



DrawingOnAir

What did you like about this tool?

- P1 - "Almost nothing"
- P2 - "Easy to learn"
- P3 - "This tool follows the movement which makes easy to draw while changing directions in the movement"
- P4 - "Good for drawing on a plane but because it is fixed it makes it difficult to make some movements fluidly, but if you have patience it can be very accurate"
- P6 - "Nothing"
- P7 - "Seems versatile in following the directing of a stroke no matter the angle or orientation"
- P9 - "I didn't like anything"
- P12 - "I like nothing"
- P13 - "Its nice with the hand movement"
- P14 - "For random textures this could be an useful brush"
- P16 - "It is a good tool for 2d figures that simulate a tape"
- P17 - "Clean width"
- P19 - "What I liked about Tool C [DrawingOnAir] is that it was shaped like a brush and it looked like it would have more freedom when drawing, but it was more complicated than I expected"
- P20 - "Nothing. This was an extremely useless tool and this one I remember because of the immense frustration it offered me"

What did you dislike about this tool?

- P1 - "It was difficult to learn and use. It yielded poor results for all the figures"
- P2 - "Uncomfortable tool to perform the required tasks. Figures had to be divided in too many subsections to provide some sort of resemblance. Difficult to produce consistent results"
- P3 - "It is impossible to predict the direction of the beam or line at the beginning of every trace"
- P5 - "Lack of stylis "
- P5 - "Has wobble effect when going in circles cause a 45 wobble "
- P6 - "Turned too much to any side or plane"
- P7 - "Resultant ribbon sometimes seems to twist for no obvious reason "
- P9 - "It is unstable, difficult, not having a marked brush makes accuracy difficult"
- P11 - "I dont like this brush, so hard to handle, the moves of the brush are so random"

- P12** - "It was hard to draw shape "Dome". For the "Flat Circle" I remember that was hard to handle the depth, it was tricky I don't know why"
- P13** - "Sometimes it does stuttery jumps, specially in turns"
- P14** - "It's not constant sometimes during stroke it would switch on its own axis making it hard to keep fine strokes"
- P15** - "Ninja brush. There is no orientation gizmo, I felt like the initial plane of the brush stroke was unpredictable. I liked this brush the least, as it didn't seem to offer more than A/B [Ours]/[TiltBrush] but was less intuitive. This brush seems to be a little glitchy, also, especially near the convergence zone between stroke arcs, the plane of the stroke seems to flip orientation unpredictably, this makes for some flat strokes, with twisties in the middle, kind of frustrating"
- P16** - "It is difficult to use for objects with volume"
- P17** - "Its use on straight lines"
- P19** - "Since I expected the direction of the cursor to change automatically when turning the wrist, but it did not. However I feel that the "brush strokes" would not work very well for 3D objects"
- P20** - "EXTREMELY ANNOYING, flapping, unusable tool. It constantly changed angle half-stroke."



TiltBrush

What did you like about this tool?

- P1 - "Effective with the circle, easy to learn and use"
- P3 - "Similar to tool D [Ours], very easy to use"
- P6 - "Easy to use"
- P7 - "Great for planar shapes. The flat circle tip really helped guide flat shape drawing"
- P9 - "It is good for planar curves"
- P11 - "Is so smooth"
- P12 - "Very good for cylinder and 2d circles"
- P13 - "Its nice with turns and circles"
- P14 - "Straightforward and easy to use for long strokes"
- P16 - "I like that in this tool the automatic rotation is different from tool A, it is easy to use it for 2d figures"
- P17 - "Width"
- P19 - "What I liked about tool A [TiltBrush] it is being able to make flat lines without any deformation in space and it is more subtle in curves"

What did you dislike about this tool?

- P1 - "It was horrible with the cylinder"
- P3 - "It is necessary to keep the tool perfectly perpendicular to the trace which is not always easy to achieve"
- P4 - "Was difficult to use, did not seem to interpret the user's intensity very well and often reversed the line for no apparent reason"
- P5 - "Difficulty maintaining path"
- P6 - "You have to rotate your arm and shoulder too much"
- P7 - "Hopeless for cylindrical shapes. As you can see for the cylinder model I have up on rings entirely and ended up making it out of vertical planks instead"
- P9 - "It is bad for the depth"
- P12 - "almost impossible for me to draw sphere"
- P13 - "Hard to make domes "
- P14 - "Hard to pinpoint the exact area to start when using it next to another stroke"
- P15 - "Very similar to A [Ours], with a different gizmo. I found the default orientation of the controller is a little more awkward (the tip is perpendicular to the brush plane at the start)"
- P16 - "Not effective for creating shapes with volume"

P17 - “Hard to use”

P19 - “What I didn’t like about Tool A [TiltBrush] is that it wasn’t very flexible. When I made the lines with depth, the line was distorted and the cursor did not recognize the direction of the wrist when it was about to draw / trace and that caused the line to be distorted”



CavePainting

What did you like about this tool?

- P1 - "Easy to learn and use, effective with the dome and cylinder"
- P3 - "It is very useful to set you up for the task. Very useful to paint vertically"
- P4 - "Is my second favorite, easy to use and almost always interprets my interactions correctly"
- P5 - "Straight forward"
- P6 - "It was precise"
- P7 - "Very intuitive and predictable like B, but perhaps more comfortable to use due to the orientation of the bar"
- P9 - "I like the shape of the brush, straight"
- P11 - "The best for drawing straight objects"
- P12 - "Quite fine for drawing cylinders"
- P13 - "Is a perfect tool to use vertically"
- P14 - "Feels like using an actual brush due to the position"
- P15 - "The squeegee brush is great for some specific stroke types, the brush tip is perpendicular to the controller, and the elbow tends to be held low, for flat planes, especially, this brush was effective. In one sense I could sculpt some areas of the sphere surface, but quickly lost perspective and kinda blew out the shape. The cylinder was easier as i could stroke down and rotate to build out an additive structure"
- P16 - "I like that it works like a paintbrush and responds to the user's wrist twists"
- P17 - "Straight lines"
- P19 - "What I liked about tool B [CavePainting] it is being able to make flat lines without any deformation in space "

What did you dislike about this tool?

- P1 - "It got me poor results for the circle"
- P3 - "Generally all the tools are way too much sensitive, it would be useful to lower the responsiveness of it. So, it is too sensitive and very hard to produce a straight line"
- P5 - "Unable to change brush"
- P6 - "Pretty same than A [GravitySketch]."
- P7 - "Terrible for planar curves such as the S and circle model"
- P9 - "I is bad for curves"
- P12 - "Draw shape "Dome". For the "Flat Circle" I remember that was hard to handle the depth"
- P13 - "Its hard to do circles"

P14 - "Sideway strokes become uncofortable"

P16 - "It is difficult to use for objects with volume"

P17 - "Hard to make curves feels like a razor"

P19 - "What I didn't like about Tool B [CavePainting] is that it wasn't very flexible. When I made the lines with depth, the line was distorted and the cursor did not recognize the direction of the wrist when it was about to draw / trace and that caused the line to be distorted and also I cannot make the curvy lines"



GravitySketch

What did you like about this tool?

- P1 - "It was easy to learn and use and effective with the dome and cylinder"
- P2 - "Limited functionality didn't allowed to perform the tasks at hand. It needed twists and multiple hand movements to recreate certain surfaces. Even with enough time to practice, I don't believe significant improvements will be noted in the results"
- P3 - "Again, same as tool A [CavePainting], easy to learn and understand. Very useful for horizontal traces"
- P4 - "similar to Tool B [CavePainting] but in another direction. I liked to design the cylinder but would only use it for details or finishes"
- P5 - "Easy to use like tool C [CavePainting]"
- P6 - "It was simple and easy to control"
- P7 - "Much more predictable. Good for straight lines and cylinder shapes"
- P9 - "The shape of the vertical brush is very comfortable"
- P11 - "Its just a stick, so the painting its more logic"
- P12 - "Perfect for drawing shaped like cylinder"
- P13 - "Its perfect to use horizontal or vertical"
- P14 - "Doing strokes sideways becomes natural"
- P15 - "Knife brush also great for some specific stroke types, similar to the fixed squeegee brush, but the brush extends along the controllers axis and the elbow is held high, but some stroke shapes are more intuitive, and "sculptural" as a consequence. Flat planes are effective, but less so than the squeegee"
- P16 - "I like that it is like a roller taken by one end, it simulates a tool that is of natural use for a person who is not familiar with the interaction in VR"
- P17 - "Best all around tool"
- P19 - "What I liked about Tool D [GravitySketch] is that it was the most noble tool to work with and easy to learn. The brush strokes were softer when I was painting. I think it is the only one that could work for 3D and even for modeling "
- P20 - "Relatively easy tool"

What did you dislike about this tool?

- P1 - "Somewhat difficult and tricky with the circle"
- P2 - "Limited functionality didn't allowed to perform the tasks at hand. It needed twists and multiple hand movements to recreate certain surfaces. Even with enough time to practice, I don't believe significant improvements will be noted in the results"
- P3 - "Very hard to draw curved traces (circular). "

- P4** - “As it is very difficult to control movements that are not just in a plane”
- P5** - “unable to change brush”
- P6** - “You have to turn your shoulder and arm a lot”
- P7** - “Hard to use for planar curves such as the S in the practice and the planar circle”
- P9** - “Nothing”
- P12** - “almost impossible for me to draw sphere without overlap”
- P13** - “Hard to draw circles and turns”
- P14** - “Hard to use on curves as you are twisting your hand”
- P16** - “It is difficult to use for curved objects given the wrist turns that must be made to follow curves”
- P17** - “Hard to continue with the strokes”
- P19** - “The only thing that would go into detail is that the wrist direction is not adjusted automatically”
- P20** - “Not really for the tasks at hand.... :)”



AdaptiBrush

What did you like about this tool?

- P1** - “Also easy to learn and use and effective with all the figures”
- P2** - “It was very intuitive and easy to learn and apply, even for the complicated surfaces presented in this study. It was able to ”predict” the required path with with extraordinary accuracy. I specially liked it when recreating planar surfaces but with a bit of more practice, I am certain that I could master the tool when drawing complex volumes. I also appreciate the reduced number of hand movements (i.e. wrist motions) required to complete surfaces.”
- P3** - “Very easy to learn, easy to follow and understand how this tool will behave. Easy for drawing in every direction ”
- P4** - “My favorite, a mixture of tools A [TiltBrush] and B [CavePainting]. It was just fluid and predictable behavior”
- P5** - “Feels very intuitive”
- P6** - “It was more precise and it adapt to the plane”
- P7** - “Seems almost as versatile as A, but more controlled and predictable. Still great for flat straight ribbons and cylinders, but also more reliable for planar curves”
- P9** - “The shape of the H is good, it helps precision”
- P11** - “Easy to handle”
- P12** - “Smart”
- P13** - “It feels nice to paint vertical or horizontal lines”
- P14** - “Really good movement and turn on the strokes path this is my favorite”
- P15** - “Good overall brush tip. orientation gizmo is predictable, I could get a good stroke on all but the most awkward planes and adjustments. Smooth planes are somewhat challenging, but for the sphere I think this was overall best for curved surfaces, I felt like i could sculpt the surface predictably”
- P16** - “This tool its good to do patter with curves without turn the hand, but only int several shapes for example”
- P17** - “Can be angled easily”
- P19** - “What I liked about the E tool is that it had the adjustment that the other models needed, so that they would work 100%. The simple fact of being able to make a base line and automatically recognize the marked line and thus be able to continue with the object is quite gratifying”
- P20** - “It was relatively easy to do the ”strokes””

What did you dislike about this tool?

- P1** - “Nothing really this one was one of my favorite tools because it was efficient with all the figures”
- P2** - “Nothing really; I think is the best tool from all of the tools presented”
- P3** - “It would be nice to be able to turn the pointer in any direction, while holding it in the turned direction and change it again at will”
- P5** - “Wobble effect when trying to draw a level circle ”
- P6** - “Very sensitive”
- P7** - “A little tricky to figure out at first, and even when I managed to get it going well I didn’t entirely understand how best to drive it”
- P9** - “It’s hard to learn how to handle it”
- P12** - “Almost impossible for me to draw sphere. Hard to handle”
- P13** - “It does jumps on turns”
- P14** - “Nothing”
- P15** - “As I get closer to the convergence point, the steadiness of the tip kind of breaks down (sometimes flipping orientation making unwanted marks)”
- P16** - “I dont like when the shape is in 2D like the flat circle”
- P17** - “Too shaky”
- P19** - “What I did not like is that if you made an imperfect line, the following lines would have the same shape as the previously made line”