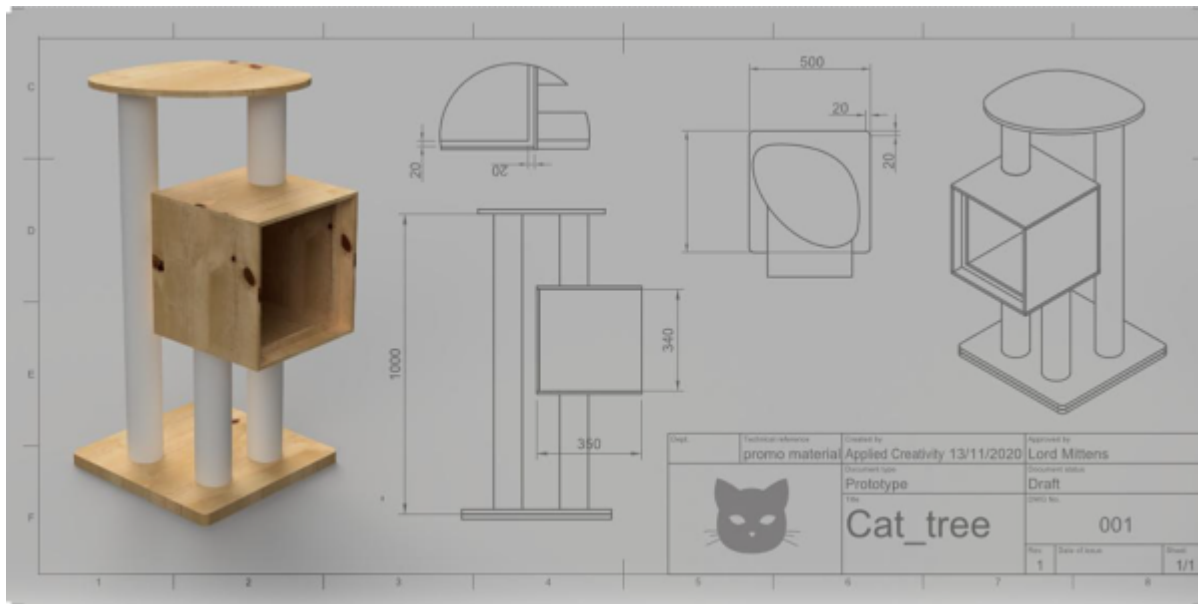




# CNC Cat Trees

SLQ Wiki Fabrication Lab 2024/07/27 11:20

# CNC Cat Trees



## Summary

**Duration:** 3 workshops, weekly, 3.5-4hrs each

**Delivery Method:** Face to Face in Fabrication Lab

**Participants:** 5 in first series

**First ran:** 13, 20, 27 March 2021

**Developed by:** Billie Ruben

**Notes for external facilitators:** This workshop utilizes CNC machining, but it doesn't need to. there's no reason that most of this couldn't be achieved with traditional hand/power tools in a more traditional woodworking shop, while still following/borrowing from the overall structure of this course.

## Skills Introduced

### Session 1: Design

- \* Design Thinking
- \* Miniature Prototyping
- \* Digital 3D modeling in TinkerCAD
- \* Exporting for CNC

### Session 2: Cut

- \* CNC Induction
- \* Cutting our parts
- \* Hand tools/ general induction

### Session 3: Assemble

- \* Assembly

## Tools, Materials & Files

Design

- Paper
- Pens
- Set up Cat Tree Prototype for demo

**Paper Prototyping**

- Cardboard for making boxes
- Hot Glue guns/sticks
- Bowl of water in case of glue gun burns
- Rulers preferable steel, for cutting
- Stanley Knives (and extra blades)
- Pencils
- 3D-printed pipes STL for mini pipes print approximately 5 per person in vase mode (1 wall/perimeter)
- Cutting mats

**3D Design**

- A laptop with a mouse (with scroll wheel) and internet connection, chargers per person
- Link to template file updated in slide desk/ wiki
- Set up TinkerCAD

classroom <https://tinkercad.zendesk.com/hc/en-us/articles/360026236693-Tinkercad-Classrooms>

- They have some posters about 3D design might be able to leverage.

[https://api-reader.tinkercad.com/api/prismic/docs/tkv3%2F62e303eb-ea0c-48a0-8ace-e2e0d542ba00\\_how\\_to\\_speak\\_3d.pdf](https://api-reader.tinkercad.com/api/prismic/docs/tkv3%2F62e303eb-ea0c-48a0-8ace-e2e0d542ba00_how_to_speak_3d.pdf)

**TO DO**

- prototype cat tree from a single sheet with fittings
- work out cost per person in materials
- decide if we want another test session
- fix up wiki so it's in a format that can be handed to other facilitators.

Workshop 1	Workshop 2	Workshop 3	Workshop 4
* General/hand tools induction * Paper prototyping to scale * Vectors in VCarve	* CNC induction online * Painting sheets * CNC Induction practical * Listing/ordering lengths of pipe	* Finishing with files/rasps * Painting Edges * Rope-Wrapping * Carpeting	* Assembly * Next steps


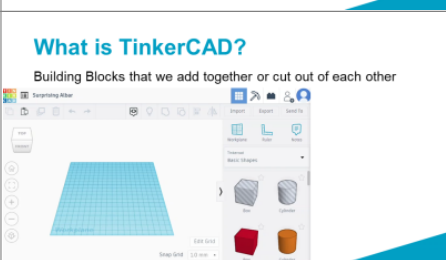
**Slides**

Slide	
 <p>CNC CAT TREE WORKSHOP Session 1</p>	

<p><b>Acknowledgement of Country</b></p> <p>We acknowledge Aboriginal and Torres Strait Islander peoples and their continuing connection to land, water and community, and as custodians of stories for millennia.</p> <p>We respectfully acknowledge the Jagera and Turrbal land on which we all meet today, and pay our respects to their elders past, present and emerging.</p>	
<p><b>Housekeeping</b></p> <ul style="list-style-type: none"> <li>• Bathrooms</li> <li>• Emergency Procedures</li> <li>• Please ask lots of questions</li> <li>• Speak up if need help</li> <li>• Slides on wiki, let me know if you'd like an laptop to follow along!</li> </ul> <p><b>SLIDES:</b> <a href="https://shorturl.at/yKVVWZ">shorturl.at/yKVVWZ</a></p>	<p>Show how to find on wiki</p> <p><a href="https://wiki.slq.qld.gov.au/doku.php?id=workshops:prototypes:cat_tree">https://wiki.slq.qld.gov.au/doku.php?id=workshops:prototypes:cat_tree</a></p>
<p><b>Facilitator Introductions</b></p> <ul style="list-style-type: none"> <li>• I'm Billie!</li> <li>• Andrei</li> <li>• Mick</li> </ul>	
<p><b>Getting to know you</b></p> <ul style="list-style-type: none"> <li>• What should we call you?</li> <li>• Have you been to the Fabrication Lab before?</li> <li>• What's your previous experience with making?</li> <li>• Why did you sign up? What do you hope to get out of these session?</li> </ul>	<p>Write reasons why folk have joined on a board/somewhere so we can tailor the experience wherever possible to suit their goals.</p>
<p><b>Have you been here, to the Fabrication Lab, before?</b></p>	<p>Tour!</p>
<p><b>The Workshop Series</b></p> <ul style="list-style-type: none"> <li>• Design &amp; modeling</li> <li>• Cutting &amp; some assembly</li> <li>• Assembly/Finishing</li> </ul>	
<p><b>What we will do today</b></p> <ul style="list-style-type: none"> <li>• Design Thinking</li> <li>• Miniature Prototyping</li> <li>• Digital Modelling in 3D</li> <li>• Exporting for CNC</li> </ul>	

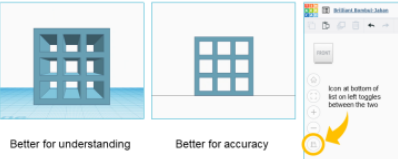
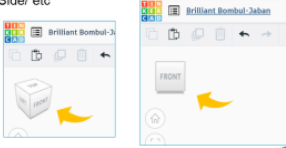

	<p>Tools, Materials, Prep</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Paper</li> <li><input type="checkbox"/> Pens</li> <li><input type="checkbox"/> Set up Cat Tree Prototype for demo</li> </ul>
	<p>Every cat and person is different We're all different. Our cats are all different! <input type="checkbox"/> We have the luxury here of making something totally unique to us and our cats.</p> <p>Planning helps us later Helps when prototyping to have a think first about wants and needs for the goal.</p>
<p><b>Our tree's construction</b></p> <p><b>MDF</b></p> <ul style="list-style-type: none"> <li>• Painted</li> <li>• Carpeted</li> <li>• Boxes, platforms</li> </ul> <p><b>PVC pipe</b></p> <ul style="list-style-type: none"> <li>• Fitting demo</li> <li>• Wrapped in rope</li> <li>• Filled with sand</li> </ul>	
	<p>What ideas: gather these, start thinking about how to incorporate given the construction methods we have available.</p> <p>Where: Pinterest, google, etc.</p> <p>What to search for: Talk about branching outside just cat trees, maybe look at equipment for other pets, like rats or ferrets? Or at children's cubby houses and playgrounds?</p>
<p>Creativity isn't about coming up with totally new ideas, it's about gathering neat ideas and smooshing them together to <i>form</i> something new.</p>	
	<p>What kinds of things does your cat like to sit in/ on? open boxes? closed ones with holes? Baskets? Platforms?</p> <p>Where does your cat like to sit? up high? hiding under things? In the sun? Near you? On their own? Why?</p> <p>How heavy is your cat? How stable does it need to be?</p> <p>How mobile are they? Can they jump really high, or do they sometimes have trouble?</p> <p>What's your cat's temperament? Playful? calm?</p> <p>What textures do they enjoy?</p>
	<p>Where will you be putting your cat tree? How large is that space? Are there any obstacles there?</p> <p>What style/colour/shape appeals to you (or the people who will live with this tree in future?)</p> <p>How are you getting it home? Do you need to pack it really flat for transport?</p>


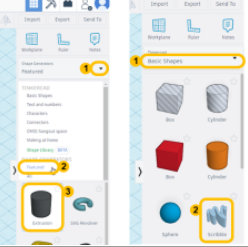


<p><b>What other things might be important for us to think about?</b></p>	<p>Limitations of our materials/time Keeping it realistic and achievable Else?</p>
<p><b>This was really brief design thinking!</b> If you are interested in Human (or cat!) -Centred Design-Thinking, IDEO have some great online resources</p>	<p>Ideo is a world-renowned design firm, invented things like the computer mouse. <a href="https://designthinking.ideo.com/">https://designthinking.ideo.com/</a></p>
<p><b>SL Prototyping in miniature</b></p>	<p>Tools, Materials, Prep</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Cardboard for making boxes</li> <li><input type="checkbox"/> Hot Glue guns/sticks</li> <li><input type="checkbox"/> Bowl of water in case of glue gun burns</li> <li><input type="checkbox"/> Rulers preferable steel, for cutting</li> <li><input type="checkbox"/> Stanley Knives (and extra blades)</li> <li><input type="checkbox"/> Pencils</li> <li><input type="checkbox"/> 3D-printed pipes STL for mini pipes print approximately 5 per person in vase mode (1 wall/perimeter)</li> <li><input type="checkbox"/> Cutting mats</li> </ul>
<p><b>Why prototype in miniature?</b></p>	<p>Think: Architecture models</p> <p>Helps explain to others Much easier to see issues in 3D physical model Get a feel for how it will all get put together/ Understand overall structure Cheaper to make mistakes small</p>
<p><b>What will we be doing?</b></p> <ul style="list-style-type: none"> <li>• Assembling mini versions</li> <li>• 20% of final size (1/5<sup>th</sup>) e.g. if something will be a metre long we make it 20cm here</li> <li>• Cardboard and 3D printed mini pipe</li> </ul>	
<p><b>How</b></p> <ul style="list-style-type: none"> <li>• Hot glue</li> <li>• Cutting cardboard to size</li> </ul>	
<p><b>Safety</b></p> <ul style="list-style-type: none"> <li>• <b>Glue gun:</b> be wary of burns, glue stays hot for really long time -submerge in water immediately if it comes in contact with skin.</li> <li>• <b>Stanley knives:</b> keep fingers clear, use cutting mats &amp; sharp blade. Don't apply much force, better to do a few light cuts than big deep ones (neater too!). Cut away from body (stand to side)</li> <li>• Watch out for <b>cardboard</b> cuts!</li> </ul>  	<p>Point out water bowl</p>

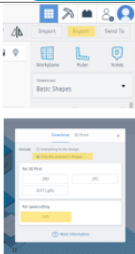

<p>Let's do it!</p>	
<p><b>Keep in mind</b></p> <ul style="list-style-type: none"> <li>• Stability –base much larger than tree</li> <li>• Size of material MDF 120*240cm, max 2 per person</li> <li>• Keep it achievable</li> <li>• Space it will fit into at home</li> </ul>	
<p><b>Our Cat's Experience</b></p> <p>Think about what it would be like to be our cat using this.</p> <ul style="list-style-type: none"> <li>• Accessibility?</li> <li>• Enjoyment?</li> </ul> <p>Reflect back upon our design notes</p>	<p>Think about what it would be like to be our cat using this.          Can they get to all the parts? (factor in mobility issues, geometry, and any nearby obstacles at home (walls/furniture etc)          Will they enjoy this layout given what we know of our cats/what we reflected upon earlier? (check)</p>
	<p>Tools, Materials, Prep</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> A laptop with a mouse (with scroll wheel) and internet connection, chargers per person</li> <li><input type="checkbox"/> USB memory stick per person with template TinkerCAD files (or put on public library?)</li> <li><input type="checkbox"/> Set up TinkerCAD classroom <a href="https://tinkercad.zendesk.com/hc/en-us/articles/360026236693-Tinkercad-Classrooms">https://tinkercad.zendesk.com/hc/en-us/articles/360026236693-Tinkercad-Classrooms</a></li> <li><input type="checkbox"/> They have some posters about 3D design might be able to leverage. <a href="https://api-reader.tinkercad.com/api/prismic/docs/tkv3%2F62e303eb-ea0c-48a0-8ace-e2e0d542ba00_how_to_speak_3d.pdf">https://api-reader.tinkercad.com/api/prismic/docs/tkv3%2F62e303eb-ea0c-48a0-8ace-e2e0d542ba00_how_to_speak_3d.pdf</a></li> </ul>
<p><b>Why 3D?</b></p> <p>Why model in 3D when we're cutting in 2D?</p>	<p>Easier to keep track of how it all fits together.          Easier to assemble in 3D so we can see where flat pieces join so we know the parts are going to fit ok.          Much harder to keep all of that in your mind if working solely in 2D.          Example: sides of boxes aren't all even, some longer than others, easy to over look.</p>
<p><b>Why TinkerCAD?</b></p> <ul style="list-style-type: none"> <li>• Free</li> <li>• Easy</li> <li>• Works on anything with internet</li> </ul>	
<p><b>What is TinkerCAD?</b></p> <p>Building Blocks that we add together or cut out of each other</p> 	<p>A liittle bit like Lego</p>

<p><b>How will we use it?</b></p> <ul style="list-style-type: none"><li>• Assemble tree (templates and our own custom parts)</li><li>• Lay out parts flat</li><li>• Export for CNC</li></ul>	
<p>Let's jump in!</p> <p><b>tinkercad.com</b></p>	<p>Open up a new web page (e.g chrome, firefox, edge, internet explorer)</p> <p><a href="https://www.tinkercad.com/">https://www.tinkercad.com/</a></p>
<p><b>Join the Class</b></p> <p>1. Go to this web address:</p> <p><b>tinkercad.com/joinclass/WL4JB35KBT23</b></p> <p><b>WL4J B35K BT23</b></p> <p>2. Join with Nickname &gt; enter your first name</p>	<p><a href="https://www.tinkercad.com/classrooms/i7CcjUKC8K">https://www.tinkercad.com/classrooms/i7CcjUKC8K</a></p>
<p><b>Tutorials</b></p> <p>Software will give us some demos when we first open it. Learn &gt; see all starters &gt;Place it! Work your way through the lot:</p> <ul style="list-style-type: none"><li>• Place it!</li><li>• View it!</li><li>• Move it!</li><li>• Rotate it!</li><li>• Size it up!</li><li>• Group it!</li><li>• Copy it!</li><li>• Duplicate it!</li><li>• Hide it!</li><li>• Align it!</li></ul>	<p>These show us how to use most of the functions.</p>
<p><b>Review</b></p> <p>If you want to go back and review any of these you can at any time:</p> <p><b>tinkercad.com/learn</b></p>	
<p>We will also learn some extra bits today</p>	
<p><b>Importing Templates</b></p> <p>1. Go to:</p> <p><b>www.tinkercad.com/things/kmhaSN7zCz8</b></p> <p>2. Click Copy &amp; Tinker</p>	<p><a href="https://www.tinkercad.com/things/kmhaSN7zCz8">https://www.tinkercad.com/things/kmhaSN7zCz8</a></p> <p>Facilitator: check that you can see everyone in Classroom mode before leaving.</p>



<p><b>Increasing grid size</b></p> <ol style="list-style-type: none"> <li>Edit Grid (bottom right)</li> <li>Change to 1000 x 1000</li> </ol> <p>Snap grid 0.1mm</p>	<p>Won't need this if using template</p>
<p><b>Scaling</b></p> <ul style="list-style-type: none"> <li>TinkerCAD is meant for 3D printing so it has size restriction of 1m cubed</li> <li>We will model in 10% size, and scale up later when we go to CNC.</li> <li>1cm real life = 1mm in TinkerCAD</li> <li>MDF will be 9mm thick, so 0.9mm in TinkerCAD.</li> </ul>	
<p><b>Perspective vs Orthographic</b></p> 	<p>In addition to moving around our object, we can also view it in two different modes: Perspective imitates looking through human eye or lense, so it's the best one when we're looking to get a feel for what our object will look like in real life, but it's quite hard to place things accurately in this mode. Orthographic is used traditionally for making plans and diagrams, and is usually used for Top/Side/Back views. It shows our objects nice and flat so it's easier to align objects to each other, and position them more accurately in space. I recommend switching to Orthographic mode.</p>
<p><b>Snap to a view</b></p> <p>Double click on faces of cube in top right to snap to Top/ Side/ etc</p> 	<p>Orthographic is particularly powerful when combined with the box in the top right, which allows you to 'snap' to a specific view by double clicking on that side of the cube. e.g. snap to a bird's eye view by double clicking on the top, a front view by double clicking on the front, etc.</p>
<p><b>Box Construction</b></p>  <p>Ensure there is a lip for the back to sit on at the base, and that the top covers the edge of the back too.</p> <p>Do this by making the sides shorter than the base by the width of the material (9mm in real life, 0.9mm in TinkerCAD)</p>	
<p><b>Adding Fittings for PVC posts</b></p> <ul style="list-style-type: none"> <li>Demo how fitting works</li> <li>Template in file</li> <li>Cut the top disc halfway through the base of the platform.</li> <li>Note: one of the discs has a hexagon, instead of a round hole (they're not all the same)</li> </ul>	
<p><b>Adding Holes</b></p> <ul style="list-style-type: none"> <li>Add functional holes for bolts by using cylinders (and polygons for hexagon-holes)</li> </ul>	<p>In the mini tutorials at the beginning we learned how to cut holes by dragging in an object and setting it's colour to "hole" then grouping the object.</p> <p>We use this same process to cut the holes for our bolts using 1mm cylinders (equating to 10mm in real life) the hexagons for nuts and bolt heads will be 1.65x1.85mm in TinkerCAD. Cylinders for our pipe will be 9*9mm in TinkerCAD</p>

<p><b>Decorative Cut-Outs/ Engravings</b></p> <p>Many ways to get them:</p> <ul style="list-style-type: none"> <li>• Add objects from gallery,</li> <li>• Import SVG (vector) images</li> <li>• Add text cut-outs using the text tool</li> </ul>  <p>How to use:</p> <ul style="list-style-type: none"> <li>• Set as holes</li> <li>• Position so object to be removed goes all the way through the box side for cut-outs, or partially through for engrave</li> </ul>	
 <p><b>Custom Shapes</b></p> <ul style="list-style-type: none"> <li>• Extrusion – simple blobby shapes</li> <li>• Scribble – draw on screen</li> </ul>	
<p><b>CNC Design Considerations</b></p> <p>Remember to be aware of 'floating' pieces if you want to cut all the way through! e.g stencils. If in doubt, consider engraving.</p>  <p>Cuts in your MDF can go right through to both sides, but only one side can be engraved</p>	
 <p>Laying out our pieces for CNC</p>	
<p><b>Save a copy!</b></p> <p>So we can keep an assembled copy.</p> <ol style="list-style-type: none"> <li>1. Click on the rainbow logo top left to see all your designs</li> <li>2. Hover over the design you want to copy until the cog appears</li> <li>3. Click that cog and click duplicate</li> <li>4. Give it a new name in the top left (e.g Cat Tree Flat)</li> </ol>	
<p><b>Remember:</b></p> <ul style="list-style-type: none"> <li>• Either side can be cut, but only one side engraved, so put the detailed/engraved side <b>down</b></li> <li>• Tinkercad will export any lines touching the floor</li> </ul>	
<p><b>To put objects flat on 'floor'</b></p> <ol style="list-style-type: none"> <li>1. Rotate object so the 'detailed/engraved' face is down. (Tinkercad will export any lines touching the floor)</li> <li>2. Copy the object</li> <li>3. Click on the 'floor' (workplane)</li> <li>4. Paste the object. It should snap to the floor</li> </ol>	

<p><b>Remember!</b></p> <ul style="list-style-type: none"> <li>• Size of material MDF 120*240cm, max 2 per person</li> </ul>	
<p><b>Exporting</b></p> <p>For whole document:</p> <ol style="list-style-type: none"> <li>1. Export (top right)</li> <li>2. Choose .SVG</li> </ol> <p>For individual or groups of pieces:</p> <ol style="list-style-type: none"> <li>1. First selecting them in the 3D view (shift+click to add more or click and drag to select a bunch in the same area)</li> <li>2. Then export &gt;svg Check that it says "Include... Only the selected # shapes."</li> </ol>	 <p>Exporting SVGs as individuals ('detailed' side so we can engraved where necessary. We will assemble these in VCarve later for the CNC)</p>
 <p><b>Keyboard Shortcuts</b></p> <p>There is also a list of <a href="#">keyboard shortcuts</a> if those take your fancy:</p>	<p><a href="https://blog.tinkercad.com/keyboard-shortcuts-for-the-3d-editor">https://blog.tinkercad.com/keyboard-shortcuts-for-the-3d-editor</a></p>
<p><b>If you get stuck</b></p> <p>You can go back and review any of the little demos at any time:</p> <p><a href="https://tinkercad.com/learn">tinkercad.com/learn</a></p> <p>Instructions for the extra bits we've learned, and sign in links are on wiki.</p> <p><a href="https://shorturl.at/yKVWZ">shorturl.at/yKVWZ</a></p>	
<p>Facilitator: check that you can see everyone in Classroom mode before leaving.</p>	

## Reflection after first Session

Discussion with the design and delivery team resulted in the following changes to be made to this course:

### Structure

many changes made to the structure, resulting in the following:

#### Prior to session 1

- Participants complete general/hand tools induction (this could be the morning of as we run inductions before the Saturday workshops)

#### Session 1

- paper prototype
- limit materials to 1 board, x number fittings. Have more fittings available for purchase.
- vcarve vector basics
  - investigate if we can scan hand drawn images and have vcarve trace them.
  - need solution for matching fittings accurately between layers

### **In-between Session 1-2 (during open lab times)**

- Check-in re design. Facilitator checks their progress/viability etc.
- Offer to help problem solve any 'found' objects (e.g branches, domes, etc) so that class time isn't taken up
- Offer help with VCarve

### **Session 2**

- Online CNC induction
- Painting demo/start
- as participants are painting run VCarve practicals (cut same item, something with corners and curves for carpet practice)
- Get list of pipe lengths

### **In-between Session 2-3 (during open lab times)**

- Offer for participants to come in and cut their own sheet
- Offer participants to come in and cut their own pipe
- (else facilitators do these)

### **Session 3**

Demo the following (do these demos regardless of if everyone has finished everything)

- Finishing edges with files/rasps (not sand paper)
- Painting Edges
- Rope wrapping
- Carpeting
- remember to take WiP photos

### **In-between Session3-4 (during open lab times)**

- offer time to continue any tasks, particularly for anyone lagging behind.

## Session 4

- Finishing off anything remaining from week before
- Assembly
- Photos!
- how to extend learning from here, what they can now make. furniture, dog house, possum box, etc.

### Carousel test



SLIDE 1

the text



SLIDE 1

the text



SLIDE 1

Show how to find on wiki \\ \\ [https://wiki.slq.qld.gov.au/doku.php?id=workshops:prototypes:cat\\_tree](https://wiki.slq.qld.gov.au/doku.php?id=workshops:prototypes:cat_tree)



SLIDE 1

the text



SLIDE 1

Write reasons why folk have joined on a board/somewhere so we can tailor the experience wherever possible to suit their goals.

