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Moralizing Design Differences in the North: An Ethnographic Analysis

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Moralizing Design Differences in the North: An Ethnographic Analysis

This multiple source case study tracks the “social life” (Appadurai 1986) of the “integrated truss system” – a prefabricated frame assembly that has been used to build homes in emergency contexts in Alaska. We combine data from three years of ethnographic research among Alaskan engineers, builders, housing advocates, and residents of remote Alaska Native communities to illustrate what design scholars describe as the “moralization of technology” through engineering practices (Verbeek 2006: 269). In this framework, moral understandings of engineering emerge from interactions with socio-technical materials and systems (ibid). From this conceptual perspective, engineering systems may take on multiple meanings and applications, including marked differences in thought, creativity, and moral affinity because different actors may engage with these systems in varied and differing settings. In examining the context of people working to address affordable housing needs in Alaska, our case study shows how a building system can take on multiple value orientations that are shaped by but also shape the “moral economy” of home building in this region. The integrated truss has influenced the home building collaborations of ‘Northern Builders’ (pseudonym), a non-profit organization in Alaska’s Interior that works with remote (off the road system, fly- or barge-in only) Alaska Native communities to address sustainable housing needs. Home builders, engineers, and other specialists at Northern Builders have extensive experience designing and constructing homes in the region and their work with communities has provided rich insights into the complexities of building in remote areas with extreme climates (Nicewonger, Fritz, and McNair 2022).

Background

The general idea behind the design of integrated truss systems for home building is to simplify the framing process and create an energy efficient wall system. To date, Northern Builders has constructed approximately 44 homes using these prefabricated frame assemblies in multiple communities in northern and western Alaska. The process involves shipping combination roof, wall, and floor trusses to a building site and then fastening them to form a structural building “sandwich slice.” Once on site, builders set and brace the trusses every 2 feet in a straight line for the entire length of the home.

To create a highly energy efficient wall system, the wall truss sections are designed to be thick (12”-18”) and in-filled with blown-in insulation, such as foam, cellulose, or fiberglass. When a vapor barrier is properly installed, this style of house ends up being very airtight, which further improves energy efficiency. As a result, this method creates a robust building envelope because it forms a double wall and thermal bridging (heat transferring from inside to outside) is reduced when insulation is blown-in all the way around the home. This eliminates the need for a wall plate, which is required where a traditional wall leaves a gap without insulation between the bottom of the wall and floor. With an integrated truss, the insulation is unbroken, and a properly insulated and sealed 12”-thick wall results in a wall with an appropriate R-40 ability to resist heat transfer. Thus, the thermal performance advantages of the integrated truss design are clear.

Figure 1. Image of insulation used in integrated truss systems. Photo by Todd Nicewonger, 2022.

Additionally, the integrated truss system was designed for homes built on unstable soils with raised foundations. Because the ground cannot support a slab, the floor system is built on foundation beams as a truss assembly (Nelson and Benesch, 2021).

Figure 2. Images of integrated truss system framework demo. Photo by Todd Nicewonger, 2022.

Another important design objective of integrated trusses was to streamline and standardize a building system that would allow repeatability and expansion and contraction of a basic design by adding or removing trusses.

Figure 3. Full view of integrated truss demo. Photo by Todd Nicewonger, 2022.

However, builders who work with these trusses argue that this goal has not been achieved because many aspects of the designs continue to evolve and improve (what one builder calls the "churn of iteration" - always improving on the most recent design). Consequently, these trusses have what cultural anthropologists describe as "multiple" or layered rather than "singular" social lives. As Arjun Appadurai has argued, "persons and things are not radically distinct categories, and [...] the transactions that surround things are invested with the properties of social relations" (2006: 15). Investigating the relationships that form in and through people's interactions with integrated truss systems provides a vantage for understanding how different contexts can generate different value orientations towards home design (Kyptoff, 1986).

Figure 4. Construction of a home using the integrated truss system. Image courtesy of Cold Climate Housing Research Center, Inc.

Method

This multiple source case study is based on ethnographic fieldwork on housing security issues in Alaska Native villages. Our overarching goal was to investigate the research question, *How can post-design investigations of the socio-cultural effects and technical performance of cold climate housing design structures contribute to the development of human-centric approaches for strengthening rural Alaskan infrastructures?* We characterize both our methods and the communities we worked with as “remote”: we examined building designs and practices in Alaska Native villages that were often off the road system with limited internet connection, and much of our data collection included conversations conducted online, by phone, and through local community research assistants over a period of three years that included the restrictive COVID-19 era. Data collection also included participating in and observing home building meetings with engineers, builders, and community residents; conducting over 70 semi-structured interviews with home construction specialists, home occupants, housing specialists, and policymakers in the region; and gathering building documents, white papers, reports, and publications. In our data analysis, we conducted reviews of transcripts of interviews and meetings for themes related to our research question. Noting that descriptions of the integrated truss system appeared frequently, we supplemented our investigation with reviews of professional practices and research, cross-checked technical and historical data, and deepened our focus to re-confirm patterns. These multiple layers of evidence helped us develop a bounded case study (Miles, Huberman, and Saldana, 2014) illustrating how local, state, and federal institutions are connected and/or have influence on housing construction practices in remote Alaskan communities.

Beyond the initial cost or buildability of a design, we explored both the performance of homes over time and the social experiences of those living in them. In early interviews, builders indicated that these insights and analyses would contribute to the improvement of future construction guidelines and housing policies. In response, we focused on intersections of building practices and participants' experiences by collecting references, news articles, stories from a range of participants, additional interviews, a review of gray literature on the subject, and several meetings with builders who had first-hand experience using the truss system. Finally, we synthesized these multiple sources of evidence in a case study highlighting three illustrative examples of how a design system influenced values and building practices in cold climate housing.

Table A: Research Phase, data sources and outcomes

% of Fieldwork for this case study	Research Phase	Data Source	Research Outcome
20%	Phase 1 (June 2020-September 2021): Exploratory research established the scope of cold climate housing design systems and issues facing the field, including the integrated truss system, through participant stories and research review.	Semi-structured interviews with housing advocates, builders, engineers, policy specialists, and related professionals. Online articles and social media spotlights on cold climate housing research.	This data provided background information and helped the team identify key building systems, research questions about design and construction processes, and gaps in understanding.

30%	Phase 2 (October 2021 – June 2022): We identified the importance of the integrated truss system to our broader research question about the post-design life of cold climate housing systems.	Multiple site visits to Northern Builders exposed external PIs (Nicewonger and McNair) to various building demos, including the integrated truss system that led to discussions with Northern Builders' staff. Participant observation both remotely and in-person of staff meetings, workshops, and construction process. Semi-structured interviews continued to take place and additional insights or stories were identified and coded.	During this phase of research, we gathered information from multiple sources with particular focus on ways in which the integrated truss system influenced perspectives and practices related to cold climate housing.

50%	Phase 3 (July 2022-present): A case study was developed using multiple sources of evidence.	Semi-structured interviews with people who had first-hand experience with the system, including with economists, engineers, and builders. Development of white paper and workshops with members of our research team that explored key themes. Identification of theoretical frameworks that helped us further contextualize the themes and examples identified in the previous activity. Written analysis.	This research allowed the research team to gather an additional layer of insights that elaborated on themes identified in earlier interviews, observations, and participatory activities. This includes the identification of how different value orientations of the integrated truss system took on varied meanings. These meanings correspond to the ways in which people interacted with the system differently.

Table A: This table of data sources provides a snapshot of the qualitative stages of research that led to the development of this case study. The exploration of how different actors at Northern Builders experienced the integrated truss system was not sequential. Instead, they experienced the system in multiple ways, including through varying modes of design, social analysis, observation, and interactions through which homes are constructed. This table synthesizes this layered process of interpretation, emphasizing both the direct methods and serendipitous experiences that often characterizes long-term ethnographic studies.

Research methods are not necessarily a means to an end, and theoretical and conceptual frameworks play an important role in analyzing findings. Anthropologists William Julius Wilson and Anmol Chaddha argue that "good ethnography is theory driven" (2009: 562). In our work, we draw on moral economy frameworks to better understand how a design like the integrated truss can take on differing meanings across varying contexts due to the different kinds of experiences of those involved with it. As anthropologist Lesley Sharp has argued, "Moral frameworks, as ideological systems, can complicate binaries, generating, in turn, naturalised understandings of social protocol, comportment, and civil behaviour: be kind to others; protect, rather than prey upon, the weak; and apply expertise for the betterment of society" (2009: 970). Not all contexts are alike, and when people are actively working to address these issues in relation to a specific social or economic setting, "moral quandaries" may arise that require new or alternative ways of thinking and applying these frameworks (ibid). This, in turn, may inspire actors to question former understandings or ideologies about the moral aspects of a particular technological system, thus creating new interpretations through their practices (see Verbeek 2006). We seek to critically investigate this particular slice of the broader social life of the integrated truss as part of a shifting social landscape that is increasingly reimagined amid climate change. This perspective will contribute to the development of a case study that can broaden learning opportunities in engineering education programs, and it will help bridge work on home design to a growing body of literature in Northern Studies that examines the emergence of new moral economies in Arctic communities (Sejersen 2022). Connecting these two bodies of literature is critical for positioning research on engineered systems within wider circumpolar considerations of housing security.

Findings

Here we draw on three examples that emerged out of formal interviews and informal conversations with builders who work for Northern Builders. Northern Builders has a long history of working in remote and predominantly Alaska Native communities, and the stories that the builders, designers, and housing specialists shared with us provide insights into varying regimes of value that have formed around this design system. We contend that each example reflects a slightly different perspective or insight into the social life of this design system.

Example 1: Integrated trusses in times of crisis

Although it has a history dating back to the 1970s, in the era of its life that we are focusing on, the integrated truss was first used in 2010 by several non-profit housing organizations and state and federal agencies in the Kuskokwim River village of Crooked Creek to replace 10 homes that had been destroyed by spring flooding (CCHRC website). These prefabricated trusses were shipped to site, tipped up one by one atop a floor, and sheathed together to form a building frame in less time than it would traditionally take to frame a house of the same dimensions. Given Crooked Creek's remote location, the trusses had to be shipped by barge and any delay would shorten the already limited window for homes to be built before winter. Subsequently, the design's ability to reduce the time it takes to frame a house quickly garnered attention from builders in the region. But, as one participant in this process observed, the stories lauding the use of this system at the time may be missing some key considerations. They argued that success had more to do with the ways teams of volunteers were quickly trained and sent to Crooked Creek to help build those homes after the catastrophic flood than it did with integrated trusses.

Consider the following story, in which a housing specialist at Northern Builders emphasizes the value of being able to train volunteers to construct these homes quickly and without much technical training:

> You don't want them doing <laugh> all those, you know, getting down into the finicky details. You want them to stand something up, make sure that it's vertical, and then tap some things to hold them in place. And honestly, the thing about the builds in Crooked Creek and Galena that I don't feel gets enough credit or enough attention is the way they organized those volunteers.

Reflecting on the training process, the housing specialist further emphasized the need to consider the volunteer system that accompanied Northern Builders' first application of integrated trusses:

> I mean, they basically set it up so that the volunteers would … spend a week learning how to do the things that they would be doing on site the following week. They walked them through day by day, this is what you're going to do on Monday, this is what you're going to do on Tuesday. This is how you do it, you know, [they did a] mockup here [in Fairbanks]. And then [the volunteers] took that [training], and they went out to the site, and they did exactly that [what they learned here in Fairbanks] to those buildings out there.

After this successful building project, stories about the affordability and efficacy of the integrated truss system spread. By the time we began collecting data on housing issues in Northern Alaska, over 20 homes had been built in the region using the method. Stories and idiomatic references to the system emerged early in our research, and most emphasized the value of this system, including how it might be extended to other settings. One plan was to develop an integrated truss plant in Bethel, a hub community for the larger Yukon-Kuskokwim Delta region (YK Delta) in western Alaska.

Example 2: Economic revitalization

The plan to develop integrated truss manufacturing in the center of the YK Delta emerged several years after the Crooked Creek flood. The primary idea for this project was to utilize local timber resources and set up a plant for prefabricating trusses which could then be used in surrounding communities to facilitate building and address severe housing shortages.

One participant in the project whose background is in economics and is not a builder or designer, reflected on the promising outlook.

> So, we did the feasibility, we worked on the business plan with the [name of organization]. Everything was going forward and they [had several] groups doing the retrofit design for building in Bethel [where the integrated truss plant was to be set up]. That would become the truss plant. They were also in talks with a truss manufacturer in Kenai who was looking honestly to retire but was going to sell his equipment from his manufacturer to them and then serve as a consultant for them for a couple of years. So, things were well on the path to 'this is going to happen.'

The feasibility study explored new, additional benefits of the integrated truss system, in turn producing a new social life for the design and generating a new moral economy around it. One interviewee explained:

> One of the things that we had found in the study - [we were contracted to develop] the business plan was, one, locally used wood from Chuathabaluk, which is upriver from Bethel, that lumber mill could actually be converted to one that produced certified lumber. There was a process for stamping and flying in somebody on a regular basis to validate and certify that the equipment was operating properly for the certification stamping. And that, two, whether that lumber from Chuathabaluk was used or lumber was freighted in from Seattle, actually, I think they found 219 different ways to get lumber there. But no matter what, one of those ways was used, they could still manufacture the trusses in Bethel and ship them out to the surrounding villages cheaper than manufacturing the trusses in Anchorage and shipping them out to the villages.

Additionally, they realized that building a truss plant in this region would allow them to maximize local materials and identify ways to buffer price hikes due to changes in the supply chain. This would create a sustainable system for producing housing materials that could be passed on to homeowners, which would in turn allow for greater investment in housing stock.

> So, a regular truss could also be manufactured. The prices were higher for a roof and ceiling truss than for an integrated truss, but they too could be supplied to a village, if that was the way the village wanted to go, or the funder wanted to go. And because they found so many different ways to get the raw materials to Bethel, very, very resilient price, you know, it wasn't a question of, oh, well, yeah, that's the price. As long as Joe keeps his lumber mill going, it was [going to be], no, this is the price. You don't have to worry about sudden spikes because Joe stopped giving you wood... So, I mean, it was to me a very positive thing and the number that needed to be produced in a year to break even was around the average of new home construction in the region.

Unfortunately, the study came to a sudden stop right before the actual investment to construct the truss plant due to a change in management at the business in Bethel. However, stories about the plan's economic viability spread long after the project was halted. By the time we began our research, some aspects of this story were common knowledge while others had been lost. Perhaps the most interesting aspect of this story is how it continues to shape perceptions about the economic advantages of building with integrated truss systems. That belief, however, is now being challenged by builders who draw attention to what happens when barges don't reach their destination and trusses are offloaded and stored over the winter and warp, which is common. Builders are also questioning whether integrated trusses truly make sense for all environments and building settings.

Example 3: "Churn of Iteration"

The idea that integrated trusses should be used universally throughout Alaskan communities has met resistance by on-the-ground construction experts who have worked with the system. This fallacy, they contend, is due to the complexity of building homes in Alaska's extremely diverse environments, in various socio-cultural and economic village systems, and in these regions' extreme and dramatically changing climate. As a result, the need to iterate or adapt home designs from site to site is a reality that does not always match the wider industrial systems that produce housing designs.

One example was shared by a longtime builder who had worked with the integrated truss system for over a decade. As they reflected, they argued that the high R-value associated with the thick walls and blown-in insulation does not make sense for all environments in Alaska. He noted that Northern Builders used an integrated truss design for a build in Tununak on Nelson Island in the Bering Sea. The coldest winter temperatures in Tununak are only negative 20-25 degrees (Fahrenheit), which is approximately the same "cold snap" temperature range as Anchorage. He pointed out that nobody in Anchorage builds 12" walls to handle "50 below" cold snaps - because they don't need to.

In Tununak, he noted, you need to build for extreme *wind* rather than extreme cold. The 12" walls make sense in a place like Huslia, in Alaska's Interior, where the average winter and typical cold snap temperatures are much lower.

This builder continued:

> The problem with integrated trusses is that they are integrated. Floor trusses are brilliant, I can't imagine using them - they are key, and they make it easier to level, and there is no need for a center beam (if you have one, it will push up). [Plus] you have to only level two sides of a house, there's no crazy

> issues with leveling a house with a center beam. It has been repeated the most, it is design for repeatability but…. If these [integrated] truss systems worked and penciled out, Spenards and Kenai Truss, they have the cut files - there is nothing stopping them, they have catalog homes. If they thought they could sell them, they would - nothing is preventing them from making them part of their catalog. Lots of things are preventing adoption. But they are not "meeting people where they are at."

Some builders contend that much *simpler building designs* (in terms of materials, shipping, and construction) can result in homes with R-30 walls, which is all that is required in many areas of Alaska. Those simpler designs are familiar to more building crews and the result is a more affordable home.

The builder has the practicality and safety of a building system in mind. When non-builders see that all the trusses go up quickly and a house is suddenly framed in, they believe it is a significant efficiency. What they do not realize is that this sequence requires the members of a remote building crew (often on muddy ground and in the wind and cold) to attach all the remaining layers and details of a wall to a frame that is already stood up. They must do all of that work off ladders, which means going around the building several times, moving and reclimbing the ladder while holding materials and tools for various layers and details to finish many important and tricky aspects (e.g., windows). This often happens late in the building season, in worsening weather, when they are pushing to get a home closed in before winter hits. By contrast, when a crew builds without an integrated truss, they complete almost all aspects of the wall while it is flat on the floor and then they tip it up and are basically done with it.

Thus, particularly for remote locations, building with integrated trusses can represent an overall project disadvantage up until the stage when the siding is complete, which is deep into a project's timeline. At that point, an integrated truss build is comparable to a regularly constructed stick home. If everything proceeds smoothly on schedule with no exposure, and if the trusses are well supported during transportation, then they can be considered optional for construction. However, if they sit in weather and/or are unsupported or damaged - common issues on their arduous journey by truck, barge, and various heavy equipment – the ease of construction is dramatically affected. Moreover, pre-build planning does not normally account for these challenges. Simply put, there is an inherent risk in the design of integrated trusses that are used to build homes in rural Alaska because they do not fit into shipping containers, yet they must be shipped long distance from the manufacturing site to the building site and, once on site, they present increased risks and complexities for construction crews.

By contrast, if the floor trusses and roof trusses (either pre-built or built on site with all pieces pre-cut to size) are packed up and shipped, the entire package can be loaded into a shipping container and shipped flat in a supported condition. This method of shipment would ensure materials arrive in the condition they were originally shipped, even if they end up sitting over winter.

In summary, these examples highlight the range of different value orientations that those involved with this engineered system have experienced.

Discussion

This case study describes the trajectory of how an Alaskan housing research group has reflected on the benefits of a prefabricated system they began using over a decade ago. At that time, they were responding to a crisis caused by major spring flooding in an Alaskan riverine community that has long grappled with housing shortages. The destruction of those homes, along with the possessions of the people living in them, was a tremendous loss to this community. The region's short building season and dependence on barge and aerial transportation services for shipping in building supplies further compounded these challenges. In response, local and federal agencies came together and decided on a housing design that uses an integrated wall and truss system that could be prefabricated off site, shipped out, rapidly assembled by volunteer building crews on site; and that facilitated a highly insulated energy efficient home. As a result, this design played a critical role in mitigating impacts from that disaster.

Fast forward to the present, the housing research center frequently defaults to this system for most remote designs, even as builders and engineers are debating whether its advantages outweigh some of its logistical challenges. Some argue that its value has been overstated, while others describe it as a practical and affordable method for building energy efficient homes in remote Alaskan communities. Still others have adapted it to fit their needs, producing new variations of the design and showing how this building system might be reimagined. Diving deeply into this debate allows us to analyze how both knowledge building and moral reasoning inform the ways that engineers assume global responsibilities related to communities affected by climate change. By outlining how different actors experience a building system in socially different and marked ways, additional questions can be asked by researchers that will allow for deeper analyses and possibly new conceptual frameworks for studying how morality figures into the design and building of homes in the North.

The examples outlined above provide a critical look at the multiple or layered ways in which the integrated truss system has been taken up in different contexts. Each of these examples points to different value orientations that shape relationships among varying stakeholders, and also points to the materiality of the trusses themselves and people's differing experiences with this system. Attending to these differences draws attention to how engineered systems become part of moral economies in various contexts. As Arctic scholar Frank Sejersen writes, the introduction of new economies of practice will not only generate "new moral expectations between people but [...] also create new agencies, resource conceptualizations, imagined communities, conflicts and problems" (2022: 164). Consequently, describing the design of integrated trusses as being embedded in wider moral debates allows researchers to attend to the plasticity through which knowledge on home construction in this region is currently emerging in response to wider socio-economic and environmental factors (Biehl and Locke 2017).

Returning to the larger question about ethics in engineering, particularly as it relates to preparing students for working on wicked problems, this case study illustrates the need to attend to how engineering practices in building design become entangled and materially influenced by moral economies (Nieusma and Riley, 2010; Riley et al. 2016). We close with the open-ended question: What role can social scientists, working with engineers and builders, have in the development of post-occupancy tools and analyses of built environments? For instance, anthropologists have tended to focus on the cultural production of design in engineering fields, but design in its broadest sense exists in multiple places that are in contention with this conceptual framework that is also dually popular in the real world (Keating and Jarvenpaa 2016; Vinck 2003; 2011). By mapping out the different viewpoints and moral economies that have accumulated around this design, we begin to see important insights into the distributed nature of design, including the need to account for builders 'perspectives.'

Conclusion

This paper tracked the trajectory from one era to another in the "social life" of this engineered system across time, place, and institutional, cultural, and geographic settings. Debates about its efficacy have come to index contrasting moral economies and value systems that influence decision-making about the technical and materializing processes of building design (Verbeek 2006). As a multiple source case study, this analysis can serve as a teaching tool in engineering and interdisciplinary classrooms for examining questions of ethics, decision-making, and interdisciplinary research. First, the role of engineering in this case illustrates human impacts on the environment and marginalized communities and provides a concrete example of the integrative nature of ethics and technology. Second, the specific example of integrated trusses demonstrates the critical need for engineers and builders to conduct systematic and comprehensive analyses of problem-solutions before deciding to apply them across differing contexts. Finally, this study highlights the possibilities of interdisciplinary research in which social scientists can draw on qualitative methods, including ethnography, to contribute to the work of engineers, builders, and housing specialists, while also gaining insights that can inform anthropological studies of materializing practices.

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