

DA VINCI BRIDGE



Drawing of Leonardo da Vinci



Statue of da Vinci in Rome, Italy

Leonardo da Vinci was born in Vinci, Italy in 1452 and died in 1519. Da Vinci is famous as a great artist, but he was a brilliant scientist and inventor, too. He completed many artistic masterpieces including the famous “Last Supper” mural and “Mona Lisa” portrait. Da Vinci also drew blueprints for inventions hundreds of years before they came into use, including the bicycle, the parachute, an armored tank-like vehicle, and the helicopter.



Last Supper



Mona Lisa

Another of his inventions is known as the Da Vinci Bridge. In 1502, da Vinci designed a bridge to cross an **estuary** (a partially enclosed, coastal water body where freshwater from rivers and streams mixes with salt water from the ocean) near Constantinople (now Istanbul), Turkey, but his design wasn't chosen for the project. His sketch and proposal were then lost for about 400 years and rediscovered in 1952.

If it had been built in the 1500s, the 920 foot bridge would have been 10 times longer than others built at that time. It was a self-supporting bridge, held together by **compression** (a force that compresses or shortens what it is acting on) and made of a single arch. It would probably have been made of stone, but da Vinci's design was different from the stone bridges of that time. By using compression, each stone would push on the others, so no outside support was needed. Instead of adding piers to support the bridge, da Vinci added **abutments** (load carrying supports) to the sides.

Da Vinci's bridge was never built during his lifetime, but in 2019, researchers at the Massachusetts Institute of Technology studied his design, investigated materials that would have been available at that time, and analyzed the geology of the area the bridge was designed for. They wanted to test whether da Vinci's bridge could stand and support weight, so they built a 32 inch long model using a 3D printer. The bridge did indeed



stand and was able to withstand **lateral** (sideways) forces and horizontal movements that might have occurred during soil movement or earthquakes. According to one of the researchers, "It's the power of geometry" that makes the bridge work!

In 2001, a bridge using da Vinci's design was built in the small town of Aas, Norway, about 20 miles north of Oslo. It is the first major civil engineering project to be built from Da Vinci's sketches. This bridge is smaller than the original bridge proposed by Da Vinci (only about 328 feet long), and made of wood. According to architect Jim Eyre, "The design principles are sound, and architecturally, it was ahead of its time."

ACTIVITY: Build your own self-supporting bridge using craft sticks

Materials:

- 18 jumbo craft sticks – colorful ones make it easier, but you can use plain ones and mark them with different colored marking pens to help you follow these instructions. Red, yellow, green and orange were used for this bridge.
- Stable working surface



Jumbo craft sticks

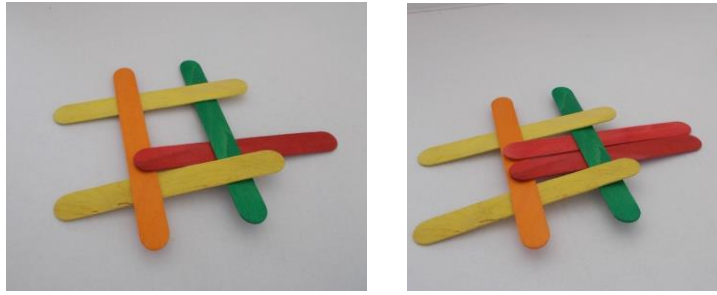
1. Begin by laying out 4 sticks as illustrated below (2 yellow, 1 orange, 1 green). You will be building from left to right.



Step 1

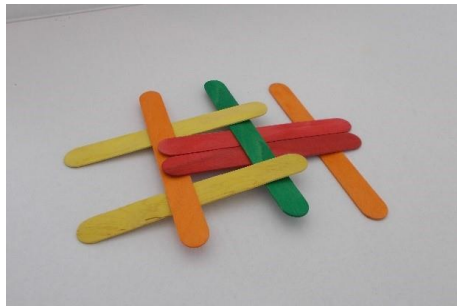
2. Sticks 5 and 6 (red): Add two red sticks and weave them under the green stick and over the orange stick. You may need to hold the orange one in place to do this. You will notice that the bridge starts to lift up. Always hold the bridge flat while you add new pieces so that it won't topple over and fall apart.





Step 2

3. Add stick 7 (orange) by sliding it under the two red sticks.



Step 3

4. Add red sticks 8 and 9 under the orange stick and on top of the green stick. Let go of your bridge slowly, and it will raise up so the red sticks make a platform. Stop here, or keep going if you want a longer bridge.

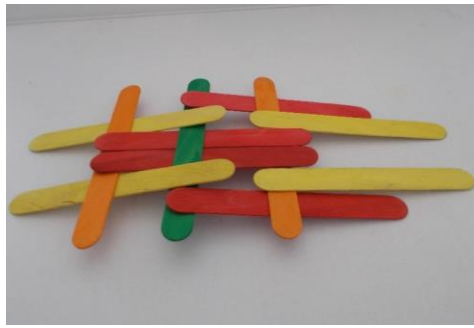


Step 4

From this point on, it is helpful to have two people working together as sticks are added. One person holds the bridge steady, and the other person adds the sticks.

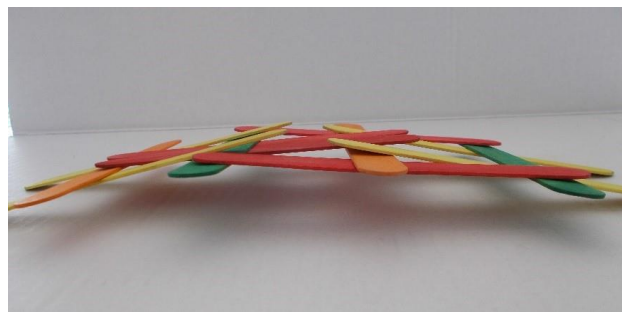
5. Add sticks 10 and 11. First press the bridge flat. Add sticks 10 and 11 (yellow) placing them on the orange stick in the space between the outer and inner red sticks.





Step 5

6. Add stick 12 (green) between the red and yellow sticks. Place it under the red sticks and on top of the yellow sticks.



Step 6

7. Add stick 13 (orange). Place it under the yellow sticks, parallel to the previous green stick.



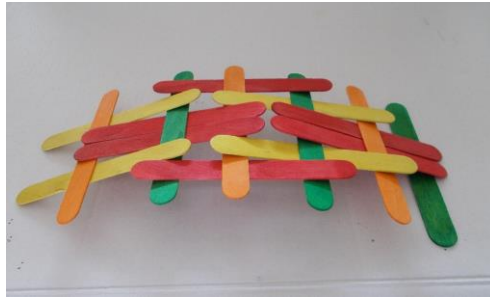
Step 7

8. Add red sticks 14 and 15 by weaving them under the orange stick and over the green stick.



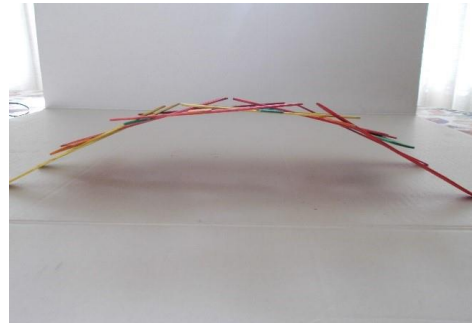
Step 8

9. Add stick 16 (green) under the red sticks.



Step 9

10. Add sticks 17 and 18 (red) by weaving them under the green stick and over the orange stick.



Step 10

Woohoo! You did it!! You can continue to follow the pattern and make your bridge longer. Keep in mind that the bridge may topple if you apply a force from the side. It is strong when supporting a downward force.

ADDITIONAL RESOURCES

Books available from the Washoe County Library System:

[*100 Scientists Who Made History: Remarkable Scientists Who Shaped Our World*](#) by Andrea Mills and Stella Caldwell

[*Amazing Leonardo da Vinci Inventions You Can Build Yourself*](#) by Maxine Anderson

[*Awesome Engineering Activities for Kids : 50+ Exciting STEAM Projects To Design and Build*](#) by Christina Herkert Schul

[*The Book of Massively Epic Engineering Disasters: 33 Thrilling Experiments Based on History's Greatest Blunders*](#) by Sean Connolly

[*Bridges: From My Side to Yours*](#) by Jan Adkins

[*Da Vinci & His Times*](#) by Andrew Langley

[*Engineering*](#) by Tom Jackson



[*Exciting Engineering Activities*](#) by Angie Smibert

[*How to be an Engineer*](#) by Emily Hunt

[*How to be Good at Science, Technology & Engineering*](#) by Robert Dinwiddie, John Farndon, Clive Gifford, Derek Harvey, Peter Morris, Anne Rooney, and Steve Setford

[*Junk Drawer Engineering: 25 Construction Challenges that Don't Cost a Thing*](#) by Bobby Mercer

[*Leonardo da Vinci*](#) by Alix Wood

[*Leonardo da Vinci*](#) by Steve Augarde

[*Neo Leo: The Ageless Ideas of Leonardo da Vinci*](#) by Gene Barretta

Videos:

Kids Fun Science, "LIFE SIZE Leonardo's Arched Bridge (Leonardo's da Vinci Bridge)

<https://youtu.be/RiHzgvw7hEg>

PBS, NOVA, "Decoding da Vinci" <https://www.pbs.org/wgbh/nova/video/decoding-da-vinci/>

Vox, "How Leonardo da Vinci Made a "Satellite" Map in 1502" <https://youtu.be/2gEwEcYnewE>

Websites:

Leonardo da Vinci Bridge – Norway <https://www.visitnorway.com/listings/leonardo-bridge-in-%C3%85s/3275/>

Dezeen, Dezeen's A-Zdvent Calendar: Da Vinci Bridge by Vebjørn Sand <https://www.dezeen.com/2015/12/04/a-z-advent-calendar-leonardo-da-vinci-bridge-vebjorn-sand-nygardskryset-norway/>

MITNews, Engineers Put Leonardo da Vinci's Bridge Design to the Test

<https://news.mit.edu/2019/leonardo-da-vinci-bridge-test-1010>

National Geographic, National Geographic Society Newsroom, Leonardo's Bridge:

Part 1. "The Master of all Trades" <https://blog.nationalgeographic.org/2013/01/17/leonardos-bridge-part-1-the-master-of-all-trades/>

Part 2. "A Bridge for the Sultan" <https://blog.nationalgeographic.org/2013/01/22/leonardos-bridge-part-2-a-bridge-for-the-sultan/>

Part 3. "Vebjørn Sand and Variations on a Theme by Leonardo"

<https://blog.nationalgeographic.org/2013/02/03/leonardos-bridge-part-3-vebjrn-sand-and-variations-on-a-theme-by-leonardo/>

