Ningyō-shi

Project by Sarah Hornik

Brief Story Concept

At the base of a mountain, hidden in a bamboo forest, lives the *Ningyō-shi*, the Doll Maker Hideyoshi Uchiyama. Uchiyama's dolls have brought him fame throughout Japan. The quality and care he gives each doll are so intricate one can swear the dolls are alive. One day Uchiyama took his crafting abilities too far. In a moment of arrogance, he declared he would make the most lifelike doll in existence. He locked himself in his workshop and began the task. Soon after, locals began to notice strange occurrences in the forest surrounding Uchiyama's home and workshop. When they went to check on the artist, they discovered he was missing. In Japanese culture, there is a long-standing belief that every doll has a soul. Unfortunately for Uchiyama, his latest creation had a corrupt soul.

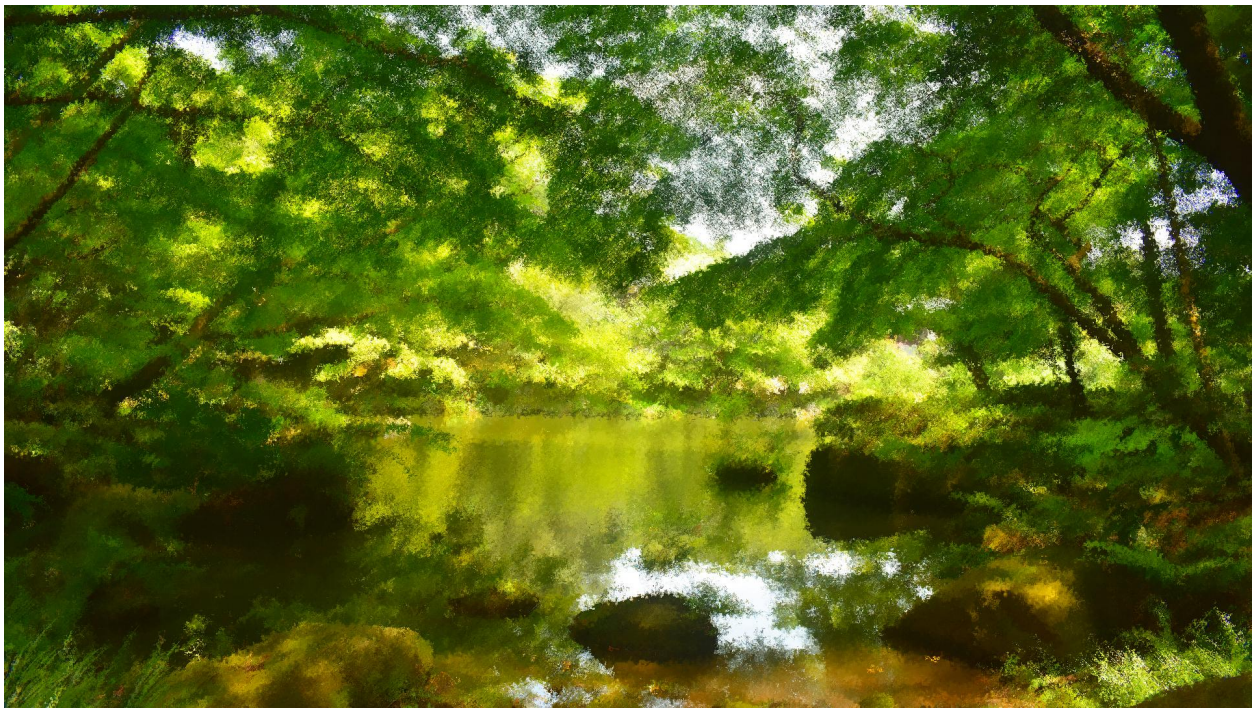
The visitors will journey through the bamboo forest to Uchiyama's workshop. There the guests will discover the beauty and danger of the dolls. They will learn that Uchiyama is being held captive by an evil doll that came to life and that they must find the artist and escape.

Expanded Story and Ride Overview with Emotional Resonance

Do you remember that special doll you had as a kid? Not the one you snuggled in bed because you thought it would protect you. The one that sat on your shelf and you swore it was watching you. *Ningyō-shi*, or *The Dollmaker*, is a themed ride about what happens when a doll comes to life, and this doll isn't your best friend. The attraction celebrates the Japanese art form and history of dolls by taking adventurous guests on a thrilling ride and educates guests on Japanese doll culture.

The journey starts at the edge of a bamboo forest. The unsuspecting adventurer is met with a breathtaking scene of greenery towering above their heads. The forest is part of the queue for the ride, and the dense shade provided by the foliage makes for a comfortable wait even on the hottest summer days. Pristine streams and picturesque landscaping within the forest will make for the perfect picture during the wait. There are even tiny statues of smiling dolls nestled into the wilderness for guests to spot. Stone lanterns, known as *tōrō*, line the path. The thickness of the foliage will block noise pollution from other areas in the theme park. The purpose is to transport the guest to a natural wonder that they can't believe exists inside a theme park.

Bamboo Forest



Pond inside Bamboo Forest

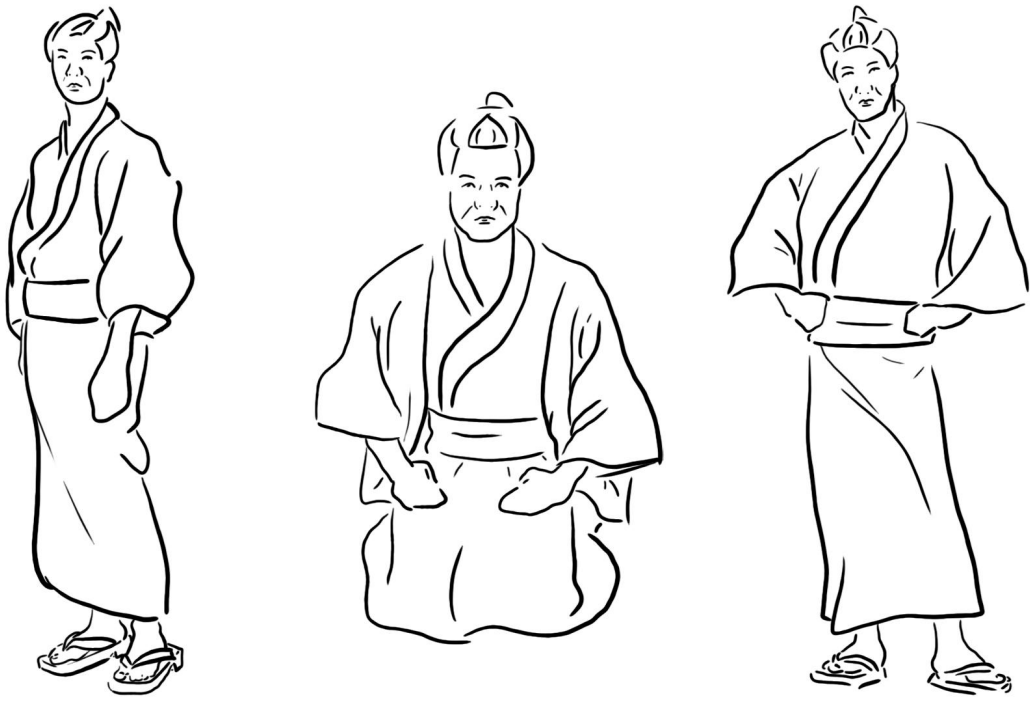
However, the deeper the guest gets into the forest the eerier it becomes. The *tōrō* are cracked. *Komainu* or lion-dogs (statues that guard spiritual sites but are found throughout Japan) make an appearance. These aren't the typical *komainu*, these look vicious. Next, the guests pass

groups of doll statues that emit a ghostly giggle. Nearby a “tree” falls with a boom (a mechanical tree that resets and falls at programmed times). As the guest turns towards the sound of the tree, the doll statues disappear into the ground. Hearing the giggling has stopped, the guests look back to the doll statues but only a grassy patch remains (the statues are on a platform that disappears underground and a grass-covered platform takes its place).

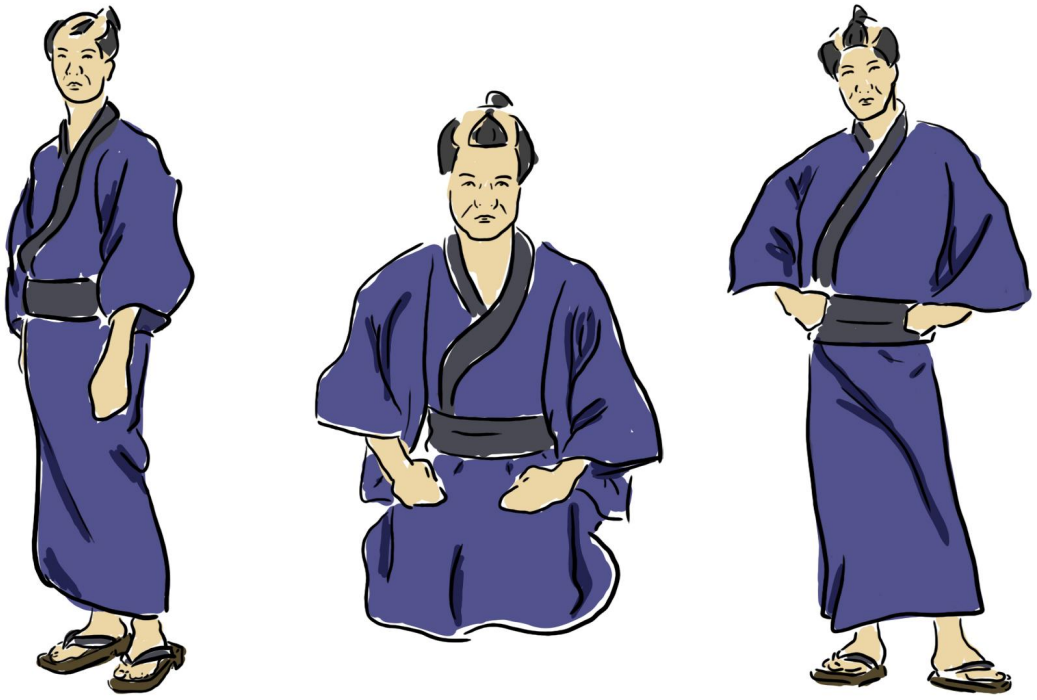
Komainu Statues

Finally, the guests see a sign that reads “Residence of Hideyoshi Uchiyama, Greatest Dollmaker in Japan.” The sign has been vandalized and now reads “DANGER.” This doubles as foreshadowing for park guests who speak Japanese. Uchiyama [内山] literally means “inside mountain” and the kanji for Hideyoshi [秀吉] means “outstanding” and “good luck.” So all together the guest sees “DANGER, inside the mountain, lots of luck.” There are weathered hand-drawn missing posters of Uchiyama on nearby bamboo shoots. He's been missing for some time.

The guest exits the forest and is met with a mansion at the foot of a mountain. The mansion is built in the traditional Japanese-Buddist architecture style. The mansion is run-down but still beautiful, it’s clear someone important lived here. The mountain is man-made but looks realistic to fool the guests, a majority of the ride will take place inside the mountain. The guests pass through the *genkan* or entryway. A man’s torn sandal is sitting at the entrance, its pair missing. Could it be Uchiyama’s? The dust on top suggests no one has been in or out of the home for a long time.



Line Drawings of Hideyoshi



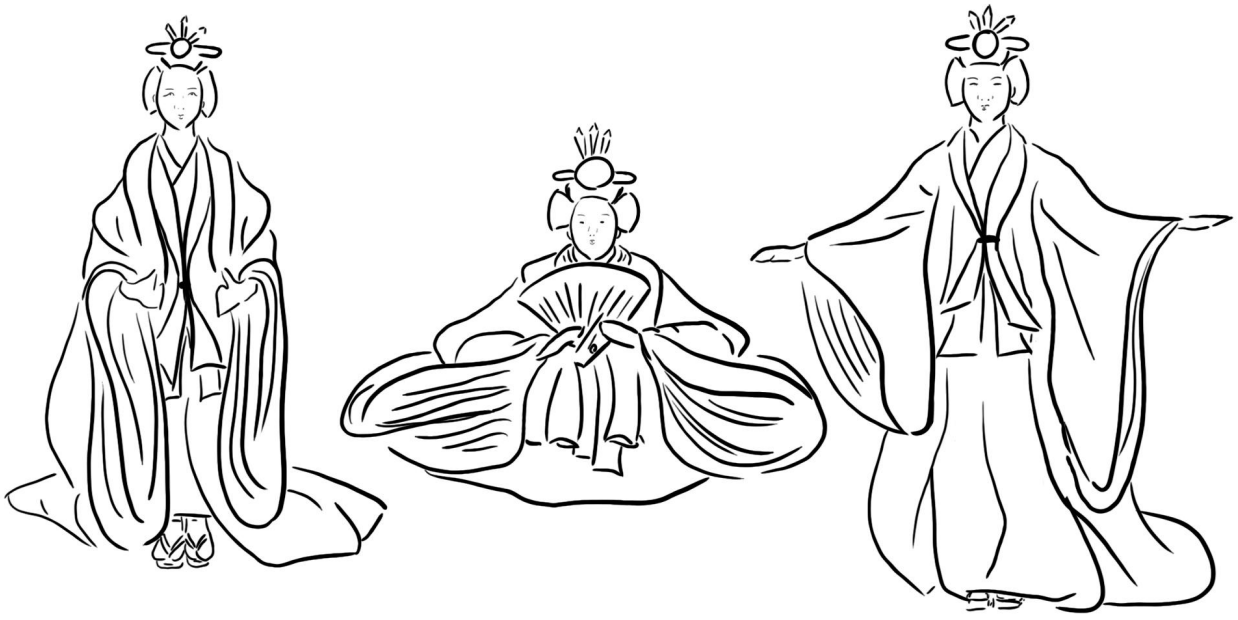
Hideyoshi with Color

Uchiyama's Home/Workshop

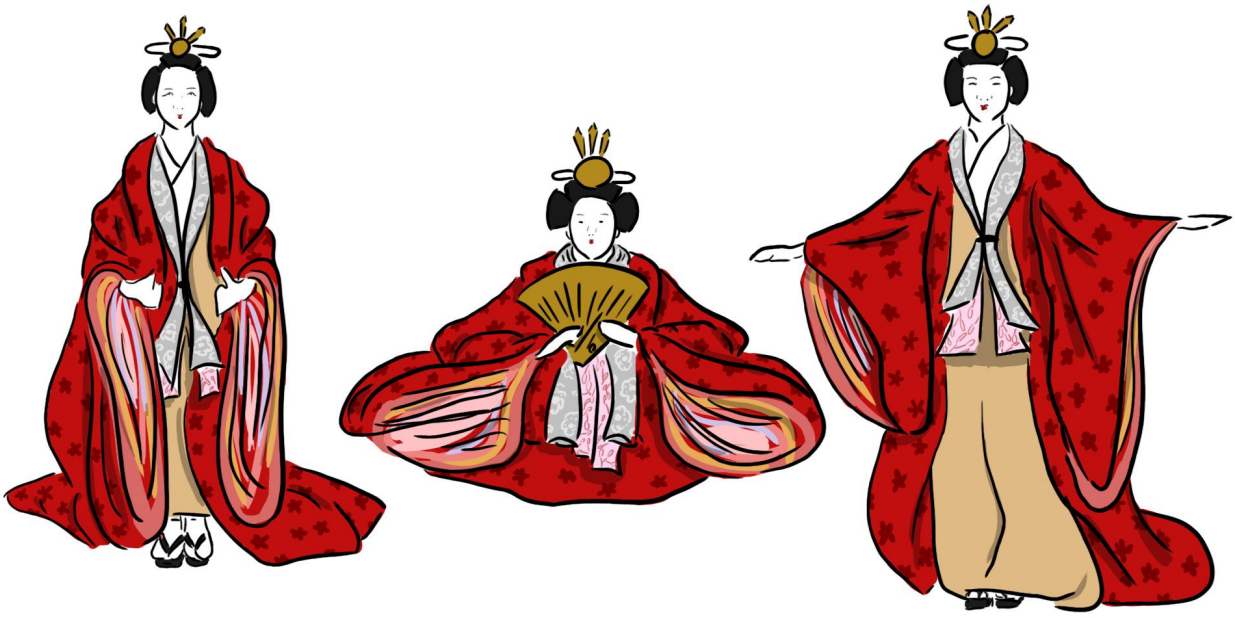
Still in the queue, the guests are now inside the mansion which they now see is a workshop inside. Everywhere they turn they see dolls and tools. Again, it's clear no one has been here in a long time. There are finished *Hina* dolls in elaborate robes to simple *Kimekomi* dolls

that are just starting to take shape. Scattered about are newspaper clippings. The newsworthy topics include how Uchiyama's dolls are being used in cross-cultural exchange, Uchiyama's Bunraku puppets being declared a cultural gem and real news stories from late 1800's Japan about the doll artform. The last news article is about Uchiyama and how he swore to make the most realistic *Hina* doll in Japan, a doll so real you would think she was a person. Next to the article is a sketch of a *Hina* doll, a stunning young woman in a red kimono.

As the guests move in the queue, the dolls in the workshop begin to have something wrong with them. Their expressions are off. Some look frightened, others vindictive. There are more sketches of the *Hina* doll woman but these have been torn to pieces. The tatami mats on the floor and the furniture have been damaged.



Line Drawings of *Hina* Doll Woman



Hina Doll Woman with Color

The guests move down a ramp (the entire queue is wheelchair accessible) and into a hallway that has traditional Japanese ink paintings along the walls. The ink paintings show the same *Hina* doll woman as before. Each painting is of a different scene. The doll woman under a flowering tree, the doll woman crossing a bridge on a spring day, each scene more beautiful than the last. A loud bang goes off and a door slides closed behind the guest, trapping them in the hallway. The lantern light flickers and when the light comes back on so does a hidden set of UV lights behind each ink painting. Now each scene reveals that the doll woman was not alone but was in fact accompanied by a demon. The paintings show her talking with the demon, shaking hands with the demon, and lasting transforming into the demon. The next door at the end of the hallway opens and guests enter the next room. Here is another ink painting. This one shows a man, who the guest recognizes as Uchiyama from the missing posters and newspapers, holding the doll of the *Hina* woman. It is a lenticular print, so as the guest crosses the room the image they see changes. They now see the doll as a full-grown woman smirking as she holds a terrified doll-sized Uchiyama in her palm.

The guests arrive at the next room where the ride begins. The guests are strapped into the seats of the flying coaster (holds up to a dozen guests). Next to the loading dock is a collection of *daruma* dolls. Each *daruma* doll has one eye colored in. The symbolic meaning of a *daruma* doll is that someone makes a goal or wish and then they color in one eye (the second eye is colored in after the goal or wish is achieved).

Room Where Ride Starts

The ride starts slowly and the guests pass through a final *shoji* door. They enter a series of hallways and are quickly jerked side to side. Each chair on the flying coaster also rotates independently of the track. The confusing passageway and movements disorient the passengers. They hear a low moan and swivel to see Uchiyama (an animatronic) on the ground. He's shocked to see visitors and speaks, "What are you doing here? It's too dangerous. I tried to stop her but I couldn't. You have to leave before --." He's cut off by the sound of a woman laughing. The seats pivot to the left and the guests catch a glimpse of a woman in a red kimono disappearing into the shadows. It was the *Hina* doll woman. They rotate back towards Uchiyama. Uchiyama tries to stand, "Quick, we have to escape before *she* catches you."

The ride jerks and the passengers swish down more hallways at breakneck speeds (hidden fans blow on the guest to create the illusion they are moving faster). The hallway begins to turn from walls and tatami mats into stone. They are now inside the mountain. The guests rush and dip through organic stone passages. The doll woman (the size of a human) is standing in the middle of the track. She's smirking as the guests zoom towards her. Just as they're about to hit her she disappears into the ground. The guests speed past before coming to a stop. They ride tilts up and they begin a slow incline. Uchiyama appears next to them. He's climbing the incline with them, "Hurry up! Hopefully, we can find a way out!"

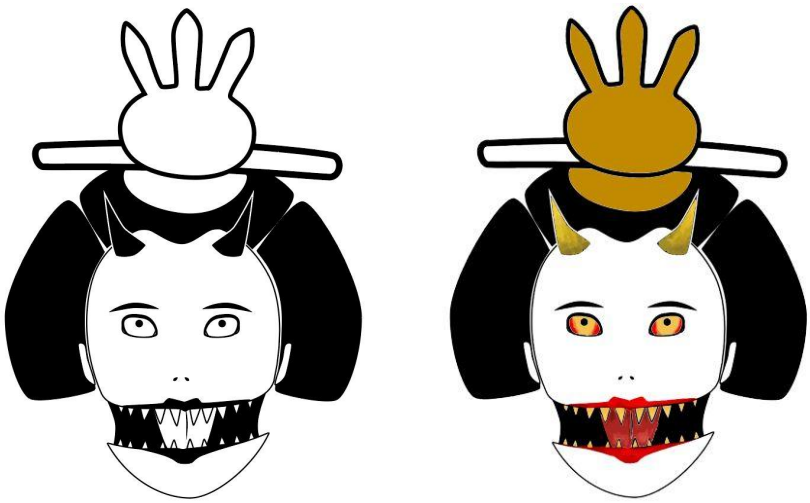
The guests get to the top of the incline and rush downwards. This time they see the doll woman, but this time she is huge. Her arms are circling the track. Her arms begin to close and the

guests rush through them, barely missing being caught. They continue onward in several daring curves of the track. The guests slow and Uchiyama appears again. He's walking alongside the track and the seats turn to face him. "That was close! Do you have any idea what would happen if she -- Oh no!"

The seats turn back forward. There is now an opening on one side of the stone. The doll woman is now massive. She says, "What pests. Who needs humans anyway?" She takes her hand fan and slices at the guests. The fan "breaks" the stalactites of the mountain/cave (the rocks are on wires and reset after the guests pass). The walls of the mountain and the ride seats tremble. The guests zoom back into the stone passageways for more twists.

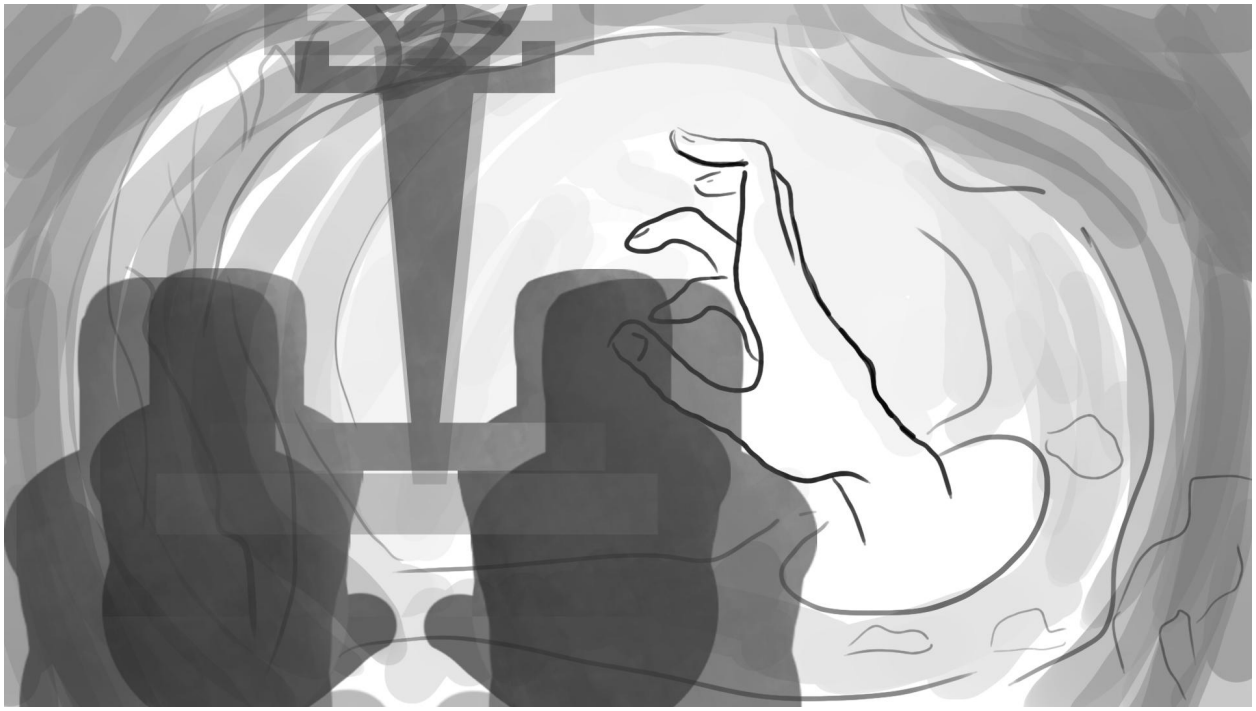
Hina Doll Woman Attacks Guests With Her Fan

The guests come out of the stone walls and are met with a giant foot. The ride tilts up, revealing a five-story tall doll woman. Her beautiful face is now the face of a demon. She bends over and "picks up" the guests. The ride shakes and the woman's hand gives the illusion the guests are being picked up but are actually moving along a hidden track. The doll woman opens her mouth, revealing a yellowed set of pointy teeth, "You humans thought you could control me? Now look who's in control!" The mountain shakes violently with her voice.



Demon Face Concept

She “throws” the guests down the mountain cavern. The guests fall backward on the track which has switched positions. They now enter a hole in the wall of the caverns. The ride turns back to facing forward. The guests are rushing past collapsing rocks. The giant hand of the doll woman bursts through the rocks to grab the guests but is crushed by a falling boulder. The doll woman screams. Uchiyama reappears, “The mountain will trap her, but we’ve got to get out of here! Follow me, I found a light!” In the distance is a circle of daylight. The guest move toward it, narrowly missing a boulder that falls towards the track.



Hand Bursting Through Rocks

They burst into the daylight. Surrounding the guests is a sea of orange *koinobori*, or fish kites. There are hundreds of kites, and it's a surreal experience to fly among them. The guest's flight slows as they begin to incline. They are now on top of the mountain. The seats slowly totter at the mountain's peak before swooping to the ground. Unlike the jerky movements that the guests experience, while dodging the boulders, this is smooth sailing. The guests glide and turn with the banks of land below. They're surrounded by beautiful scenery. Finally, they come to a smooth stop in a Japanese garden. The guests get off and are greeted by a group of *daruma* dolls. These dolls have both their eyes colored in, representing how the guests completed their goal of finishing the ride, freeing Uchiyama, and their victory over the doll woman.

Koinobori Kites, Exit from the Mountain

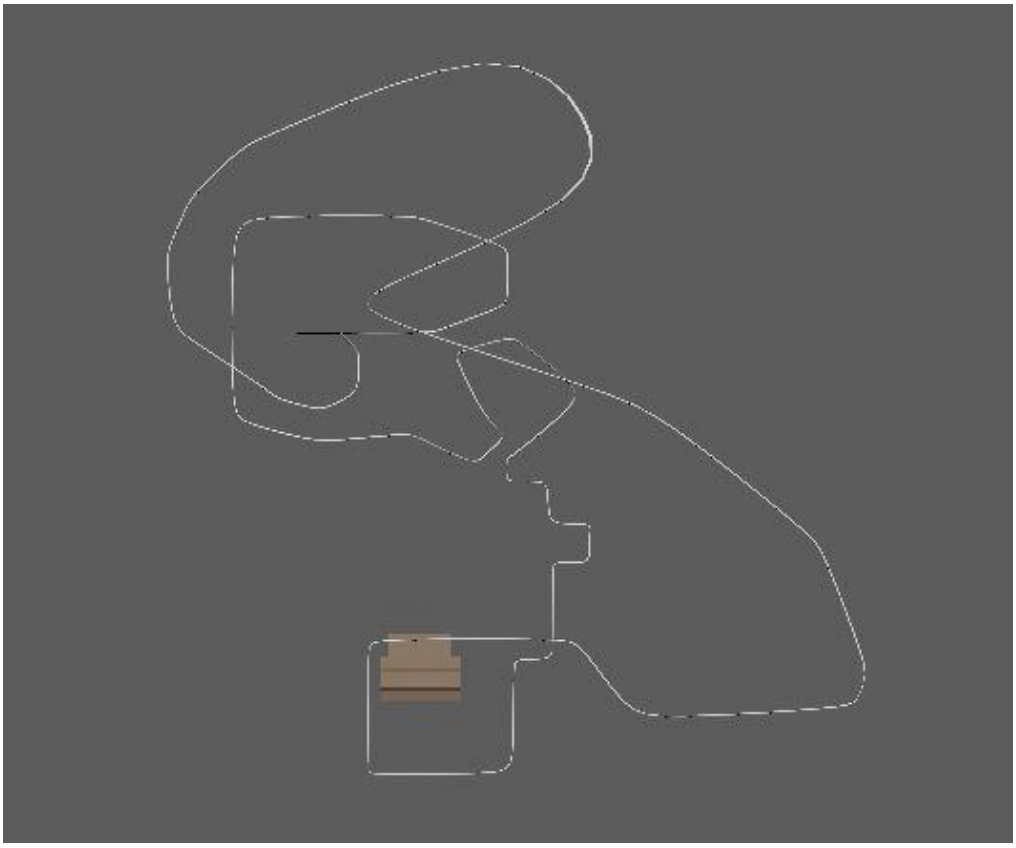
End of Ride

The guests exit through a final room which is a mini-museum about the history of Japanese doll making. Here guests can take their time and enjoy viewing antique dolls and reading about the process of doll making and the purposes of different dolls. This way the attraction educates the guests just as much as it delights them. The guests leave through a different part of the bamboo forest where the amusement park proprietor may choose to include smaller attractions such artists giving doll-making demonstrations, puppeteers, or small food stalls serving Japanese foods such as *kushikatsu*, *gyoza*, *matcha*, or a specialty flavored bamboo ice cream. Other artist demonstrations that will wow visitors are *amezaiku* (Japanese candy sculpting), calligraphy, and woodblock. All of which can sell their finished product to increase the park's revenue.

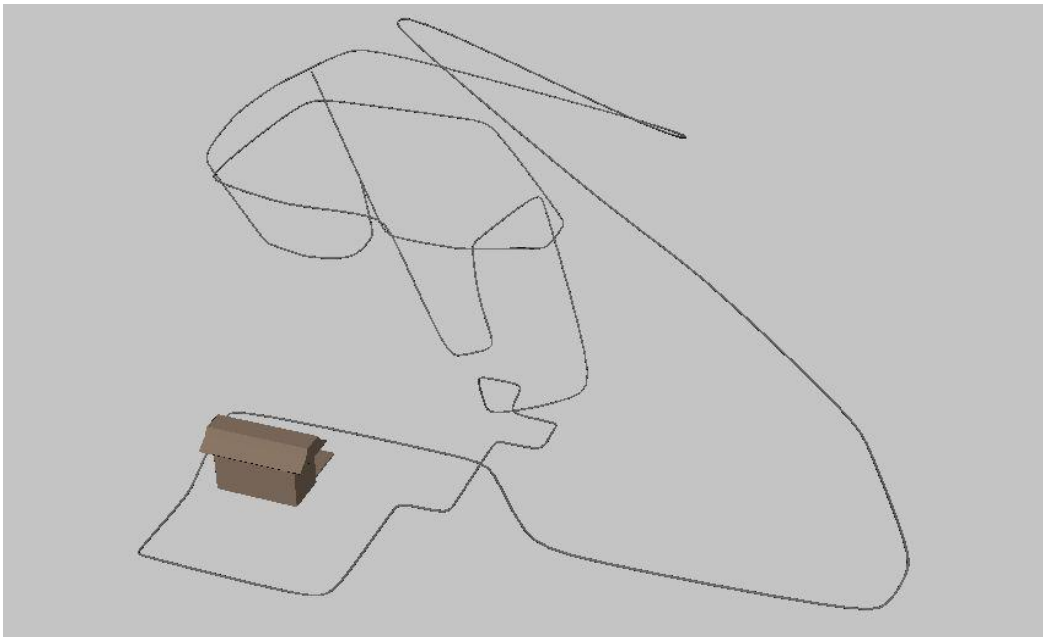
Below is a layout of the ride. Parts of the ride will go below ground level, other parts will be stretched to the top of the mountain.

Rough Layout of Ride

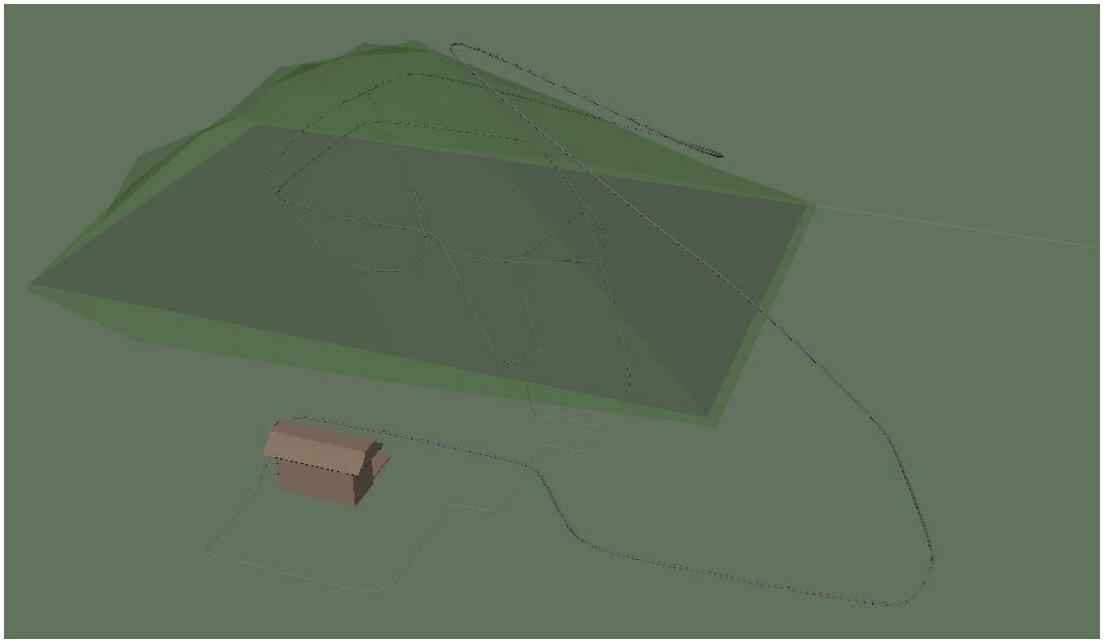
Rough Layout of Ride Above Ground/Mountain



Track



Track



Track Above and Below the Ground and Inside Mountain

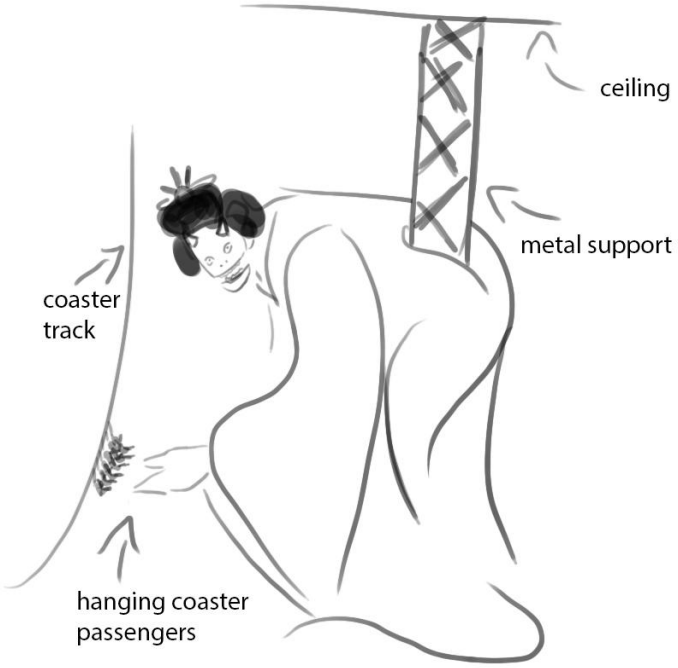
Additional Note on Concept

The *Ningyō-shi* attraction will introduce park visitors to the complexity of the Japanese art of doll making. The concept for this ride came out of the desire to fairly represent Japanese culture in amusement parks. Often, countries outside of Japan tend to Orientalize the culture or unfairly focus on one aspect of Japanese media or news (e.g. anime, work culture, gender roles). This leads to a misunderstanding of the culture. The *Ningyō-shi* attraction is designed to provide a thorough, fair representation of Japanese culture. This does not compromise artistic style or storytelling. If this attraction were to be built, there should be additional consultation with scholars of Japanese culture, Japanese artists, and historians to bring in more perspectives. The design and educational aspects of the ride are appropriate for both Japanese guests and guests not familiar with Japanese culture. Doll making is a fine art, and like most fine arts the general public does not have a deep understanding of the medium. While Japanese guests will most likely resonate on a more personal level with the ride's design, there is still a lot of opportunity for originality and education. The attraction fits in with amusement parks based on the history of dolls and puppets in entertainment. Most doll and puppet shows in amusement parks use French marionettes, German puppets, or American puppets. *Ningyō-shi* shows guests the equally complex Japanese art of dolls and puppets that rarely make it into amusement parks. The attraction is family-friendly. There are suspenseful moments in the ride, but the level of fright will be appropriate for children aged ten. Finally, the ride is designed to be one of the most eco-friendly coasters in the world. Creating sustainable amusement parks is a top priority. While

this coaster does take up a large space, it was designed to provide multiple benefits to the park system which will be discussed in detail below.

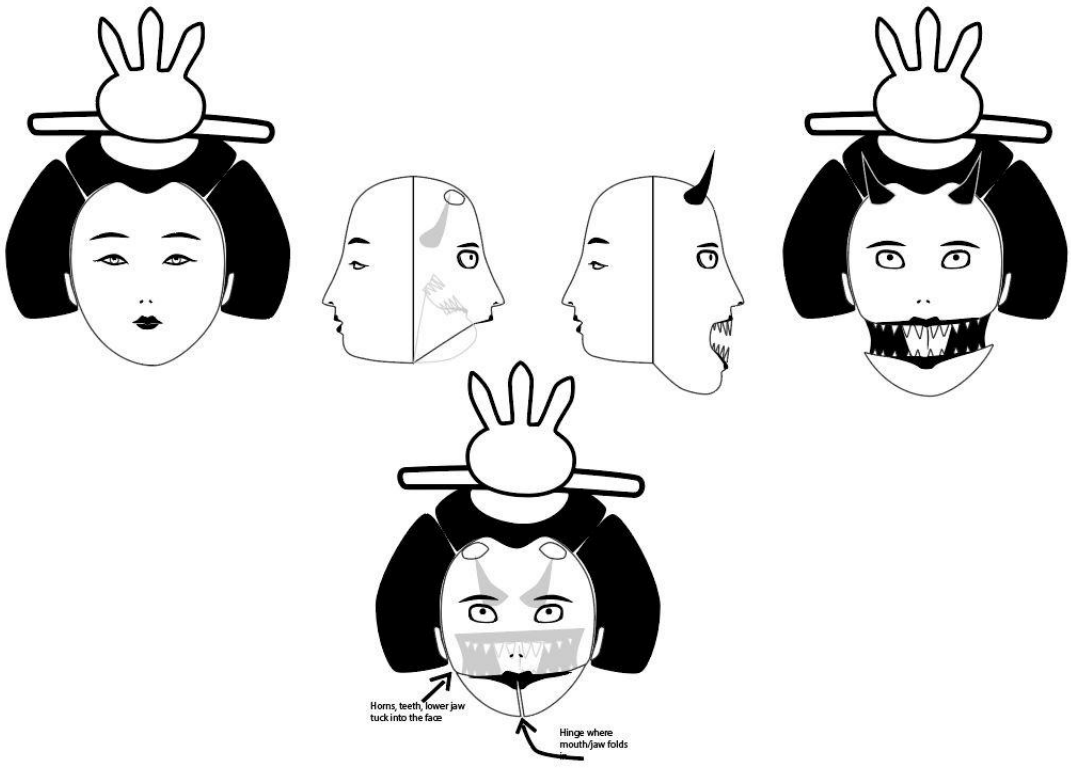
Design Innovation

The boldest design choice in the ride is the five-story tall animatronic at the climax of the ride. The animatronic will measure around 65 feet, making it the largest animatronic in the world. The measurements come from the idea that when the doll woman "picks up" the guests they will fit into her hand. To trick the guests into believing this, the animatronics hand should be large enough to convince the guests that the animatronic could grab them. Six feet should be large enough. If a woman is five feet and has a hand length of six inches, to scale up her six-inch hand to six feet her new height would be 60 feet. Her hairstyle and any other accessories would add several more feet, making the final animatronic around 65 feet tall. Most of the animatronics movement will be in the upper half of her body. Since her kimono will cover most of her body, and since she will be a large structure within the complex mountain structure, structural supports can be hidden inside her body to support the ride and building. Lighting and angles will hide the structural support. For example, when the animatronic bends over to "pick up" the guests, structural support could be going through the entire length of her body from the floor to the ceiling. The back of the animatronic is open so as she rises her body moves around the structural support. The guests are angled to look at her face and her hair will block the structural support from view.



Giant Animatronic with Supporting Structure

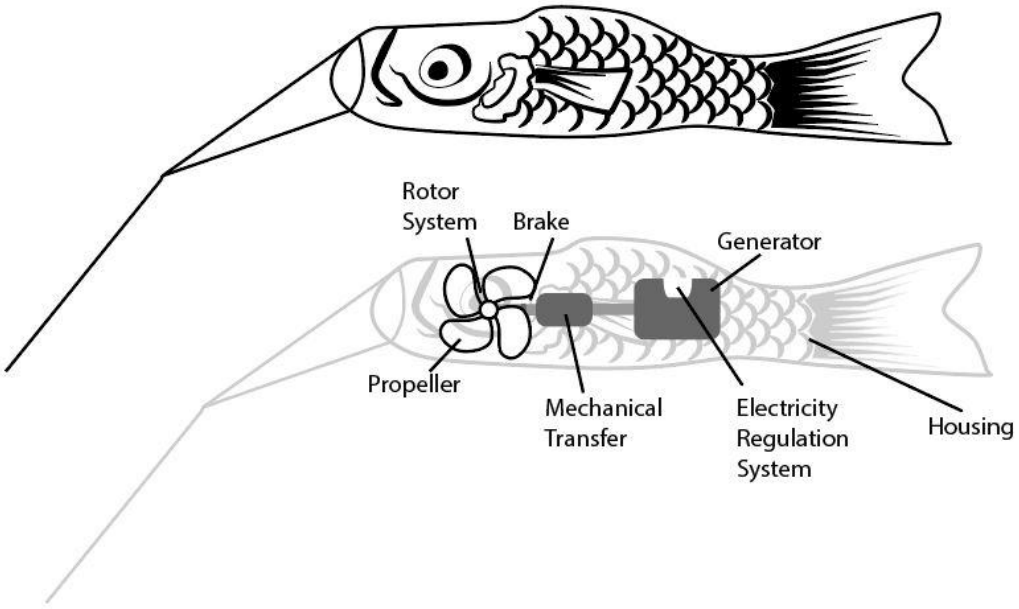
The animatronic's face will switch from the beautiful complex Hina dolls are known for to the face of a demon. This idea comes from Japanese Bunraku puppets. The puppets have two-sided faces. Puppeteers quickly switch the faces of the puppets without the audience noticing. After the guests see the first, beautiful face they enter a stone passageway. During this time the beautiful face turns 180 degrees into the doll's hair, rotating the demon face outwards. The demon's horns were inside of the head and came through the holes in the forehead. The mouth of the demon comes down lower than the jaw of the beautiful face, to hide this part of the machine the demon jaw, like the horns, also folds into the head and folds out for the reveal. The demon's mouth will collapse into the head and push outwards when the faces change.



Doll's Face Concept

The second major design choice in this attraction is a form of green energy that is aesthetically incorporated into the ride while also powering the ride. The *koinobori*, or fish kites, that the guests fly through near the end of the ride are secretly hundreds of airborne wind turbines. Airborne wind turbines are relatively new in the development of green energy. The purpose of which is since land turbines cannot be built everywhere (land restrictions, air restrictions) and are costly, a wind turbine that is based on a kite can solve this problem by being inexpensive and easy to set up. For the attraction, instead of having one large kite with multiple

engines on it, there will be one small engine in each *koinobori*. On the outside, the guests see colorful kites for kids, matching the theme of dolls and toys. On the inside of the fish is an engine that converts wind into power. Since the kites are lightweight and mobile they can move over the year as the wind patterns change with the seasons. The kite string can be adjusted so that the kite flies higher or lower depending on the wind. As a result, a guest might go on the ride in May and soar through a cluster of *koinobori*, and return in October to see the fish spread out over the length of the track. The color fabric of the kite can be changed. So one month the *koinobori* might be orange, the next blue, rainbow the next. The colors can be changed to match holidays (orange and black for Halloween, blue and white for the winter holidays, gold for Golden Week, colors to match national holidays, etc.). The fabric can be changed to another animal or shape such as a dragon. So not only can the kite turbines change location to maximize energy creation they can be altered to create new park experiences.



Koinobori Energy Kite

The next design innovation is that the mountain in the design is a hydroponic system that can grow food for the amusement park. Much like the koinobori, guests will not be aware of the practical purpose of the mountain but will enjoy the look of it. To the best of the project creator's knowledge, designing a "living" mountain for an amusement park that produces food would be the first of its kind. Most amusement parks build mountains only to tell a story or for structure. This is a way to maximize space in the park. Further information about the mountain-hydroponic system is in the Ecological Impact section of this pdf.

Additional Creative Use of Materials

The *Ningyō-shi* attraction is all about having guests experience Japanese doll and puppet culture (*Ningyō* means both doll and puppet) so the ride exclusively uses practical effects. While there is a trend for attractions to use augmented or virtual reality to pay homage to this traditional art, computer effects should be avoided when possible. Computer technology is reserved for programming the animatronics to move, programming the coaster seats to shake and sway at certain times, and of course to provide a safe experience.

The visible construction should follow the look of traditional Japanese architecture and avoid nails (iron was not common in Japan in past centuries). The *kanawatsugi* technique is the use of wooden joints that lock together. Though metal will be used in the animatronics, ride system, and construction to meet modern safety standards, to convince guests that the theme is coherent throughout the primary materials should be organic. This means wood, bamboo paper, and dyes should be used over plastics and metals. The scene will use other traditional Japanese arts. As mentioned previously, ink paintings are used to tell the story. Other mediums that promote storytelling are *shodo* (calligraphy), woodblock prints, wooden sculptures, fans, *maki-e* details, *byobu* (folding screens), and masks. When metal is visible (e.g. the supports holding the ride's rail) it can be painted to appear as if it is wood cut into the *kanawatsugi* style.

Not only should the scene and props feel authentic to the story there should also be opportunities for the guests to interact with the scene. Throughout the home/workshop there will be drawers for the guests to open while they wait in line. Inside there will be additional props for the guests to discover. There are sections in line in which they can interact with dolls. The guest will be able to change the look of a doll by swapping the faces, clothes, and accessories (all of which are secured to a table by rope to prevent being lost). A guest will be able to change the personality of the doll in seconds and there will be enough possible combinations that any guests farther back in line will still be able to create an original look. To fit the theme and the looming sense of danger, the dolls that the guests interact with should become less beautiful and creepier as they move through the line. In the smallest nooks of the building, small dolls will be placed so that waiting guests will constantly have new props to see as they move in the queue.

Executability

The size of the giant animatronic and the air turbine kites are the most difficult aspects to execute. As mentioned previously, the size of the doll animatronic most likely means it will have to double as structural support. There is also a concern that the animatronic will need to be strong enough to support its weight while still being light enough to move. An animatronic of this size is possible, it just hasn't been done before. The animatronic is designed to be wearing a kimono.

By using real fabric the weight will be reduced and the fabric's flow will cover whatever structural supports are hidden within.

The *koinobori* air turbine is more technologically advanced. Air turbine technology is still being developed so it might be several years before this idea can physically happen but eventually will be possible (Anderson). Necessity is the mother of invention and this would be the first time it's necessary to build hundreds of small kites for an amusement park that generate energy. Most energy kites move in a circle but the *koinobori* kites are currently designed not to. On the inside of the kites are the blades and rotors. The blades will be parallel to the kite opening. Think of the blades like a pinwheel. The blades will need to be parallel to the "O" shape mouth of the kite for the wind to push the wheel. Most rotors and other parts are usually metal which would not work for a small kite. As 3D printing improves, it should be feasible that a lightweight plastic rotor can be printed for the turbine. There are improvements to plastics that will happen in the coming years that will help. There have been several new geometric structures and materials, especially graphene, that have proven to be up to 10 times as strong as steel. Though not every ultra-light plastic will be ideal for each part of the energy kite, there are enough options that this idea could move into physical production. The size of the kite will determine the acceptable weight. In some cases, heavier materials may be preferred in the structure to reduce strain on the total surface area.

The rest of the ride uses technology and structures that already exist. Flying coasters, programmed seats, animatronics, hydroponics, and artificial mountains all use technology and techniques that are used regularly. The challenge is bringing everything together.

Ecological Impact

To reduce the environmental impact themed entertainment has, methods to reduce waste and emissions need to be done in every aspect of construction, maintenance, and user interaction. As mentioned previously, one green initiative is the use of the *koinobori* wind turbines. These turbines will provide enough clean energy to power the *Ningyō-shi* attraction and other nearby facilities. One of the benefits of this is that it will provide green energy if the amusement park is not connected to an energy grid that runs on sustainable energy. There are "green" power plants that are powered by non-sustainable sources such as coal. By creating an air turbine system in the attraction, there's assurance that no coal power is being used at any time. This will reduce the distance energy will have to travel to get to the attraction. So instead of having to use power from a power plant across the state or territory, the energy only travels a few meters.

Next is the use of material. Wherever possible, building materials and props should come from recycled and repurposed materials. When new lumber is used, emissions are created by transporting the lumber and processing the lumber. A tree will release stored carbon when it is

cut down. This can be avoided by reusing lumber. If new lumber is needed, virgin lumber should only be sourced from sustainable forests. Concrete produces 8% of global carbon dioxide, which is more than the entire country of India (Warburton). Simply put, there is no room for traditional concrete in a sustainable future. There are several alternatives to concrete that are available. Solutions include using 3D printed bricks made from recycled plastic, ashcrete (concrete made from coal byproduct that was once discarded), and papercrete (uses waster paper). Rubberized asphalt is made from recycled tires and is more durable, safer, and quieter than asphalt. Using these new building methods will cut down on the amount of waste in landfills and the construction emissions. There are going to be several props within the attraction (dolls, furniture) that can be secondhand to reduce emissions. There will be significant amounts of fabric used for the giant animatronic's kimono. The fashion industry accounts for 10% of global greenhouse emissions. The best option would be to use fabric made from organic products or recycled products. Some brands create fabric from recycled water bottles which use up to 90% less energy and water. Bamboo is a material that is used throughout the home/workshop scenes (tatami mats, furniture). Bamboo is one of the most sustainable plants due to its rapid growth, is one of the best plants in terms of carbon sequestering, and does not require pesticides. Important building material in any project is insulation. Cork insulation is carbon-negative, meaning it absorbs more emissions than what is created during production. To clear up any misconceptions, cork is sustainable, not endangered, well-managed, and there is enough to meet demand. Cork comes from the bark of trees. When the bark is stripped from the tree, it allows for the tree to absorb more carbon. Removing the bark does not hurt the tree. Other eco-friendly insulation methods include recycled shredded denim and recycled newsprint. LEDs should be used for lighting where needed and natural sunlight where possible. The dirt that is removed during construction should be repurposed to build the grassy banks the ride goes over at the end. Alternatively, the dirt removed during construction can be stored at the park's maintenance and gardening facility. When the path going through the forest needs repair this dirt can be used to fix it. The forest path will need regular maintenance to be wheelchair accessible.

The natural landscape of the attraction was designed with sustainability in mind. Bamboo was chosen because of the environmental reasons mentioned above as well as the cultural significance of bamboo in Japan. The idea of the bamboo forest was inspired by the Sagano Bamboo Forest in Kyoto. Even though the trend for themed entertainment is to reach zero emissions and the *Ningyō-shi* ride is designed to run on renewable energy there will still be emissions produced by the construction, transportation, and the guests. According to climate scientists, it is not enough to be climate neutral, companies and individuals need to be climate positive. The bamboo forest will aid in the removal of emissions from years before the development of the *Ningyō-shi* attraction. Ideally, the ride sits near the edge of the amusement park so the bamboo forest can extend beyond the park's official boundary and into a larger forest. The more bamboo the more carbon sequestered and less air pollution. If the attraction covers 8 acres, and one acre of that grows bamboo, that acre can absorb up to 29. 65 tons of carbon per

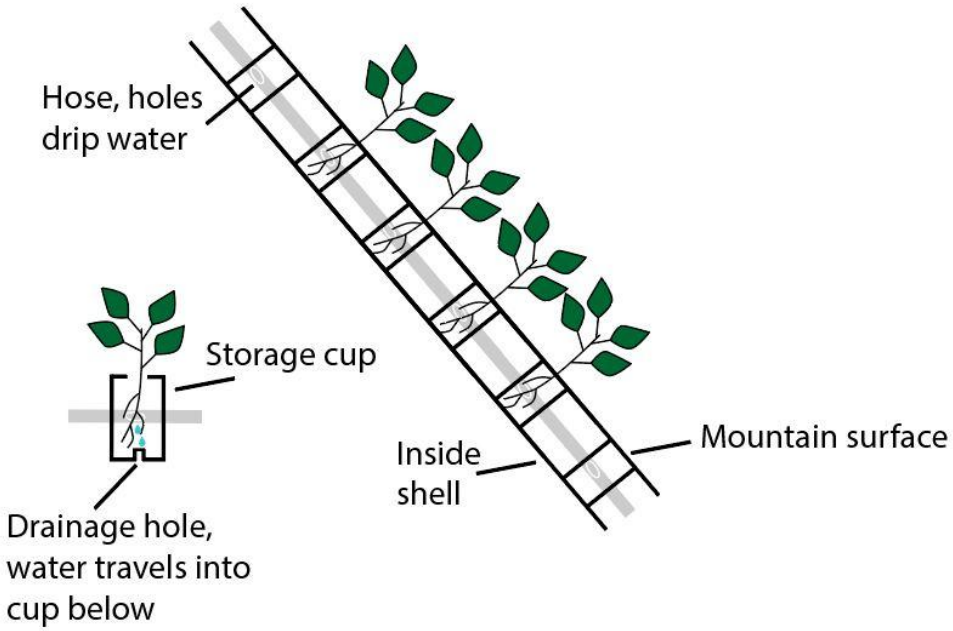
year (Laidler). Additional foliage will absorb more and there should be various tree species mixed throughout the bamboo. Tree ensures nutrient-rich soil and increases the soil's ability to absorb carbon. The bamboo can be harvested and used to make compostable skewers, eating utensils, and cups for the amusement park's restaurants and concession stands. The bamboo then quickly regrows, creating a sustainable forest and providing renewable raw materials to the park. Importantly, only native species should be planted in the park. If the park is located in North America the only bamboo that can be planted is Arundinaria. Other regions, such as Japan, have more variety to choose from. If the park is located in an area that does not have a native bamboo species, then native trees that look similar to Japanese tree species should be planted.

The pond and streams that run throughout the bamboo forest are necessary. Amusement parks are traditionally covered with asphalt, but a pond and stream system will allow for water runoff to be directed. Bamboo does require high amounts of water but also needs drainage. The pond and stream system will allow for irrigation so that water can constantly be brought to the bamboo, drain back into the pond, then be brought back to the bamboo. The water drainage system must be maintained, as any leaks that result in normal wear and tear reduce the efficiency of the system. The drainage and irrigation system for the bamboo forest needs to be low-flow to reduce energy costs. Though the pond may look still, it will be moving at all times to prevent mosquitoes from nesting. A small hydropower system can be added to the streams to diversify the power created on-site and increase the amount of power produced. Though the system is low-flow, advancements in hydropower technology will one day create sensitive systems that are compatible with slow bodies of water.

As with any amusement park, there is a not-so-glamorous side when dealing with human waste. The bamboo forest is ideal for distributing treated liquid and solid human waste. By repurposing human waste, the park will be helping the environment and reduce maintenance costs by not having to purchase fertilizers. A water treatment plant will clean the sewage produced by the guests, making the water clean enough to drink. Since the number of guests in an amusement park often disproportionately produces more waste than what is needed in the city the park is located in, the bamboo forest will help to even out the amount of water/sewage from the guest by being an area the water can be released and absorbed. There is the issue of solid human waste. The amusement park can build several bathrooms that use composting methods to deal with waste instead of sewage treatment methods (composting human waste is more common in countries outside of the US). The waste will be sent through the pipes to a composting facility, away from where guests will see or smell it. This facility can also compost the bamboo utensils mentioned above and food scraps. Composting food scrap and utensils is a necessity for any park to maintain a healthy climate and environment. Once composted the waste becomes dirt. This dirt is "clean," coming in contact with it will not make someone sick. The dirt can then be added to the bamboo forest to promote soil health. Lastly, in terms of foliage, there are several other

species present in the attraction. Different species of flowers, trees, bushes, and grasses promote biodiversity which will benefit local species (insects, birds, etc.) and soil health.

The mountain that will be built for the attraction will be covered in a "green roof" that doubles as a hydroponic system (*Environment and Ecology*). Hydroponic systems do not use soil, so the amount of weight added to the mountain will be minimal. Hydroponic systems are efficient in water usage so water will not be wasted and there will not be excess water to add weight to the structure. If there is excess runoff water the stream at the base of the mountain will bring the water back into the irrigation system. The hydroponic system will grow edible plants that can be served to the staff and guests in the park's restaurant. So instead of "farm to table" cooking the park will have "ride to table," making the attraction sustainable and unique. Depending on the type of plant and climate, one acre of land (the estimated size of the hydroponic mountain) can produce upwards of 60,000 lbs of food a year. Food usually travels long distances to get to the consumer, by being grown on sight the energy spent on transportation will be minimal. The amount of emissions a green roof can sequester varies based on the plants. The additional maintenance of the green roof often means that the green roof "breaks even" between the amount of carbon sequestered and the maintenance emissions. The benefit of installing this green roof, other than for food, is that it will be energy efficient because of cooling costs. Most artificial mountains in amusement parks are painted dark colors and the artificial surface attracts heat. By covering the mountain in green plants it will remain cool. This is true for both the attraction inside of the mountain and the outside surrounding areas. The double-shell structure will work as insulation for the mountain, reducing the amount of insulating material needed for the project.



Mountain as a Hydroponic System

One final suggestion for this attraction is that it should be built on degraded farmland. Economically, degraded farmland will be cheaper to buy. Farmland can become unhealthy for several reasons; a monoculture drains the soil of specific nutrients, livestock damages the topsoil layer, pesticides may have made the habitat inhospitable. However, farmland can be restored. The climate solution resource Project Drawdown estimates that there are up to 1.1 billion acres of farmlands that need to be restored, making this a top issue in solving climate change. One way for an amusement park to show dedication to the environment is not to develop on healthy land and disturb an ecosystem, but to develop on unhealthy land and restore an ecosystem. Most theme parks are built on healthy land, ruining biodiversity in the area. This attraction is meant to re-establish biodiversity. If the attraction is built with the above tactics, not only will it have a lower carbon footprint, it will meet 15 of the 82 climate solutions the Project Drawdown resources have outlined for climate security around the globe. Not all climate solutions outlined by this resource will apply to this attraction, the ones that are have been incorporated. To summarize, the following areas this attraction meets the standards of Project Drawdown are...

- Abandoned farmland restoration
- Alternative cement
- Bamboo production
- Composting
- Green and Cool Roofs
- LED Lighting
- Low-flow fixtures
- Micro Wind Turbines
- Net-zero Buildings
- Nutrient Management
- Recycled Paper
- Other Recycled Materials
- Small hydropower
- Tree intercropping
- Water Distribution Efficiency

Thank you for reading!

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