Wiigwaas: Building with Birch in the Great Lakes

PAPER

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Keywords: Low-carbon construction, indigenous design, life cycle analysis, circular economy, non-extractive architecture

Our exploitative models of building and design arise from misconceptions about the relationship between energy and objects. The current emphasis on efficiency, performance, and life cycle assessment are not adequate remedies for the problem. Through an analysis of Anishinaabe material harvesting techniques and building technologies, this paper contends that the lighter methods of low-carbon construction practiced in the Great Lakes region for millennia are ideal alternatives to this flawed conceptualization, because they are clear and direct in their embodiment of energy and material. It includes careful study of material life cycles of traditional birchbark precedents designed to be light and portable, to be assembled quickly, and to decompose gracefully, like *wiigwaasi-jiimaanan* (canoes), *waaginogaan* (domed lodges), and *makakoon* (bark vessels). These models for making hold the potential to redirect prevailing conversations among architects and designers about sustainability, transition, and resilience in ways that are more ecologically responsible and better recognize and value indigenous cultures and material practices.

DESIGN AND ENERGY

Central to the climate trouble designers and architects face today is confusion about what energy is and how it is used. Seldom can we clearly see the many ways we are entangled with it. We might remember the classic definition that it is "the capacity to do work," but this seems increasingly difficult to pin down in the elaborate contemporary objects we make and use. Two fundamental ways of understanding energy—operational and embodied—have emerged as useful lenses through which to analyze design, but the increasing complexity of our products, buildings, cities, and supply chains still render us largely powerless to create meaningful change.

Operational energy's focus on *performance* has governed design decisions for at least the last 250 years, when James Watt improved the efficiency of the Newcomen steam engine in the industrial area around Birmingham, England. Watt set a precedent for combustion that led to muscle cars in the 1960s, oil crisis subcompacts in the 1970s, hybrid vehicles in the 2000s, and Tesla's fully electric fleet. For better and worse, the prevalent expectation for design improvements in a car, an air conditioner, a home, or anything that consumes energy while in use, has often been increased speed or efficiency. For the centuries of industrial development that have accompanied our increases in atmospheric carbon, performance has been the dominant paradigm for understanding energy in design.

The second paradigm—embodied energy—is more recent. It conceives of an object's very *existence* as an expression of energy. Every designed object came into being through some type of work, and therefore *the thing itself* serves as a material record of its embodied energy. It is the coal that fired the bricks that are recorded in a building in Manchester; it is the solar electricity that mills the aluminum that is written into the body of a MacBook. As historian Barnabas Calder puts it "form follows fuel."[1] These objects are made from components with specific weights, histories, and climate impacts, each of which can be traced back to their sources somewhere on earth. The architect Kiel Moe refers to this property of every designed artifact as its material and energetic *empire*, sometimes with vast territories, which when effectively mapped can reveal a tyrannical scale of influence, even for seemingly benign products.[2]

SUBLIMATING ENERGY

Unfortunately, these empires can be extremely difficult to perceive because of the extent to which energy has become abstracted and sublimated in our lives. The wealthiest nations of the world today consume quantities that are orders of magnitude out of synch with the history of our species. To illustrate this point, Calder looks to the Pyramid of Khufu, the largest at Giza, writing that "Estimates suggest that it cost around 78 million days of labour, spread over a force of tens of thousands of labourers, probably working for more than a decade."[3] Given current rates of consumption among US residents, every seven people in America use more energy over their course of their lifetimes than the pyramid required for construction.[4] While those seven Americans also consume 28 times more energy than their contemporaries in Bangladesh,[5] their everyday lives likely aren't comparable to the luxurious standard once reserved for the Egyptian Pharaoh. Why is that?

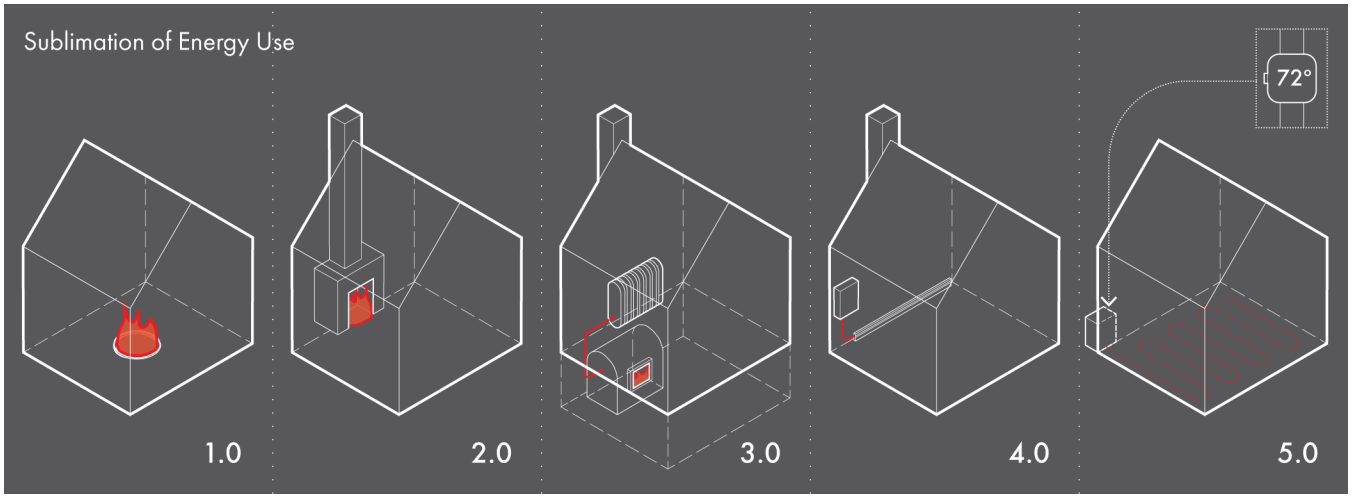

Figure 1. By design: Sublimation of energy use through five generations of domestic heating. Drawing by author.

Globally, we have accumulated centuries worth of infrastructure, including plumbing, power, and gas lines that make it easy to consume energy and resources without realizing it. The effortlessness with which a light switch is flipped, or a toilet is flushed belies the substantial effort it actually takes to deliver electric current or pressurized water to a point of consumption. A related phenomenon was identified by William Jevons in his 1856 book *The Coal Question*, in which he observed that the increased efficiency of Watt's steam engine had not brought about an expected decrease in coal consumption but instead had the opposite effect.[6] The Jevons paradox, as it's known, repeats its unfortunate moral throughout the history of design, as each successive generation of technology seeks to make things easier in the name of progress, but in the process conceals the difficulty, the labor, and therefore the energy that was more apparent and perhaps more *respected* in the technology which it has displaced. This tendency toward invisibility, towards abstraction, is no accident, it is by design.

To choose a somewhat classical example, we might look at the development of the hearth. Tasked with a design brief to heat the occupants of a home, the basic strategy is simple—a wood fire in the middle of a shelter. As fuels, materials and the home begin to change, this might be supplanted by a coal fireplace or cast-iron stove, located at the edge of the room. The fire requires less tending in this new arrangement, and while the flame might not be directly visible, it remains a significant presence in the room. In the next generation, a large fuel oil boiler is placed in the cellar, distributing its thermal energy through the home by means of steam pipes and ornamented radiators. The dangers of combustion are moved out of the living space, but the radiators remain bulky obstructions in each room and announce their consumption through clangs and hisses. Following this, the unit is superseded by a natural gas condensing boiler, installed in a small closet almost anywhere in the house, circulating hot water silently to baseboard radiators that can nearly be forgotten. In the final iteration, a fully electric heat pump is installed halfway outside the house, passing a glycol solution through radiant tubing embedded in the floors or walls. This version has no presence in the room at all, aside from the warmth it produces. The system itself might be controlled by a digital application accessible from anywhere in the world, fully completing the dramatic dissociation of the users from the original design brief: to keep them warm. Over the course of a few hundred years, the design solution has evolved from a possible source of fiery death to a numerical readout on our wrist.

While many steps in this process are obvious improvements, they are also clear illustrations of design's prevailing tendency towards abstraction. Hannah Arendt writes in her 1958 book *The Human Condition* that these "[t]ools and instruments ease pain and effort and thereby change the modes in which the urgent necessity inherent in labor once was manifest to all. They do not change the necessity itself; they only serve to hide it from our senses."[7] After each celebrated leap forward in design we thus move continually towards forgetting the sources of our comfort, and the material, energetic, and intellectual work that went into its creation, leaving us vulnerable to the contingencies of time and the possibility of our designs' eventual failure. This pervasive sense of disconnection, in which we relegate sites and systems of production to distant, unknown landscapes, characterizes much of what has been referred to as "modern," "civilized," or "developed" ways of living and thinking. The danger lies in the fact that we take these comforts for granted. The conditions of their creation and the prospect of their destruction both seem to us equally unreal.

ENERGY AND RESPONSIBILITY

Eddie Benton-Banai, a member of the Lac Courte Oreilles Band of Ojibwe and one of the founders of the American Indian Movement, shares a story of when *Nanabozhoo*, the shape-shifting Anishinaabe figure sometimes referred to as original man, travels west to seek the gift of fire. When he arrives at the

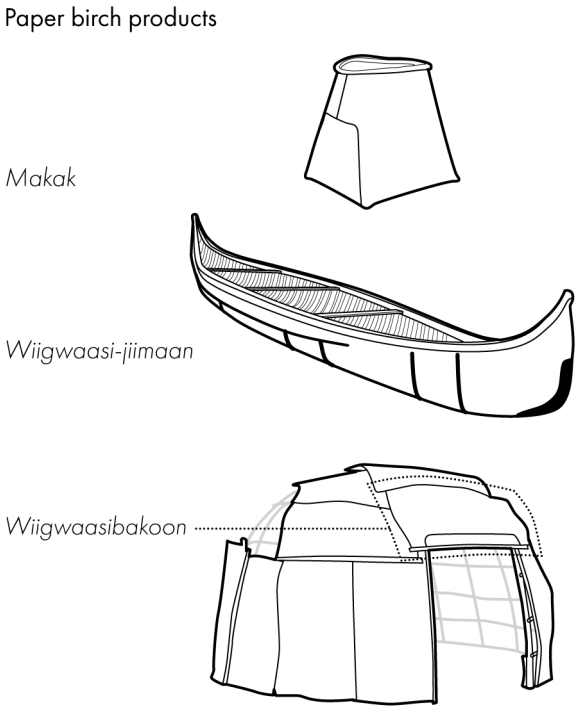

Figure 2. Three objects made from *wiigwaasi-mitig*. Drawing by author.

Firekeepers lodge, he receives it, but is cautioned that "fire is a very special gift from the Creator. If you respect it and take care of it, it will take care of you and bring you warmth. But locked up in this goodness is also evil. If you neglect fire or use it in the wrong way, it could destroy the entire Creation."[8] Robin Wall Kimmerer, a member of the Citizen Potawatomi Nation reflects on the same story and writes that "All powers have two sides, the power to create and the power to destroy. We must recognize them both, but invest our gifts on the side of creation."[9]

Conventional design practice fails in this recognition. While designers undoubtedly invest their gifts in creation, we are notoriously bad at recognizing the destructive potential of power. We have slowly started to reform through tools like life cycle analysis, and theoretical frames like circular economy, but for now they function only as strategies for mitigation rather than revolution. These techniques can't significantly improve most design practices because they continue to estrange us further from the very real and damaging effects caused by our acts of creation. It is hard to imagine a more abstract, disembodied representation of design than the many-paged table of inputs and outputs that represent a completed life cycle analysis. It is counterproductive to push energy and materials farther from ourselves in this way. We should instead try to better understand our sources by looking directly at them, by bringing them close.

Among Anishinaabe people, some ceremonies are marked by a sacred fire, which is carefully tended by firekeepers for the duration of the event, around the clock and through the night, sometimes for several days. The sacred fire is a source of heat and flame, but also a point of connection, one that requires attention, gratitude, and respect. The responsibility of the firekeeper is both to add wooden fuel to keep it alight and to ensure it stays under control—a clear, direct act of caretaking that seeks to maintain balance in an energetic system.

RESPONSIBILITY & RESPECT IN ANISHINAABE DESIGN

This reciprocal relationship of shared respect characterizes most products of traditional Anishinaabe design. It can be observed through a single material, taken from *wiigwaasi-mitig*, the paper birch tree, and three useful objects made from its bark: the *makak*, a folded vessel used for storage, the *wiigwaasi-jiimaan*, a canoe which was once the dominant mode of transportation throughout the Great Lakes region, and *wiigwaasibakoon*, lodge coverings that assemble to create weatherproof winter homes, yet are lightweight and flexible enough that a single person can roll them up and carry a family's roof on their back.[10] These objects might be referred to as "traditional," since they have their origins in Anishinaabe techniques that have been continuously practiced since time immemorial, but they are by no means artifacts or relics. Indigenous artists and designers have never stopped creating them, and as large numbers of younger indigenous people seek ways of reconnecting with their cultures, these objects are seeing a resurgence—being reinterpreted, customized, and shared across YouTube, Facebook and Instagram.

The contemporary adaptations of these forms testifiy to the incredible aesthetic and functional variety that can be achieved by experimenting with the materials immediately at hand in any given environment. To walk through the five lifecycle phases of these three birchbark products is to observe a design process that is clearly, directly, and respectfully related to both resources and energy, a process that does not estrange or abstract them, but instead holds them close.

STAGE 1: EXTRACTION (HARVESTING)

We might begin with the conventionally named phase of "material extraction", though a more appropriate term when referring to birchbark around the Great Lakes would be "harvesting," as the process of slicing and removing the outer bark from the underlying cambium does not harm or kill the tree when properly performed, an incredible property of the species.[11] Generally abundant in the forests of Upper Michigan, Wisconsin, and Minnesota, the bark is readily accessible to indigenous people seeking to assemble a *makak* or *jiimaan*. Under the conditions of treaty rights affirmed by the 1983 Voigt Decision in the 7th Circuit U.S. Court of Appeals, hunting, fishing, and gathering on public—and in some cases private—land in the ceded territories of the Ojibwe is guaranteed for tribal citizens.[12] At the heart of this and similar court cases in the region were questions of extraction, as state departments of natural resources feared that unfettered indigenous rights

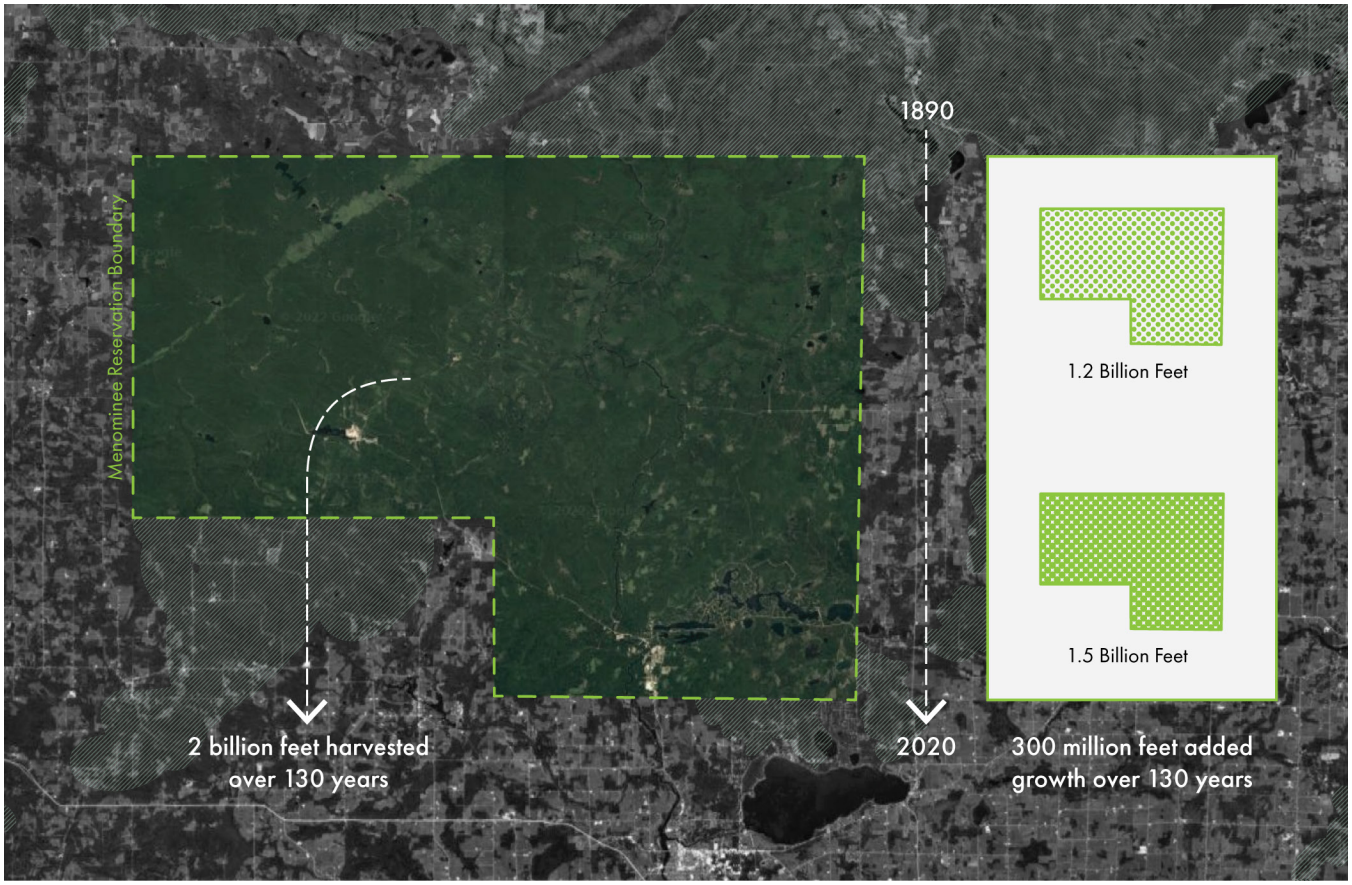

Figure 3. Sustained yield forestry on Menominee reservation. Drawing by author.

would lead to overexploitation of plant and animal species in the ecosystems surrounding the lakes. This has not taken place in the forests, due at least in part to the traditional practices that require protocols of gratitude, including the offering of *asemaa*, the tobacco used in asking for guidance or giving thanks. Robin Wall Kimmerer describes the practice in her book *Braiding Sweetgrass*: "[T]he harvest begins," she writes, "Not with a saw…but rather with a conversation… Traditional harvesters recognize the individuality of each tree as a person, a nonhuman forest person. Trees are not taken, but requested. Respectfully, the cutter explains his purpose and the tree is asked permission for harvest. Sometimes the answer is no."[13]

One has only to look to Menominee lands in Wisconsin to see the astonishing long-term results of this type of reciprocal relationship. After beginning commercial logging in 1890 within the hardwood forests that cover 95 percent of their reservation, the Menominee have produced more than 2 billion feet of timber on their land through their own forestry over the past 130 years. In spite of that impressive harvest, the overall quantity of *living* trees on their lands has actually *increased* from 1.2 billion to 1.5 billion feet of timber over the same period of time.[14] The legal boundaries of the reservation are clearly visible in satellite imagery, where a dense green rectangle marks the difference between the continuously improving species diversity within the Menominee forest, and the more exploitative logging and agricultural practices that characterize the lands outside their borders. The scale of impact is profound, with results that can be perceived even from space.

STAGE 2: MANUFACTURING (ASSEMBLY)

The second stage of the lifecycle, assembly, is straightforward for most *wiigwaas* products, and marked by minimal processing. Because the bark is most pliable when first removed from the tree, curving and folding methods like those used to form a *makak* are best performed right on the spot, immediately after harvest.[15] To fabricate a canoe, formwork is required, but this can also be accomplished onsite by laying bark on the ground, weighing down the center of the hull with stones, then propping up the sides of the sheets with stakes, lashing them to a white ash frame, and securing the final shape by inserting cedar ribs and battens.[16] The use of the forest as both site of material harvest and *in situ* fabrication workshop means that the first two phases of the product's lifecycle are bound to the very place the bark grew—from seed, to sapling, to mature tree—ensuring respect for the material and the life that enabled its creation. This is a far cry from mineral mines pushed to the geographical periphery and forgotten by designers and consumers, even as they power and supply our factories. Here in the forest, it is hard to forget or ignore the debt owed to a site

Figure 4. *Wiigwaasibakoon* and reed mat insulation on a *waaginogaan*. Author's photograph at Ziibiwing Center of Anishinabe Culture & Lifeways.

of extraction, when the peeled trunk is visible beside the gradually emerging canoe. When material costs are made this plain during fabrication, respect is a given, and waste is reduced.

STAGE 3: DISTRIBUTION (TRANSPORTATION)

In the third phase of the lifecycle, transportation, *wiigwaas* benefits from its high strength to weight ratio. This property made the birchbark canoe the preeminent form of transportation for Anishinaabe nations around the Great Lakes because they could be quickly and easily portaged around rapids and across difficult terrain by only one or two people.[17] When the French *Voyageurs* arrived as traders, they abandoned their European vessels and adopted the design, ultimately enlarging the *jiimaanan* into wide cargo vessels called *Canot du Maitre*, a significant advantage in the region.[18] The *makak* similarly achieves the functionality of a ceramic vessel with a fraction of the weight, and the paper-thin *wiigwaasibakoon* serves the equivalent purpose of hundreds of pounds of roof shingles. The weight of a product is directly tied to its carbon emissions, as freight accounts for around 30% of all transportation-related fuel combustion.[19] When an object is lightweight, it requires less energy to move, and its carbon footprint remains light as well. The *wiigwaas* products of the Ojibwe are object lessons in how to design for maximum functionality and capacity while using an absolute minimum of material means.

STAGE 4: USE

The fourth stage of these products' lifecycles, use, is not characterized by much consumption. But they are each prone to frequent animation by their human companions, all versatile objects that remain in motion by virtue of their relationship to the activities of human life. The *makak* can be used for long-term storage, and when seams are bound firmly can be airtight containers. Combined with the antimicrobial properties of the bark, this creates a suitable container for perishable food items. If the seams are sealed with spruce pitch, the container becomes as watertight as the canoes, and can then be used for boiling—the water inside the vessel keeping the bark from burning even when exposed to direct flame.[20]

The most remarkable feature of the *jiimaan* during the use phase is its fast and easy repair, made possible by its creation from elements abundantly available in the Great Lakes landscape. *Canot du Maitre* on long voyages made a practice of recoating the seams of the canoes every night.[21] The thick black pitch that marks each new repair is ingeniously inconspicuous due to the patchwork aesthetic of the original design. The contrasting black stripes at each seam of a newly completed *jiimaan* creates an irregular, imperfect pattern that anticipates the inevitability of repairs. Each successive patch is thus not perceived as a blemish or an aberration to the carefully composed whole, as is always the case for the gleaming white products of modern designers, but instead serves as a visible record of an event in the life of the boat and its crew, as well as a sign of the material and energetic inputs that will continue to modify its appearance throughout its useful years, almost as if the object itself were alive. Perhaps most importantly, this patina of care accretes on the hull through many repeated acts of devoted maintenance, performed by those who depend on the boat to carry them through rough waters. These marks of repair are thus meaningful displays of interdependence and a reciprocal habit of care. The *jiimaan*, like the very best products, is designed not to be worn out, but to be gradually broken in.

The *wiigwaasibakoon* are tied fast across a domed frame of saplings in overlapping layers that keep rain, snow and wind out, while keeping heat in. Forming some hybrid between the building paper and hardwood shingles that characterize many American Colonial homes, these birchbark sheets might appear quite different in terms of their seemingly ephemeral presence. Indeed, part of the genius of their design is that they are highly portable and not permanently fixed or sealed to their structural frame, so they may be removed relatively quickly, and rolled up with the reed mat underlays that serve as insulation for the lodges, forming a lightweight, portable shelter that should be the envy of Jean Prouve's modular houses.

While these structures are meant to be moved in accordance with the seasonal cycles and activities that structure Ojibwe life throughout the year, it would be a mistake to think of them as more akin to the design of a tent than to a home. First, because these are semi-permanent structures, built and occupied in specific locations for months at a time. Some sites, and the bent sapling frames left on them, might be revisited during the appropriate time year after year, forming a series of seasonal homes that share a portable weatherproof superstructure.[22] But more significantly, the clarity with which the *waaginogaan* expresses its semi-permanent nature reveals a profound truth about architecture that most American homes attempt to conceal. Both are in a constant state of flux, and *both* require extensive maintenance and repair to go on existing at all. Building is a noun, but it is most importantly a verb, a truth that our efforts at life cycle analysis attempt to expose, but ultimately fail because we continue to privilege the seeming permanence of the product, rather than the systems responsible for its creation and destruction. The *waaginogaan* is a radical model for domestic architecture because it doesn't carry the illusions and pretenses of permanence that are assumed prerequisites for the design of a home. In this temporal honesty, it acknowledges its dependence upon the land around it, and signals that it will someday, like all things, return to the land again.

STAGE 5: END OF LIFE

This brings us to the fifth and final stage, end of life. Proponents of circular economy and design for disassembly are particularly interested in the possibilities of this phase. They suggest that at the end of an object's useful lifetime, it might miraculously be reused, upcycled, carefully disassembled in accordance with its designer's wishes, or be broken down into components that can be shredded, smelted, melted, or pulped into

new materials bearing various degrees of resemblance to their sources. Aside from being an energy intensive process in its own right, it is far from comprehensive, with only around one third of consumer waste currently being recycled, the majority of which is from the already biodegradable and compostable categories of paper and cardboard.[23] More problematic materials, like plastics, chemicals, rare earth metals, mercury and the other hazardous rubbish densely intertwined in e-waste, are effectively recycled at much lower rates.[24] While the rhetoric of circular economy has led companies like Apple to theoretically commit to using all recycled materials in their designs by a still unspecified date,[25] the reality of applying this type of system still seems a long way off.

These anxieties are not present in the fabrication and use of traditional *wiigwaas* designs. Thin, lightweight objects, which even upon initial completion seem to walk the narrow edge between existence and end of life, they can last for generations with proper maintenance and repair. The handful of materials that go into their making: birchbark, spruce root lashings, cedar battens, white ash frames and pine sap sealants, are minimally processed, and are thus never far removed from the natural cycles from which they came. The final decision to either repair the object or to say goodbye is not an agonizing one, as its materials can easily reenter the carbon cycle by being mulched in the yard, and supplies to fabricate a replacement are equally close at hand. Elder Rosella Kinoshameg has said the following about coping with human death, but the same perspective could be useful in thinking about design:

> When we come into the world, we are born through the eastern doorway, and then we have our journey. And wherever it ends—we don't have to go to old age—then we have completed our circle. And when we leave this world, we go through the western doorway…When somebody dies a lot of people are sad…but we should be happy because they are born into the spirit world—they are going back to the creator.[26]

RESPONSIBLE DESIGN PRINCIPLES

These three objects are the products of highly specific environmental, ecological, and cultural conditions, and developed over thousands of years of iteration and experimentation. This is precisely why they are so well suited to their tasks. This is why they exist so harmoniously within their contexts. This is why they are so balanced between their cultures of production and use, and leave so little footprint behind. As we attempt to confront the parallel and interrelated legacies of colonialism, resource extractivism, and climate change, it's worth carefully studying the Anishinaabe perspective on design, one that has led to the creation of very few permanent or monumental structures. We should all aspire to this quality of design, to this way of being at home in the world.

I do not mean to say that these specific products or methods are appropriate or applicable to other locations. In fact, it is exactly the opposite. To begin making identical birchbark objects in Latvia for export to Australian markets for example, would be a disaster. However, what we can discern by looking at these precedents is that no product of human creation can ever truly be decontextualized, except through the damaging leaps of imagination that abstraction entails. No matter how flat the world becomes, how interconnected our cultures, no matter how internationally styled or universally efficient a design paradigm purports to be, the best solutions to design problems will always be those most deeply rooted, most connected, and most situated in their place.

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