Working DRAFT

Spectrum of Modularity:

An Alaskan Case Study of Modular Housing Types

Final Report
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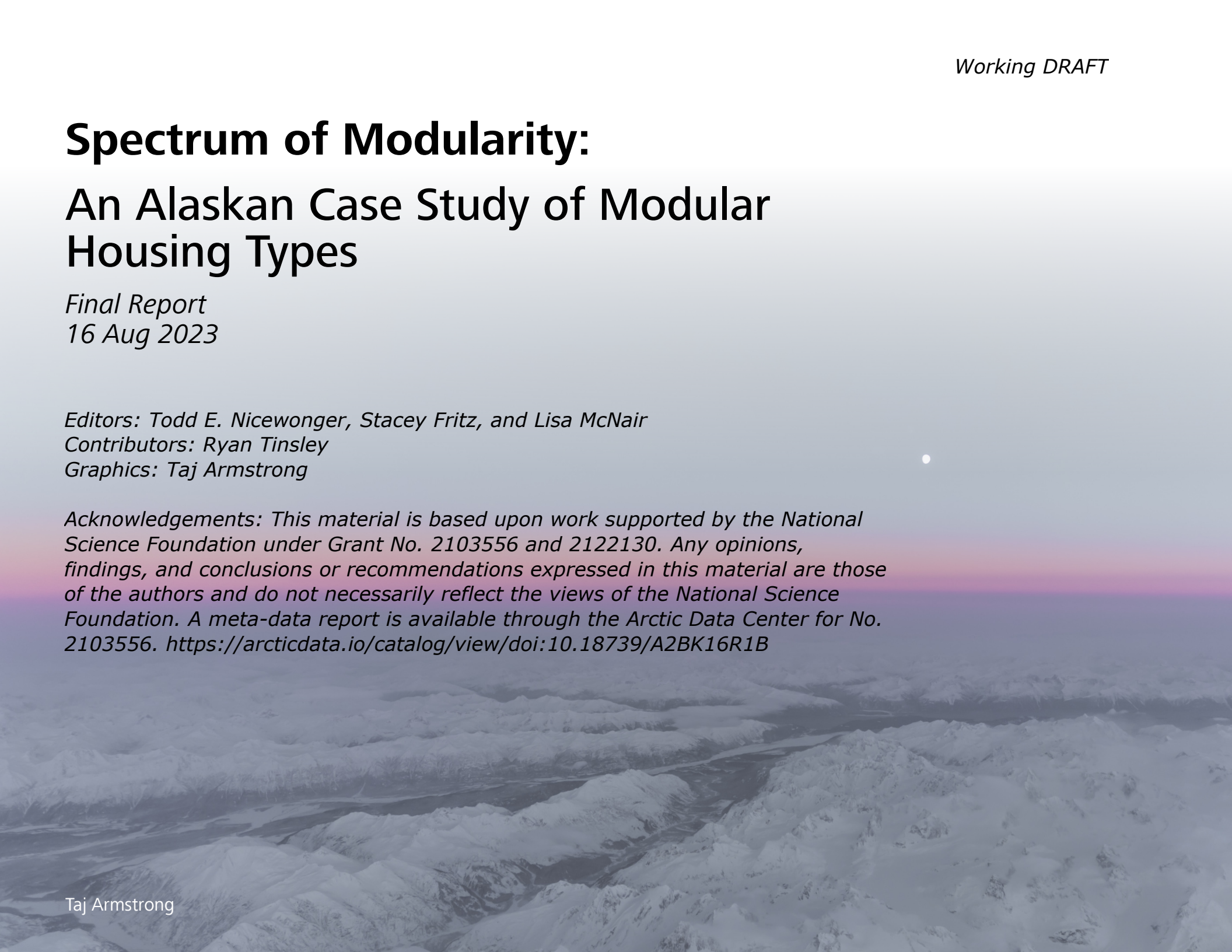


Contents

Summary

To communicate and utilize research of different options for Alaskan housing, a framework for comparison is necessary. The design work in this document attempts to unify our language and model for approaching modularity in housing by using a set of visual guides to compare variables and characteristics of different housing styles.

While this is by no means a comprehensive exploration, this work can act as the beginnings of a framework to identify where modularity has appeared in physical structures, throughout their lifecycle from manufacturing and construction to usage and reparability. It is also an opportunity to present gaps in the housing style marketplace, as well as highlight case studies in which examples of existing housing prototypes have been studied in detail in order to fulfill the need for truly modular and adaptable housing.

Work that was completed is based around the concept of a "Spectrum of Modularity" in both the manufacturing and usages stages of a housing structure. This graphic format was chosen to show some of the important characteristics of modularity that were identified in collaboration with researchers:

> In the Manufacturing stage, structures are plotted on axes of Fabrication, from Pre-Fabricated to On-Site Construction, and Reusability, from Single-Use to Design for Reassembly
>
> In the Usage stage, structures are plotted on axes of Potential for Modification, from Static to Dynamic, and Longevity, from Temporary to Permanent

15 housing styles were chosen for the Spectrum of Modularity. This list is developed from previous attempts at developing similar graphics, and was refined further throughout the collaborative process. This includes:

> 11 varied styles of available housing (Catalog, Emergency, Log Structure, Manufactured, Quonset Hut, Shipping Container, Structural Insulated Panel (SIP), Vehicle, Wall Tent, Yurt, 3D Printed)
>
> 4 prototype Cold Climate Housing Research Center (CCHRC) prototypes (Anaktuvak Pass, Quinhagak Integrated Truss, Quinhagak Octagonal, Unakleet Shipping Container)
>
> 1 conceptual housing system (Adaptable)

Project Specifications

Use Case

Academic journals and publications

Presentations to experts, stakeholders, researchers

White papers for builders, decision-makers, planners

Iconography

Standard system to match typography and layout design

Neutral icons reproducible with simple strokes and limited color

Easily adaptable to various sizes, mediums, and formats

Original assets for open distribution

Colors

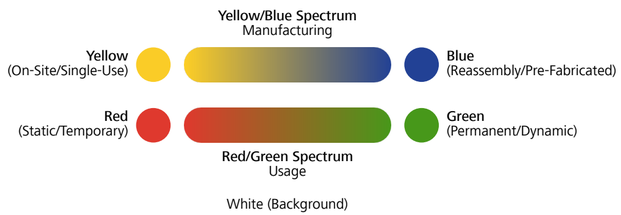
Limited use of color to accentuate

Utilization of shadow to imply depth and spacing

Cost-effective reproduction on print documents

Usage of grey in middle of gradients to show spectrum

Ensure accessibility by never using only color to differentiate



Typography

Convey authority while maintaining interpretability and neutrality of source

Maintain readability in digital, printed, and potentially impaired conditions

Adjacent to government/official resources, signage, handouts, etc.

Frutiger Next
Frutiger Next
Frutiger Next
Frutiger Next

AaBbCcDdEeFfGgHhIiJjKk
LlMmNnOoPpQqRrSsTtUu
VvWwXxYyZz0123456789

Deliverable Specifications

Spectrum of Modularity

- Digital graphics for slide deck, website, etc (high quality PNG files)
- Printable graphics for handouts (8.5 x 11” PDFs)
- Editable versions of work (PSD/Illustrator files)

Housing Style Briefs

- Digital cards for each style (high quality PNG files)
- Printable cards for each style (8.5 x 11” PDFs with cut marks)
- Editable versions of work (PSD/Illustrator files)

Individual Assets

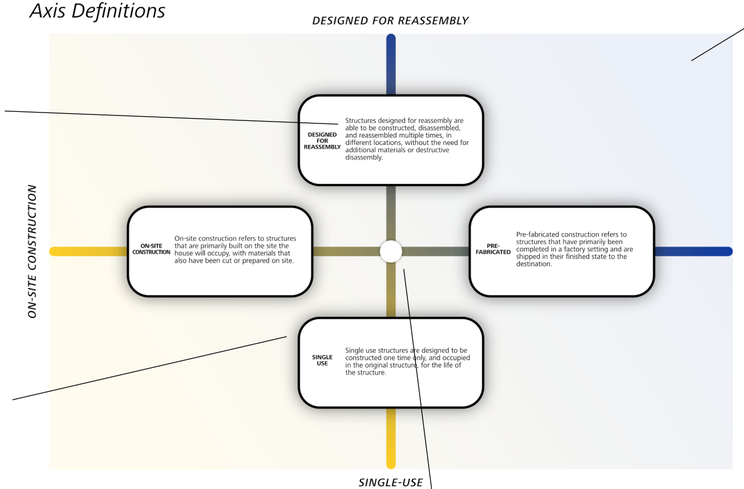
- Icons, Spectrum axes (individual PNGs)

Supporting work

Infographic Breakdowns

Spectrum of Modularity: **Manufacturing**

Axis Definitions



Axis definitions
Provides an easy guide to interpreting the Manufacturing and Usages axes that styles are plotted on

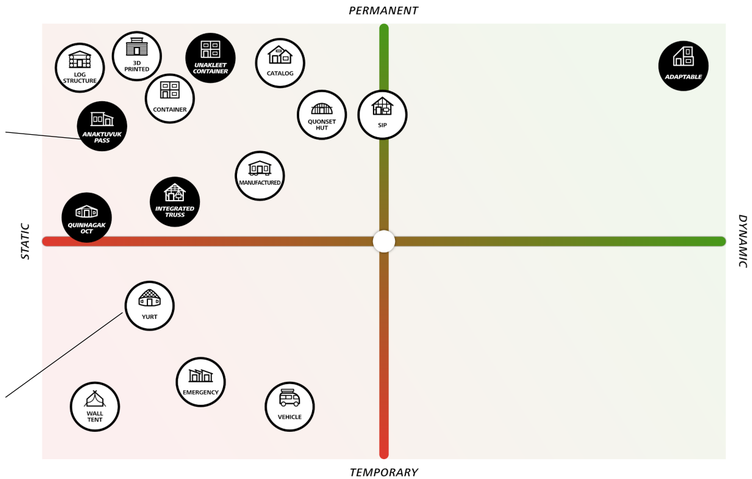
Background shading
Provides subtle cues to approaching edges of spectrum

Drop shadow
Implies separation of elements from spectrum itself to reinforce definitive nature of text

Spectrum middle
Anchors a center-point that defines boundaries between extremes of axes while still acknowledging "grey area" in spectrum

Spectrum of Modularity: An Alaskan Case Study of Modular Housing Types

Spectrum of Modularity: **Usage**



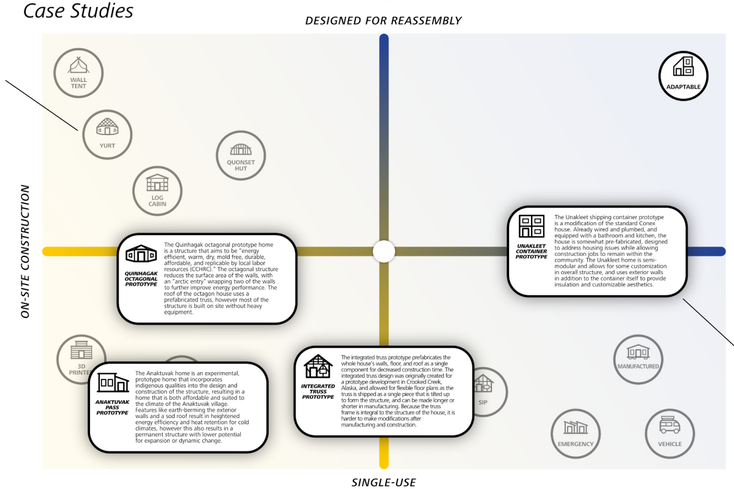
Bold, oblique text/knockout icon
Differentiates case study styles

Lack of Shadow
Connects housing style icons to spectrum

Spectrum of Modularity: An Alaskan Case Study of Modular Housing Types

Spectrum of Modularity: **Manufacturing**
Case Studies

Reduced transparency
Allows icons to fade into background while remaining readable and comparable



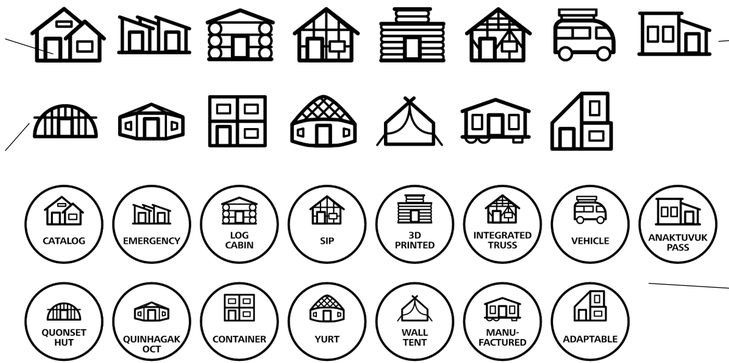
Drop shadow
Implies separation of case studies from other housing styles to highlight importance

Spectrum of Modularity: An Alaskan Case Study of Modular Housing Types

Spectrum of Modularity
Icon Library

Standard visual cues
The inclusion of a standard door on most icons anchors around a common element

2 stroke widths
The use of only 2 stroke widths with no shading is optimal for reproducibility

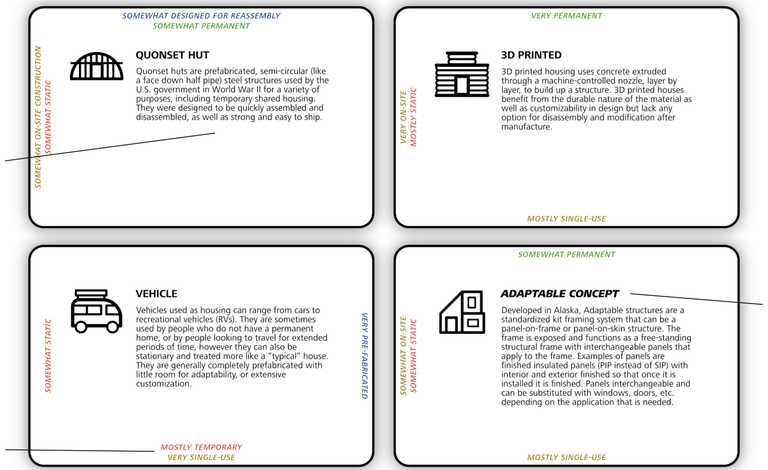


Flat front design
A simple, front perspective for icons allows for easy identification of visually distinct features

Options for presentation
Both an icon only set and icon "badge" set are included

Spectrum of Modularity: An Alaskan Case Study of Modular Housing Types

Spectrum of Modularity
Housing Style Briefs

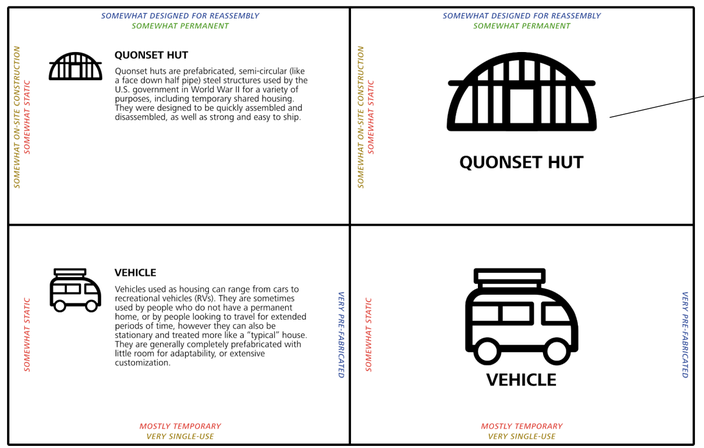


Descriptions
Card formats allow for longer descriptions of each style and reduce clutter on spectrum

Relevant spectrum information
Axes positions and color-coordinated text allow for quick identification of structure style traits

Bold, oblique text
Differentiation of case studies carries through to cards

Spectrum of Modularity
Housing Style Briefs - Printable

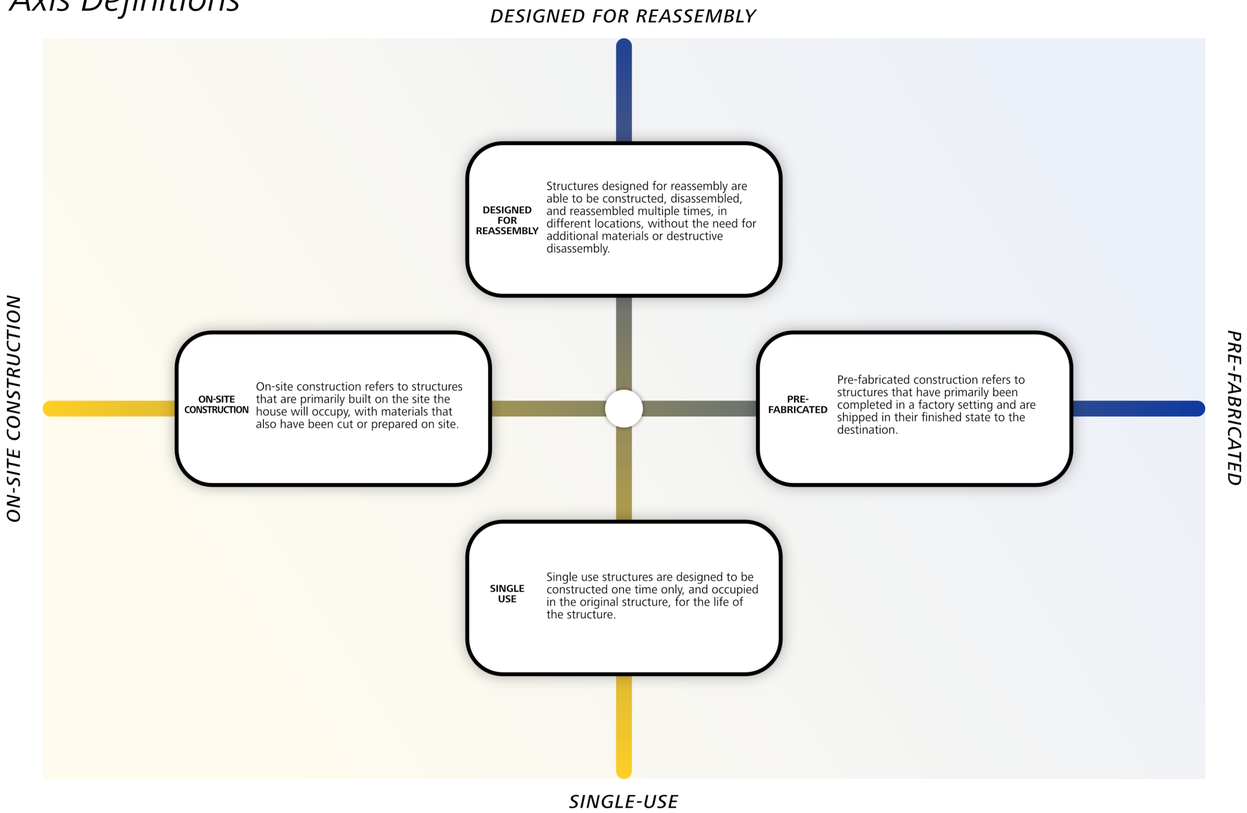


Connected outlines
Individual blocks become connected rectangles for simple printing and cutting

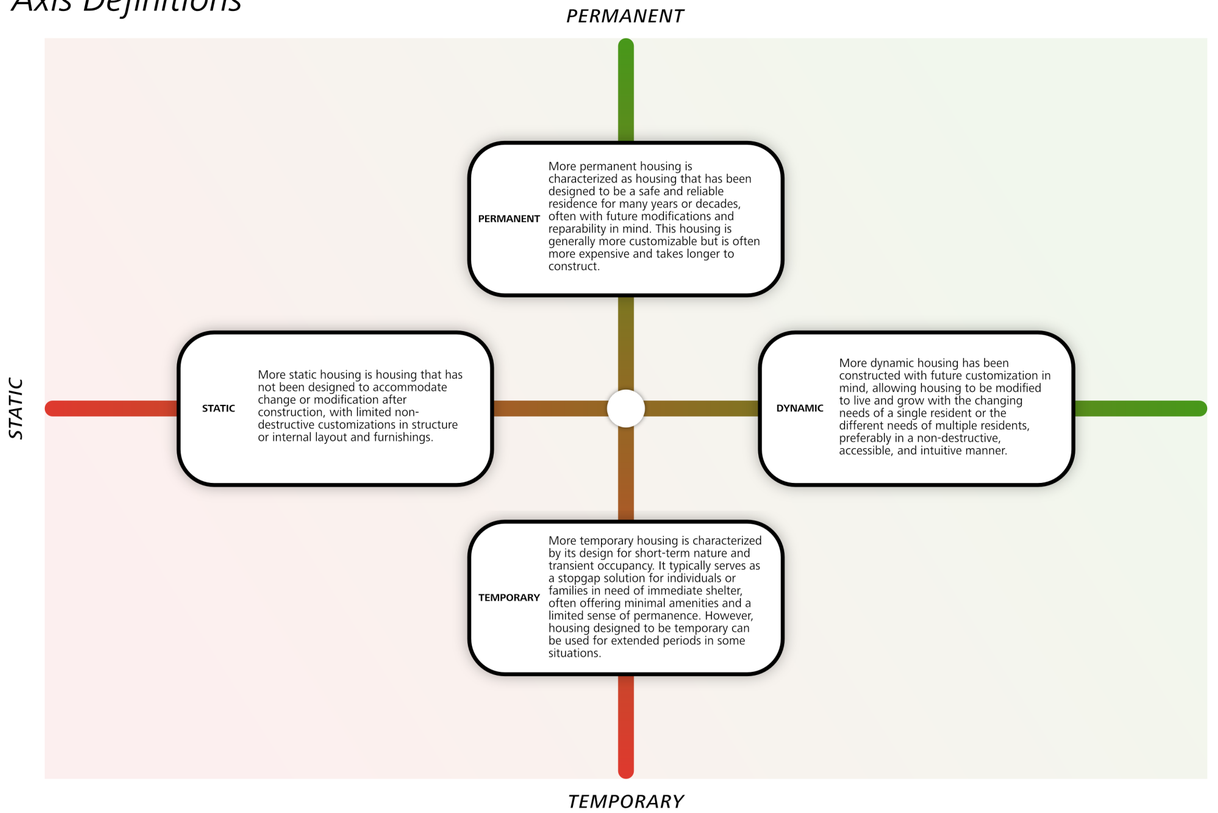
Front and back
Advantage is taken of front and back of cards to allow for easy identification

No drop shadow
No drop shadow is included to reduce clutter and improve print quality

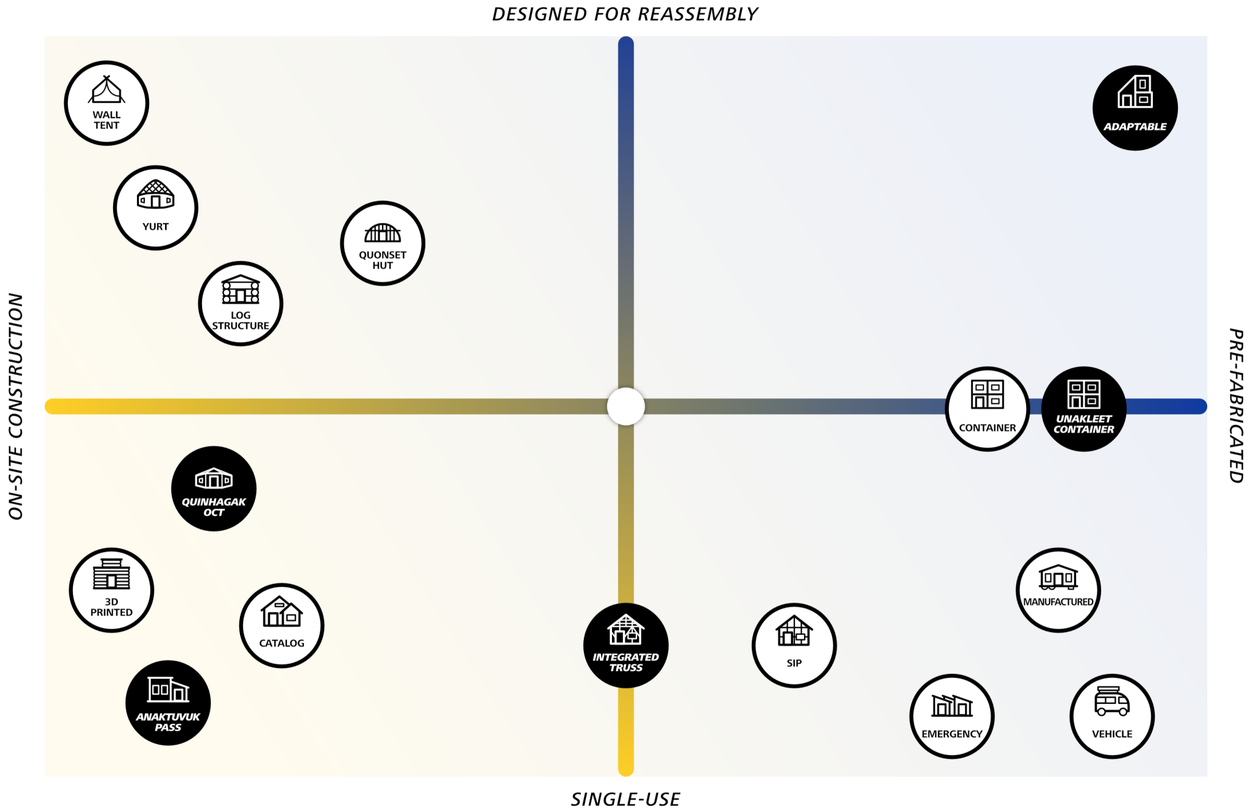
Spectrum of Modularity: **Manufacturing**
Axis Definitions



Spectrum of Modularity: **Usage**
Axis Definitions



Spectrum of Modularity: **Manufacturing**



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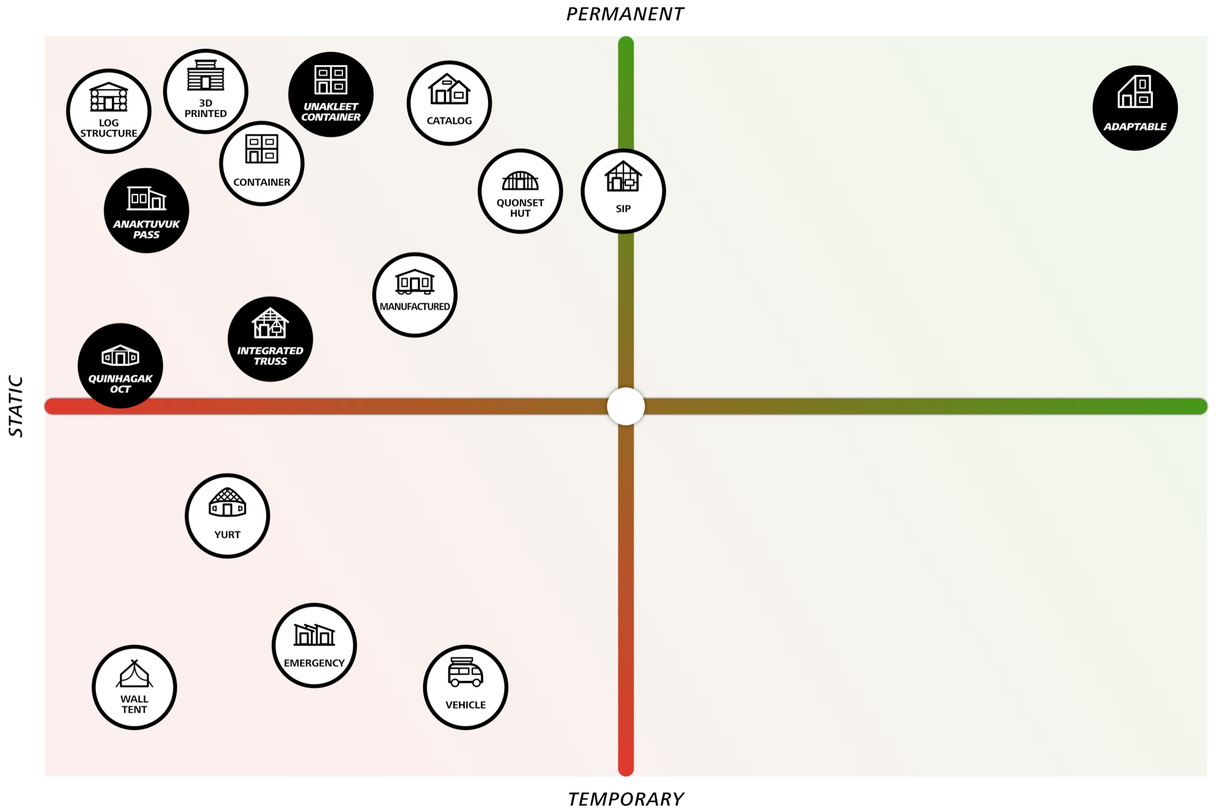
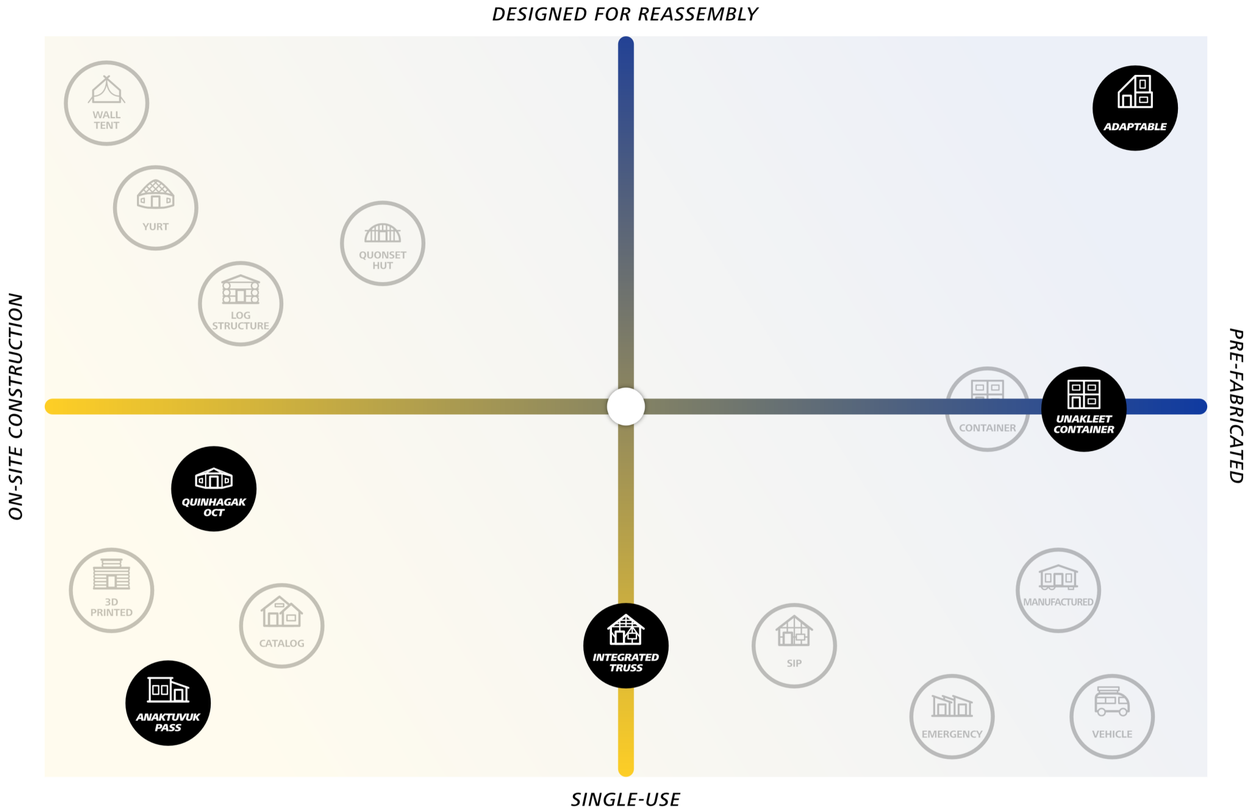
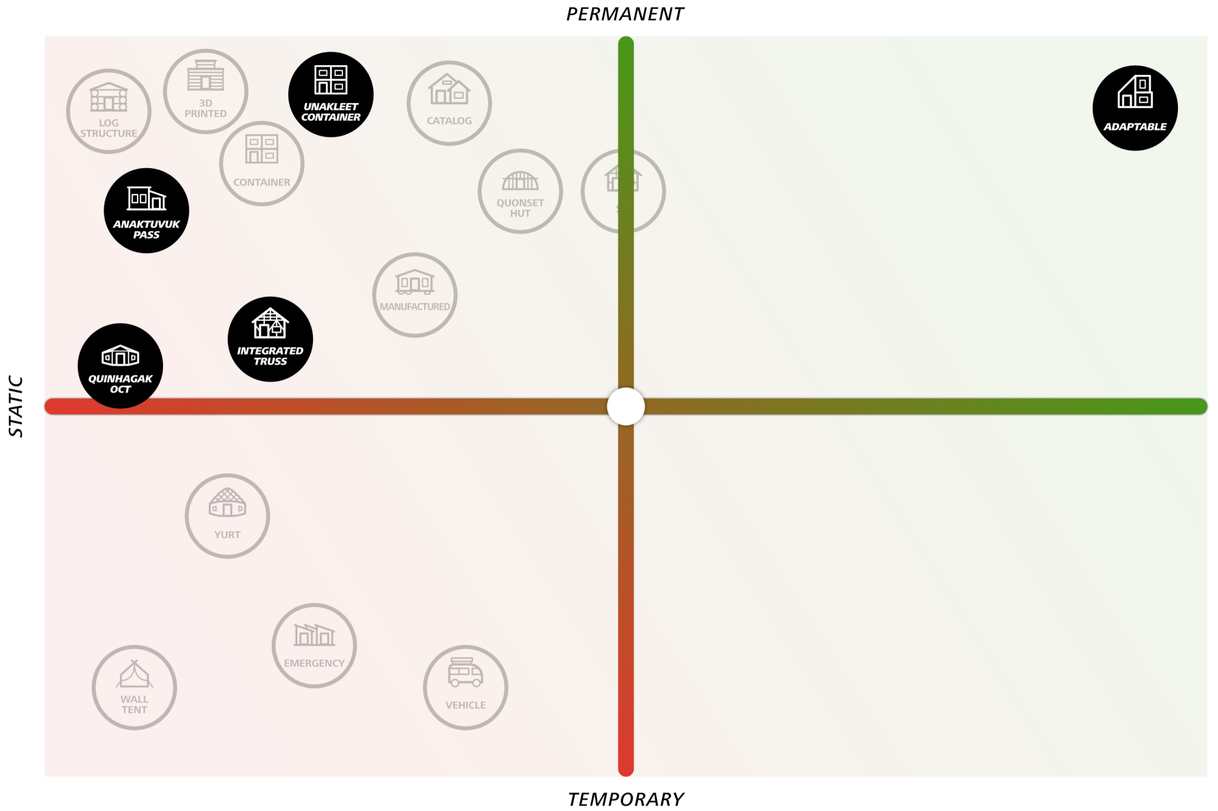


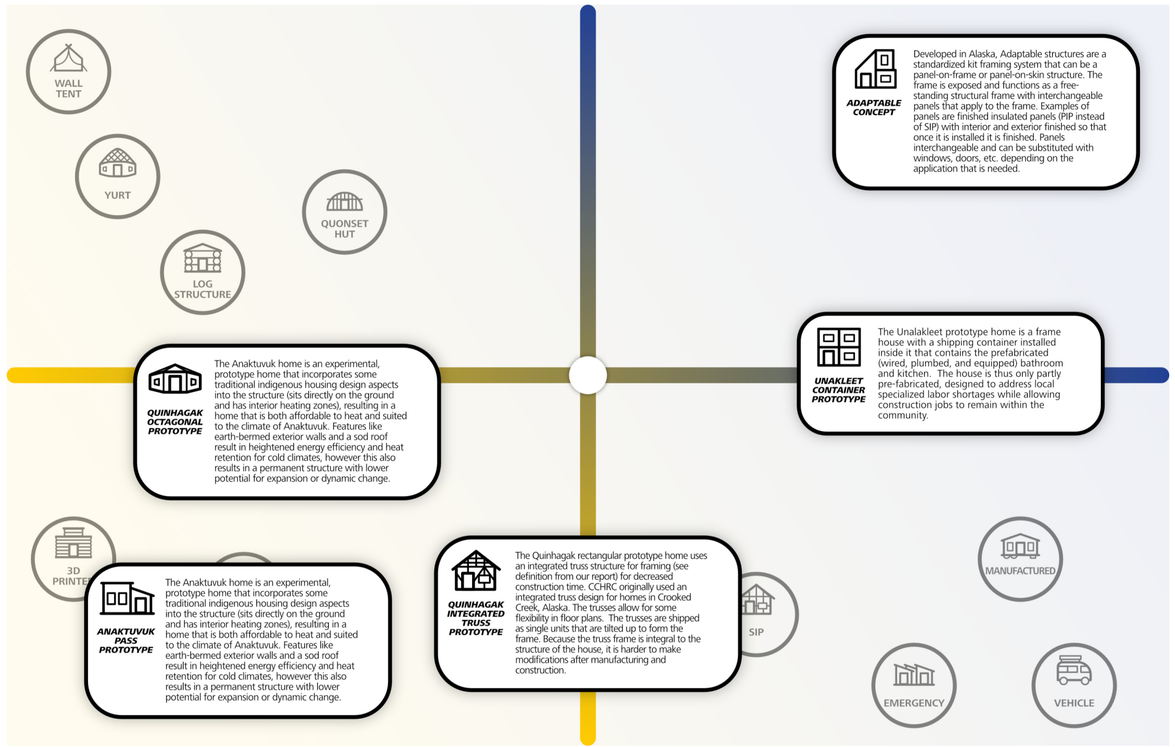
Spectrum of Modularity: **Manufacturing**



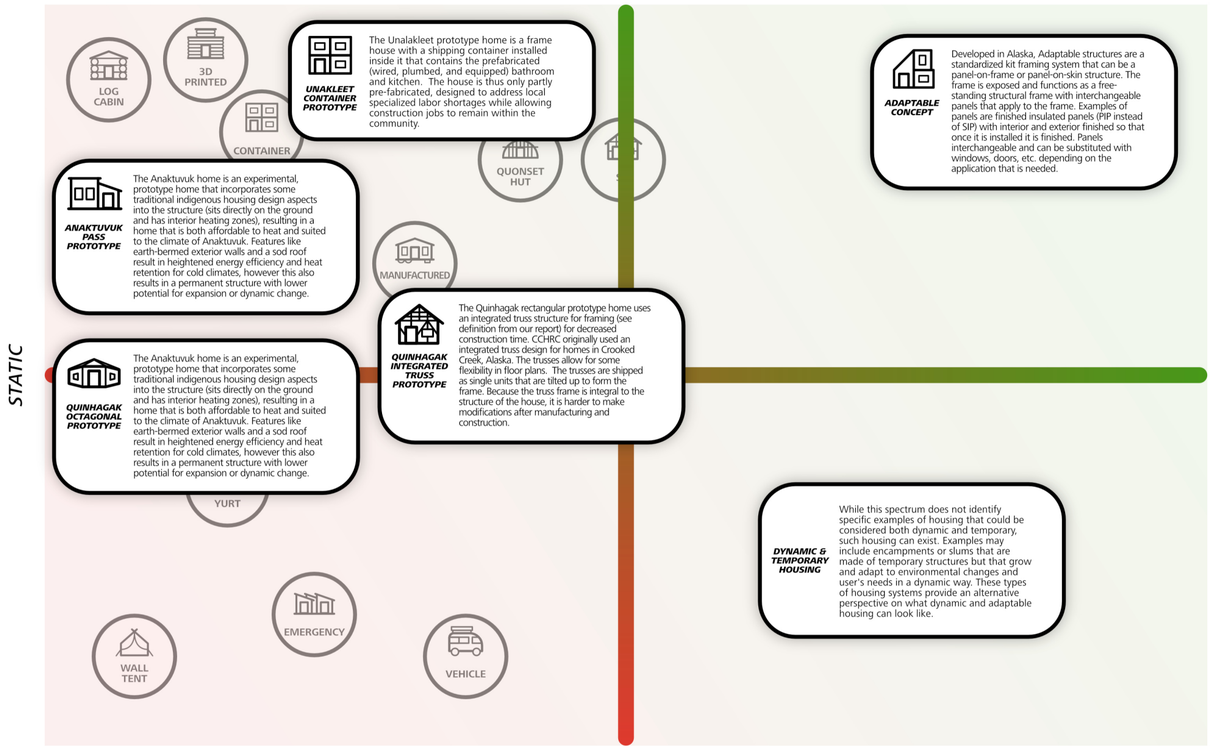
Spectrum of Modularity: **Usage**



Spectrum of Modularity: **Manufacturing**
Case Studies



Spectrum of Modularity: **Usage**
Case Studies



Spectrum of Modularity
Housing Style Briefs

SOMEWHAT PERMANENT

SOMEWHAT STATIC

MOSTLY PRE-FABRICATED

MANUFACTURED

Manufactured homes, formerly known as mobile homes, are a subset of pre-fabricated housing primarily designed to be moved to a location through road transportation. They are built on a trailer frame with axels and wheels, though these can be hidden. Many manufactured homes are not transported again once they reach their destination.

SOMEWHAT SINGLE-USE

MOSTLY DESIGNED FOR REASSEMBLY

VERY ON-SITE
MOSTLY STATIC

YURT

A yurt is a traditional round tent, usually framed with wood and covered in felt, animal hides, or fabric. They are particularly quick to assemble like a wall tent but can provide more structure and permanence while still allowing for disassembly. Yurts can have a deep cultural significance in some areas.

SOMEWHAT TEMPORARY

VERY DESIGNED FOR REASSEMBLY

VERY ON-SITE
VERY STATIC

WALL TENT

Classic wall tents are timber poles lashed together with a canvas cover. They are meant to be temporary dwellings in a variety of environments. While these tents are easily built, disassembled, moved, and rebuilt, they have a low durability and little room for modification.

VERY TEMPORARY

MOSTLY PERMANENT

MOSTLY STATIC

CONTAINER

Homes that are constructed with shipping containers, which in Alaska are often called a ConEx. These shipping containers are prefabricated structures that can be shipped with normal methods to their destination. They can be used as a single "tiny home" dwelling or connected to form larger structures. The steel shell of a shipping container reduces the ability for modifications but provides a strong frame for building an interior space.

SOMEWHAT PRE-FABRICATED

SOMEWHAT SINGLE-USE

Spectrum of Modularity
Housing Style Briefs

VERY PERMANENT

MOSTLY ON-SITE
SOMEWHAT STATIC

CATALOG

Catalog homes, which were popularized by the Sears Modern Homes Catalogue that were available via mail-order, are a style of kit housing that are ready to build. They have pre-cut materials and some pre-fabricated elements, but are still constructed on-site. They are similar in repairability and expansion capabilities to typical stick-frame houses and are permanent structures.

MOSTLY SINGLE-USE

MOSTLY STATIC

EMERGENCY

Emergency or disaster relief housing is a category of housing that is intended to provide temporary relief shelter after natural disasters, emergencies, or other mass loss of housing. A common style is the "FEMA trailer", however other varying styles exist. Most are not designed to be permanent solutions to houselessness, although it is not uncommon for these structures to be used longer than intended.

MOSTLY TEMPORARY
VERY SINGLE-USE

SOMEWHAT PRE-FABRICATED

SOMEWHAT DESIGNED FOR REASSEMBLY
VERY PERMANENT

MOSTLY ON-SITE
VERY STATIC

LOG STRUCTURE

Log structures are widely used across the pan-arctic but can found around the world due to the simplicity in their construction. Kits are available with pre-cut materials that can then be built by the consumer, somewhat similar to how a catalog home could be ordered. "Modular" log cabins are also sold, with pre-fabricated structures that are delivered in sections and then assembled at the site. While log cabins can theoretically be disassembled and rebuilt, their durability and permanence make this rare.

MOSTLY PERMANENT

STRUCTURAL INSULATED PANEL

Structural insulated panels (SIPs) are structural panels, usually engineered using wood sheathing on either side of a foam core. SIP homes can be high performance with fast construction times due to the prefabricated walls and roofs. Other materials can be used to create a SIP (e.g., metal, plastic, concrete, etc.) for constructing homes and other structures.

MOSTLY SINGLE-USE

SOMEWHAT PRE-FABRICATED
SOMEWHAT DYNAMIC

Spectrum of Modularity
Housing Style Briefs

SOMEWHAT DESIGNED FOR REASSEMBLY
SOMEWHAT PERMANENT

SOMEWHAT ON-SITE CONSTRUCTION
SOMEWHAT STATIC

QUONSET HUT

Quonset huts are prefabricated, semi-circular (like a face down half pipe) steel structures used by the U.S. government in World War II for a variety of purposes, including temporary shared housing. They were designed to be quickly assembled and disassembled, as well as strong and easy to ship.

VERY PERMANENT

VERY ON-SITE
MOSTLY STATIC

3D PRINTED

3D printed housing uses concrete extruded through a machine-controlled nozzle, layer by layer, to build up a structure. 3D printed houses benefit from the durable nature of the material as well as customizability in design but lack any option for disassembly and modification after manufacture.

MOSTLY SINGLE-USE

SOMEWHAT STATIC

VEHICLE

Vehicles used as housing can range from cars to recreational vehicles (RVs). They are sometimes used by people who do not have a permanent home, or by people looking to travel for extended periods of time, however they can also be stationary and treated more like a "typical" house. They are generally completely prefabricated with little room for adaptability, or extensive customization.

VERY PRE-FABRICATED

MOSTLY TEMPORARY
VERY SINGLE-USE

SOMEWHAT PERMANENT

SOMEWHAT ON-SITE
SOMEWHAT STATIC

ADAPTABLE CONCEPT

Developed in Alaska, Adaptable structures are a standardized kit framing system that can be a panel-on-frame or panel-on-skin structure. The frame is exposed and functions as a free-standing structural frame with interchangeable panels that apply to the frame. Examples of panels are finished insulated panels (PIP instead of SIP) with interior and exterior finished so that once it is installed it is finished. Panels interchangeable and can be substituted with windows, doors, etc. depending on the application that is needed.

MOSTLY SINGLE-USE

Spectrum of Modularity
Housing Style Briefs

SOMEWHAT PERMANENT

MOSTLY ON-SITE
VERY STATIC

QUINHAGAK OCTAGONAL PROTOTYPE

The Quinhagak octagonal prototype home is a structure that aims to be "energy efficient, warm, dry, mold free, durable, affordable, and replicable by local labor resources," (CCHRC). The octagonal structure sheds wind and resembles traditional round designs, and includes an arctic entry," wrapping two of the walls to further improve energy performance. The roof of the octagon house uses prefabricated trusses and a central hub, and most of the structure is built on site without heavy equipment.

SOMEWHAT SINGLE-USE

SOMEWHAT PERMANENT

MOSTLY STATIC

QUINHAGAK INTEGRATED TRUSS PROTOTYPE

The Quinhagak rectangular prototype home uses an integrated truss structure for framing (see definition from our report) for decreased construction time. CCHRC originally used an integrated truss design for homes in Crooked Creek, Alaska. The trusses allow for some flexibility in floor plans. The trusses are shipped as single units that are tilted up to form the frame. Because the truss frame is integral to the structure of the house, it is harder to make modifications after manufacturing and construction.

SOMEWHAT PRE-FABRICATED

MOSTLY SINGLE-USE

MOSTLY PERMANENT

VERY ON-SITE
MOSTLY STATIC

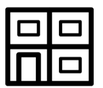
ANAKTUVUK PASS PROTOTYPE

The Anaktuvuk home is an experimental, prototype home that incorporates some traditional indigenous housing design aspects into the structure (sits directly on the ground and has interior heating zones), resulting in a home that is both affordable to heat and suited to the climate of Anaktuvuk. Features like earth-bermed exterior walls and a sod roof result in heightened energy efficiency and heat retention for cold climates, however this also results in a permanent structure with lower potential for expansion or dynamic change.

VERY SINGLE-USE

MOSTLY PERMANENT

SOMEWHAT STATIC



UNAKLEET CONTAINER PROTOTYPE

The Unalakleet prototype home is a frame house with a shipping container installed inside it that contains the prefabricated (wired, plumbed, and equipped) bathroom and kitchen. The house is thus only partly pre-fabricated, designed to address local specialized labor shortages while allowing construction jobs to remain within the community.

MOSTLY PRE-FABRICATED

SOMEWHAT SINGLE-USE

Spectrum of Modularity
Icon Library

Notes

This work is the basis of what can be developed as a full framework for approaching housing structures through the perspective of modularity. While beyond the scope of this work, I can envision a fully interactive digital tool that allows users to choose what variables they are interested in comparing, and adjust a multi-layered spectrum in real time to show them. Combined with options to explore further different housing styles with popups, images, and other media, this can be both an informational and actionable tool in exploring housing in Alaska and beyond. New ways of expressing multi-variate data (that go beyond the traditional XY axis) can be shown in digital interfaces which can fully unleash the functionality of this Spectrum of Modularity. These may be explored in further research and development of this project.

If there are any updates or corrections that need to be made to this work, please don't hesitate to contact me through my email.