Oswall (Open Source Wall): Rethinking Residential Wall Construction through Collaboration, Crowd Sourcing, and Iteration

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ABSTRACT
Collaboration is essential to the kind of innovative, revolutionary, game-changing innovations necessary to improve our world. When we work within the confines of our own disciplines, we forego the myriad ways other thinkers approach problems. As designers, we are trained to maintain control of our work, to be the “master builders” and overseers of everything from overall concept to minute detail. So, we struggle with collaboration and, as a consequence, miss out on the potential leaps forward that can result from having a diversity of voices at the design table. Oswall is a collaborative construction system that endeavors to leverage collaboration to make a game-changing leap forward.

Oswall (Open Source Wall) is an experimental wall prototype that challenges conventional residential wall construction through an open, collaborative approach to material, fabrication, and installation methods. It proposes an “open source” construction platform in which third-party designers, engineers, scientists, or “do-it-yourselfers” can create, produce, market, and sell “applications” that are plugged into the wall. These apps allow the end-user of the wall to customize his or her house according to lifestyle, number of occupants, season, or climate, and to draw continually on current technological innovations. Specific wall applications under development include a solar collection application, a rainwater collection application, an active ventilation application, a wind-energy harvesting application, and a passive heating application.

1 INTRODUCTION
This paper will review two previously constructed wall prototypes, Drape Wall and Cloak Wall, and will illustrate how the third prototype in the series, Oswall, will advance the research agenda set forth in those earlier projects. Oswall itself will leverage three primary developmental strategies—collaboration, crowd sourcing, and iteration—in order to interrogate effectively conventional residential construction. The paper will define these terms and identify how the authors plan to utilize them. Finally, the performance goals of the wall will be discussed in relation to larger issues of prototyping, as a recognized form of academic research.

2 HISTORY
Oswall is the third in a series of wall prototypes constructed over the past four years. While each wall was developed independently, under its own set of criteria, together the walls form an evolutionary lineage of explorations that build off one another. The first wall prototype was called “Drape Wall” and the second, “Cloak Wall.” Each has threads that inform the current Oswall scheme and, so, are worth briefly reviewing here.

2.1 DRAPE WALL
Drape Wall, completed in 2006, explores energy conservation, modular component assembly, and pre-fabricated construction for an inexpensive house. It allows for quick assembly through stackable high-strength, low-weight exterior modules, held in place by interlocking interior modules (fig. 1). A pattern of clear openings allows for light infiltration. The modules can be configured to face the sun, reducing the need for electric lighting. Holes along the entire length of the wall system open to allow for natural ventilation, reducing cooling costs. A quilt-like fabric on the interior surface of the wall creates an interactive weather seal. Through the interplay between the hard outer shell and soft inner fabric,
the homeowner can control the interior environment in response to outside conditions, such as temperature, humidity, weather, light levels, and desired views.

While Drape Wall was successful in many ways, it also had numerous shortcomings. For example, it required a rigid aluminum frame for support. As a result, it was never truly compact as a system and was difficult to erect on-site. Additionally, some of the materials in the final prototype were simply stand-ins for what was originally intended.

2.2 CLOAK WALL
Cloak Wall (fig. 2), completed in 2007, represents three primary advancements over Drape Wall. First, as was mentioned above, Drape Wall requires an aluminum frame for support. Cloak wall is self-supporting, clamped to its foundation by vertical tension cables. Second, the openings between blocks are of a fixed, uniform size in Drape Wall. The geometry of Cloak Wall’s blocks allows them to slide along one another horizontally, in order to adjust the opening size in response to desired orientation or view. Third, the surfaces of Drape Wall’s blocks are monochromatic and static. For Cloak Wall, collaboration with a computer science researcher led to the development of a sophisticated paint application. Coated with color-shifting paint, borrowed from the automotive industry, the wall surface is able to either reflect or absorb radiant heat depending on whether the sun is high in the sky (summer = reflection = light color) or low in the sky (winter = absorption = dark color).

As with Drape Wall, however, Cloak Wall still had several problems. First, the tensile structural system, as constructed, has proven insufficient, upon testing, for the support of heavy roof loads. Practically, this means that the wall still needs a rigid frame for support. Second, the theory of using color-shifting paint to either enhance or inhibit the transfer of heat is still just that: a theory. It has yet to be empirically tested, and a system has yet been developed to transfer heat from the plenum space of the wall modules to the interior of the house.

3 OSWALL: COLLABORATION, CROWD SOURCING, AND ITERATION
Oswall is the third in this series of wall prototypes (fig. 3). It addresses the shortcomings of Drape Wall and Cloak Wall while carrying forward their strengths. Three methodological approaches define the wall’s development: collaboration, crowd sourcing, and iteration.

3.1 COLLABORATION
First, as was the case with the previous two wall projects, Oswall is being developed, fabricated, and subsequently tested through a collaborative effort involving electrical, mechanical, and biomedical engineers; a product designer; an artist; an architect with significant research in materials; students; and a host of fabricators. It promises to be the most collaboratively driven of all three wall projects.
3.2 CROWD SOURCING
Second, Oswall will evolve through “crowd sourcing.” This term refers to the use of many voices, usually via the web, to generate, share, and rank ideas. Oswall will evolve out of the enthusiasm of its collaborators and from a publicly distributed call for app ideas. A website will define the project and an app, provide specifications, and then solicit input. Peers with expertise in areas such as sensor and actuator technologies, advanced and sustainable materials, fabrication, and construction will develop app ideas in detail. The most compelling apps will be worked out technically and, ultimately, produced physically for a first-round prototype of the wall.

3.3 ITERATION
Finally, Oswall will be built upon its precedents, as we learn from previous missteps, and will evolve further simply through the iterative process with which it is being developed. Through incremental advancements in some parts of the project, we can hone, in Oswall, what already worked well. By starting over on other parts and asking the “crowd” what it thinks, we can make big leaps forward. In other words, iteration, rather than resulting in a baby-stepped permutation of a nearly identical variation of what came before, can actually free up parts of a project to advance further because creative energy is focused on an unresolved portion of the design. In this case, Oswall’s infrastructure, which has benefited from the several designs that preceded it, is evolutionary. Its apps, on the other hand, will be entirely new and, thereby, can exhibit the kind of advancements necessary to address pressing disciplinary and global problems.

4 OSWALL PERFORMANCE BRIEF
As mentioned earlier, Oswall reimagines conventional residential construction. It endeavors to be cost effective, customizable, self-regulating, and minimally demanding on the environment. To accomplish this, it utilizes a porous structural framework that serves as an armature and a series of modular applications that clip into the wall and perform a variety of tasks (fig. 4). These tasks range from heating and ventilation to lighting and communication. Together, these two parts (the armature and the apps) comprise a construction system that is highly adaptable to different users and different climates, inexpensive to fabricate, easy to build with little equipment, and responsive in real time to user or contextual changes.
CONCLUSION

"Neuroscientists have shown that working with your hands exercises different parts of your cerebrum than sitting and cogitating. Ever wonder why Detroit isn’t producing 100-mpg cars? One reason might be that the engineers there spend all their time tinkering with CAD software—developing design concepts in a purely virtual sense. They aren’t ripping open cars to see what’s possible, the way those amateur ultra-mileage Prius hackers do (some of whom, by the way, have modded their hybrids to get 100 mpg)." “How DIYers Just Might Revive American Innovation,” Clive Thompson, Wired Magazine, March, 2008.

The image of networked hackers modding high-tech cars in their garages is an accurate portrayal of the spirit with which we are approaching the design, development, and construction of Oswall. We are prioritizing the unique knowledge of our collaborators, the wisdom of crowds, and the tacit information gained through iteration. Constantly evolving networking technologies and the unprecedented levels of communication they enable uniquely inform our process. As such, the development of Oswall presents pressing questions of architects today: Is our role as master designers the same as it was 500, 50, or even 5 years ago? In a climate where architects have grown increasingly irrelevant, can we reinsert ourselves as expert networkers, strategists, and ethical decision makers? Can we relinquish control over our work for the common good? Can we work in a truly collaborative capacity with others to solve the significant and real problems we are all facing?

Oswall, above all else, is an open-ended question. As the third project in an evolutionary series of projects, it is more “market ready” than ever. However, we continue to view our research as the construction of full-scale sketches. This way, we are not intimidated by failure. As Bruce Mau states in his Incomplete Manifesto for Growth, “Make mistakes faster.” This is when real progress is made and when true growth can occur. Oswall is a messy and difficult endeavor, but through the efforts of a diverse team of collaborators, its outcome will be unpredictable and novel, and, most importantly, will invigorate the debate over the relevance of academic research for architecture today.

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