



Usability Study of the Pen Tool in Interface Design Software

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Introduction

- Design software : trace, draw or edit figures
- Pen tool == Design software
- Create, edit and perfect design endlessly
- Anchor points : allow for flexibility and manipulation
- Absolute control over the curve



<https://www.youtube.com/watch?v=yKnmzNkyzaA>

Why the Pen Tool?

- Introduced in 1987, hasn't changed much
- Not popular due to its steep learning curve
- Digital pen tool not similar to its analog counterpart
- Instead of dragging, click and create anchor points



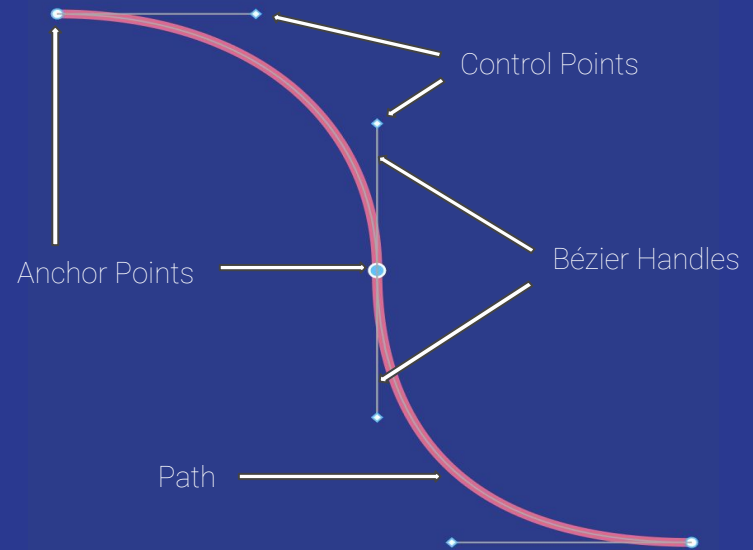
Terms you need to know

Bézier Curve: Mathematically defined curve used to make smooth curves that can be scaled indefinitely

The curve is defined by four points: the initial position and the terminating position (which are called “**anchor points**”) and two separate points that control the shape of the curve (which are called “**control points**”)

Bézier Handle: The line connecting the anchor point and the control point that are tangential to the bezier curve

Path: combination of linked Bézier curves



Executive Summary

1. Original 7, adaptive tasks on Sketch and Figma
2. Pilot tested with 2 participants
3. Refined to 5 adaptive tasks
4. Success of task : Completion of task
5. In-lab testing
6. Screen and video-recording

Executive Summary

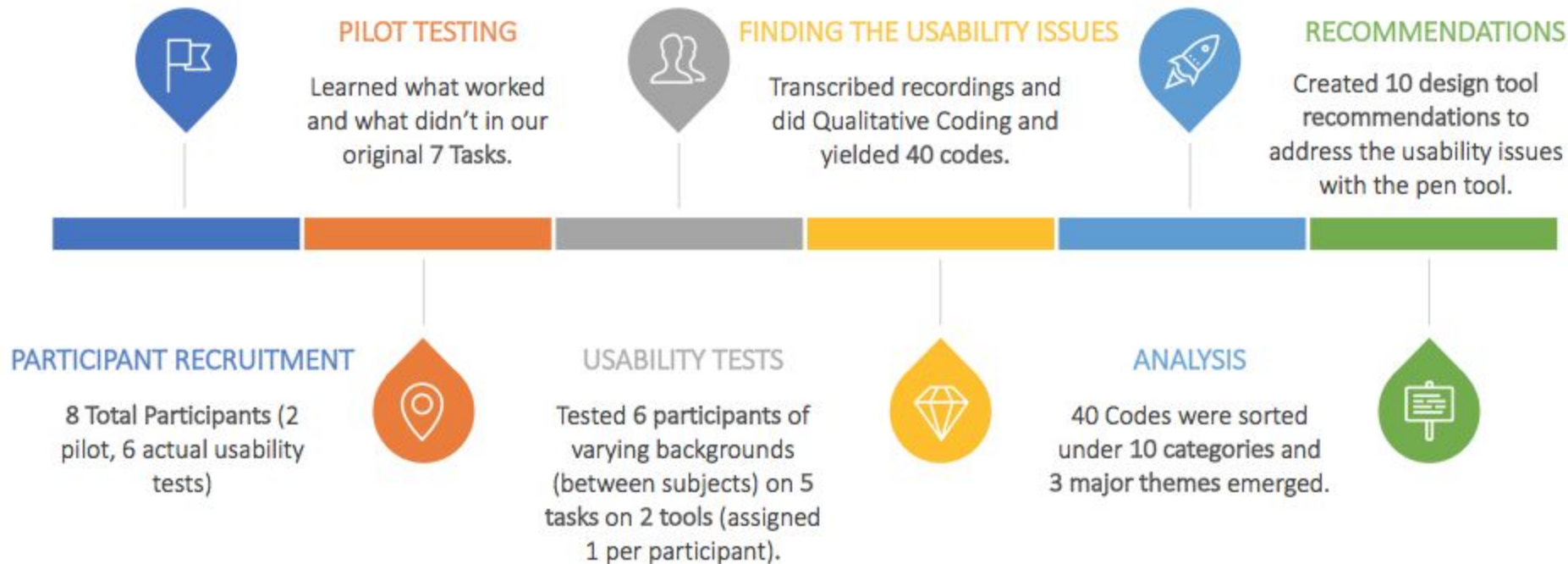
Most frequent problems:

- **Unintuitive** interactions
- **Mismatch** between analog and digital pen tools
- **Unclear** labels
- Lack of **Feedback**



Methodology

USABILITY METHODOLOGY TIMELINE











Recruitment & Participant Selection

- Screening Questionnaire (qualtrics)
- People with varying design experiences (from none to expert)
- Recruited 8 Participants - 2 for Pilot and 6 for the actual usability tests



Final Participants

	Background	Design Tool Experience	How long?	Tool and Proficiency	Group (Tool)
1	Architecture	Yes	> 2 years	Adobe Illustrator (Advanced)	Figma 
2	Engineering	Yes	1-2 years	Adobe Photoshop (Basic)	Sketch 
3	Art	Yes	> 2 years	Adobe Illustrator (Expert)	Figma 
4	Library Sciences	Yes	1-2 years	Adobe Photoshop (Intermediate)	Sketch 
5	Finance	Yes	< 1 year	Sketch (Basic)	Figma 
6	Business	No	-	-	Sketch 
7*	Computer Science	Yes	1-2 years	Sketch (Basic)	Figma 
8*	Computer Science	Yes	< 1 year	Sketch (Basic)	Figma 

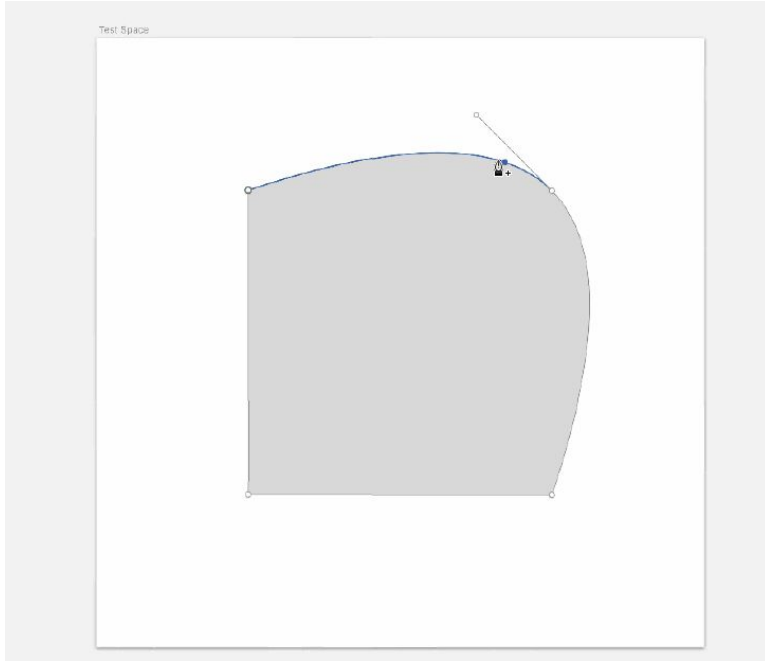
** 7 and 8 are Pilot Participants*

Usability Test Characteristics

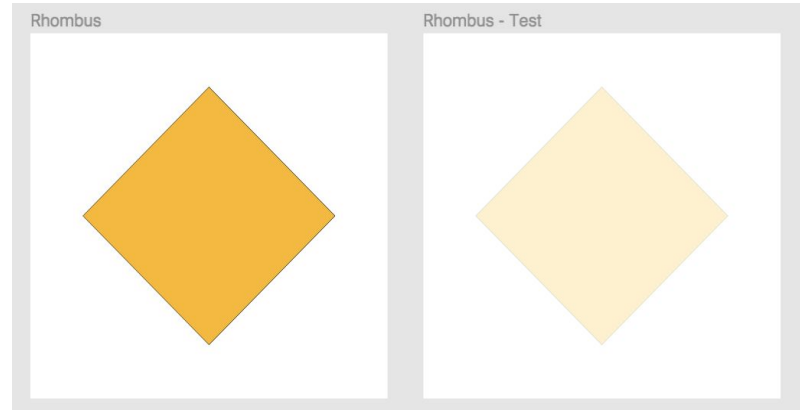
- In person (conference room)
- One person moderator
- Video recording and screen sharing (WebEx recording)
- Two observers (in a separate room via WebEx)
- Think out loud protocol
- Focus on using the Pen Tool to create shapes



Test Plan (Tasks)



Narrative while in the “Test Space”
exploring different tools

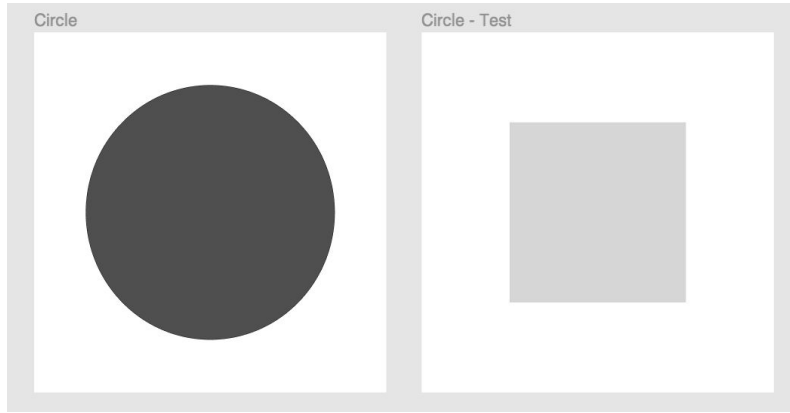


Task 1: Draw a Rhombus

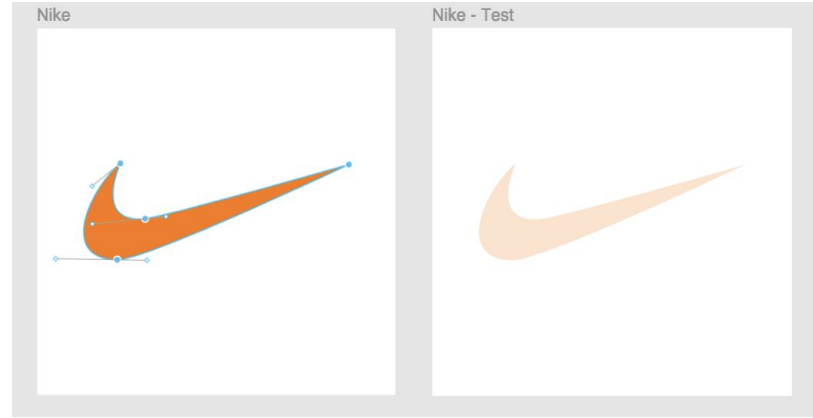


Task 2: Create this shape using a triangle

Test Plan (Tasks)



Task 3: Create a circle out of a square



Task 4: Draw a Nike sign

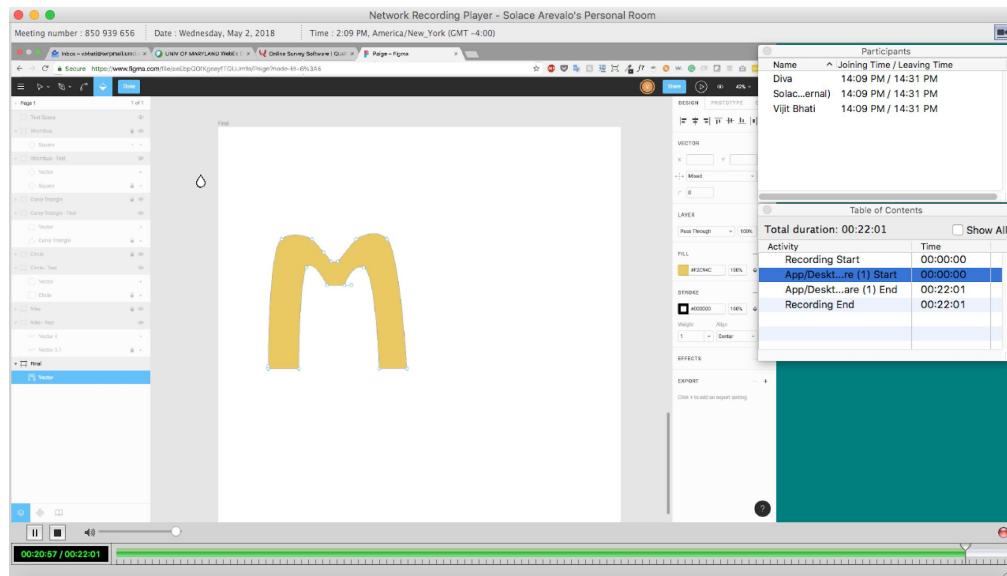


Task 5: Create a logo from Memory



Data Collection:

- Audio, Video transcription
- Observation notes
- Qualitative Coding
- Quantitative Data



A	B	C	D
Time Stamp	Exact Transcription of Quotes	Observer Comments	Code
4:05	I don't know what that is	User could not figure out how the bezier handles change according to different vector options even though she tried clicking on a handle	Control Point Manipulation
5:00	It seems like fairly very basic. Feels like it is very limited with what I can do with it	It is due to the fact that she cannot see other options that are available in Illustrator like text, merge objects etc.	Prior Experience
5:35	Aah...this is strange	User was confused while trying to add more anchor points using the pen tool	Adding points
7:39	I am trying to fill it....oops i was changing the stroke	User was using the stroke color option instead of the fill color option to color the vector shape in Task-1	Fill tool
8:26	yeah...umm..done	User was able to manipulate the bezier handles successfully to make the shape for Task-2	Control Point Manipulation
9:38	I can either use this	User tries to use corner radius instead of the curve tool to create a circle from a square shaped vector	Previous Experience
9:50	I can't control the points	User tries to manipulate the anchor points initially but realizes that she needs to use the curve tool for bezier	Control Point Manipulation

Codes → Categories → Themes

Control Point / Anchor Points	
Control Point Manip.	11
Point deletion	1
Point alignment	1
Curve Tool	2
Manipulating Curves	1
Grouping Curves	2
Bend Tool Issue	1

Adding / Deleting Points	
Adding Points	2
Point Addition	1
Adding Points	3
Point deletion	1

Fill / Coloring	
Fill tool	2
Stroke Color	1
Fill Color	2
Coloring Vectors	1
Fill Tool Issue	1

Dragging Gesture	
Dragging Vector points	6
Dragging Pen tool	2
Vector Point Issue	3

Feelings	
Lack of Feedback	1
Frustration	3
Appreciation	1
First Impression	1

Bezier Handles	
Control Point Manip.	11
Bezier Manipulation	1
Bezier Axes	4
Bezier Handle Issue	2

Selection / Move Tool	
Moving Shapes	3
Selection Problem	1
Resizing Shape	1
Double Clicking	1

Lack of Control	
Unclear Point Property	2
Incomprehensive Pen-tool modes	5
Frustration with Angles	1

Info / tool hierarchy	
Unclear Menu	1
Tool Labels	1

Habits / Way of doing things	
Previous Experience	7
Lack of Control	3

Quantitative Results

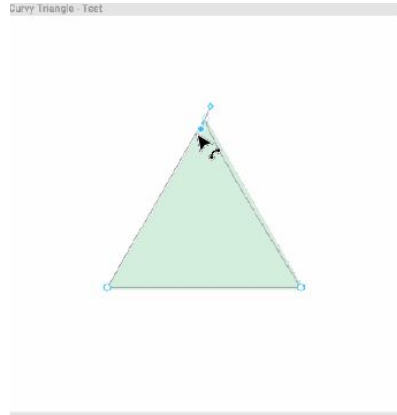
		P1	P2	P3	P4	P5	P6
Task 1	Task Success	Yes	Yes	Yes	Yes	Yes	Yes
Square	Task Completion Time	1min 4sec	56sec	49 sec	2 min	62 sec	43 sec
	How many times he / she repeated the task	0	0	0	1	0	0
Task 2	Task Success	Yes	Yes	Yes	Yes	Yes	Yes
Bullet	Task Completion Time	23sec	4min 19sec	1 minute	3min 50 sec	66 sec	3min 10 sec
	How many times he / she repeated the task	0	1	0	0	0	0
Task 3	Task Success	Yes	Yes	Yes	Yes	Yes	Yes
Circle	Task Completion Time	1min	3min	1min 56 seconds	4 min 1 sec	115 sec	2min 31sec
	How many times he / she repeated the task	1	0	1	0	0	2
Task 4	Task Success	Yes	Yes	Yes	Yes	Yes	Yes
Nike	Task Completion Time	5min 22sec	16min 5sec	1 min 11 seconds	13min 30 sec	60 sec	2min 14sec
	How many times he / she repeated the task	2	4	0	5	0	1
Task 5	Task Success	Yes	Yes	Yes	Yes	Yes	Yes
Logo from Me	Task Completion Time	2min 21sec	5min	8 min 4 seconds	5min 50 sec	510 sec	9min 30 sec
	How many times he / she repeated the task	0	0	0	1	0	1

All tasks were completed **100%**. The task that took longest (**average ~6 min**) is **Task 4 - Nike Logo**. It is also the task that was repeated the most. **Task 5 - Logo from Memory** was the second longest.

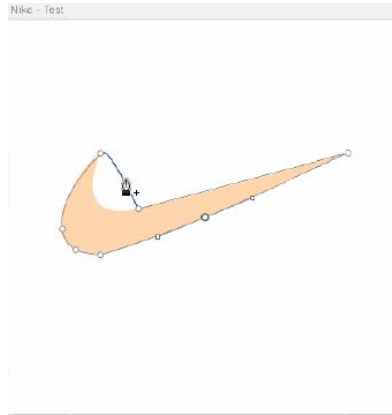
Key Findings

- General lack of control
- Mismatch between Design Tools and User's Mental Model
- Usability Issues in the Design Tools

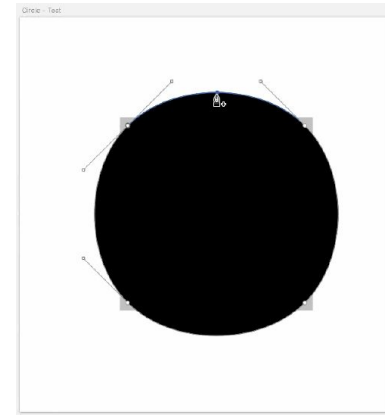
General lack of control



Failure to move the anchor point as expected

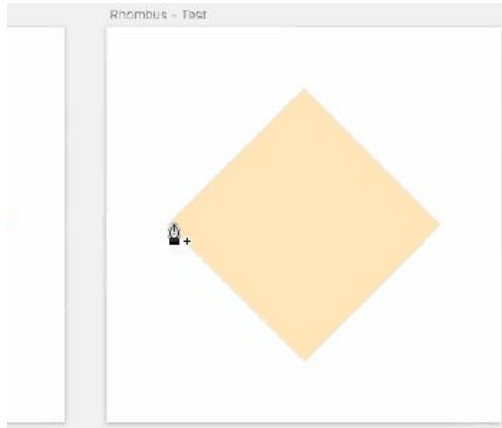


Lack of control over the curvature of the bezier curve

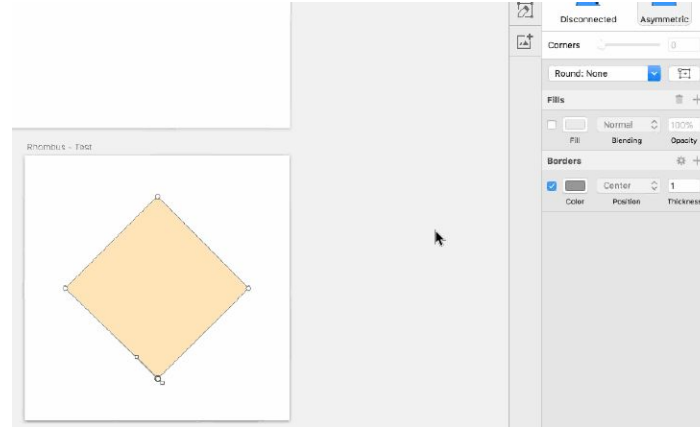


Participant adds more anchor points to manipulate the curve

Mismatch between Design Tool's Conceptual Model and User's Mental Model



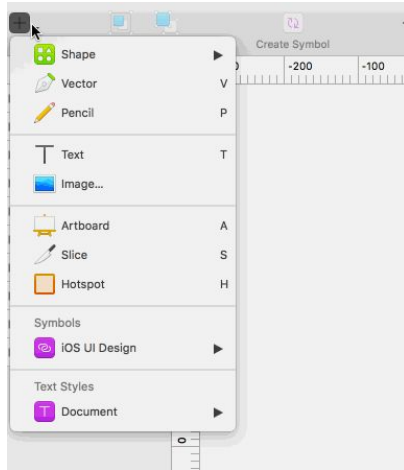
Mental Model of dragging the mouse to draw a shape



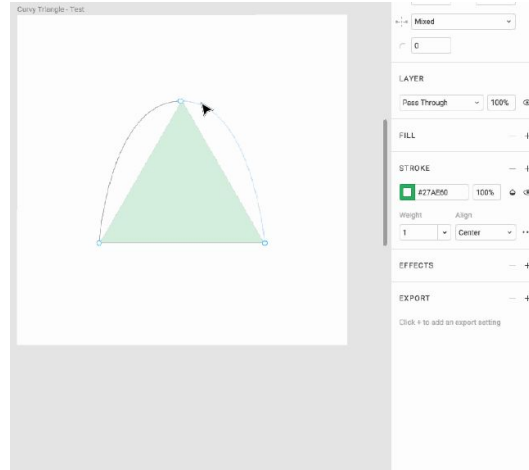
Mental Model of selecting a drawn shape



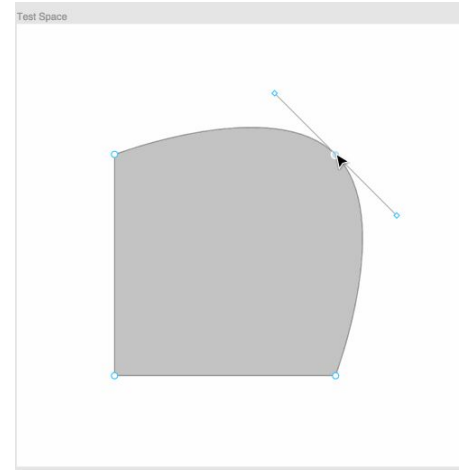
Usability Issues in the Design Tools



Tools hard to find

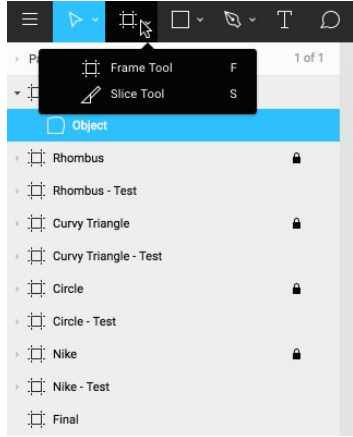


Fill Color Tool Confusion

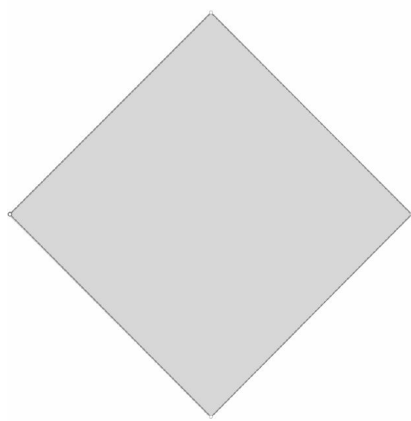


Double Click Function

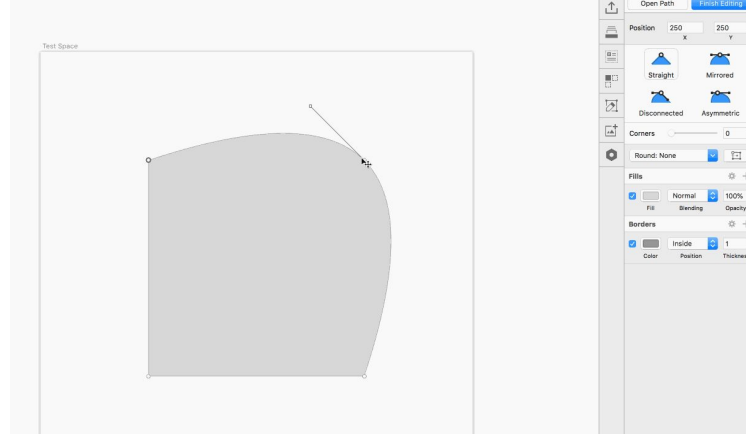
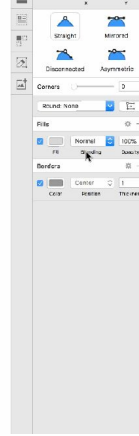
Usability Solutions in the Design Tools



Better Tool Display in Figma



Better Fill Tool Option in Sketch



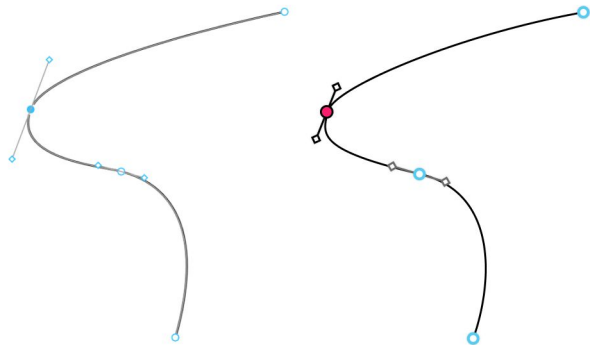
Double Click Function in Sketch



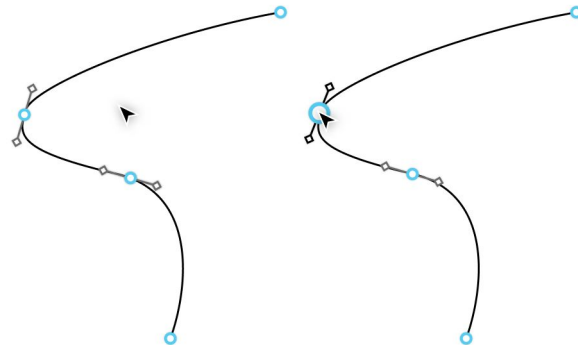
Recommendations

- Improving Visibility
- Improving Recognition
- Understanding Mental Models

Improving Visibility



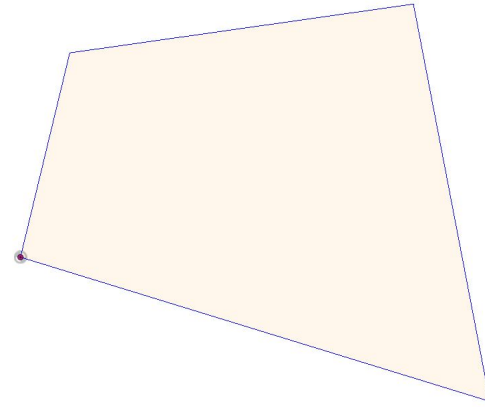
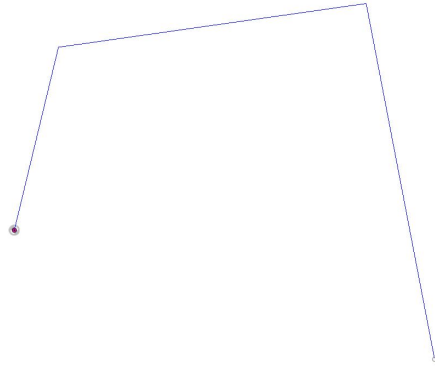
Use color and size to differentiate b/w selected and unselected points



Increase the size of the anchor point on hover to indicate clickability



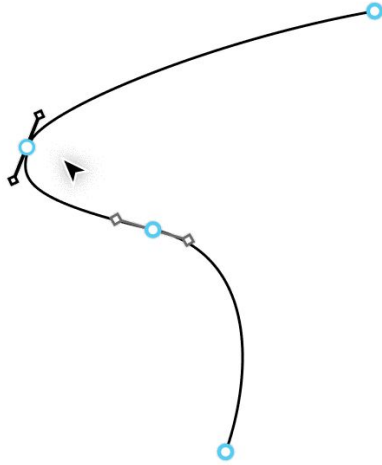
Improving Visibility



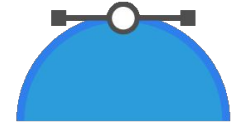
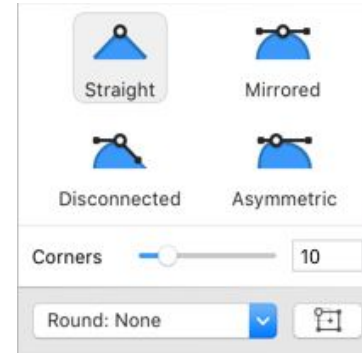
Denote closed paths with colored/shaded profiles



Improving Recognition

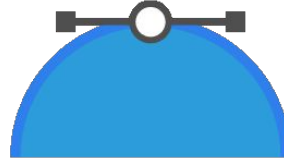
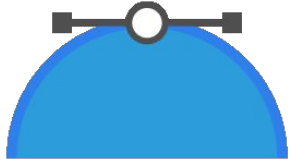


Subtle animations on the control points indicated they can be moved.



Animated previews clarify what a user can do with the selected option

Understanding Mental Models



"Mirror" should mirror sensibly.



Understanding Mental Models

Double clicking should change the status of the selected item rather than the object as a whole.



- Clicking and dragging should intelligently make a line that is either straight or curved.



Future Scope

- More participants for more betterer results
- More tools
- Usability testing our recommendations
- More research into mental models behind design

Conclusion

Design tools are broken and ***as designers***, we need to fix them.

- The mental model new users follow while using these tools is fundamentally different from how the tools were designed to be used.