A KINETIC MUSEUM:
AN EXPLORATION OF PHYSICAL/MECHANICAL INTEGRATION

By David S. Post

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Rall State University
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INTRODUCTION

This thesis is a study of the relationship that connect or could connect the realm of machinery, the power of human physical action, and architecture. Each element has various strengths and weakness. But, if combined, a solid entity could arise.

The space which this exploration is to take place is an old factory in Holland, Michigan. This factory contains a variety of early Industrial Revolution equipment that is obsolete to today's standards, but provides a premise for designing a kinetic museum. The museum would be one of providing the individual the opportunity to explore their abilities to control machinery which controls changing elements within the architectural environment. By doing so, architecture can become active, controlled by physical participation. Integration with the space can be achieved.

The realization of human potential is the key to this thesis. Human potential can be enhanced by the machines that we create. Human potential plus the power provided by the machine can create architecture that defies the gods. Man and architecture can only benefit from this integrated triad.
THOUGHT BACKGROUND
Throughout history, architecture has been changed by various technologies. The Industrial Revolution, in turn, has been responsible for creating various elements that have made our lives easier and more convenient. Architecture, as a result, has also become more convenient as well. Automatic heating and cooling systems, indoor plumbing, hot water heaters, and microwaves have helped to create an environment that requires less work for the building's inhabitants. The benefits are numerous. We have more time to do the things that we want to. But, have we lost something in the process?

That something might come in the form that we, as a society, take architecture for granted. Thanks to the fruits of the Industrial Revolution and its innovations, most of our labors required to sustain a building's environment is no longer needed. Architecture has been transformed from an active to a passive entity. We no longer interact with the buildings that we create because automatic systems do the interaction for us. Little interaction, in turn, leads to little responsibility and little concern.

A question, however, can be raised over this point. Society cannot nor should not revert back to an era when we had to interact with architecture. We must always go forward, but we must do so in a manner that we still remain responsible for our creations. Integration of physical participation and mechanical methods is a possible avenue to take. The individual would be given the opportunity to manipulate architecture to the their desires. The mechanics would drive the effects. This driving process, however, would be one of simple means. When physical participation stops, so does the mechanics.
By taking this route, the best of both worlds can be realized. Innovative mechanical drive systems can be created to enhance effects that could not be possible by human intervention alone. The individual driving the effects could have the sense of accomplishment and reward for their efforts. For without his/her efforts, the mechanics and their effects would not be realized. The result of this interaction is simple. Architecture could once again become active due to the fact that human interaction would be needed to power the potential of the space. The space, in turn, could not be taken for granted because the individual would be responsible for it. Architecture could therefore continue to adapt and be shaped by technology, but we would be the ones that power that technology instead of the other way around.
SYNTHESIS

By keeping my premise in mind, I searched for the right atmosphere in which to carry out my ideas of physical and mechanical integration. The Western Machine Tool Works site offered me such a space. The factory and its contents speak of an age long gone; the beginning of the Industrial Revolution.

Why this period, why this building? To answer that, I will simply say that this is one of the few periods in history that physical participation and mechanical methods were truly interconnected. The early Industrial Revolution and its inventions were of a very simple nature compared to today's standards. The machines, which were powered by a stream or steam locomotive, were completely worthless without a high degree of control from its operator. Speeds, direction and distance of engagement were all controlled by means of cranks, handles, and drive wheels. These elements, in turn, were controlled and positioned by physically participating and integrating with the machine. The two acted and produced as one. Both man and machine worked together.

As mentioned in the history of Western Machine Tool Works, the factory contains nothing but this vintage yet operable equipment. With this environment serving as a backdrop, various new effects and spaces could be created to enhance the theme of physical and mechanical integration. This theme would consists of not only educating the individual about the equipment and its functions, but also making a strong point that the architecture within the factory could be changed and manipulated. By doing so, the architecture, both existing and new could become integrated with the individual. Architecture would be active and controlled by physical means.
SYNTHESIS

The question after this point now lies with what should become of the factory? Its original function is no longer valid nor profitable with today's standards. Since I am dealing with the idea of educating the individual about the equipment, the idea of creating a museum seemed rather fitting. This museum, however, would not be a typical one where the objects sit in place and the individual observes. Instead, the museum would be very kinetic in all aspects. At every angle and every function, the opportunity to interact with the equipment and thus the architecture would be provided for. The result of turning a drive wheel could be one of making walls rise out of the floor and/or the changing of light levels.

The advantage of creating such an environment is that interaction with the architecture can become more apparent. The individual that realizes that the architecture can be manipulated will do so in the manner that he/she wishes. The next individual, in turn, would do the same. By providing an array of effects and elements to change, a multitude of combinations can be created. Thus, the environment of the building would never be the same.

This changing space could teach the individual two lessons. The first one is obvious; what did the equipment produce and how did it work. The second lesson is a little more subtle. The individual will sense that he can control his environment, but he does need help to do so. The machine can help us to do things that we can not do ourselves. However, we are the masters of our inventions. We should not rely on the machine to do the work for us because once we do, we will take the action for granted. Architecture, in turn, should not be taken for granted as well.
PROJECT BACKGROUND
PROJECT HISTORY

The history of my building of exploration is a tale of a great rise and slow fall. Western Machine Tool Works started its operations in 1890. From its humble beginnings, the factory saw itself change and change again in the form of additions and more workers. The products that were produced, radial drills, metal shapers, and metal tappers, were of very high quality and as a result, added more business.

The period from World War I to World War II, is the peak of the factory's output and prestige. During WWII, the business employed three hundred workers that worked around the clock. The emphasis on quality, however, did not wane despite the government's demands. As a result, Western Machine Tool Works was awarded the 1943 "E Army/Navy Production Award," that recognized the business's ability to have high output and high quality.

The story from this point, however, takes on a different tune. After WWII, the factory's business was doing quite well despite the post war slump. One big mistake was made during this period however. The business never adapted to the new industrial methods and means devised during the 50's and 60's. The result is obvious. Western Machine Tool Works continued to make products that were no longer useful to the market. The machinery that made the products were the same relics of WWI and WWII. Business fell and fell. The workers were reduced to making replacement parts rather than creating new pieces of equipment.

Currently, Western Machine Tool Works is still a business, but not much goes on. On most days, the factory sits idle. The interior still contains the equipment used during the wars. Although the equipment is oiled and ready to go, it is doubtful that they will run again.
CULTURAL BACKGROUND

The cultural side of Holland, Michigan is a mix of complex values. Although the percentage of people with Dutch heritage is only 30% of the total population, the community still holds onto the Dutch traditions. There is an insistence to be prompt and to be tight with finances. Stores are generally closed on Sundays and the political structure is one of being supportive of the Republican Party. And how could I forget, the annual celebration of Dutch heritage expressed by the nation's fifth largest festival; The Tulip Time Festival.

Because of Lake Michigan and Tulip Time, the influx of tourists is intensive from early May to Labor Day. The tourists bring money and the demand for social, cultural, and commercial functions that are usually not present in a non tourist community. The diverse industry / service economic base adds to Holland's ability to survive bad financial periods and off tourist years.

The city does have problems however. A surge in growth has increased crime and weakened the small town character of Holland. The local governments do not have an apparent long term plan to meet the demands of growth. Developers, without any real guidelines, destroy the land for strip malls and fast food restaurants.

The climate is one of extreme changes. Summers are quite warm and winters are quite cold. There is also a great accumulation of snow during the winter thanks to Lake Michigan. The lake is also responsible for creating consistent breezes that blow through the area. But, having the lake next door has plenty of advantages over a land locked city. Less humidity is one of them. Being able to see a sunset every night is another.
CULTURAL BACKGROUND

Holland is a city that offers much potential. Its location on Lake Michigan and Lake Macatawa helps to add to the beauty of the area. The surrounding countryside consists of a mixture of woods and farmland. Glacier deposits have made the countryside a series of gentle rolling hills as well. It is no wonder that Holland is becoming a large retirement community. Holland is a city that will stay consistent and traditional, but, thanks to tourists, the city is willing to try new things.
SITE DEVELOPMENT

The site of Western Machine Tool Works is quite an advantageous one due to the direct access to Lake Macatawa. The immediate neighbors consist of a recreational park to the west, a "coal dock" to the east, and a historic residential district to the north. Five to six blocks east is the downtown / Hope College area. The only disadvantage of the site is that a pair of railroad tracks that lie twenty feet from the factory's south elevation can not be removed.

With this given situation, I began to explore how to link all of the neighbors of the factory together. The park was my answer because many people from the neighborhood go here for various reasons. I wanted to provide amenities that would not only draw more people, but also help in establishing the links that could connect the factory with the park.

The links and amenities were then plotted down on a series of axes. These axes, in turn, were created to link new and existing points of interest. One axis along Lake Macatawa was very helpful in creating new functions in the form of towers. Each tower defined its own axis and its own area. Each tower, in turn, had a different function suitable to the space it occupied. By doing so, each space and each tower had its own identity.

Another element that was useful in defining the axes was the use of trees. I arranged trees in a manner that defined visual links from one space to another. The result was a natural avenue. The use of trees was also useful in creating an axis from the downtown area to the lake. By doing this, the downtown area could be spiritually linked to Lake Macatawa and to Lake Michigan.
SITE DEVELOPMENT

The last connection that was explored was one of bringing water onto the site. I wanted to do this to enhance the quality of museum and to symbolically bring water from Lake Macatawa to a micro brewery right across the street from the factory. The result was an overhead canal that would "leak out" at certain locations as to create water play areas within the park.

Another consideration of the site design was providing a space for the docking of trans-Lake Michigan hover craft. This docking station would provide another mode of public transportation for the city of Holland and help to bring in more tourists. The tourists would then be directed through the museum in order to welcome them to the city.

Overall, the site plan does not drastically change the existing fabric of the neighborhood and the park. All I did was use the existing criteria and added simple elements that would enhance the feel and the experience of the site. The factory and the park could flow into one entity. The neighborhood would have a stronger identity and more amenities to enjoy. Holland would have another form of public transportation and another strong tourist attraction. All of this would be made possible by the museum. Architecture would be more active and appreciated as a result.
DESIGN BACKGROUND
After much thought and design solutions, the complex ended up being divided into seven areas. These areas consist of a variety of functions suited to meet the needs of the museum and the marina. Five out of the seven received much attention because they make up the heart of the complex and are described later in this book. The other two areas consist of museum - area three and a convenient store that serves both the marina and the adjacent neighborhood.

Museum - area three is primarily an education space that allows the visitor to witness museum employees using the original machinery for its original purpose. Visitors could also partake in making parts for machinery under employee guidance as well. The convenient store is self-explanatory. The other five areas, which are to be described later, received most of my attention.

I wanted these five areas to accomplish three objectives. The first objective was making sure that each area carried out the physical/mechanical integration theme. The second objective was one of making the museum part of the adjacent park. By doing so, the two separate entities could flow into one. Taking advantage of the water canal and pedestrian axis paths helped to make this possible. The third objective was one of making sure that the designed forms and the elements of change were reflective of the existing character of the factory. The reason being that one, this factory is in a historic district and two, the existing character is very moving and very strong. I felt that whatever I did should not subtract from this strong voice from the past.

By keeping these three objectives in mind, the five areas of exploration were created to not only suit their function, but also create a cohesive whole. Its is from this point
that the idea of creating a consistently changing interior came into being. Why this approach? I felt that the theme of physical/mechanical integration needed this atmosphere to make the effects more apparent and more importantly, make the architecture more interactive with the user. The result would be an interior that is never the same. Every time a person enters the complex, something new is happening. Architecture becomes alive as a result.
Of all the areas within this project, this space has the least amount of physical/mechanical integration elements. This is primarily due to the function of the space. The bar is an area for loose social interaction and communication. The partaking of spirits and all of the activities that go along with that has also been considered. Because of these activities, the need for the elements of change were not needed as much unlike the other areas within the complex.

The design focus was altered toward a different route. Because of the bar's location near the marina, interior/ exterior interaction became the main emphasis. By taking this route, the activities of the museum could transition themselves to the activities of the marina. The activities of the bar could spill into the museum and marina as well. The bar, in turn, would become the oasis of the complex.

The elements of change that would be powered by the physical/mechanical integration would primarily deal with making the interior/ exterior interaction possible. The windows that make up the facade could be cranked open to allow pedestrian traffic to and from the bar. These same windows could be cranked into a closed position in order to protect the bar's interior from the elements. The interior of the bar, in turn, would contain its own type of screen to be used at the discretion of the users. These screens could be raised or lowered for a duel purpose. The first purpose is one of creating a light level that the user is comfortable with. The second purpose is that the screen could block off the adjacent table in order to create a more private setting. These screens would be located throughout the bar in a defined pattern. Seating would, of course, correspond with the screens to create an ordered setting.
Another design consideration that was explored was the using the water canal to my advantage. This canal symbolically brings water from Lake Macatawa to the micro brewery. Because of this connection with the micro brewery, I thought that a series of waterfalls could diverted from the canal and cascade into the bar itself. Beer produced at the micro brewery could also cascade into the bar by using the canal and waterfalls as a conveyor system. The excitement of seeing this beer being lowered into the bar from the micro brewery would add to the festive atmosphere of the bar.

Overall, the bar and all of the activities associated with it, would be one of a relaxed yet very social atmosphere. The users of the museum could come here to reflect upon what they have experienced. The users of the marina could come to enhance the experience of boating. The adjacent neighborhood could finally have a place to engage in a bar setting. The bar, in turn, would be suited to help the three parties to converse and exchange values in a fun, ever changing, setting.
RESTAURANT

This an area that considered individuals that are adventurous and non adventurous. The restaurant is a two level area that overlooks the marina and Lake Macatawa. By taking advantage of this view and being located directly above the bar, a series of opportunities came into being.

The first opportunity came in the form of providing seating for the adventurous. This seating would be one of providing the user the opportunity to position themselves within a certain area. This provision of opportunity comes in the form of a platform that can be moved by the user's physical/mechanical integration. These platforms would be big enough for four to six people and for two people only. Each platform has a different route to be moved upon and could be positioned anywhere along that route. Interior / exterior interaction would also be provided for if the users chose to go outside. All of the platforms would be located on the second level.

The effects of the platforms would be seen by the non adventurous individuals sitting on the ground floor and the people in the bar. The non adventurous seating would be one of a typical restaurant. Only small elements of change would be incorporated within this space. Like the bar, the user can effect their lighting level, but can not block off the adjacent table. Most of the changing effects would be determined by the adventurous users above.

Another opportunity came in the form of providing service for the restaurant. The kitchen, which is located in the basement, needed a convenient way to get food to the restaurant above. A series of glass encased dumb waiters was the solution. By doing this, the users of the restaurant can experience the coming and going of their meals.
RESTAURANT

The result of all of these elements is a space that can accommodate the different levels of adventure within the user. Those who prefer a normal restaurant setting can sit on the ground floor and overlook Lake Macatawa in a relaxed atmosphere. The adventurous at heart, however, can take advantage of the second level and all of the opportunities of movement and physical/mechanical integration. Motion, however, will always be constant on both levels. The dumb waiters and the water canal located high above will help to make the constant motion apparent. The activities of the bar below won't detract from this atmosphere either.

Overall, however, the restaurant is more of a formal gathering space than the bar below. This is a space for more intimate and personal conversation. This a space were families can gather, businessmen make deals, and were lovers can engage in private conversation. The constant motion of the space helps to enhance the view and the constant motion of Lake Macatawa. In the restaurant, the physical/mechanical integration not only effects the architecture, it also helps to make a connection with beauty of nature found in the form of Lake Macatawa.
RESTAURANT - VARIOUS VIEWS
Of all of the areas within the museum, the gallery is a space of providing for the needs of a temporary exhibit. These exhibits may come in the form of painting, sculpture, and/or live performance. The gallery, as a result, must be an adaptable space that can accommodate such exhibitions while carrying out the physical/mechanical integration theme. To achieve such a task, the following solutions were created.

The first solution dealt with creating changing elements that could accommodate painting and sculpture. Partitions and tables were the first things to come to mind. But, because the physical/mechanical integration theme was important, the partitions and tables should be controlled as such. The partitions simply rise out of the floor while the tables fall from the ceiling by mechanical means. Because of the flexibility issue, the partitions and tables can be raised or lowered to a multitude of heights and positions.

Lighting of the space would be just as flexible. The users within the gallery can simply swing the structure that supports the lights into any position within a 180° arch. The lights on the structure, in turn can be positioned at different angles. The result of the user being able to control the lighting is one of experiencing the objects on display in many different conditions. The object becomes more alive and real to the user.

Another issue that needed to be addressed was the providing for the needs of a live performance. Often, the performers need a space to prepare for the performance and a way to signal the audience that the show is about to begin. The solution was one of using an existing loft space as a ready room and creating stairs that lead to the performance
space. When the performers walk down the stairs, the audience can sense that the performance is about to begin. The same existing loft space could also be used as more space for a painting, sculpture exhibition if there was a required need. Receptions could take place here as well.

The gallery, as a result of these solutions, would be able to adapt to many different needs. Interior / exterior interaction was also incorporated so that outdoor exhibitions could enhance the gallery. Natural lighting levels could also be changed by physical/mechanical integration.

Overall, the gallery can show the user that physical/mechanical integration can create a flexible space to suit the needs of different exhibitions. With the change of a few effects, the nature of the exhibition can greatly change. The result can be very powerful. Art, whether it be an object or a performance, can be manipulated by the user and in turn, become more real and provocative.
Like the title suggests, this area of the museum is the beginning. Not only does this area introduces the visitor to the museum, the museum introduces itself to the visitor. Although this may sound strange, it really is not. This area is one of introducing to the visitor the possibilities that can be achieved by means of physical/mechanical integration. It is here that the elements of change are most apparent.

The effects caused by the elements of change are of a simple nature. Interaction with the elements of change causes immediate reaction. For example, the turn of a crank causes a wall to immediately rise out of the floor. All of the effects would be like this. By doing so, the visitor can realize two things. The first realization is that it is okay to move and play with the equipment. The second realization is one of discovering that the visitor can effect the architecture through physical/mechanical integration.

Like the other areas within the complex, a combination of effects would be made possible. The opportunity for consistent change would be the result because each person using the elements of change would alter the architecture to their desires. But, as mentioned before, these changes would be instantly apparent to enhance the sense that it is okay for the visitor to play with the equipment. The visitor can therefore proceed to adjacent areas of the museum without hesitation of interaction with the equipment.
Like museum - area one, this area also consists of elements of change that can effect the architecture of the space through physical/mechanical integration. But, unlike area one, this area is much more subtle in revealing the effects. The visitor is required to interact on a higher degree, but has more opportunities of controlling the architecture.

The elements of change within this area, however, takes advantage of one of the most powerful forces on earth; water. The adjacent water canal is to provide the water in a manner that can be highly controlled. The force provided by the water falls on a water wheel that powers the effects. The visitor, in turn, can control the rate of the flow and the direction of the water wheel. The effects powered by the water wheel can be controlled through physical/mechanical integration. The effects, however, will not be as apparent. Each element of change requires a higher degree of power, but their effects are much stronger.

Again, a multitude of combinations will be incorporated with the elements of change. These combinations are also not as apparent as area one's effects. Instead, the combinations will be much more subtle. By doing this, the visitor is challenged to notice detail.
CONCLUSION

All of this exploration, time and occasionally frustration have helped me to create a project that is both complex and challenging. There are so many possibilities that can be accomplished through the physical/mechanical integration theme. What I explored and produced for my thesis is just the tip of the iceberg. So much more detail and exploration of mechanics would be needed to make this project a reality. The costs to create such a space would also not be cheap.

The question now is where do I go from here as far as this project is concerned? I guess my only answer is that I hope someday that somebody realizes that Western Machine Tool Works is more than lake front property. The equipment housed within its walls are an amazing thing to look at. It is almost like going through a time warp when walking around the factory and seeing these machines sitting there waiting for someone to come in and start them up again. If only the factory could speak to us. The stories it would tell, the lessons it would teach. But, this is often the fate of factories that are no longer useful to society. The factories fade away and wait for a wrecking ball to destroy them. These factories, however, contain something that we often do not see. Like Western Machine Tool Works, old factories have helped our nation become what it is today. Renovating today may help us to build a better future. Providing homes for the homeless or creating day care centers are just some of the possibilities. Creating a kinetic museum is another. The point is that these factories deserve a second chance. They have helped us once to create jobs and dreams. They can, given the chance, help us again. Western Machine Tool Works has this possibility.