the region beyond. Students, soon to join the first generation of Rwandan architects, were the first to learn the technique then translated and transmitted it to the villager-builders. In addition to acquiring the knowledge, they had to adopt and appropriate it in order to accommodate local conditions. For instance, Masoro is near a tin mine. The rocky ground gave us back pains after weeks of digging with hand tools. Thanks to the rigidity of the ground, however, the floor did not require hardcore surfaces. Instead, a damp proof membrane was laid directly above the flattened rock and soil-filled EarthBags on top, a technique that students and the EarthKhaya consultant innovated. On top of the EarthBag sub-floor, the compacted earthen

finish floor was laid, another unfamiliar practice.¹² When faced with the difficulty of fetching water at a distant pump, a small pool was dug and secured with EarthBags, returning to its original application in soil retention. The construction process advanced both the EarthBag application and the students' professional practice abilities.

Second, within the three month construction period students learned to think through the social and cultural impact of the construction process. As elsewhere in the world, construction is a male-dominant profession in Rwanda. Immediately after the war, however, Rwandan women found themselves to be 70% of the population, tasked to rebuild their destroyed land with limited experience: previously women were not allowed to own land or business.¹³ Gender issues were always in the foreground in our project, and students assumed the roles of tutors to training women in skilled labor and in managing positions. The use of weaving in our house was another opportunity to engage women in Masoro who were skilled in basket, bowl and mat making with local materials including sisal, reeds, banana leaves and papyrus. Although a sophisticated and common trade, weaving has not been explored for its alternative applications, such as in construction, since the precolonial era (Figure 3).¹⁴ Furthermore, it is labeled as women's work. Taking advantage of the skills that many of the villager-workers already had, sisal weaves were applied as screens in front of the kitchen and bath, and to divide the hall from the exterior to breathe air and light into the heavy interior of EarthBag structure (Figure 4). Given the UoR students' design, the association women figured out the appropriate weave and executed it. Their collaboration resulted in transforming object making skill to space making. One student took the idea further and deployed it on a piece of furniture that changed from a bed to chair to a table, to be used flexibly in limited space (Figure 5).



Figures 3, 4 & 5

In addition to the work on site, students were integral to coordination off-site. Their knowledge of Rwandan domestic habits and constraints in the building sector were critical in programming and planning of the new home. For instance from the joint workshop between students and the villagers we learned the need for rooms for single men and created bedrooms with individual exterior doors. They bridged between English and the local Kinyarwanda, but more importantly they were able to negotiate between design and unskilled labor, to bargain prices, and navigate government bureaucracy.

Our commitment to teaching villager-builders construction skills had an unexpected social outcome. Our 50 participants were extremely poor, for the lack of better word. They were so poor that even though they were given mere 50 US cents per day for their backbreaking work, they would never miss a day. Because of their material poverty, their social and political status in the village was low. However, upon completing the EarthBag workshop and encouraged by the quality of the house they had built, they established a professional association to build and teach this new construction type in Masoro and eventually everywhere in Rwanda. They realized that their skills to alter the built environment will lead them to new jobs and give them a unique voice in their community. Although the new association will face many future challenges, the event offered a measure of success for participatory design and construction processes.

Third, the need to communicate with uneducated, unskilled villager-workers pushed students to question the discipline's conventions and its communication tools and invent alternative methods on their own initiative. In fact, it was an easy leap for the Rwandan students, themselves from villages, to see the limits of design tools. It was us western designers who gained a valuable realization to open ourselves for better communication.

In the middle of the construction process, the design team invited all of the 50 villager-workers to participate in the design workshop. We asked them to first draw the houses they live in, then to draw their dream home. Some were too shy to draw. Many responded with elevations from multiple points of view showing multiple facades in one drawing. It became clear that plan, section, axonometric and perspective drawings were foreign to them. One of the villagers could not write, read or draw and that factor discouraged her from participating. The design team finally realized the enormous challenge that stood between people with limited access to education, in Africa or elsewhere, in taking control of the decision making processes regarding their built environment. We also came to see the insufficiency of conventional design tools in creating an equal platform. One of the student interns gave her a stack of blank paper. She began placing them on the floor in arrangement of her house. She told the program of each room to the student, and a pad and pencil in hand, the student transcribed the plan according to her description. Although simple, the student's innovative communication could not have come out of a hierarchical relationship that often divides academia and the uneducated client. Here the designer/ contractor took on a role of a facilitator and a proxy who spoke in his client's stead.

In study abroad courses offered in the West, it is doubtful that such congruency of interests and sharing of urgency could occur. Yet for UoR students Masoro was a field first, experimenting with a foreign construction technique and suddenly and fully immersed among numerous stakeholders outside of their familiar studio. In the process of construction, however, the workshops and countless reviews of the day's work allowed our project to oscillate between fieldwork and design forum, or embedded forum in the field.

The same student who assisted the villager wrote the below text reflecting on his experience in the project.

Home is made in a country where Security is huge investment,
Fear to live more days, keep quiet to hide feelings,
J.M.V, young but with muscles, effective
Old men Rugiracyane, Nice smiles to hide inside suffering emotions,
Suruduwiri (local beer) as Lunch.

Home is made by Mud above Tins mines,
Sweat and dust mixes,
Rocky soil digging, hope to find minerals

Home is made of experiments, from waste to effective materials,
Strings for alignment, levels for plumb,
Tamping for resistance

Home is made of reminders, Instantly give love to corner guides,
Dunhill for a little break, chips are the best, Music to feel better.

Home is made of endless process of finding construction sites,
Official's criticism but not promising,
Thousands spying visits,
Umuganda an impressive nice move,
Rooms for bosses not for homeless.

Home is made of Rose's nice dances, Francoise eager, Scott's trumpet music, Kassim's
crazy driving
Gapita a courageous deaf kid, French talking mothers while weaving

Home is made by white men smelling the site's dust,
Hope and courage, wishes and dreams

Rene Isabane
Kigali, December 2013

From "Field vs. Home" to "Field/ Forum"

The Rwandan project challenges us to find a teaching model for western academic institutions to engage globally pressing issues in the field. There are numerous research initiatives in Africa by native institutions, especially in South Africa.¹⁵ But among western projects in non-western fields, the outcome has been unsatisfactory. Prevailing trends are: charity projects; indexical academic research; and touristic field-trips. After the initial research period, local stakeholders in the field often do not take equal part in the forum beyond their normal position as the object of study. The language (European) and the disciplinary tools (orthogonal drawings) distance the locals. It is difficult for western instructors and students to internalize the urgency of the risks

that the field presents. For instance, the daily risks that Rwandans contend with - material scarcity, economic insecurity, lack of fundamental infrastructure, censorship of speech and possible future violence – remain abstract for many in the West. Rwanda’s policies in service of western style development above all else also gives a skewed impression of the nation as a copy of the West, a less than equal partner. On the other hand knowledge that connects and possibly normalizes Rwanda to the western eye has faded compared to sensational reports on violence during the genocide and the post-genocide economic growth. It is tempting to conclude that it is futile for westerners to study in the developing world.

Eyal Weizman’s Forensic Architecture helps us consider an alternate approach. Among the research courses based in the West and working in non-western areas, the program by Weizman distinguishes itself from humanitarian charity, neoliberal development, or “dark” tourism. Forensic Architecture does not contrast the home with the field but interfaces between *field* and *forum*.¹⁶ Spatial manifestations of states’ and non-states’ political control over citizens are collected in the field, graphically indexed, spatialized and analyzed. Disseminations of theory and discourse are carried out in the forum in articles, seminars and exhibitions. The program understands the term *forensic* as the practice and skill of presenting an argument before a professional, political or legal gathering, inspiring its description as the art of forum.¹⁷ It suggests that forum does not take place at home in opposition to the field but is another type of field where acumens are mined, theories challenged, and politics is made spatial. Forensic Architecture revives the unique ability of design disciplines to overlap the home and field in the forum.

Designers in cross-cultural work, including western educators, wrestle with the binary of the West versus non-West when seeking new models of engagement in the globalized world. Yet design thinking must be at service wherever the interrogation of space as material witness is requested, anywhere in the world. In this context the West is no longer the sole interrogator, or non-West always the interrogated. Conflicts and collaborations originate not along longitudes or latitudes but around definitions and conditions of human rights. Researchers are asked to investigate how the built environment is instrumentalized for the purposes of impinging upon them or enhancing them. As Rwandan students were able to interrogate spaces that were made according to western development standards, architectural and engineering designers are prompted to propose tools and an open forum for critical engagement.

In such design thinking, the centrality, stability and supremacy of home/ lab and those of the disciplinary regimen are negated. By revealing how space is a political endeavor that could construct conflict, we could also suggest the opposite may be also true: design of space could be deployed to construct peace. Clues for such spaces and perhaps the beginnings of them may be already present as failed attempts within our violent past.¹⁸ Design thinking that oscillates between field and forum transforms failed spaces of violence into an apparatus for imagining a

different society via graphic and textual presentations. In a teaching and construction project in Rwanda, we attempted to apply such a method of reaping future potentialities from the violence of the past and struggles of today. UoR students' images and text responded to vivid memories of the past violence in their daily space characterized by development and surveillance. Another set of students turned industrial waste and outdated craft into contemporary construction materials for Rwanda's underrepresented constituents. Without those spaces of failure, students could not have questioned the discrepancies that persist today and motivate themselves to challenge them. Assisted by students and realizing that no powers could take away the knowledge and skills they have gained, Masoro villager-builders were able to establish their own professional association which will prompt them to control their activities and spaces. This does not justify the past violence in any way, nor does it create a linear narrative for Rwanda's development history. Rather, it makes history and today's challenges available for us to freely mine and appropriate instead of being conditioned by it. In this context a humble but important role of western designers may be to structure the project so that such experimental methods could be unleashed. Such method could render the existing binaries (West and non-West, past and present, field and home) obsolete and generate instead a new forum based on common political aspirations. Fieldwork that is capable of creating such a forum could further the roles of architectural and engineering education.

¹ Formerly Kigali Institute of Science and Technology until 2013.

² See for instance Ewing, S. et al, eds. *Architecture and Field/Work*, Critiques: Critical Studies in Architectural Humanities Series. Routledge, 2010.

³ Hyndman, J. *Managing Displacement: Refugees and the Politics of Humanitarianism*. University of Minnesota Press, 2000, 89.

⁴ For critique of the Lagos project, in architecture and non-architecture disciplines, see Joseph Godlewski, "Alien and Distant: Rem Koolhaas on Film in Lagos, Nigeria" in *Traditional Dwellings and Settlements Review*, volume XXI Number II, 2010, 7-19; Ikem Stanley Okoye "Architecture, History, and the Debate on Identity in Ethiopia, Ghana, Nigeria, and South Africa" in *Journal of the Society of Architectural Historians*, Vol. 61, No. 3 (Sep., 2002), pp. 381-396, University of California Press; George Packer "The Megacity: Decoding the chaos of Lagos" in *the New Yorker*, November 13, 2006.

⁵ Rem Koolhaas *Lagos Wide & Close: An Interactive Journey in an Exploding City*. Directed by Bregtje van der Haak, 2005.

⁶ Yutaka Sho *Spaces of Everyday Rwanda: The Rwanda Picture Project*. Syracuse: Standing Stone Books, 2013.

⁷ I failed to find African theory writing for beginning designers at the time.

⁸ The idea of Africa portrayed as the shadow of the West was inspired by James Ferguson's *Global Shadows: Africa in the Neoliberal World Order*. Durham N.C.: Duke University Press, 2006.

⁹ OZ Architecture. *Kigali Conceptual Master Plan* (Rwanda: Ministry of Infrastructure, 2008).

¹⁰ J. Arutchelvi, M Sudhakar, Ambika Arkatkar, Mukesh Doble, Sumit Bhaduri1 and Parasu Veera Uppara1.

"Biodegradation of polyethylene and polypropylene" in *Indian Journal of Biotechnology*, Vol. 7, January 2008, 9-22.

¹¹ The EarthBag Construction System has been developed with the professional expertise of Mr. Willie van Schoor, head of the Department of Structural Engineering at the Cape University of Technology. The system was the subject of study in the department of structural engineering at the university in 2008. The system was tested to Agreement Board specifications and easily exceeded the specified standards. Dr. Johnny Anderton, the director of Eternally

Solar, is in the process of completing the certification by the French Agreement Board (from an interview with Dr. Anderton in July 2013 and from Eternally Solar's brochure).¹² Earthenable from California conducted a workshop in Masoro in August 2013.

¹³ Elizabeth Powley "Strengthening Governance: The Role of Women in Rwanda's Transition: A Summary." United Nations Office of the Special Adviser on Gender Issues and Advancement of Women (OSAGI) Expert Group Meeting on "Enhancing Women's Participation in Electoral Processes in Post-Conflict Countries," at Glen Cove. (19-22 January, 2004).

¹⁴ One exception is the Kimisagara Football for Hope Centre by Killian Doherty that used weaving in screens, ceilings and lamp shades. Some of the traditional Rwandan structures were built with woven reeds. Figure 3 shows King's palace in Nyanza.

¹⁵ See especially the work from African Center for Cities at University of Cape Town: Gerhard Bruyns and Arie Graafland, eds *African Perspectives: DSD Series Vol. 7* (Delft School of Design Series on Architecture and Urbanism), Nai010 Publishers, 2013; and Edgar Pieterse *Counter-Currents: Experiments in Sustainability in the Cape Town Region*, Jacana Media, 2013.

¹⁶ Forensic Architecture's website <http://www.forensic-architecture.org/project/>

¹⁷ Ibid.

¹⁸ Walter Benjamin articulated the concept in the 19th century: "History is the object of a construction whose place is formed not in homogenous and empty time, but in that which is fulfilled by the here-and-now. For Robespierre, Roman antiquity was a past charged with the here-and-now, which he exploded out of the continuum of history. The French revolution thought of itself as a latter day Rome." From *On the Concept of History* (1940) and developed by Masachi Osawa in *Animalistic/Humanistic: 1. The Origin of Society*, Tokyo: Kobundo, 2012, 19.

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