Toward Stewardship: An Antarctic case study for methodologies of critical reflection across time, place, and species.

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Written by an alum who completed the design-build certificate at the University of Colorado Denver, this paper considers pedagogy and the student experience in design-build education. Examining a project from Spring 2022, an Antarctic field camp located in the South Shetland Islands, the paper argues for the pedagogical model of distributed authorship in design-build education as a counterpoint to the traditional individually directed architecture studio. In this model, students develop meaningful working relationships with their peers, consultants, engineers, community partners, and the client in order to integrate a wide array of ideas and expertise into the project. The model aims to educate well-rounded students who can enter architectural practice as effective, ethical stewards of the environment, cultivating relationships that serve the planet and treating buildings as catalysts for large-scale change.

INTRODUCTION

In 2021, Colorado Building Workshop, the graduate design-build program at the University of Colorado Denver, partnered with Bespoke Project Solutions, an Antarctic contractor, to design and build a new Antarctic field camp for scientists from NOAA Fisheries. Since 1996, NOAA Fisheries' Antarctic Ecosystem Research Division (AERD) has operated a camp at Cape Shirreff on Livingston Island, one of the South Shetland Islands. Four to eight scientists occupy the camp during the austral summer, collecting data on Antarctic krill and krill predators—including seabirds (skuas, gulls, and penguins) and pinnipeds (fur seals and leopard seals)—that is used to inform management of the krill fishery.

The existing Cape Shirreff Field Camp consisted of three traditionally stick-framed buildings, the largest of which was 470 square feet, connected by a wood deck. A fourth building, a bird blind doubling as an emergency shelter, was located about a mile from the others. After twenty-five years, the buildings were degraded, and the scientists were spending much of their field season dealing with severe water infiltration and mold growth. As a result, AERD sought to replace the camp with new construction. The new buildings are known as the Holt Watters Field Camp.

To minimize their footprint on the site, AERD divided the project into two phases, planning to construct two new buildings and demolish two existing buildings per phase. The first phase was coordinated with the 2021-2022 academic year, during which twenty-two Master of Architecture students enrolled in the design-build certificate worked on the design and prefabrication of two buildings—referred to in nautical jargon as the Galley, a kitchen and food storage area, and the Berthing Suite, a bunkhouse. The students assembled the panelized buildings on campus in Denver during a three-week summer term, completing them in June 2022.

A deploying crew, consisting of Bespoke Project Solutions, a Colorado Building Workshop professor, and program alums, subsequently disassembled the buildings and packed the materials into shipping containers. The containers were transported by truck from Denver to Long Beach, California, and then shipped to Punta Arenas in southern Chile, arriving in October 2022. In the port of Punta Arenas, the crew unpacked the containers and loaded the materials onto the deck of a chartered vessel to make the three-day voyage across the Drake Passage. Shortly after reaching Livingston Island, inclement weather halted the unloading process. The ship had to leave and return to the island three times to complete the delivery of building materials, tools, and food rations. Inflatable Zodiacs made over 360 trips from the ship to bring supplies ashore, and an ATV made 380 trips carrying loads of supplies across the final quarter mile of rocky ground to the building site. The crew re-assembled the two buildings over the next twenty-seven days, completing them in early February 2023.

This paper focuses on the student experience of the project during the Spring 2022 semester. During this period, students completed schematic design, design development, construction documents, and a full-scale mock-up. Through an analysis of teaching methodology and educational outcomes, the paper demonstrates how a structured approach to distributed authorship can help students develop mature ways of thinking about the practice of design. In particular, the paper argues that

Figure 1. The Holt Watters Field Camp in Antarctica, February 2023. Image credit: Erik Sommerfeld.

distributed authorship foregrounds relationship-building as a key ingredient in successful projects and emphasizes the contextual nature of drawing as a language of communication between authors and audiences. Centering relationships throughout the design process can enrich architectural responses to the climate crisis by teaching students to cultivate networks of care that extend beyond the building envelope.

Beginning with a theoretical discussion of the Antarctic context, the paper proceeds to introduce Colorado Building Workshop's distributed authorship model, which complicates the typical model of individual authorship present in both design studios and Antarctic architecture. A series of diagrams explain the methodology, showing how teams of students interacted with each other and with various professional partners during the project. A brief discussion of the challenges of the model follows. Finally, the paper speculates on how teachers can evolve their handling of the climate crisis in architecture education, advocating for teaching an ethic of stewardship in addition to conventional techniques for building sustainably.

CONTEXT FOR ANTARCTIC ARCHITECTURE

Descriptions of Antarctica tend to focus on absence. The continent has no indigenous human population. There are no cities and no permanent residents. There are no terrestrial mammals, reptiles, or amphibians. Few birds live outside of the marine environment. Insects are scarce, as are plants. Scientists estimate that areas of the McMurdo Dry Valleys have not held liquid water for six million years, making the region one of the driest environments on Earth.[1] In the winter, the sun does not rise for months.

This line of thinking runs deeper than noting physical and biological absences. Antarctica also works as an abstract negative, maintaining spatial and political equilibrium across the globe. With a name derived from the Arctic—which in turn takes its name from a northern constellation—"the Antarctic" conveys a false sense of equivalent, geometrically opposite regions, telling nothing of the southern continent's intrinsic qualities. The Antarctic Treaty, crafted in 1959 amidst rising Cold War tensions, sealed off the continent from becoming involved in global conflicts (Articles I and V prohibit nuclear weapons testing, among other things).[2] In dedicating Antarctica to peaceful use and shared scientific endeavors, the signatories intended to demonstrate the possibilities of international cooperation. The treaty conceptualized the continent as a blank slate on which to write a counternarrative for a global audience.

In the last decade of the nineteenth century and continuing through World War I, during a period now known as the Heroic Age of Antarctic Exploration, European explorers engaged in a contest to be the first to reach the South Pole, and—after Roald Amundsen's party achieved this in 1911—in other expeditions seemingly concerned as much with proving human endurance as with exploration.[3] These men also built the first buildings in Antarctica, sometimes transplanting vernacular architecture from wildly different climates, as Robert Falcon Scott's expedition did with the Discovery Hut, prefabricated in 1901 by an

Australian builder in New Zealand.[4] Installed in 1902, the hut was complete with a verandah that made its spaces so cold the crew chose to sleep on their ship, anchored nearby, instead.

Contemporary architecture has progressed dramatically from the humble and poorly functioning early huts. Today, the flagship stations of Britain, Belgium, and Brazil, poised atop snowy sites, advertise national presence and technological advancement.[5, 6] These buildings perform exceptionally well; they also reinforce the perception of Antarctica as negative space. As Antarctic scholar Elizabeth Leane writes, "Antarctica is ground, not figure—it is nothingness."[7] And in architect Giulia Foscari's characterization, Antarctica serves as a "white backdrop" for buildings.[8]

Britain's Halley VI Research Station provides a vivid illustration of this figure-ground dynamic and its implications. Designed by Hugh Broughton Architects, the high-tech facility is mounted on skis, enabling it to relocate in response to the movement of the Brunt Ice Shelf. In a one-point perspective photo on the firm's website, the station appears as a seemingly infinite chain of modules advancing out of a blizzard.[9] At the same time that this image renders the Antarctic landscape as nothingness, other images of the project supply foreign associations to fill the void. Side elevations evoke Archigram's Walking Cities.[10] An early schematic rendering shows an uncanny resemblance between the splayed legs and chamfered edges of the modules and the Maunsell Forts at Red Sands in the Thames Estuary, built to defend Britain against air raids during World War II.[11, 12] More than just a response to the requirements of building on a shifting ice shelf, the form of Halley VI is imbued with traces of war and apocalypse.

There is certainly a real need for innovative architectural strategies to deal with unstable ice shelves, massive snow drifts, extreme wind loads, and frigid temperatures. Technical challenges notwithstanding, contemporary Antarctic stations like Halley VI present a consistent visual image that emphasizes the harshness of the environment over the vulnerability of its ecosystems and the boldness of human presence over our capacity for sensitivity. One could draw a parallel between the Heroic Age of Antarctic Exploration and a subsequent "Heroic Age of Antarctic Architecture," both periods that were dominated by individual authors—nearly all of them white, male Europeans. What would happen if we designed buildings less concerned with projecting a national brand? What if we acknowledged the pattern that has persisted throughout human history in Antarctica and responded with stations that kept a low profile, expressing a message of human service to larger ecosystems?

AUTHORSHIP AND AUDIENCE IN ARCHITECTURE EDUCATION

Traditional architecture education valorizes individual authorship through the structure of design studios. A typical studio involves the design and critique of a speculative project, with the goal of making the design as "good," or theoretically sound, as possible. While promoting a single-minded focus on conceptual depth, teachers remain uncritical of the nature of the exchange between author and audience. This exchange usually involves a default author, an individual student, and a default audience: the students' peers, their instructor, and the guest critics who offer feedback during juried reviews. In addition, the student may be consciously or subconsciously influenced by the desire to reach more nebulous audiences: Pinterest users or ArchDaily readers, for example. Although students may succeed in defending a project in front of an academic audience at review time or appealing to internet communities with a post, they do not develop a complete toolset for communicating architectural ideas that have value for a range of constituents and can overcome the hurdles of project delivery.

In their introduction to *Architecture Live Projects*, Harriet Harriss and Lynnette Widder write, "Live Projects occupy the borderlands between the simulacra which architectural education favors—the speculative project, supported by lecture and seminar-based exercises—and the trial by fire of professional practice."[13] Because borderlands are indeterminate spaces, unburdened by expectations, they are ideal sites for experimentation with alternative models of authorship. Operating in this zone and free of the need to adopt the default structure of a studio or the economically stable hierarchy of a firm, Colorado Building Workshop organizes students in a non-hierarchical manner by grouping them into multiple, overlapping teams. Instructors determine the teams based on the scope of the design brief, significant components of construction, and essential aspects of project delivery. The teams are connected with intentional audiences: the client, consultants, contractors, product vendors, fabrication shops, and tradespeople.

Instructors give up their role as the primary audience for student work and invest more energy into moderating discussions and facilitating collaboration between students and professionals. Students learn the importance of building meaningful relationships and leveraging those relationships to enhance the project in areas where they lack expertise.

Employing a distributed authorship model can help students gain mature perspectives on the practice of design—perspectives that might otherwise take years of professional practice to attain. In particular, this pedagogical approach teaches students to view buildings as catalysts, not isolated ends; to preference values over aesthetics; to accept that meaning emerges from the layering of simple ideas; to become comfortable with uncertainty; to use drawing as a language for developing ideas in dialogue with others; and to recognize how architectural projects are embedded in larger systems. The following section presents details of the methodology of the Antarctic design-build project and elaborates on these educational outcomes.

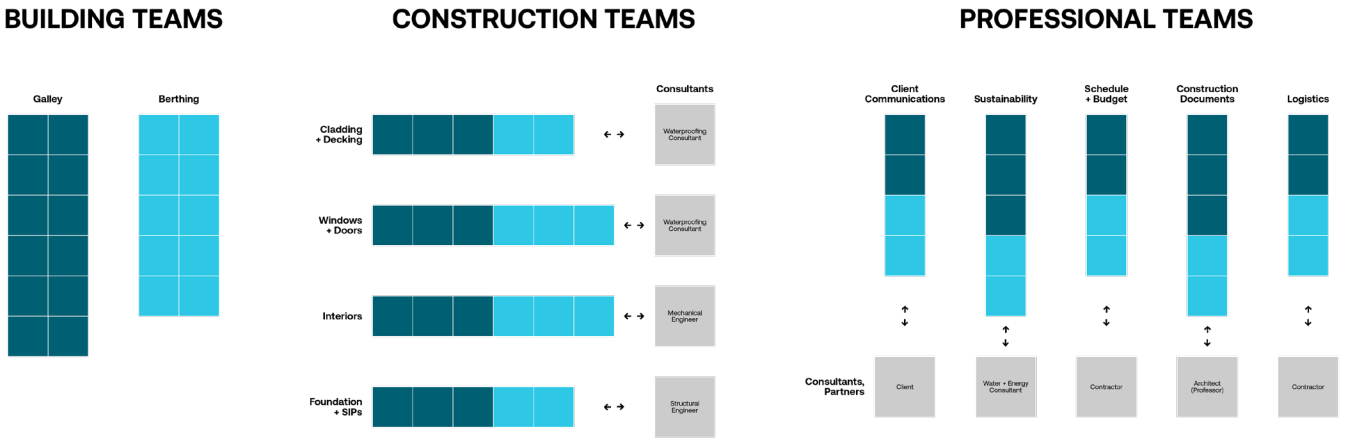


Figure 2. Student groupings. Image credit: Jacob Taswell.

DISTRIBUTED AUTHORSHIP IN PRACTICE

The design process for the Antarctic field camp began with an iterative and democratic schematic design phase, lasting about two weeks. Students first wrote a joint statement of values and then chose to work individually or in small groups to produce studies in space planning and sketch models exploring formal gestures. Students and instructors met as a large group to discuss and critique work on a daily basis, sometimes taking the temperature of the room with anonymous votes. All ideas were in the public domain, enabling students to feel comfortable exploring design directions similar to those of their peers. This situation is tacitly discouraged in typical studios, which prize originality. As the project unfolded, schematic design proposals were increasingly distinguished by nuances rather than sweeping differences. At the end of the phase, the design solidified with a presentation to the client that included drawings (featuring curated design options) and a physical model.

At the beginning of design development, Colorado Building Workshop faculty grouped the students into building, construction, and professional teams. Each student simultaneously participated in one team in each of the three categories, interacting with three different sets of teammates. Instructors considered students' preferences when assigning the teams using a ranked-choice balloting system. As the authors of *Leading Collaborative Architectural Practice* point out through their citation of self-determination theory, "control over which task to undertake" makes students' work "feel less like an obligation," encouraging deeper engagement.[14]

Figure 2 illustrates the groupings. There were two building teams. One focused on the design of the Galley, and the other focused on the Berthing Suite. Four construction teams, including members of both building teams, were responsible for developing and detailing critical building systems: Foundations and SIPs, Interiors, Windows and Doors, and Cladding and Decking. Each construction team worked horizontally and at the scale of the campus to bridge between the building teams and maintain cohesiveness in the overall design. All four construction teams worked together in a vertical stack and at the scale of the detail to create thoughtful, functional assemblies within a single building. Finally, five professional teams handled aspects of project delivery: Client Communications, Sustainability, Schedule and Budget, Construction Documents, and Logistics. The professional teams again bridged between the building teams and challenged students to manage the broader ramifications of implementing design decisions made on paper.

The focused teams provide a scaffold for students to confidently engage in designing and managing a complex project that could otherwise become overwhelming. In addition, due to the many ways in which three team assignments can overlap, each student occupies a unique niche, positioning them to make substantive contributions to the final project outcome. The teams also allow students to collaborate with professional partners in targeted ways. During the semester, each construction team worked with a dedicated consultant to integrate engineering expertise early in the design process and to produce technically sound drawings. Each professional team also worked with a consultant or constituent to meet client expectations and sustainability goals, adhere to schedules and budgets, and anticipate and solve logistical challenges.

To represent the distributed authorship model from a student perspective, Figure 3 arranges the three teams in three-dimensional space, with the student at their intersection. The student whose perspective is shown here was on the Galley building team, the Windows and Doors construction team, and the Client Communications professional team.

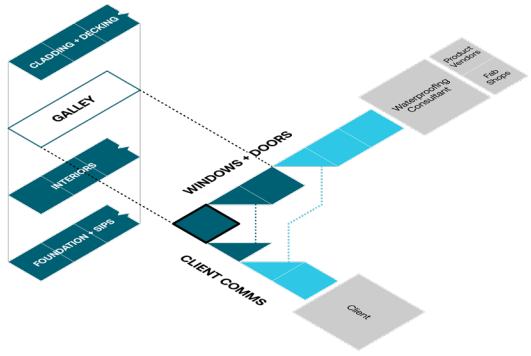


Figure 3. Student perspective diagram. Image credit: Jacob Taswell.

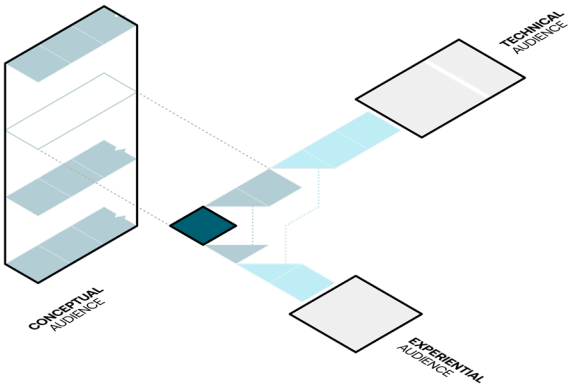
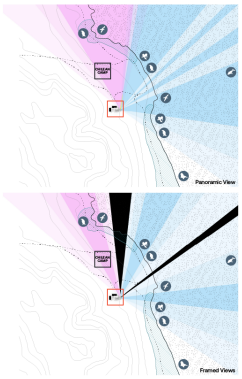


Figure 4. Major audience types. Image credit: Jacob Taswell.

Figure 4 demonstrates how each axis terminates in a specialized audience. In this example, the student's conceptual audience was the Galley building team. The Windows and Doors team had a responsibility to the other members of the building team to ensure that the placement, development, and detailing of the openings in the building—along with the interior trim and exterior shrouds—flowed from and supported the primary conceptual agenda. Persuading the building team to accept the construction team's recommendations required analytic drawings comparing the results of many design iterations.

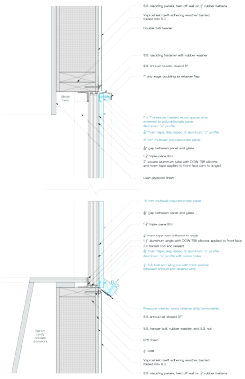
The student's technical audience included consultants, product vendors, and fabrication shops. This audience required the Windows and Doors team to prepare drawings that were rigorous and clear in order to procure the right products and understand how these products would interface with larger systems; to properly waterproof the openings and eliminate thermal bridges; and to produce custom elements for the buildings' window shroud/winterizing panel system.

Finally, the student's experiential audience was the client. The Client Communications team facilitated conversations with the client by translating the work of the entire design team into drawings that explained the functionality of the design and illustrated the experience of the spaces. In addition, the Client Communications team fielded the client's questions and feedback. Figure 5 shows examples of working drawings from these three exchanges between authors and audiences.



WINDOWS → GALLEY
Analytic Drawing

CLIENT COMMS → CLIENT
Illustrative Drawing



WINDOWS → WATERPROOFING CONSULTANT
Technical Drawing

Figure 5. Examples of drawings with authors and audiences. Image credit: Jacob Taswell, with drawings by Jacob Taswell and Antonio Valencia.

CHALLENGES

The dynamic, decentralized nature of this authorship model can create challenges. In particular, it is necessary for students to resolve their own competing priorities and for teams to negotiate productively when their ideas come into conflict. Anticipating these challenges, instructors asked students to draft a unifying statement of values during the first design charrette of the semester. The statement consisted of a set of five core issues to prioritize in the design and a joint position articulating the designers' stance on the brief and vision for a successful project. The goal of this exercise was to establish a shared direction for design work and a method for evaluating design decisions. Students presented this statement to the client at the end of the charrette for feedback and subsequently secured client buy-in. Mutual understanding between the design team and the client enabled students to justify architectural moves on the basis of performance rather than aesthetics. The Windows and Doors team wrote a similar statement of values to guide their work during design development.

Another challenge of distributed authorship is the lack of a project manager to coordinate communication and workflow. It is crucial that teams (construction teams especially) avoid becoming siloed and consistently make information available for other teams to use. Early in the project, instructors actively communicated information and set the cadence of meetings. They deliberately stepped back throughout design development until students independently scheduled meetings, joint working sessions, and internal deadlines. Students used the productivity platform Slack, with a channel for each team, to allow everyone to track the progress of any team at any point in time. They used a central Revit model for the CD set. Many teams preferred to work in representative 3D modeling software, such as Rhino or SketchUp, before sending drawings to the Construction Documents team for input into Revit.

CONCLUSION: AN ETHIC OF STEWARDSHIP

In her book *Staying with the Trouble*, ecofeminist scholar Donna Haraway uses the titular phrase to describe a blend of critical reflection and action that generates the best incomplete response possible at any given moment—the basic instance of a larger, ongoing process of flourishing in the Anthropocene.[15] Stewardship is another useful concept for addressing the overwhelming challenges of climate change, habitat destruction, and the accumulation of waste. Typically associated with landscapes, contemporary theories of stewardship in environmental science have roots in indigenous land management practices that have existed for centuries.[16] Stewardship rejects quick technological fixes and accepts caregiving as a continuous practice. The term does, however, allow for the possibility that humans will repair and even improve ecosystems to the point of thriving—an aspirational meaning that sustainability lacks.

Architecture education that promotes an ethic of stewardship, characterized by a mission beyond making an airtight, well-insulated, and solar-powered building, teaches students that design is about providing a service, not a product. Practicing an ethic of stewardship means cultivating relationships in service to the planet and treating buildings as catalysts for large-scale change. The architecture of the Holt Watters Field Camp supports ecology research and the implementation of evidence-based policies to protect Antarctic krill, a key organism in the marine food chain, from overexploitation by commercial fisheries.[17] AERD's field camp is a node in a much more extensive network of research stations that support the Commission for the Conservation of Antarctic Marine Living Resources. This international body is part of the Antarctic Treaty System.

Stewardship connotes long-term care, which distinguishes it from conventional approaches to sustainability. In the case of the Holt Watters Field Camp, stewardship is closely connected with the history of Antarctic fur seals in the South Shetland Islands. In the early nineteenth century, the first Antarctic settlers (before the continental explorers of the early twentieth century) converged on the islands for their abundant seals, nearly hunting them to extinction.[18] When finding seals became difficult and profits dried up, the British and American settlers abandoned their outposts, leaving behind a ruined ecosystem. Over the next two centuries, the fur seal population gradually rebounded with the help of legal protections. But, today, carbon emissions have irreversibly altered the Earth's climate, threatening the marine life of the South Shetland Islands in ways that cannot simply be "turned off." Human stewardship is crucial for the ecosystem to survive.

As designers who "stay with the trouble," students should learn to navigate the challenges of project delivery that speculative projects shed all too easily. In studios that frame the practice of design as more than the individual pursuit of conceptual elegance, they should learn to collaborate with experts from other disciplines, to come together around shared values, to make strategic decisions in light of schedules and budgets, and to think critically about materials and methods. Students should continue to study proven strategies for making passive buildings. And they should remember that designing a net zero energy building does not help overfished krill, starving penguins, migratory birds whose travel patterns are being disrupted by climate change, and seals once hunted to the brink of extinction. Each of these species deserves more than sustainability as usual. The Antarctic design-build project is just one imperfect instance, but it points to the attitudes and ethics that teachers and students must cultivate in the twenty-first century. As students become attuned to a practice of relationship-driven, ethical design, they open doors to rich careers of stewardship devoted to the Earth's most vulnerable inhabitants.

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