

# The Leonardo

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Leonardo was able in his short life influence so many different realms of life. Bill Gates recently purchased the Codex Leicester, one of Leonardo da Vinci's notebooks for more than thirty million dollars. What was in those notebooks? In the notebooks are a vast variety of ingenious ideas, from diagrams of war machines to numerous drawings of human anatomy. Leonardo documented ideas dealing with flight by sketching bird wings and helicopter plans; he even sketched the first beginnings of a parachute hundreds of years before man would fly. If you were to take a look at his notebook, before even translating his Latin based scribbles you would have to untwist with a mirror his backward writing method, that some say was used to encode his then radical ideas.

These countless innovations from a man who during his life traveled Europe and was most famous not for his inventions but instead for his ability to paint, and sculpt. There are dozens of museums throughout the world dedicated to him and his accomplishments, and his sculptures, and paintings are admired all over the world. From his garden room located in the castle of Milan to Last Supper, Leonardo da Vinci has left the world countless masterpieces.

Many argue he lived long before his time. One can see why with a look at his innovative drawing and diagrams found in his numerous notebooks. Leonardo's life has been studied for hundreds of years, and still people can't seem to get enough of him. That is why "The Leonardo" will be such an addition to the Salt Lake area, giving the public the chance to learn of him, his many achievements, and the countless innovations built upon his founding ideas.

Enclosed are a few ideas that have been considered as possible exhibits in the science center portion of the museum.

# Leonardo's Parachute

Leonardo da Vinci was very fascinated with the idea of flight in general. He designed the first parachute, but never got the chance to fully develop it. To teach patrons at the "Leonardo" about his fascination with parachutes we came up with a couple ideas.



## Parachute designs over time

It would be interesting if in the exhibit there was common information dealing with design of parachutes over time, highlighting key changes. There are a books available that highlight these some of these changes (*Physics Today* "The Fluid Physics of Parachute Inflation" Aug. 1993) as well as a couple good websites (parachutehistory.com and parapublishing.com). Accompanying the designs of the parachutes I think it would be fascinating if there were fun facts like the first jump from an airplane is claimed to be by Grant Morton who jumped with a silk parachute folded in his arms which he threw out as he left the plane. It would be easy to incorporate parachute material, and show how that has changed through the years showing both the advantages and disadvantages of design and material.

## Interactive displays

It is clear that interactive exhibits tend to keep the audiences attentions longer helping them gain a deeper interest in what they are looking at. A couple of ideas that I was able to come up with deal with models that would allow the patrons the chance to see how parachutes work. One way in which we could accomplish this is with clear tubes that patrons could drop parachutes down, and depending on the design be able to see the effect design has on the speed of the drop. The tube would allow for consistent resistance eliminating the effect of wind currents that may be present in the museum. The patrons could build there own small models and drop them down the tubes, or use museum models.

The patrons could also feel how it feels to be in a parachute and see what it feels like to control it. This could be accomplished easily by creating a swing like parachute harness that the patrons could strap into and pull on the controlling handles giving them a taste of what parachuting would feel like. It is possible that they could watch a screen and play with a parachute simulator where they try and land on a target or on a football field by controlling the program via the parachute handles. This would provide the patrons with the closest thing to parachuting without going to the airport.

## Parachute dropping annual egg contest.

On the 27<sup>th</sup> of November, 2002 we had the first annual parachute egg drop contest at Cottonwood High School with Doug Wagstaff's class. This contest we intended to be the pilot contest for an annual contest that will be held at the museum. The 33 physics students were separated into groups of three and designed a parachute that mimicked Leonardo's design. The parachutes were restricted to a square yard in size and were attached to a baggy which held the egg. Each team was given 15 sheets of bathroom tissue to pad the egg anyway

they saw fit. The eggs were then lifted to 30 feet in the air and dropped. The object of the contest was to land nearest to the center of the bull's eye (a ten foot target on the ground) without breaking the egg.

The students had a great time, and we were all impressed at the variety of parachutes created. Some stretched Leonardo's design attaching five garbage bags to a pyramid shaped frame, and other had sewn the parachute together in such a way as to reduce the amount of cross supports needed. The winning team almost hit the very center of the bull's eye, and won the hundred dollar prize.

In looking back on the contest of course there are a couple things we would change. Because this was the first try it was hard to know how much padding to allow each team. It turned out nicely because most of the parachutes were heavy, and dropped quickly. There were some that were lighter made of balsa wood and tissue paper but most built there parachutes using fabric and wooden dowels. The one that descended the slowest could have used only a few pieces of bathroom tissue. I think the amount of bathroom tissue to be used needs to be presented in the rules outline pushing the teams to construct a realistic parachute model. Other rules like the length of the fasteners to tie to the baggie needs to be established.

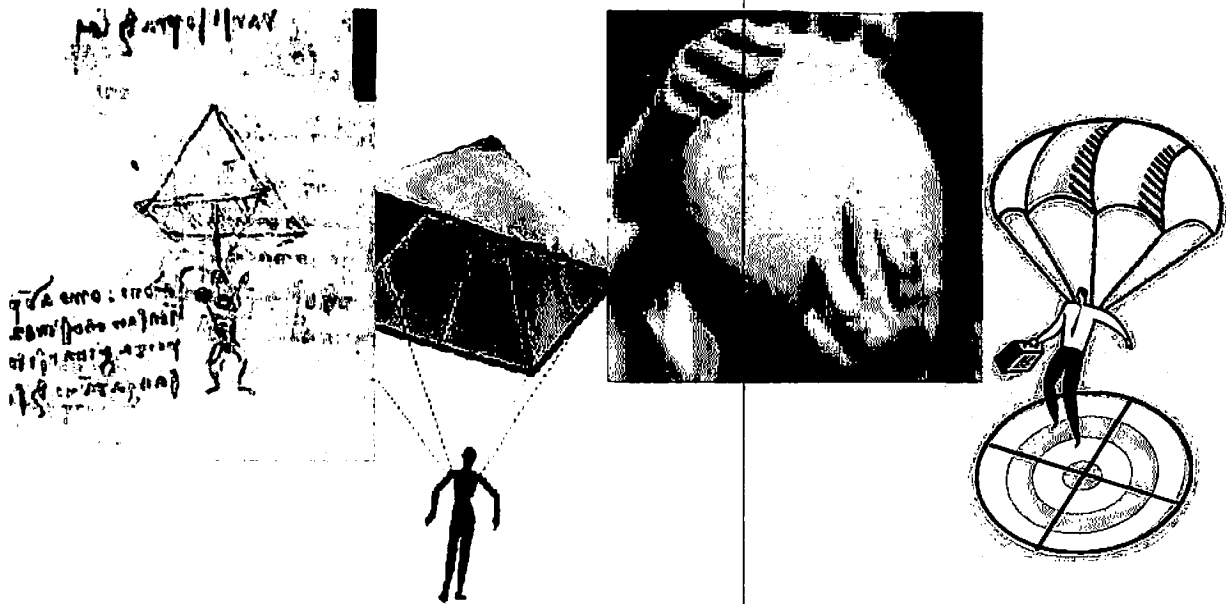
High school students are capable of pretty incredible work, and I don't doubt that the parachutes will improve every year the contest is run. As they are pushed with more stringent rules I am confident that we will see more impressive models. In talking with the students many were surprised at the amount of padding it took to protect the egg. As juniors most of the students seemed excited at the opportunity to compete in the contest next year, and many feel they could design an even better parachute.

The idea was presented that instead of the target being directly below the dropping point it might be extended, forcing the students to design a parachute that would travel horizontally as it descended. This is just one way in which the contest could be modified enhancing the difficulty. Doug Wagstaff was very pleased with the outcome, and looks forward to next years parachute contest.

Enclosed is an example of what the contest outline could look like.



The following information was obtained from the records of the  
 Department of the Interior, Bureau of Land Management, on  
 the subject of the above-captioned land.  
 The land is situated in the County of [County Name], State of [State Name].  
 The land is described as follows:  
 [Detailed description of the land, including acreage, location, and any other relevant details.]  
 The land is owned by [Owner Name], who is the [Relationship to land, e.g., owner, lessee].  
 The land is subject to the following conditions:  
 [List of conditions or restrictions on the land.]  
 The land is being offered for sale to the public.  
 The sale will be held on [Date and Time] at [Location].  
 The minimum bid for the land is \$[Amount].  
 The highest bidder will be awarded the land.  
 The land is being sold "as is, where is" and the purchaser will be responsible for all taxes and other charges.  
 The Department of the Interior, Bureau of Land Management, is not responsible for the accuracy of the information provided.  
 For more information, contact [Contact Information].



## **Leonardo Da Vinci's Annual Parachute Contest**

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Object of the contest is to drop an egg suspended in a parachute down approximately 30 feet onto a 10 foot target without breaking the egg.

### **The design**

The parachute can be no larger than a yard square.

The suspending fasteners can be no longer than one yard a piece

### **The objectives**

The Parachutes will be judged on two components, accuracy, and speed.

Accuracy- closest to the center of the target.

Speed- parachute that doesn't break the egg.

### **Provided supplies**

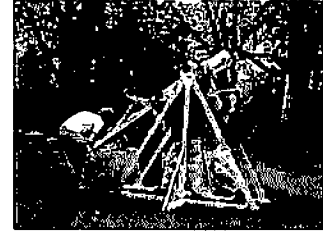
Egg will be provided in a zip lock baggy with 5 sheets of 2-ply bathroom tissue.

### **Prizes**

A \$100 prize will be giving for 1<sup>st</sup> place and \$50 for 2<sup>nd</sup> place.

# Leo's Weapons

While Leonardo da Vinci lived in Milan he was contracted to design certain weapons of war. Leonardo designed a number of war tools on paper but wasn't able to build or develop more than a couple. The best way to learn about weapon design and the theory behind the design is to play with them. At the "Leonardo" patrons will have the chance to shot a catapult, or fire a crossbow, and understand how and why the simple machines work the way they do.



## **How his weapons work**

It is necessary that the basic physics behind each of the weapons displayed is clearly laid out for patrons to study and understand. It is important that examples and facts are given (a horse weighing  $x$  pounds could be thrown 65 yards with a trebuchet  $y$  feet long.). We will need to show how this trajectory information is still used today in shooting shells out of large cannons etc.

## **What other armies were using**

A brief history of weapons being used during his time will give the audience a better understanding of why Leonardo is so impressive with his ideas. This can also give them some idea of what life during his time was like.

## **The catapult ally**

This is where the patrons will have the chance to really touch, see, and learn. I envision an ally corridor of netting where patrons will have the chance to fire Leonardo's model catapults, and crossbows; shooting rubber balls across the room at stationary targets. The weapons would be set up in such a way that they could change the influencing factors and see how a degree change here or there effects the landing point of the ball. This trajectory could also be photographed from the side using a simple digital camera, allowing the patron to analyze more extensively the trajectory of the ball.

## **Computer simulation**

One other way that we would be able to make the idea of trajectory and catapults interactive is by using a computer game approach. By setting up a pair of computer patrons would have the chance to "bomb" there opponent by changing all the input factors that they have learned about by experiencing Leo's Weapons exhibit. Unfortunately I wasn't able to find an already produced program that would be as simple as we might want but there are a lot of complex war games that exist.

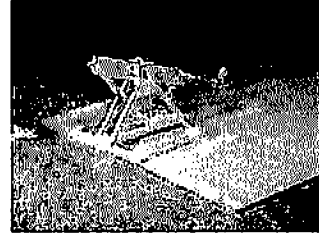
## **Catapult kit contest in the lab**

The "Leonardo" could give their patrons the chance to experiment with their own catapult while inside the museum. These kits could range in intricacy

and could be used in contests or just for fun. Kits could be designed easily for a catapult using rubber bands or for a trebuchet using counterweights.

### **Catapult or Trebuchet Contest**

This contest could easily mimic the parachute contest dealing with catapults or trebuchets. This contest could be left almost entirely up to the contestants giving only some size requirements, or could be a lab project for school classes or groups where they use pre-built frames with a number of building options. The contestants could control such deciding factors as; placement of key pivot points, stops to influence release angles, and lengths of arms to influence the speed. These "pre fabricated" models could be easily built and reused over and over. The contestants would measure accuracy by either hitting a target at a set distance or by competing for distance and being penalized for shooting the object of the straight line. The mechanical engineering department has pre-fabricated models made of PVC pipe that they use with school classes (Prof. Meek).



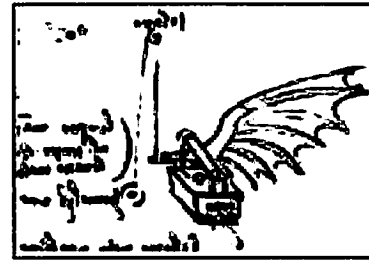
It could be possible to contact the "Guinness Book of World Records" and see what the record is for a small scale trebuchet, or keep the winning trebuchet of that years contest up for display in the museum. This would both allow patrons year long to see and learn about the contest, as well as give patrons an idea of what a winning model looks like. I think each year the envelope will be pushed, and records will be broken.

### **Cross bow**

Leonardo also designed cross bows, and this could easily be incorporated in this war machine theme. The idea of shooting cross bows next to the catapult in the "catapult alley" would allow the patrons to see the difference speed and angle have.

# The World of Flight

Everyone is fascinated with flight the fact that they can get a plane that weighs more than several busses combined, in the air is mind boggling. Leo's world of flight has to be interactive as well as informative. We can achieve this by teaching them concepts then allowing them to explore those. Because Leonardo didn't really develop flight his models may be used, but other flight concepts will also need to be explained.



## **Flight concepts**

It is essential that the concept of flight is thoroughly explained. This will help museum guests better understand how the idea of an airplane evolved from Leonardo's models through early development to planes we have today.

## **Nature and flight**

The idea of nature and flight was discussed as a possible focus point to help connect Leonardo's world of flight to his inspiration, nature. He sat and watched all kinds of birds fly, while carefully trying to capture what allowed them to soar. Comparing different flying animals to man made wings could connect the two in a way that could spark interest as well as draw similarities between the two. This connection hasn't been fully explored but I thought it necessary to mention.

## **Interactive learning aids**

The idea of a "wind box" where a large air mover, (like the ones used to blow up big air toys) could blow air through a plastic box, simulating wind past an airplane. The box could then have a couple sets of vertical slits opposite each other where a couple different wing foil designs could be held in place, this would allow patrons to twist these designs and feel the effect the different designs and angels have on lift and drag.

## **Model airplanes**

There are a number of airplane kits produced (White Wings, Revell Monogram, Hasegawa are just a few). Rubber band powered planes could be built in one of the many labs using our own design, or a kit developed by another company. This could be one of the many contests school classes or community groups could compete in at one of the Leonardo labs. They would be able to build rubber band powered planes and compete for distance.

Paper airplanes could help teach the idea of gliding and provide an inexpensive way of interactivity. Sheets of paper could be copied with lines outlining folds to build airplanes, or directions could be posted. Because this is a hobby that many Americans have, it is easy to find directions for numerous different paper airplane designs ([paperairplanes.co.uk](http://paperairplanes.co.uk), [zurqui.co.cr](http://zurqui.co.cr) are just a couple sites I found to be interesting). Kids could have a contest as often as everyday, competing for distance or accuracy. Because the designs could be



easily shared, and because everyone loves throwing paper airplanes, I think this could be a great addition to the flight exhibit.

### **Leo's Helicopter**

A model similar to the idea with the wind tunnel and lift could be incorporated into a helicopter interactive display, where a spinning blade could be controlled by the patrons controlling both speed and the angle of the blades. The blades depending on the angle and speed of the blade will lift and slide up a pole. The model can also be attached to varying weights to show the power of helicopter blades. Leonardo's spiral shaped helicopter doesn't provide a lot of lift, but a simple working model of Leonardo's helicopter could be interesting to see in motion.

Fun facts about lift and angle can be used to help guests get a good understanding of the concepts. For example information like this blade would have to spin 1000 revolutions per-minute to lift 5 pounds could be provided or a blade as big as a basketball court would only have spin at X revolutions per-minute to lift a full size truck.

### **Flight simulators**

Flight simulator that simulates different planes and helicopters in flight is an inexpensive interactive way for guests to learn more about flight. It would be necessary to find programs that were realistic giving the most authentic feeling of flight controls. I had the chance to speak with Michael Daly a navel officer who mentioned the idea of using the Navy or Air Force to help with a simulator (*Michael Daly (801)977-1101*).

## Mirror Writing

The Mirror writing exhibit has been constructed in the past using a chalk board and a large mirror it allowed the patrons the chance to test their skills at writing backwards like Leonardo did when writing in his many notebooks. This exhibit could allow patrons to see how writing has been a way for people to write in code all throughout history. It could focus on different types of code as well as penmanship as a whole.



### What has been done

Many museums across the world have had some kind of exhibit on the idea of writing or code. The museum of Science in Boston has done some work on this topic, and the bookstore carried a simple 'write backwards' kit (*office (617)589-0100 or Larry Bell (617)8890-282*). Other museums or traveling exhibits have had interactive stations as simple as a chalk board, chalk, and a mirror, reviews I read about this simple design wrote that it was fun, and one of the favorites (*mos.org, or people.memphis.edu*). Simple programs exist that have been used to flip writing allowing patrons to see what it would look like had Leonardo written it. I used "paint" to flip the name Leonardo as an example.



### What can be done

This simple exhibit will interest many, and can teach everyone about left handed Leonardo's way of writing backwards. This exhibit could be simple enough to be stationed on a mobile cart, or in a small corner of the museum, or large enough to fill a section. It could either be a small interactive game or a large comprehensive exhibit dealing with other hand writing, and language related topics.

# The Human Body

Leonardo did incredible work when it came to studying human anatomy. He has pages and pages of notes diagramming different parts of the human body. A lot has changed in the way the human body is studied now there is technology that allows a surgeon the opportunity to create a hologram image of the part of the body that they will be operating on. It will be fascinating to compare and contrast the differences between Leonardo's diagrams and current computer generated images of the body.



## **Old vs. New**

Because Leonardo did such interesting diagrams of the human body I think it would be great if in the exhibit we could compare his drawing to images of the body to see how accurate he was. This could be done by printing and mounting some of his drawings and placing them next to modern prints of the same parts of the body. It could also be compared by using existing computer programs to compare the two.

## **Interactive technology**

After speaking with Kurt Albertine in the school of medicine I was better able to understand the existing technology that might be useful. He suggested a couple ideas; one was the idea of possibly using the SCI Run project to navigate through the body. This program is a very extensive analysis of the human body where a frozen corpse was sliced and documented digitally, this huge program would allow patrons to look at the human body as very few have. It might be too much for what we are looking at. Many medical textbooks come with programs that allow some virtual navigation through the body, for our purposes a program like that may be more user-friendly. He also suggested the use of a company named Voxel, which is a local company that creates holograms. They print some pretty amazing holograms of parts of the body that could help show how the body works.

## **History**

It is always fascinating to look at how medicine has changed throughout history. I think timeline type display could be very interesting, for example show when "bleeding" was an accepted form of medicine. This I think would help the patrons understand and appreciate medical breakthroughs.

## **Modern medicine**

This "Human Body" exhibit could lend itself very nicely to a section dealing with modern medicine, and medical breakthroughs. This could be periodically updated to, in a dummed down way explain, what modern breakthroughs exist. This I imagine could be updated by medical students at any one of the many colleges in the area and could highlight medical breakthroughs or developments much like medical journals or periodicals do.

### **Computer Animation and interactivity**

The idea of computer animation in this field has also been discussed. This could be an interactive way patrons could see the body. If they could control a robotic arm that in turn moved a digital image of a human arm in such a way to see how bones, ligaments, or the circulatory systems all work together. This could be the modern equivalent to the old full size human skeleton in so many doctors' offices today. The idea was also suggested to locate a life size Milton Bradley game of Operation, which could be a fun way to make the exhibit interactive.



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# Morph with the Mona Lisa

There aren't many more recognizable or famous paintings than the Mona Lisa. For this reason it would be a fun addition to include this attraction in the museum dedicated to the painter. Leonardo was a painter, and because so much of the science center will deal with aspects of his life that aren't painting it is important to highlight his incredible talent



## Morphing

In the past, and on the Science on Wheels morphing has been done, but in an old fashion way. By using a transparent mirror and lights they are able to give the illusion of a morph with themselves and an object behind the mirror. Today there exists in places like zoos and museums little photo booths that allow you to morph your picture with such things as dollar bills, or famous painting. It would be fun if patrons had the chance to play with this concept in the Leonardo. The programs exist; in fact there are a number of them out there that can easily do this kind of image manipulation (*morpheussoftware.net*).

## What about the Mona Lisa

There has been a lot of study done on the Mona Lisa, and it would be only fair if some of that information was shared with the patrons. There is nothing like going to a museum and learning interesting facts that can be shared with ones friends and family. These interesting facts are what strike ones interest in a topic. Sandra Blakeslee wrote an article about Mona Lisa's smile, and explained why it comes and goes. Who is the Mona Lisa, and for who was it painted. Why did he spend so many years on painting it, and why do some consider it his masterpiece. All these interesting facts can be used to wow the little scientists that come to the museum.

## Digital enhancement

The idea of making a <sup>age</sup>collogue compiled of digital photos of patrons that enter the museum was an idea that was discussed. This would mean that as a guest enters the museum a digital photo would be taken, this together with photos of the last couple hundred guests would then be compiled into a collogue of the Mona Lisa, or another neat picture or photo. These could feasibly be saved and printed for guests, but would be projected on a wall in the museum where the patrons would be able to look and try to find themselves. This software exists on the consumer market; it would just need to be organized in such a way to photograph guests and update itself periodically.

As a side note along these same lines the idea was discussed of documenting physical facts from patrons as they enter the museum. A device could be used to both measure weight, and height of guests, the information could then be used to create a histogram of the last X number of guests. This statistical information could somehow be incorporated in a "science with numbers" section of the museum.

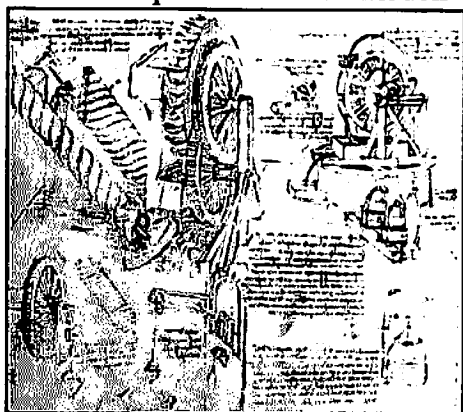
# Water Fun

Leonardo was fascinated with water, and designed a number of neat water concepts. He developed a number of different water pumps including a water screw. He designed numerous bridges and canals to use water to their advantage. He even designed shoes to wear when one needs to cross a body of water alone.



## The water screw

Leonardo's design of the water screw I envision as a possible attraction. People love to see models that use water, and what better water model than an interactive water model. This could be designed like Leonardo envisioned pumping water up against gravity. This could be done either by using a small electric motor, or human power using gears, and a crank. The water that is lifted could run over another design Leonardo envisioned the water wheel. The water wheel could transfer the power back into usable power to light a light bulb or measure power. This incredible contraption could be made as a table top model or a full size lobby model, either of which would attract a lot of interested guests.



## Modern day water power

Water power has been a useful source of power since medieval time, and this idea could lend itself to a number of incredible exhibits. From the Panama Canal, to Hoover Dam, mankind has tried to use water to make life easier. Hydro power could be an exhibit in and of itself. There have been a number of interesting articles written dealing with fascinating topics like these that could be models for interactive and capturing exhibits ([howstuffworks.com/hydropower-plant.html](http://howstuffworks.com/hydropower-plant.html), [wvic.com/hydro-works.htm](http://wvic.com/hydro-works.htm), [wavegen.co.uk](http://wavegen.co.uk), [\*Hydropower for the Future\*](#), Allison Stark Draper).