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Portability: Making Art an Urban Event

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by
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Abstract

Conventional art exhibits shown in museums do not draw a wide range of visitors. Art museums display valuable works for the public to view; however, it is the institutional reputations that bring visitors, not the artwork. Creating a separate space for temporary exhibits with a high-image, celebratory, portable structure will draw more people to art exhibits.

This thesis will research two areas: urban event structures and portability. The design will represent a solution through drawings and models, based on a precedent review of portable and urban event architecture.

By separating the temporary exhibit from the museum, the experience can be focused on the art, not the museum. Including the benefits of an urban event setting, such as visual activity and movement, will reinforce the ideas behind the portable museum as a space that through its own high-image structure will bring in more of the general public to experience art.
portability: making art an urban event
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Introduction

The enjoyment of art is a notion valued by our society. Exhibitions of artworks in museums provide society not only with pleasure but with the grasp of valuable ideas, ranging from religious accounts to personal expression, movements throughout history, and understandings of spatial representation. Great care is taken to preserve these artworks for study by current and future scholars. The appreciation of the artwork, however, is not limited to this upper echelon of learned individuals. Scholars, school children, high school and university students, and the public in general appreciate art for a multitude of culturally imbued values. This implied value of art has been expressed not only in educational settings, but also by our communities as a whole. The emphasis placed on the care of artworks and the careful creation of spaces to display these works for the public has not gone unnoticed. All of this care and cultural appreciation of art, however, is not manifested by museum attendance. Increases in visitor attendance are recently noted, but overall attendance among the entire population has
not increased as much as it has among the population with previous cultural interest in museums.¹

Great art museums of our time generally have strong reputations and cultural recognition, and can even be considered tourist destinations. Sometimes, however, it is these significant reputations that bring visitors rather than the artwork itself. Even more detrimental to the museum, some visitors are driven not by interest in the subject, or in the educational value of the art, but simply because the museum provides a diversion.² Unless a considerable effort is made for a well-publicized program of events, significant effort is essential in order to promote multiple visits.³ Visitors have also been known to view as many artworks and galleries as possible instead of viewing a specific artwork for any length of time.⁴

This is not the only detrimental aspect of large museums. Beginning with the large national galleries and trickling down to individual cities’ large art museums, an increasing number of smaller towns and cities have been stripped of their local masterpieces to serve a supposed greater good when displayed among other national or worldly masterpieces. “This

² Treinen. p 88.
³ Treinen. p 86.
⁴ Treinen. p 88.
ideal museum would do to the rest of the world what Constable said a National Gallery would do to the distribution of artists in England: ‘If we must have a national gallery (as they say) it will be the end of art in the small cities of England, and art will cease to exist there as it has ceased in every country that has one.’”

The idea of this thesis it to propose a solution for the problems associated with temporary art exhibits—low attendance rates, inconvenience, and intimidating reputations—associated with great museums. It proposes a portable temporary exhibit space separate from conventional museums. By supplying this structure with its own significance, greater availability, and by creating a fun experience, an urban event, its own high image will draw people and bring art to a broader public.

Research into portable structures, successful urban events and the associated architecture will support the design of a portable exhibition space whose goal is to offer an enriching cultural, educational, experiential and public event. This thesis brings together aspects of transportation, material connections, and site connections in relation to portable architecture, with aspects of urban events such as magnitude, excitement, movement, visual stimulation.

Beginning with background information as to why museums have suffered in the areas of temporary exhibits and not achieving goals of repeat attendance, this thesis proposes a solution that brings together two areas of research to determine actionable principles for a basis in the design of a temporary portable exhibit space. In the Background section several problems will be addressed with current temporary exhibits such as institutional museum reputations, expense of visiting, oppressive reputations of museum curators and people most closely associated with museums, disinterest in art, and dull museum experiences.

Following the Background and Problem Statement, the history of portable structures will be discussed. Beginning with the first portable structures—Native American tipis, Bodouin tents, and Asian yurts—construction methods, uses and methods of disassembly and transportation will be studied. Continuing on with more advanced technology, other types of portable innovations will be researched, such as Buckminster Fuller’s Dymaxion House, the Charles and Ray Eames House, Frei Otto’s cable net structures, fabric tent systems and pneumatic structures. Focusing the research of these portable structures on topics such as transportation, demountability, material connections and site adaptations will help determine actionable principles for the design of the portable exhibition space.
The second major area of research will include the innovations and analysis of successful urban events. Determining the factors that contribute to fun urban events such as the theater, the circus, Bernard Tschumi’s Parc la Villette, and Renzo Piano’s and Richard Roger’s Pompidou Center will provide knowledge to enhance the overall experience of the temporary exhibit. An urban event space will provide the needed activity and excitement to draw greater crowds and provide an enjoyable atmosphere for the urban art exhibit.

Studying precedents in both portable structures and urban events will provide strategies and solutions that can be used or adapted for the design of a new portable art exhibit. Concentrating on specific characteristics in each field will help to focus the choice of precedents, so each can be a valuable learning tool. Precedents include the nomadic museum Ashes and Snow designed by Shigeru Ban, the Carlos Moseley Music Pavilion designed by FTL Happold, the Global Olympic Village designed for the 1996 Atlanta Games also designed by FTL Happold, and the Mobile Dwelling Unit designed by Lot-ek. Each of these precedents has been chosen for its exemplary solutions to problems such as economy of space, use of materials, transportation methods, exciting experience among others, which will all be necessary for a successful portable urban art exhibit.
From the investigation into these two main categories, portability and urban events, specific actionable principles will be determined to stimulate the design process. The designs of an urban portable art exhibit will address and resolve all pertinent issues focused on in the background and introduction.
Background

Collections displayed in today’s museums are quite extensive, but space is also very limited and a large portion of the museum’s holdings are kept in storage. Much of the time museums try and exhibit their works through temporary exhibits, or loan artworks to other museums as traveling exhibits so that a wider section of the population has the chance to experience as much art as possible. Even though museums and curators make an effort to make art accessible, there is still a “hard-core of non-visitors, of people without secondary schooling and without vocational qualifications.”¹ A large majority of the population can only be motivated to visit museums under very unusual conditions. Typically about 15 to 20 percent of the adult population realistically comprises the group of visitors who regularly attend museum exhibits.²

Although museum attendance has been reportedly increasing, it has been established that the increases include repeat visits from those already involved in high-culture. In order for museums to gather a wider range of new visitors, extremely high marginal costs must be incurred for advertising and establishing and maintaining connections to groups in the general

¹ Treinen. p 86.
² Treinen. p 86.
region.³ More successful museums are those large, internationally recognized museums that are located near large urban centers where they can depend on the leisure infrastructure of the location to bring in visitors who might otherwise not have made the effort to visit a museum. Considerable effort is still necessary to succeeded in drawing tourists from different regions to a permanent or temporary exhibit.

Visitor behavior is an obstacle to overcome in museum design as well. In the visitor’s opinion, museums house cultural experts who collect objects and present them as signifiers of cultural meanings.⁴ Typical visitors are not knowledgeable about the specific background information needed to fully appreciate each piece of art, and commonly keep their own museum experiences private—determining the value of each piece through personal likes or dislikes, not objective or educated opinion.⁵ Gliding through as many exhibits as possible and not lingering too long at any one particular piece, visitors rarely stop at a single art piece long enough to comprehend the intended meaning or even to read the accompanying text provided to help grasp important ideas that can be gathered from the work.⁶ But visitors thrive on anonymity while touring an exhibit—rarely asking questions for clarification or explanation,

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³ Treinen. p 86.
⁴ Treinen. p 88.
⁵ Treinen. p 88.
⁶ Treinen. p 89.
nevertheless seeming to appear knowledgeable in order to gain the knowledge from the curator.\(^7\)

This ‘linger period’ in front of each object can be connected directly back to the visitor’s level of secondary schooling—the longer linger period, the higher the level of education achieved.\(^8\) The exception to this statement is when popular media become involved in art. When people have been exposed to previous examples of art through television, print or other forms of mass-media, upon seeing the actual piece in a museum the visitor is prone to a longer linger period and educational ideas presented are reinforced.\(^9\) “The more the contents of an exhibition are accepted as symbols by general public opinion, the more that exhibition will be seen as an ‘attraction,’ the less it will be regarded as part of the symbolic stock of an elite intellectual group and the more frequently it will be visited.”\(^{10}\)

To determine a way for art to be experienced by more people in a fun, exciting way, this thesis will take into account these factors of museum visitor behavior. Knowing that visitors stay for short periods of time at each piece, have a need for cultural entertainment, and wish for anonymity while touring an exhibit will guide the design of the temporary portable art exhibit.

\(^{7}\) Treinen. p 87.
\(^{8}\) Treinen. p 89.
\(^{9}\) Treinen. p 89
\(^{10}\) Treinen. p 91.
Going one step further with these observations, another key element to be considered during development of the exhibit is that “smaller exhibitions with fewer elements and simpler communication goals are often used more thoroughly by visitors than large ones. When there is less to do, visitors tend to do more.”

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Portability

It is part of human history to be nomadic. “The kinetic object has an innate potency that has persisted throughout design history.”¹ There is a need in our modern culture to constantly be on the move, physically and mentally, discovering the next, new technology and discarding the old. This constant movement is abundantly apparent in the longevity of our buildings. We require permanent structures, but then when a new style or market demand occurs we are all too ready to tear down and move out the old and bring in the new.

This constant cycle of construction and demolition is not necessary in today’s society. With the technological advances in computers and mobile telecommunications, it is becoming less of a necessity for workers to commute to a centralized facility, or for people to go to the grocery store when they can order online and have food delivered to their door. The world is able and willing to move to a decentralized, portable world, transporting people wherever they wish, and returning to our inherited roots of nomadic life.

Primitive culture is the root of portable dwellings. The earliest societies had a nomadic lifestyle. Their dwellings reflected that in their choice of materials and building forms. These

materials and forms reflect the values of individual cultures, as well as universally known methods and techniques that spread across whole regions. In most cases, these same cultures, such as Native Americans and Bedouin tribes, are still living in these same structures today, tied to their ancestral roots, but not to the land they live on.\(^2\) Three of these geographically specific portable buildings are the Native American tipi, the Bedouin tent, and the Asian yurt.

The tipi of the American Indians is only one of several types of Native American dwellings, but it is the dwelling that suited these nomadic dwellers best\(^3\). Made of lightweight, natural materials, the tipi was designed for fast construction, fast demountability and portability. The tipi, although having various size and complexities, is basically circular in shape at the base, and consists of timbers to make the frame, and animal skins for the covering. The tipi, according to Native American tradition, is owned by the women of the tribe.\(^4\) It is the women who construct the frame and sew the animal skins for the cladding, and who are also responsible for the assembly of the tipi.\(^5\)

The structure of the tipi is determined by the individual tribe. It can have either three of four main poles, with supplemental poles lashed together at the top, in a distinct pattern, which

\(^2\) Kronenburg, Houses, p 18.  
\(^3\) Kronenburg, Houses, p 18.  
\(^4\) Kronenburg, Houses, p 18.  
\(^5\) Kronenburg, Houses, p 18.
is also determined by the traditions and beliefs of individual tribes. The cover is constructed typically out of buffalo skins in a semicircular pattern. The skins are lifted onto the tipi by a lifting pole, and then pinned into place over the entrance. The erection time of the tipi is approximately 20 minutes—5 minutes for the poles and 15 minutes to attach the skins.

Although simple in form and material, it is the other ingenious features of the tipi that have made it so suitable to the nomadic lifestyle. “The building is set up at an angle, braced into the prevailing wind and it has a smoke flap which can be moved to avoid draughts and to ensure smoke from the fire is not blown back inside. Streamers on the tips of the poles indicate the wind direction.” Inside the tipi another cloth is pinned up to collect dew and condensation, so the moisture is directed outside the living area. The interior cloth and the trapped air space also provide an extra layer of insulation between the exterior and the living/sleeping areas.

The success of the inherent practicality and simple beauty of the tipi can be demonstrated by the fact that it was manufactured in its original form for commercial sale in

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7 Kronenburg. Houses, p 19.
the West, for those looking for personally constructed moveable homes.\textsuperscript{11} The tipi perhaps represents a closer connection to nature and the environment that was once and is now again becoming very desirable to those who have lived in such disconnect with nature for so long.

The tent is a potent symbol of shelter, regardless of cultural/geographical boundaries. Beginning in the vast desert areas of North Africa, the Bedouin tent is the distinctive home to the desert nomad. The tent form is unique to the harsh climate of the region in which it originated, and has been developed over thousands of years to be responsive to the environment. Every detail of the tent has been rigorously designed for pure functionality and practicality against the harsh climate. It makes use of available materials and is a lightweight transportable refuge for both people and animals.

The composition of the tent involves woven strips of fabric, which is usually goat hair, and is about 60 to 70 centimeters in width.\textsuperscript{12} These strips are sewn together with strengthening tapes, to which tension fasteners are affixed. Unlike the tipi, the tent relies on tension for support rather than a rigid structural frame, so the rectangular fabric is then stretched over poles which have been constructed on the inside.\textsuperscript{13} The fabric is fastened into the ground with ropes

\begin{itemize}
\item\textsuperscript{11} Kronenburg. Houses, p 20.
\item\textsuperscript{12} Kronenburg. Houses, p 21.
\end{itemize}
and pegs. The walls of the tent are then attached and secured to the ground with rocks or sand. The interior of the tent has divisions created from more fabric and has different areas for cooking, sleeping (separate for men and women) and a public area.

The materials used in the construction of the tent are easily adapted to changing climatic conditions. The fabric walls can be raised for ventilation, and lowered for poor weather conditions. The roof fabric is wool, which swells when it gets wet, making it waterproof. In areas with poor ground conditions, alternate fastening methods are used to secure the roof fabric such as fastening the guy wires to bushes, which are then buried into the ground, providing more resistance and a stronger hold. To spread the load over the roof fabric and prevent punching shear from the supporting poles on the inside, wooden spreaders or a rag spreader is placed between the wooden pole end and the fabric.

The success of the tent for shelter and portability is exhibited best by the Bedouin culture. The Bedouins, who believe that they are only truly free in a nomadic culture, have perfected the art of portable architecture. The Bedouins possess nothing that can’t be moved by

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14 Topham. p 10.
16 Topham. p 10.
two people. They can travel faster than any other nomadic culture, covering up to 64 kilometers a day, and moving their entire camps every two to three weeks.¹⁹

The standard transportable dwelling used in Asia is referred to as the yurt. The construction of the yurt has been perfected over centuries; it would be hard to improve further the light-weight, easily-assembled/disassembled structure. Adaptation to both winter and summer conditions has also been perfected in the yurt’s design.

The primary element of the yurt is its trellis wall. Constructed of willow, with pivoting joints made traditionally from rawhide, the pieces can be contracted for carrying and then expanded for use.²⁰ The walls are placed in a circular arrangement, with a tension band for support at the top.²¹ A rectangular door frame is inserted into the lattice wall, and then roof poles are inserted to create a conical crown. The traditional yurt cladding is constructed from up to eight layers of felt for warmth and insulation, as well as weatherproofing. The women are responsible for making the felt and the erection of the yurt (which takes less than an hour),

²⁰ Kronenburg. Houses, p 23.
²¹ Kronenburg. Houses, p 23.
while the men are responsible for the wooden frame. The yurt is transported either by a horse or for wealthier owners, a cart.

The more subtle features of the yurt include a sundial, which is made by facing the structure towards the south and letting the sun enter through the smoke hole in the top. The yurt can be adapted to warmer weather by rolling the felt up from the bottom edges to let in breezes, much like the Bedouin tent. The floor can also be adapted to the weather conditions with just a simple addition of more layers of rugs/felt, or with the addition of layers of dried grass in the winter for more insulation. The practicality of a yurt is still applicable to modern Asian cultures, and to anyone wanting a portable structure that is easily assembled and inexpensive.

The sophisticated manner in which ancient people perfected such simple shelters with ease of assembly and transport can be a lesson for all contemporary designers. Perhaps the most important lessons can be learned from the materials chosen, which are all locally found and suitable to the purposes at hand, while not harming the environment. Using lightweight

22 Kronenburg, Houses, p 23.
23 Kronenburg, Houses, p 23.
24 Kronenburg, Houses, p 23.
25 Kronenburg, Houses, p 23.
fabrics and light wooden frames/structures is the fundamental element present in all nomadic designs.

Other portable structures did not evolve out of the need for survival. The medieval performance stages were often set in demountable theaters, or ‘mansiones.’ Actors would travel from town to town, setting up these stages to perform, and then take them down and move on to the next city. Single plays would often have durations of up to 40 days, and other structures, such as boxes or galleries, would also be built to accompany the platform stages or booths in the town squares. Floating pavilions were also constructed during the Renaissance in Italy to celebrate special occasions. Often these teatri del mondo would be circular in form and hold activities on several levels. Whether performing in the small town squares of medieval times or floating down canals during the Renaissance, these transportable entertaining venues were enjoyed by many who would have not had the opportunity to attend if a more permanent single location were chosen.

In more recent history, Buckminster Fuller developed cutting-edge technology based on lightweight materials and mass production. His first recognized design became known as the

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28 Kronenburg. Houses. p 42.
Dymaxion House in 1928, which was light enough to be transported by helicopter.\textsuperscript{29} Although none of these houses were actually built, principles of borrowed technology from the aircraft and automobile industries were carried over into the housing market. Fuller utilized the newest of the metal alloys of the time, aluminum, for his designs; it was strong, light enough for assembly/disassembly, and could be easily moved.\textsuperscript{30} The structure was round in plan and domed to minimize heat loss and amount of materials, and to maintain the best mobility and maximum strength.\textsuperscript{31}

From the design of the Dymaxion House, Fuller moved onto another simple, mass-produced dwelling, the Dymaxion Deployment Unit (DDU). Once again combining technologies from different fields, grain storage bins were used to create the main structure of the dwelling.\textsuperscript{32} The 5.5-meter diameter steel grain container was combined with a re-designed segmental top to allow for more headroom, windows, a ventilation system, and curtains for interior room divisions.\textsuperscript{33} The DDU arrived on site fully furnished, but in a demounted form,

\textsuperscript{29} Kronenburg. Houses, p 50.  
\textsuperscript{30} www.hfmvg.org/dymaxion  
\textsuperscript{31} www.hfmvg.org/dymaxion  
\textsuperscript{32} Kronenburg. Houses, p 51.  
\textsuperscript{33} Kronenburg. Houses, p 51.
and could be assembled with a removable steel mast. Used for military housing, or factory housing, the DDU housed many soldiers after the start of World War II.\textsuperscript{34}

Fuller’s most influential housing design was the Wichita House. Created as a substitute product for aircraft manufacturers after the war, the house employed, once again, features borrowed from the aircraft industry such as the use of Duralumin, the same alloy used in aircraft production.\textsuperscript{35} Designed as a full-sized family unit, it weighed only four tons. Thousands of orders were placed, but due to problems between Fuller and the Beech Aircraft Company on the refinement of the design before production, delays caused funding to fall through and only two homes were built.\textsuperscript{36} The design of the house included many innovative features such as automatic natural ventilation, air filtering, automatic roller-cupboards, moveable partitions, centralized vacuum cleaning, and it could be transported on one single truck and assembled in one day by six men because no component weighed more than five kilograms.\textsuperscript{37}

Another instrumental designer of portable structures is Frei Otto, who shares Fuller’s ideas on efficiency of form and lightweight, flexible structures. Otto is associated most

\textsuperscript{34} Kronenburg. \textit{Houses}, p 51.
\textsuperscript{35} Kronenburg. \textit{Houses}, p 51.
\textsuperscript{36} www.designmuseum.org
\textsuperscript{37} Kronenburg. \textit{Houses}, p 51.
commonly with fabric tent systems, cable net structures, pneumatic structures and lattice domes, all of which incorporate his ideas of lightweight structures, ability to be moved, and technical perfection. Making some of the first attempts in design of these types of structures, Otto developed methods of structural testing to get his concepts constructed.

Otto is well known for his soap bubble experiments, used to determine shapes of pneumatic structures. In every bubble, “membrane stresses are of equal magnitude at every point and in every direction of the surface…a soap bubble will therefore always adopt the shape corresponding to the minimum surface area for the enclosed volume of air—i.e. a soap bubble is always a ‘minimal surface.’”\footnote{Roland, Conrad. Frei Otto: Tension Structures. New York: Praeger Publishers. 1970. p 86.} In designing the actual pneumatic structure, forms can be taken directly from the bubble experiments due to this natural condition of equal stressing of the soap membrane itself.

Otto is also associated with his extensive work with cable net structures and tents. These complex structures were also developed and tested through the use of study models and full scale mock-ups. The success of these structures relies upon complete studies of the models, wind tunnel testing, and the correct patterning of the cable net and membrane pieces.\footnote{Koch, Klaus-Michael, with Karl J. Habermann. Membrane Structures Innovative Building with Film and Fabric. New York: Prestel. 2004. p 33.}
Otto’s first widely recognized cable net structure was the West German Pavilion at Expo 1967 in Montreal. His break from traditional forms into a more free-flowing organic shape proved successful as they displayed the potentials of an enclosure based on tensile principles, even though the borrowed technology of detailing was not as sophisticated as the overall form at the time of construction. The construction and design of the structure exhibited all of Otto’s principles of lightweight, prefabricated, demountable structures and was considered “the work of architecture at Expo that is likely to be longest remembered.”

In the advancement of portable technology, not only were individuals making huge progress, but entire industries were also moving ahead as well. Walter Gropius, Jean Prouve, and Charles and Ray Eames explored the industry of pre-manufacturing for houses in which “good design could be composed and efficiently constructed.” Since methods of pre-fabrication began with Henry Ford’s assembly line, it was also only natural for the automobile industry to create its own style of portable living. The Airstream Trailer and others such as the Aerocar Land Yacht were on the market and taking advantage of the American drive for mobility and freedom. These new recreational trailers ranged from modest accommodations to

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40 Koch. P 33.
41 Kronenburg. Houses. p 56.
42 Siegal. p 19.
high-end, state-of-the-art features such as kitchens, dinettes, heating, ventilation and electric systems along with the standard sleeping spaces. Whether pulled behind a standard vehicle, or with the vehicle incorporated into the design of the trailer, leisure travel is still widely supported and companies such as Airstream are still demanding that the latest technological innovations be integrated into their designs.

With the addition of the highway system and the tractor trailer, a move towards ‘flat-pack’ design emerged. With trucks as the means of transportation, homes were designed that could be folded flat and unfolded on site and assembled into living spaces. Carl Koch designed the Acorn House in 1945 for this exact purpose. Other manufacturers today include Flat-Pak House, where a number of available pre-manufactured parts can be ordered to fit client needs and then shipped to and assembled at the desired sites. Earlier innovators in this area include Sears and Roebuck with their mail-order house in 1895, and in the 1830s, John Manning’s Portable Colonial cottage, which utilized interchangeable pieces with dimensional coordinates to create flexible designs for customers.

Carl Koch, designer of the Acorn House, was involved in streamlining the construction process and solving several problems of the previous Lustron House which had been designed.

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43 Topham. p 12.
44 Siegal. p 22.
by Carl Strandlund.\textsuperscript{45} The original design was completely pre-fabricated from vitreous enameled steel panels. Arriving on a single truck, the 3,000+ components were all specially designed for the house and were coded for quick assembly on site.\textsuperscript{46} The large number of customized parts and the longer than expected erection and construction times led Lustron to call upon Koch for a re-design. The new design solved many of the previous problems and produced a more attractive home. The major contributions made by Koch to the design included a reduction of parts to just 37 factory assembled components, and it used less material overall.\textsuperscript{47} Its design concept relied upon folding panels to create the main living spaces. These panels would arrive folded up around the core spaces (kitchen and bathroom) on a truck, and then would be expanded upon arrival to create the bedrooms and living/dining areas.

More recently other innovators in the field of portable architecture pushed boundaries of acceptable standards. In the 1960s, Archigram was responsible for the most radical ideas about futuristic living, such as Peter Cook’s Plug-in City, Dennis Crompton’s Computer City, and Ron Herrons’s Walking City,\textsuperscript{48} all using nomadic structures as a theme. These futuristic design proposals featured entire cities fit for change and adaptability to new situations. Whether or not

\textsuperscript{45} Kronenburg. \textit{Houses}, p 70.
\textsuperscript{46} Kronenburg. \textit{Houses}, p 70.
\textsuperscript{47} Kronenburg. \textit{Houses}, p 71.
\textsuperscript{48} Siegal. p 23.
these artistic notions were to be, as their names suggest, plugged-in to existing infrastructure or ‘walked’ to their next destination, these highly imaginative designs were planned down to specific details, depicting new connections to infrastructure as well as inspiring unorthodox methods of solving complex architectural problems. Despite the fact that these architectural whims were never built, they were inspirational for a new generation of portable architecture.

For the most part, portable architecture directly serves the needs of specific clients with challenging needs. A recent example is high-image architecture that can travel to well-known destinations and capitalize on the recognition of already important, bustling city centers to maximize the amount of attendance or participation in certain events. The IBM Traveling Pavilion, designed by Renzo Piano, is an example of how a temporary space can directly serve a specific client need, in this case communicating technology, as well as taking advantage of central and sensitive locations.

The main form of the pavilion was a semi-circular 3-pin arch. The two main segments of the arch represent a combination of traditional and modern materials, giving a widely acceptable, yet highly technological image to the pavilion. Each arch segment was constructed from “six polycarbonate pyramids fixed at the point and the rim by cast aluminum joints to

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49 Kronenburg. Houses. p 111.
laminated timber (larch) booms…Neoprene gaskets and adjustable stainless steel rods were used at connection points to allow for differential movement between the various materials.”50

The pyramids were not only structural, but created the exterior skin. Neoprene was used for weatherproofing and to account for thermal movement and for tolerance in construction due to the temporary nature of the pavilion.51

Twenty-three customized trucks containing the building components, internal equipment and furniture arrive at the site; two of the trucks contain the mainframe computer and the air conditioning chilling plant.52 After arrival, a rented fork-lift truck moves all pieces of the pavilion to their correct locations for assembly. The foundation consists of adjustable jack legs with spreader feet to carry the load, but where soft ground conditions exist concrete strip foundations can be installed.53 The floor structure consists of trussed steel components and plywood floor panels. After the floor installation, the arches can be set into place on the floor platform, and then the end walls, also of steel and timber, can be erected.54 Conditioning of the internal space takes place from beneath the elevated platform floor. Hot or cold air is

51 Kronenburg. Portable. p 44.
52 Kronenburg. Portable. p 44.
53 Kronenburg. Portable. p 44.
54 Kronenburg. Portable. p 44.
pumped up through floor vents using the elevated steel truss floor system as a plenum for running necessary pipes.\textsuperscript{55} It takes up to three weeks to assemble one large exhibition space. Visitors enter into the space by ramp and are greeted by a foyer space containing a cloak room and office spaces. “The success of the IBM pavilion was such that four times the number of people predicted visited it at each site and in 1986 the design team were asked to prepare a design for a second pavilion.”\textsuperscript{56}

The success of the pavilion not only represents the functional success of the design by Piano, but illustrates the advantages of a portable structure placed temporarily in prominent locations to take advantage of a wider array of the targeted population. The synthesis of technology and nature in the design of the IBM pavilion takes into consideration the sensitivity to light and external site features, making it an suitable choice for such sites as the Natural History Museum in London, St. Mary’s Abbey in York, and even the Eiffel Tower in Paris.\textsuperscript{57}

Another instance of portable architecture taking advantage of multiple sites and functional design is the Hong Kong Tourist Association (HKTA) Pavilion. Designed to travel to several European countries to promote Hong Kong as a tourist destination, the structure had

\textsuperscript{55} Kronenburg. Portable, p 44.
\textsuperscript{56} Kronenburg. Portable, p 46.
\textsuperscript{57} Kronenburg. Portable, p 46.
to be extremely compact and able to deploy quickly. The solution by Lorenzo Apicella features standardized steel trailer platforms as the base unit for construction.\textsuperscript{58} Traveling to sites on a standard semi-trailer, the units can be transformed to different arrangements upon arrival. Typically the base is hidden with a removable skirt and entrance stair and ramp.\textsuperscript{59} The floor

\begin{itemize}
\item \textsuperscript{58} Kronenburg. \textit{Houses}, p 146.
\item \textsuperscript{59} Kronenburg. \textit{Houses}, p 146.
\end{itemize}
and roof membrane stretch between two trailers to create an interior space. The two end trailers also extend upwards by use of hydraulic rams placed in each corner to create a second floor space which is connected over the double-height interior space by a bridge, which also provides stability to the overall structure.60

The pavilion is transported in three standard 13.5-meter trailers. Two of the trailers provide the main structure of the pavilion, while the third carries furniture, a generator, and the air conditioning plant.61 The erection process follows a very specific sequence that combines both manual and machine labor, taking a team of six 24 hours to complete the transformation of the trailers into the pavilion.62 The central floor space is positioned between the two trailers utilizing aluminum trusses as supporting beams and greased shoes for the lateral adjustment.63 A single roof membrane is stretched around the perimeter of each unit and drawn tight around the rest of the structure to unify the entire design.

Although the Hong Kong Tourist Association pavilion was highly specific and required more sophisticated means of construction than most portable buildings, “the client’s response to the use of innovation was positive in that they appreciated the value that such a dramatic

event structure would have in terms of their own marketing and promotional objectives.\textsuperscript{64} The tourist pavilion also allows the tourist association greater flexibility with their choice of sites and reachable audiences; not being limited to trade shows and other tourist exhibitions allows Hong Kong to create their own unique identity with an appropriate image.

Another area of design where portable architecture is often appropriate is concert venues. Housing a symphony or the Rolling Stones, this variety of performance requires temporary stages due to the transient nature of entertainment, with world and local tours occurring regularly. Creating spaces for the performers is quite challenging—not only because of the theatrical requirements of some of the artists and proper acoustics, but also because of the careful planning in design to deal with quick erection and even quicker dismantling. Image is also an integral part of the design, especially when dealing with well-known artists whose own reputations are reflected in each stage design.

The Carlos Moseley Music Pavilion designed for the New York Philharmonic and the Metropolitan Opera was commissioned for outdoor performances to be held throughout the public parks of New York. The design constraint placed upon the architects, FTL Design and Engineering Studio, was that the entire stage had to be constructed on site in less than six hours.

\textsuperscript{64} Kronenburg, Portable, p 109.
and taken down in even less time. The final design solution, utilizing seven standardized trailers and crane technology could accommodate a full orchestra.

The four main parts of the pavilion consist of a tensile roof membrane, a tripod-like truss structure to hold the roof, a fold-out stage, and a series of amplification towers for improved acoustics. The individual pieces of the stage arrive in seven standard 13.5-meter trailers; three of the trailers hold the trusses that form the tripod, and five of the trailers are used to create the actual stage platform. Hydraulic foot pads are used to stabilize the stage and adjust to create a level surface, hydraulic pistons push out the stage (which is transported folded up like an accordion) made of marine ply panels. The tripod is erected by unfolding each individual truss, locking them in place, connecting the larger front two together and then

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65 Kronenburg. Houses, p 97.
66 Kronenburg. Portable, p 177.
bringing the third to connect and then lift up together to the full height. Each truss can pivot vertically and rotate around a pin in order to ensure this three-dimensional placement and vertical escalation. The roof membrane is stretched taut between the three trusses and contributes to the acoustic performance along with the complex sound system designed by Jaffe, Holden, Scarborough, which calculates sound delays and is programmed to give the impression of reverberation that is vital to classical music.

To maximize the erection time several features were accounted for at the beginning of the design to ensure no lost time due to miscalculated errors or inexperienced labor. In the construction of the tensile membrane, the decision to use polyester ropes instead of cables ensured that the ropes could remain inside the fabric during transport and would save valuable time on site, even though they would need replacing after only two years. Another feature that helps with erection time is that lighting and electric wiring are permanently inserted into the structural trusses.

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67 Kronenburg. Portable. p 177.
68 Kronenburg. Portable. p 177.
69 Kronenburg. Portable. p 177.
The design solution has been considered by some as more of a machine than architecture, due to the mechanical process by which the main structure is erected; however, it is definite that the structure adds to the concert by creating such a dramatic event in its own assembly sequence. In use for over eight years, this pavilion “certainly possesses the excitement of a transitory performance, not only in its fully erected state, but as a performance in itself with mysterious hydraulically operated structures…In this way it attracts attention to the more conventional performance which it supports.”72

Utilized for temporary solutions, portable architecture has also been used for structures at Olympic Games. In 1996, the Atlanta Olympic summer games featured the FTL Happold AT&T Global Olympic Village—a multi-purpose commercial building with meeting areas, restaurants, and an AT&T communications center.73 The exterior of the pavilion would also be used as a large projection screen, showing results and highlights of the day’s events.

The main complex designed by FTL Happold was a 9,000-square-meter space, consisting of three pavilions. The two main shell-like pavilions featured two-story glass curtain walls, relocatable interior elevators, and a bridge connecting the two main pavilions at a second

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The entire structure was made of readily available parts such as scaffolding and tensile fabric membranes and can be dismantled, moved and reassembled in another location and used for other purposes.\textsuperscript{75}

Each of the two main shell-like pavilions is fabricated from five steel portal frames which are assembled on the ground and then lifted by crane to their permanent vertical positions.\textsuperscript{76} Longitudinal bracing is provided between the portal frames by tensioned cables secured back into the ground.\textsuperscript{77} Only the smallest end of the pavilion requires cross bracing to support the full-height glass curtain wall entry.\textsuperscript{78} To secure the portable structures to the ground, temporary concrete foundations were used; the short-term nature of the facility allowed the foundations to be minimal for a venue of this size.

The constant use and public interaction of the AT&T Olympic Village supported the use of a temporary structure. Placed in a prominent location at the Olympic Games, it allowed hundreds of thousands of visitors to benefit from the availability of the restaurants and communications center. The best feature, however, was the fact that the structure could be

\textsuperscript{74} Kronenburg. FTL, p 75.
\textsuperscript{75} Kronenburg. FTL, p 75.
\textsuperscript{76} Kronenburg. Houses, p 145.
\textsuperscript{77} Kronenburg. Houses, p 145.
\textsuperscript{78} Kronenburg. Portable, p 198.
disassembled and removed, limiting the amount of redundant architecture which is inevitably constructed in cities hosting Olympic Games.

Portability has also experienced great achievements in the area of dwelling. The Mobile Dwelling Unit (MDU) was conceived of by the firm LOT-EK as an experimental design project. The main concept was to take an existing standardized shipping container and transform it into a useable living space for individuals traveling the globe. The MDU is to travel via standard, existing means of transportation to join with other MDUs in urban harbors at the next destination.79

The main concept of the unit is to be one tight and compact standard unit while traveling, and an expandable living space when placed into the MDU harbor. When stationary, the full volume of the container is available for use along with each of the side niches pushed outside of the container’s eight-foot boundary. Each of these movable sub-volumes is divided along the length of the container into compatible working halves—cooking/eating and sleeping/bathing.80 The arrangement of the sub-volumes “organizes a passage from most public to most intimate activities that marks out a diurnal cycle: arriving, cooking and eating,

80 Scoates. p 45.
working and viewing, resting and bathing.”81 Each of these sub-volumes is expressed on the exterior of the units when occupied, or could just as easily be wrapped by another skin to conceal the individual volumes.

The transformation from the standard container to the MDU involves cuts in the metal walls to facilitate the construction of the side, top, and bottom panels of the extrusions. Floor groves give access to the sliding tracks which facilitate the movement of the sub-volumes. Lighting is also incorporated in slots in the floor and ceiling, much like the sliding tracks, emphasizing the push/pull of the interior spaces. While traveling, the individual volumes slide back into place and interlock with each other, leaving a flush, untouched appearance to the container.

Once the MDU travels to its next destination, it is loaded into a MDU vertical harbor by a crane that runs parallel to the holding racks. “The harbor is a multiple-level steel rack, measuring 8 feet in width (the width of one container) and varying in length according to the site. Its stretched linear development is generated by the repetition of MDUs and vertical distribution corridors.”82 In these corridors, all support services are located such as elevators, stairs and needed supplies such as electric, water, and waste lines. The MDUs are plugged into

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81 Scoates. p 70.
82 Siegal. p 51.
these support services once they are secured onto the steel brackets. The harbor is in constant change and transformation due to the ease of installation and transportation inherent in each unit.  

Along with portable designs for temporary pavilions, homes, and concert stages, a few portable structures have been designed for the display of art exhibits. Designed for a traveling photography exhibit, Ashes and Snow, a nomadic museum was designed by Shigeru Ban to travel with Gregory Colbert’s artwork from city to city. The space inside the museum was designed completely around the individual pieces of work that were to be displayed, and the overall feeling of the exhibit showed this cohesive nature between the art and the individualized space.

The museum was made from 148 stacked shipping containers, industrial paper tube columns, and a tensile fabric roof. Other materials used include oriented strand board for the main entry wall, wooden planks for the interior walkway, loose gravel for the floor area that was not walkable by patrons, and an aluminum frame for the roof and wall panels that were not occupied by the shipping containers.

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83 Scoates. p 62.
The shipping containers were stacked in a staggered pattern and alternate spaces were filled with a tensile fabric, which was fastened at an angle to shed rain water and let ventilation in and up through the interior of the exhibit hall. The roof, a tensile fabric stretched over a frame, was not sealed from the elements. The overall climatic conditions of the museum, however, were very comfortable in temperate weather without the use of a controlled environmental system, staying cool with cross ventilation and with the white tensile roof reflecting most of the sun’s heat.

The structure for the center of the roof was supported by hollow paper tube columns. The main structural elements were sets of two columns about 24 inches in diameter, with a triangular pediment at the top to achieve the desired height, and to provide a tension tie between the columns and the peak of the roof. Photographs were hung with a tension wire connected to a tension cable strung between the columns the entire length of the museum and to anchors in the floor (which were covered by the loose gravel), mimicking the tensile nature of the roof and the side vent panels. It was also this ‘loose’ hanging of the photographs by thin wires that allowed them to sway in the natural cross ventilation of the interior, giving constant life and change to the exhibit throughout the day.
At the close of the exhibit, the entire structure was unbolted and disassembled. The shipping containers were left in the current city, to be used again for shipping. With the current price of shipping containers, it was more cost effective to purchase new ones in the next location. The rest of the structure along with the photographs was packed and shipped to be reassembled at the next site, with new shipping containers available, and the exhibit ready to be viewed by the next set of eager patrons.

Temporary portable structures can be valued for their ability to adapt to various sites, to be transported quickly by conventional means and be erected in a timely fashion. The secret to their success, however, is that key features of portable structures are designed to determine individual success. The success of structures like the Carlos Mosley Music Pavilion relies on the individual details that were designed to solve the given time and transportation constraints. The solutions to these specific problems generated innovative ways to look at the portable structure as machine and realize the full potential of what the portable venue could provide to the spectators and users.

Each structure, designed for a unique purpose, carries with it its own unique solutions that can contribute to the designer’s drive for function and suitability to such important features as material choices, material connections, connections to the ground, or connection to varying
contexts. The Hong Kong Tourist Association Pavilion, which travels around the world, developed a unique solution employing hydraulic pumps to add a second floor to the semi-trailer in which it arrives on site. In this specific project, connections to the ground and material connections were of the utmost importance due to the extra stability required for the raising of the second floor by hydraulic pumps.

Resulting from all of these temporary solutions are very innovative details in construction and form. For the IBM Pavilion form was as important as the portability. Creating a beautiful form from a temporary structure is often quite simple due to the repetitive nature of the regularized pieces and construction details. In this case the resulting form created from all of the integrated structural pieces creates an airy, flowing space perfect for the pavilion’s purpose. The uniqueness and individuality of each structure provides each client with the needed functionality and image recognition needed to bring visitors and patrons into their facilities.
Event Architecture

It is has become standard in our society to need entertainment and diversion from our daily lives. As sophisticated technology continues to increase, the working class has experienced a change from long work days to shorter work days and an increase of leisure time. As the need for diversion and activity increases, so too does the need for entertainment venues. The refined structures that house various types of entertainment venues contribute to the overall experience of the event, and when designed properly for the specific activity, they can add to the connotations and visual imagery people then begin to associate with certain genres of activity or entertainment, ultimately creating exciting experiences and drawing great crowds.

Some of the first cultural structures that are associated with urban events include circus tents, stage sets, and exhibition buildings (commonly used at World Fairs). The circus is a widely known event that creates excitement from the minute the first train cars arrive in town, to the erection of the tents, the beginning of the show, all the way through the tear-down and the re-loading of the train. With this excitement, much anticipation and eagerness is built up over the entire day and experienced by all the eager patrons, who in some cases have traveled great distances just like the circus itself.
The short-lived and brief nature of the circus builds up a great sense of event. Every minute of the circus day is planned down to the minute; the rigor and precision of the schedule creates a ritual for the employees of the circus, as well as for the enthusiastic viewers.¹ Not only is the show part of the event, but the entire process of traveling and assembling of the tents contributes to the event experience. The circus is not simply a super-spectacular form of mass entertainment, but a celebration of life itself, and that is what so attracts people to it—its straightforward, simple and fun nature.²

The structures of the tents themselves also contribute to the entertainment of the event. With colorful fabrics and animated forms, these circus tents of the past still provide cultural imagery for the circus even though today circuses are mainly held in large indoor arenas. The form of the circus tent with its innovation and creativity embodies the American spirit of entertainment.

Multiple tents create the circus community in each performance destination. A very specific arrangement of the tents ensures the maximum privacy of the performers and the maximum entertainment for the patrons. The entrance to the big top is located at one end of the main tent. The performer’s entrance ("back door") is placed at the middle

¹ www.ringling.com
² www.ringling.com
of one of the long sides of the main tent. The midway (the area outside the main entrance) will be organized in front of the big top entrance and will hold concessions, the ticket wagon or a small side-show or menagerie. Performers, equipment, trucks, and animals not in the menagerie are located outside of the back door to the big top, in an area off-limits to the public. The entire arrangement of the circus with multiple tents and a sense of procession leading up to the big-top by way of the midway create a sense of event and excitement. The ritual of erection, the promenade to the entrance, the memorable tent imagery, and even the dismantling of the show all provide the circus with necessary elements to hold patron’s interest and keep them coming back.

Another form of event architecture includes exhibition pavilions, the most well known being Joseph Paxton’s Crystal Palace. The innovation developed by Paxton to accomplish the construction for the Crystal Palace led the 1851 World’s Fair to symbolize the industrial and economic superiority of Britain during that time. The Crystal Palace drew unprecedented numbers of visitors and exhibitors from around the world to see the spectacle of primitive and modern industry, art works and the exhilarating structure.

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3 www.circusweb.com
4 www.circusweb.com
The structure itself was considered a marvel of engineering at the time. No other structure was suitable to be constructed within the time constraints, but Paxton developed a specific fabrication technique that employed a great economy through the use of repetitive elements and the re-use of materials from construction all the way through to the final finishes.\textsuperscript{5} Like the ritual of construction in the circus tent, the Crystal Palace also reveals a construction sequence to its patrons. The articulation of the building assembly allows spectators to see how the building was built up and could be repaired or replaced. The whole hierarchical construction process is evident in the completed building.\textsuperscript{6} The resulting building that arose for the 1851 World’s Fair gave Britain a great cultural image of the time because of its assembly and production innovations along with its great spatial achievements.

The structure itself was also a success because of all of the elements it could house inside due to its large volumes. The great clear spans and central promenade were large enough to hold concerts, the world’s largest organ, as well as a circus.\textsuperscript{7} The amount of activity and entertainment was enough to bring people, but it was also due to this vast,

\textsuperscript{7} \texttt{www.victorianstation.com}
structurally expressive building that the event was successful. Paxton may have also
started a revolution in architectural history—creating a model for department stores,
where voyeurs and consumers are stimulated by the vast amount of activity visible at one
time.\(^8\)

Another exposition building which exploits the technology of the time is the
Phillips Pavilion for the 1958 World’s Fair in Brussels. Commissioned by the Phillips
Company to exploit their current technology in sound and video, LeCorbusier combined
a world-class structure with a multi-media display.\(^9\) Being an exhibit in itself, the
Phillips Pavilion synthesized its expressive form, a unique eight-minute video and a
corresponding eight-minute audio score composed by Edgard Varese into a unique
translation across the arts.

Pushing the boundaries in all fields represented in the Pavilion, over a million
visitors participated in the display—making it a success, but hardly being understood.\(^{10}\)
The strange, but provocative form, along with the visual and aural presentation couldn’t
help but draw visitors to it, to experience and be a part of the spectacle. Architecture

\(^8\) McKean. p 29.
\(^9\) www.lib.umd.edu
\(^{10}\) Treib, Marc. *Space Calculated in Seconds: The Philips Pavilion, LeCorbusier, Edgard Varese*. Princeton,
played the role of orchestral instrument and of sound box, container and contents.\textsuperscript{11} This radical concept received both good and bad press for its challenge of established boundaries in all fields, but the Philips Company considered the Pavilion a success and was pleased with the outcome created by LeCorbusier and Varese.\textsuperscript{12}

Known mainly for its dramatically composed form with its hyperbolic curves and skewed entrances, the Pavilion, although not easily understood, touched many of its visitors. Providing the necessary visual and experiential excitement that is sought out by most World’s Fair visitors, the Pavilion succeeded in capturing a memorable representation composed of light, color, rhythm, sound and image.\textsuperscript{13}

Modern representations of urban cultural events have been developed in the form of parks and outdoor entertainment arenas. Bernard Tschumi’s Parc la Villette in Paris is a stimulating example of a modern urban event. The intention of the park is to create a place of meetings and activities that would re-invent urban space, while being integrated into the city.\textsuperscript{14} Tschumi brings the park together through a series of points, lines and surfaces. The system of points, or follies, brings color and rhythm to the park in a

\textsuperscript{11} www.nexusjournal.com
\textsuperscript{12} Treib. p 114.
\textsuperscript{13} Treib. p 226.
47

harmonious way that contrasts with the organic trees and lawns, as well as energizing the park with a bright red color.\textsuperscript{15} The follies are laid out on a 120-meter by 120-meter grid and are based on a 10.8-meter cube, but each is distinct and provides a unique function.\textsuperscript{16}

The follies are the most distinct feature of the park and provide the park with a specific imagery that is easily recognizable by park-goers. Punctuating the park, these follies give

\textsuperscript{15} www.villette.com

\textsuperscript{16}
scale and points of reference for park-goers as well as signifying the location of various facilities. Providing very important functions, such as the information kiosk, music kiosk, or elevated views that overlook the entire park, the follies are one of the most entertaining aspects of the park, providing playful and unexpected elements for visitors to interact with.

A series of lines or walkways is also integrated into the entire park experience. The walkways create a cinematic event, helping the visitors to discover all the elements of the park. The walkways are either perpendicular axes that force themselves rigidly across the park, or organic and wandering. Each walkway leads the park-goers through an exciting journey throughout the grounds.

The surfaces, or prairies, are two large open spaces which give the park the needed break from the contrived follies and walkways. It is the combination of these three elements—follies, walkways, and prairies—that give the park an energetic, exciting feeling, encouraging the visitors to explore the entirety of the grounds. These elements

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16 www.villette.com
17 Philips, p 117.
18 www.villette.com
Museums can also become centers for urban entertainment; however, the opportunity for this genre of urban entertainment is almost always ignored in favor of institutional forms and atmospheres. One example of how a museum can be intertwined into an exciting cultural event is the Pompidou Center in Paris.

This enormous museum, including its great cultural significance for what is exhibited inside, is also a display of its own visually stimulating architecture. “The one-million-square-foot building located in the Beaubourg quarter of Paris and facing a great piazza cut into the dense surrounding urban fabric was intended as a cultural bazaar, a challenge to the idea of museum as monument.”

The planning for the museum from the beginning considered how the building would fit into the existing framework of the surrounding district, and tried to evoke some of the energetic feelings associated with the Latin Quarter of Paris. The architect’s goal was to incorporate the architecture into the

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street life of the district, opening up a generous amount of space on the site and giving it back to the people—bringing art and culture to the man on the street.\(^{21}\)

This generous gift of an urban plaza is very successful and yields an area of exciting activity outside the museum, a place for tourists and city dwellers to lounge, watch street performers and shop from street vendors, creating a bustling center of activity outside the already active museum façade. Adjacent to the Pompidou Center on the southern side is another open space occupied by the Tinguely Fountain, a water sculpture which is in constant motion. This area also provides constant activity and stimulation around the museum for visitors and residents to experience and be drawn into the lively urban center. The Pompidou Center is a testament to Richard Rogers’ statement, “Architecture can and must enliven the urban scene, serving the needs of the people who live and work in the city.”\(^{22}\) Rogers also testifies, “It is my belief that exciting things happen when a variety of overlapping activities designed for all people—the old and the young, the blue and white collar, the local inhabitant and the visitor, different activities for different occasions—meet in a flexible environment, opening up

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21 www.parisdigest.com/monument/centrepompidou.htm
22 Steele., p74.
the possibility of interaction outside the confines of institutional limits.”

The Pompidou Center exemplifies Rogers’ ideals—it opens the neighborhood up to diverse possibilities while energizing the urban atmosphere in its consideration of all varieties of the public.

Another museum defying cultural institution status to create a public space featuring urban activity is the Carré d’Art in Nimes, France, designed by Sir Norman Foster. The commission called for galleries, libraries, cinema, auditorium, conference suites and storage areas. The site is opposite one of the best preserved Roman temples, the Maison Carrée, within the dense urban fabric of Nimes. Relating to this historically sensitive site was quite a challenge—relating the old with the new and trying to imbibe pedestrian life in a plaza overtaken by automobiles.

This intensely diversified program required very carefully planned spatial layouts, which resulted in a nine-story building, five of which are underground in order to keep to the scale of the surrounding urban fabric. In order to revive the urban fabric around the Maison Carrée, the Carré d’Art appropriated the square between the two buildings. The use of the square with the new program caused a ripple effect which extended beyond the

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23 www.greatbuildings.com/buildings/Centre_Pompidou.html
designated site to the surrounding streets, which were turned into pedestrian streets to regenerate the social fabric.\textsuperscript{27} The Carré d’Art linked not only the old with the new, but also the new pedestrian square to the city center, increasing the accessibility to the new pedestrian realm. The flow of people in the area has stimulated new cafes adjacent to the square.\textsuperscript{28}

This revival of the pedestrian square through the addition of the multi-purpose Carré d’Art energized the community and has created a space for urban events. Now a common site for outdoor concerts or informal political meetings, the plaza has become a
With the growing desire for leisure and entertainment activities, the need for specific facilities is being structured to fit individual needs. Ranging from circuses to urban museums or multi-functional urban plazas, centers that draw the most varied crowds tend to embody movement and activity throughout the entire day. Whether it is the daily ritual of the circus or the normal pedestrian movement across the plaza in front of the Pompidou Center, areas with dense visual activity provide urban events spaces with dense pedestrian activity. Being able to draw large crowds to a specific location is already half of the challenge when designing for an urban event. It seems that the more successful events such as World’s Fairs have the ability to draw wide-ranging crowds due to the intense variation of other leisure activities to select from in the surrounding or nearby Fair grounds. Urban events like Tschumi’s Parc la Villette, where specific structures have been designed solely for interaction and diversion, also appeal with its range of distinct follies and naturalistic settings, to a wide array of the public’s desires for leisure.
Background Summary

The origins of portable architecture provide the necessary background and starting point for the design of a new portable structure. Each vernacular structure, the tipi, the yurt, and the tent, can be considered successful forms of mobile dwelling, due to their durability and appropriateness of material and form in relation to survival and functionality for daily life.

Advanced technology has brought mobile architecture back into the foreground of design. With this shift back to mobile origins, it is technically possible for people to travel the globe and be accompanied by their own living spaces. The designs of Buckminster Fuller’s Dymaxion House and Karl Koch’s Acorn House pushed the limits of accepted home design to incorporate quick erection and mobility. New technology has also been conveniently adapted to numerous contemporary designs which require moveable pavilions to travel around the globe. The IBM Pavilion or the Hong Kong Tourist Association Pavilion exemplifies modern technological advances in construction with their use of standard transportation methods, site connections, and spatial capabilities. Several portable structures also utilize the most basic of construction techniques in order to ensure the ease of on-site erection. This does not, however, require the design or function to be basic; in some cases it requires highly refined solutions to produce structures that are easily disassembled, transported and then reassembled with ease.
With the straightforward principles of standard transport, carefully chosen materials, appropriate material connections, site connections and other sustainable features, strategies for new designs can be created. By keeping these simple ideas in mind when designing a new portable structure, all elements needed for a successful design should be available.

The design of a portable art exhibit to attract a wide range of visitors cannot rely only on techniques of portable architecture. Incorporating the ideas of an urban event with the portable structure is also essential to attracting more patrons to the exhibit. Following the simple notions of urban event architecture such as visual stimulation and movement can maximize the excitement surrounding the entire art exhibit. Urban events such as the plaza in front of the Pompidou Center or the plaza between the Maison Carrée and the Carré d’Art have an urban existence that embodies energy and stimulates the public need for diversion so that each day there is a hustle and bustle that provides the daily stimulation needed to draw a large variety of people.

Placing a portable art exhibit in a place where expected activity and excitement occur naturally can help to draw additional visitors to see the art. Even if the portable exhibit is placed in an area of lesser urban excitement, the ideas of visual stimulation, movement,
expressive forms, and prominence can be incorporated into the exhibit itself to create the urban event experience.
Proposition/Hypothesis

Making art exhibits available to the public may seem to be an easy task. Museums are readily available and open to visitors; however, the problems with museum attendance lie more with the majority of the population not wanting to attend an exhibit because it may seem uninteresting or too intellectual. This thesis proposes to make art available to those potential visitors who may otherwise not attend art exhibits. By presenting exhibits in exciting urban settings, relying on prominent locations and daily pedestrian activity, this portable art exhibit will reach out to a wider array of potential patrons.

Drawing upon the research in areas of portability and urban events, several design strategies and principles have been extrapolated. Standardized transportation methods are the main concern of portable structures. Utilizing transport methods such as tractor trailers, barges and standardized shipping containers, easy adaptations can be made to suit countless varieties of portable structures. Whether or not the actual shipping container is used or just its proportions and overall dimensions can denote a place to start the design of a new portable structure. Starting from these regulated dimensions, a designer will be ensured of their structures’ ability to be moved without encountering too many more regulations on the road or in the water.
Maximizing the potential in a portable structure, *materials and construction techniques* need to be flexible. Being able to get the most out of each individual piece, like the combination of functions such as structure and electrical into one unit allows for a quick assembly and consequently a quick disassembly of the portable structure. Dealing with different types of site conditions, foundation flexibility is essential to deal with minor changes in topography. Using the foundation not just as a stabilizing device, but also as a way to level the portable structure also maximizes the flexibility of materials and construction techniques. Utilizing adjustable jack legs or hydraulic foot pads are solutions for standard ground conditions; temporary concrete strip foundations can be used where ground conditions are less than favorable. Also, the borrowing technology from other industries such as boating, aircraft, or automobile provides the most innovative solutions that really create an efficient portable structure. Utilizing fabric details from ships, recycled shipping containers or innovative metals from the aircraft industry help to push the boundaries of portable structures. Configuring this borrowed technology in new and specific ways allows designers to build upon tested technology and fabricate it to suit the needs of portable structures.

*Portability* itself is also a key factor in the design of a moveable structure. The ability for the designed space to ‘fold’ or disassemble into easily transportable pieces (utilizing
standardized transportation and flexible materials) is the key factor to the success of the overall objective. Designing a system to allow for portability depends on the predetermined necessity of space requirements. Whether the space will be self-contained or whether the outcome will be able to be added to etc. all factor into the choice of how the structure will become transportable to several locations. Smaller spaces may be contained in an individual container such as LO-TEK’s Mobile Dwelling Unit, or will several trucks will be necessary to transport all pieces like the IBM Pavilion, which needs 23 trucks. After spatial requirements are set and a system of transportation is chosen, other factors also need to be discussed such as access to electric, plumbing, ventilation and temperature control systems—all of which can considerably alter or terminate a design if no solution to these problems can be found. A successful solution concerning the portability of a structure would be executed with all of these factors fully integrated into the final design solution.

Learning from urban events other design strategies can also be gathered. *Sensual stimulation* is the most easily understood element of urban events. Creating activity and movement through the use of expressive building forms provides the needed visual stimulation to keep visitors actively engaged in the experience of the space. With soaring tensile structures, or highly articulated building facades that express thing such as mechanical or
structural systems like the Pompidou center can be examples of how to provide this needed visual stimulation to visitors. Building systems that truly express their function to visitors like highly articulated structural systems allows the visitor to be more intimate with the building, spending more time speculating on how it works or why the material takes on a certain shape or size. Engaging the visitor through this visual and sensual stimulation, it may just involve the visitor more than that at a less sensually focused space and creates a more enjoyable overall experience.

In combination with these design strategies, the location of these urban events in previously established high activity urban centers will also affect the success of the portable structure. Drawing from established patterns of pedestrian activity, the temporary structure will gain recognition and an identity associated with the surrounding urban activities. This location, sometimes associated with cultural landmarks, will draw upon existing tourism and regular pedestrian activity to increase attendance to the portable art exhibit.

Drawing from these five design principles, this thesis will create a temporary, portable art exhibit that draws from the existing urban fabric of each location in order to bring art to a larger number of people than is currently being served.
Design Strategy

In beginning the design of a portable art exhibit in a high density urban center, site issues should be considered first. Possible locations could range from main city squares, piers, public fair grounds or busy city parks—which lead to various types of ground conditions that need to be accounted for in the design of the portable structure. Considered next are the transportation issues. Deciding how the exhibit will travel (land, water, and air) could all have a huge impact on overall dimensions, load, deployment and construction.

After the decisions of site and transportation, program elements can be added to determine sizes of needed space or approximate square footages of floor areas. With this addition of program elements a variety of other necessary items must be discussed such as needs for electricity, water supply, waste removal, and temperature needs (heating/cooling) in order to realize the scope and complexity of the project. Other aspects of the portable exhibit that will be considered are access to and from the exhibit (pedestrian and vehicular), availability of trained workers/equipment needed to erect the structure, and an overall structural form that will be able to collapse and travel to several dissimilar locations.

This thesis proposes an art exhibit space that will be flexible and able to expand from one original unit of approximately 2,700 square feet to an unlimited square footage increasing
by 2,700 square feet with each additional unit. The site considerations for the location of this art exhibition space have been limited to ground conditions with no more than a 3% slope and either a paved ground surface or stable soil conditions which are suitable for the distributed load of the 2,700 square foot unit. To accommodate the variety of sites, an adjustable foot foundation will be used to spread the load evenly over the entire floor area of each unit.

The base transportation unit for this exhibit will be a standard 52’ x 8 ½’ tractor/trailer combination. The trailer will also meet appropriate height restrictions of 13 ½’. Adapting the standard size of the trailer will provide this exhibit with the floor surface area, and the storage
for all structural pieces used in the remainder of the design. Another trailer will be used to transport the display boxes which will be used to house the artworks used in the exhibit.

After setting limitations on site possibilities and choosing a transportation method, program elements were then considered. The main program elements include a large open, flexible gallery space for the display boxes housing the artwork, a ticket area and secure access points for entrance and exit. With this criteria set in place, a decision was made for this flexible space to be unconditioned from the elements, other than the exception of the roof canopy to shield the art and patrons from direct sunlight. This open-air exhibit space then called for each of the display cases to be their own micro-environments in order for the artwork to be stored at the correct temperature and humidity conditions.

This flexibility of space and necessity for each box to be a micro-climate led the design to incorporate an electrical grid to the main floor surface so that the spatial arrangements of the display cases would not be limited. The grid is designed along with the standard size of the display boxes so that the outlets are kept to a minimum while providing the greatest spatial flexibility. Lighting is also incorporated into each display case to optimize the viewing potential of each work of art. Ambient lighting was also considered for the remainder of the
exhibit space and is incorporated along the two main structural arches that form the general spatial arrangement.

To provide the electricity for the lighting and for the control of the micro-climate display cases, an on-site generator or an on-site electrical hook-up will be connected to a main breaker box that will control all of the electrical circuits, which are ran through the floor grid.

The structure for the main exhibit space is comprised of two main arches that create a stable 3-pin structural configuration, utilizing the floor structure as the tension cord at the base of each arch. The structural arches are comprised of 11’ lengths of aluminum tube which are able to be pulled apart for storage and transport to the next site. A PVC coated polyester fabric is used for the roof/wall covering. The erection of the structural arches and placement of the fabric all contribute to the urban event of the entire exhibit. The construction sequence is an event in itself available for the entertainment of passersby. The casual observer will be able to watch the entire sequence from the arrival of the truck on site, to the tensioning of the fabric and addition of access ramps to the exhibit floor.

The combination of all the site, transportation, program, structural, and mechanical elements with the high-activity urban centers will provide patrons an exciting event. It will
draw from the existing pedestrian traffic to gather a wide array of visitors, some who might never notice or participate in a temporary art exhibit in a traditional museum.

3.7 construction sequence
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