**Editing tools we will use**

- **Edit (v)**: Allows you to drag ends of 3’ and 5’ ends.
- **Break (b)**: Breaks an existing strand into two pieces.
- **Erase (e)**: Deletes the entirety of a strand on a single helix.
- **Auto staple**: Populates all existing scaffold strand (blue) with staples. Also adds crossovers where possible.
- **Force path (f)**: Creates a connection with no length, between two bases (5’ to 3’). Allows for things to be spaced out in Cadnano.
- **Move (m)**: Moves you around the “Base-editing” window. Can also do this with the arrow keys.

**Beware! In this older version of Cadnano there is no undo feature 😞**
**Changing working area**

To add more bases: with the **Edit (v)** tool selected, move the orange bar (click and drag) all the way to the right of the “Base-editing” window and click the arrow.

Choose number of bases (the open boxes) to add.

**Adding cross-overs**

With the **Edit (v)** tool selected, click on a strand around the area you want to add a cross-over.

The small numbers with the right angles show where cross-overs can be placed. The number tells you which helix the cross over will connect to. Click on the number to add the crossover.
**Closing a break**

With the **Edit (v)** tool selected, hold **Shift** and click on either the 3’ or 5’ end around the break to join the strands together.

**Removing a cross-over**

Just double click on the crossover.

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**Adding a new strand on a helix**

Sometimes you want to add a strand on an existing helix. With the **Edit(v)** tool selected, move the orange bar to the location that you want the new strand to appear. In the “Cross Section” window, click on the helix number you want the strand to be added.
Connecting separate bricks in a structure

Sometimes you want to have your design have disjoint regions in the Cadnano design, like when making a hinge. But the scaffold still needs to route all sections of the structure to be in a single loop. We use the **Force path (f)** tool to add connections across gaps in the design.

1. With the **Force path (f)** tool selected, click on the 3’ end (triangle) and then click on the 5’ end you want to connect to.

2. Click **Confirm**
In cadnano2 you can toggle what parts of the strands you can select, for today leave them in this configuration. If things start acting strange, check that they are toggled to the right state.

You can move around either region with the arrows keys and can zoom in/out with the scroll wheel.

Rejoice! This version has undo! Press Command+Z to undo your last actions.
Changing working area

To add more bases: at the right side of the “base-editing” region, there will be small arrows. Click on the arrow.

Choose number of bases (the open boxes) to add.

Adding a new strand on a helix

Sometimes you want to add strand on an existing helix. Using the Pencil tool, click and drag along any helix to draw on a new strand.

Adding cross-overs

With the Select tool, click on the strand you want to add a cross-over. The small numbers with the right angles show where cross-overs can be placed. The number tells you which helix the cross over will connect to. Click on the number to add the crossover.
Closing a break

With the Select (v) tool selected, hold Shift and click on either the 3’ or 5’ end around the break to join the strands together.

Removing a cross-over

Using the Select tool, click on the cross-over, it will turn red. Press the Delete or Backspace key to remove the selected cross-over.

Connecting separate bricks in a structure

Sometimes you want to have your design have disjoint regions in the Cadnano design, like when making a hinge. But the scaffold still needs to route all sections of the structure to be in a single loop. We use the Pencil tool to add connections across gaps in the design. Click on a loose 3’ end (arrow) and then on any 5’ end (square).
Steps to making a structure

1. Choose a cross-section of helices for the object.
2. Create loops of scaffold for pairs of helices.
3. Connect the scaffold helices together to make a single loop.
4. Click the Auto-staple tool to populate the structure with staples.
5. Break staples!

Staple breaking rules for today

1. No loops. All staples must have a break in them.
2. Keep the length between 24-48 bases long. This is 3 to 6 “blocks”. A block is a region of 8 bases, demarcated by the darker lines in the software.
3. Staples should have one “long” domain. A “long” is a staple region that binds two or more continuous blocks of scaffold on a single helix.
4. No “long – short – long” motifs. A “short” is a staple region that only binds a single block of scaffold on a single helix.
5. No staple segments smaller than 8 bases (one block).

Useful numbers

1bp = 0.34nm
2.6 nm