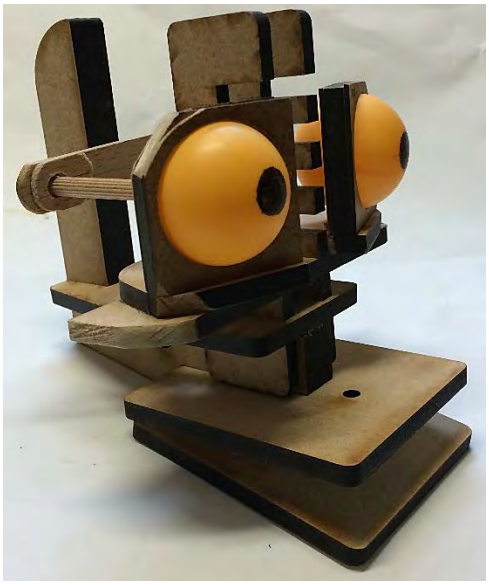
Puppet heads based on cardboard eggs build by Character Design-students, 2019

The Nordberg-Controls

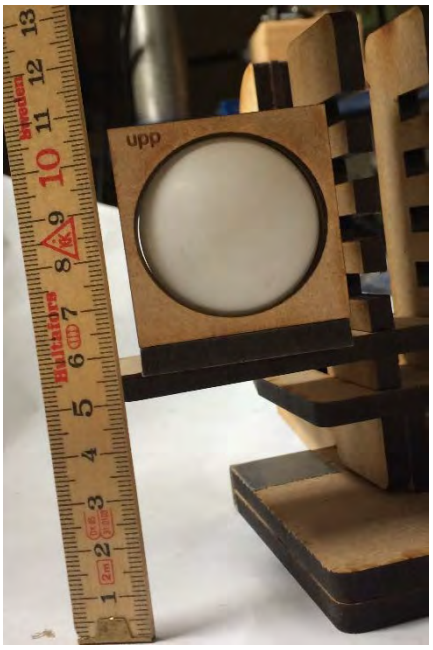
Laser-cut controls for hand-puppet heads

Mattias Nordberg and Jakob Dittmar, Malmö University (2019)



(all measurements in these instructions are in cm / mm)
Dimensions of controls:
from ca 10 x 10 x 13 cm to ca 18 x 18 x 13 cm

These controls are suitable for heads slightly larger that 10 x 10 cm to much larger: max. distance of upper lip to center of eye ball is 14 cm with standarf form of controls. As the kit's eye-boxes can be set into a puppet head without being fixed to the controls, even larger heads can be steered with these controls.



Material:
for the controls:
6 mm MDF (medium density fibreboard) or similar sheet material: 43 x 21 cm
3 mm MDF or similar sheet material: 14 x 12 cm
super glue or contact glue (wood-glue works, but not that well)

for the eyes:
2 ping pong-balls
2 dowel rods, between 6 to 8 mm diameter
1 strip of wood approx. 2mm diameter, 20 mm wide, approx. 20 cm long
OR a bit of stiff wire, approx. 15 cm

for movable lower jaw:
fishing line or nylon thread
Gaffer tape

Introduction:
To control the movement of the eyes and mouth of a hand puppet, some basic mechanism is needed inside the puppet's head, obviously. While an abundance of individual control mechanisms exist, they all demand quite some development, adjustment, and care. Also, most are build as specific solutions for individual puppets. In difference to that, the control mechanism described here consists of a standardised kit that was developed by Mattias Nordberg for puppet building on the Character Design-course at Malmö University.

It is cut from 6mm MDF (medium density fibreboard) or similar sheet material with a laser cutter. It is quickly produced and assembled. The kit suits quite diverse head measurements

and shapes, as its modules can be put together according to the dimensions and restrictions given in individual puppet heads (s. images below). Of course, not all options of the kit have to be used, opening the mouth or moving both eyes in synchronicity is not always wanted.

Access to the controls is provided through the back of the puppet's head: their rear end provides the grip to hold them, while one finger steers eye movements and another can close and open the mouth. Together with the controls, the puppeteer holds the attached head, and even the body of the puppet, if it is connected to the controls – for connecting the head to a neck or body two holes at the bottom of the controls are provided, locating this joint behind the jaws. As always: heavy puppet bodies will pull down and tire the hand and arm accordingly.

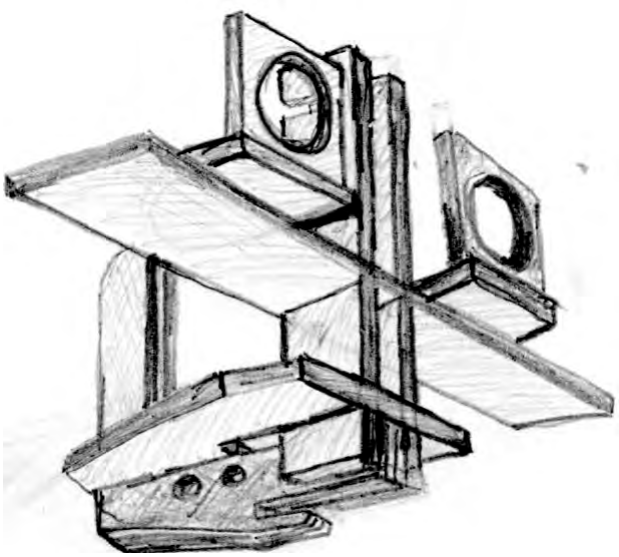
For added stability of the controls it is advisable to cut out from a bit of 3 mm MDF or other material one of the grip-forms. Two layers of 6 mm and one layer of 3 mm fill the distance between the two uprights perfectly and make the controls rather sturdy and even easier to glue together.

If you build puppets' heads based on cardboard shapes like Easter eggs as introduced by Hansjürgen Fettig (check out his books), it is easiest to plan the face's dimensions and outline with the controls in mind (image above is built from egg with 23 cm length). Glue the controls into the head and stabilise the head if needed. Depending on the shape and width of the puppet's lower jaw, you need to close gaps between the control's lower jaw and the face's / mouth's edges (its lips) before you glue the back of the head to its front. Make sure that the holes for the eyes and the placement of eyes on the control do correspond really well! If you build the head's shell first, you can adjust the control and place the eyes exactly to the needs of the puppets face. Finish the head with the controls in place. Be careful to not damage or smear colour into the eye-settings.

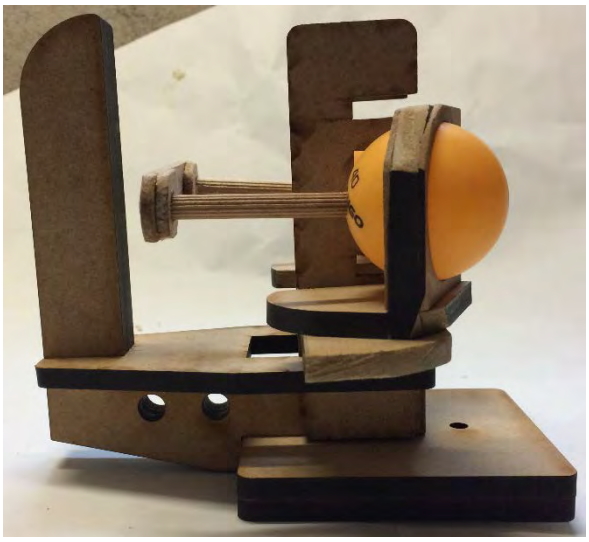
Assembly:
An image of all parts with added names is provided at the end of this despcription, please check, if naming of parts in the following description seems unclear.

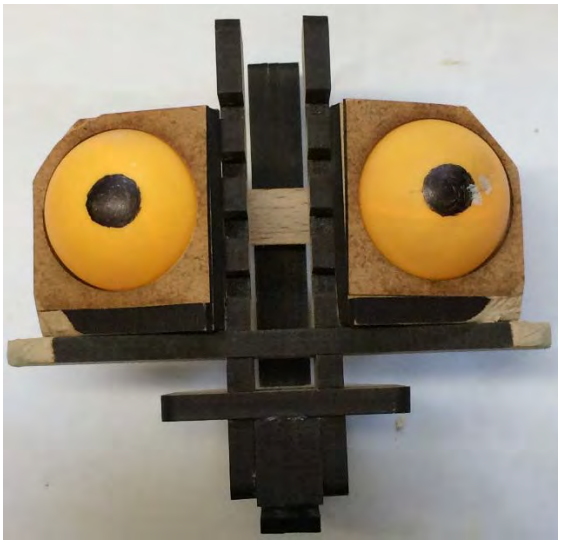
Two uprights are slotted into the base plate, usually with their lowest cut and most of the times with the slots towards the wider end (the front) of the base plate.
Set in the three parts of the grip - if you have cut a third copy from 3 mm material, otherwise you need to glue the two copies of the grip into place: the grip protruding upwards through the back slot of the base plate and the bottom of the grip with the slots for the lower jaw and the holes for the neck-joint underneath the base plate and between the feet of the two uprights.

Slot in the horizontal bar into the upprights slightly below the intended height of the eyes.

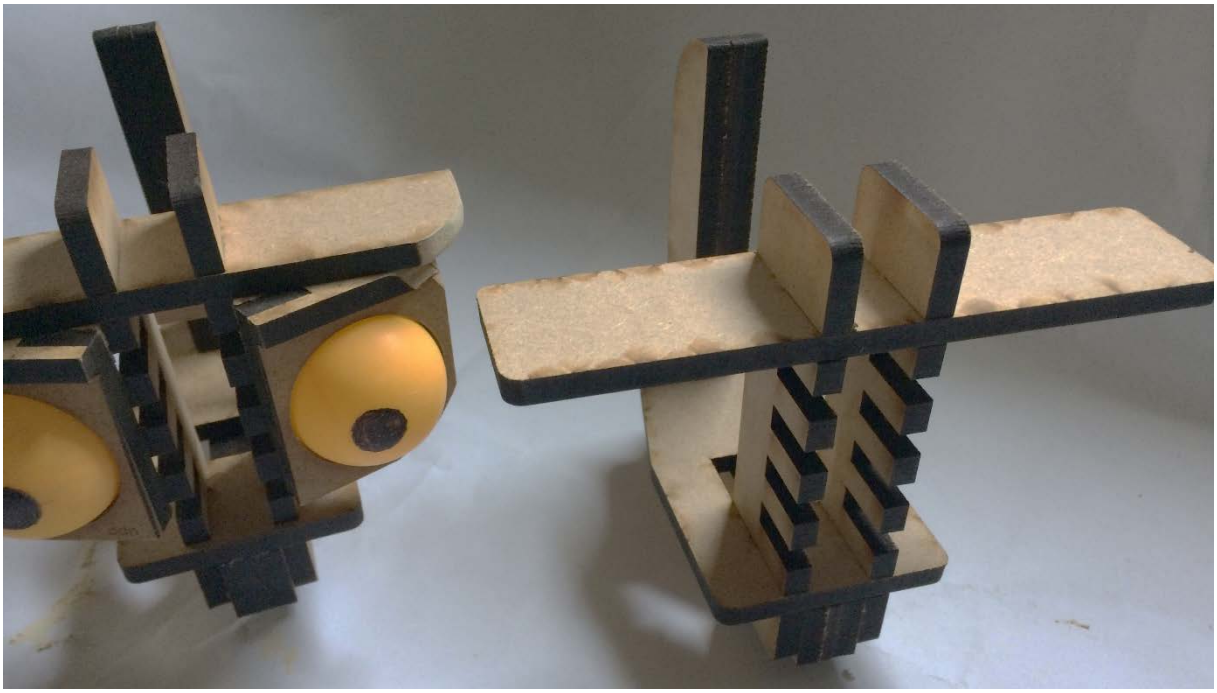


The kit's main horizontal bar is used to place the eyes and as horizontal stabilisation for the puppet's head. It's ends have to be cut and sanded into shape before being glued into the head's shell. The two central uprights of the control can be sawn off above the horizontal bar to provide more room in the head (not shown in the images used here). This allows for easier placement of the eye-boxes on the horizontal bar, as well.





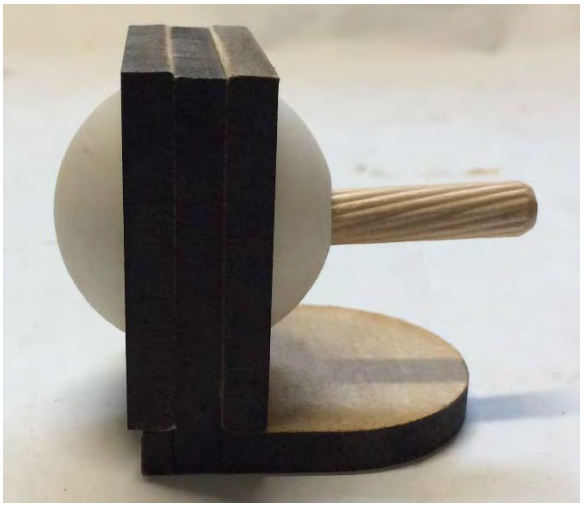
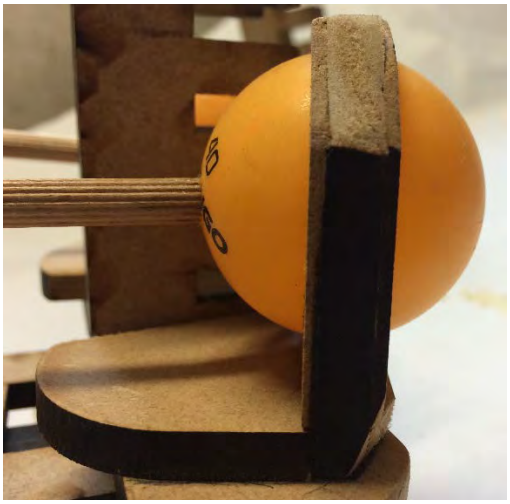
The eye-boxes might need to get rounded at their edges for proper fit in the head's shell as well. Alternatively, especially, if the controls need to provide more stability for the head, the horizontal bar can be slotted into the uprights further up and the eye-boxes are glued to it from below (s. image below).



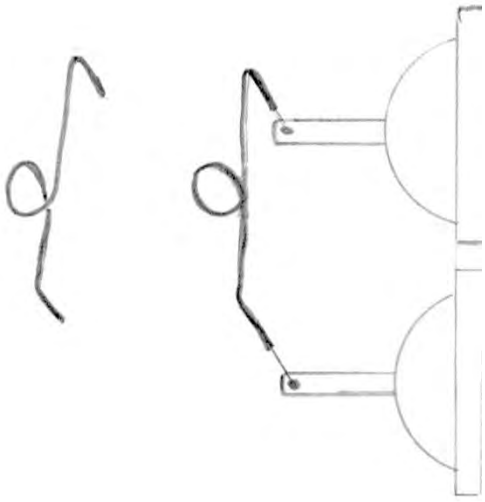
And: if all this seems to provide too little support for the head, a second copy of the horizontal bar can be cut and shaped to fit into the head: place it on top of the two uprights to offer a second tier for gluing the controls into the puppet's head.

The eye-module consists of a box or frame that provides a setting for a ping pong-ball. These boxes are build around the ball, into which a dowel rod is glued before the box is assembled. Also, a vertical hole is drilled through the rod close to its end (make this right-angled to the rod, i.e. crossing the rod in 90 degrees). The rod can later be twisted to place the hole exactly horizontal or vertical.

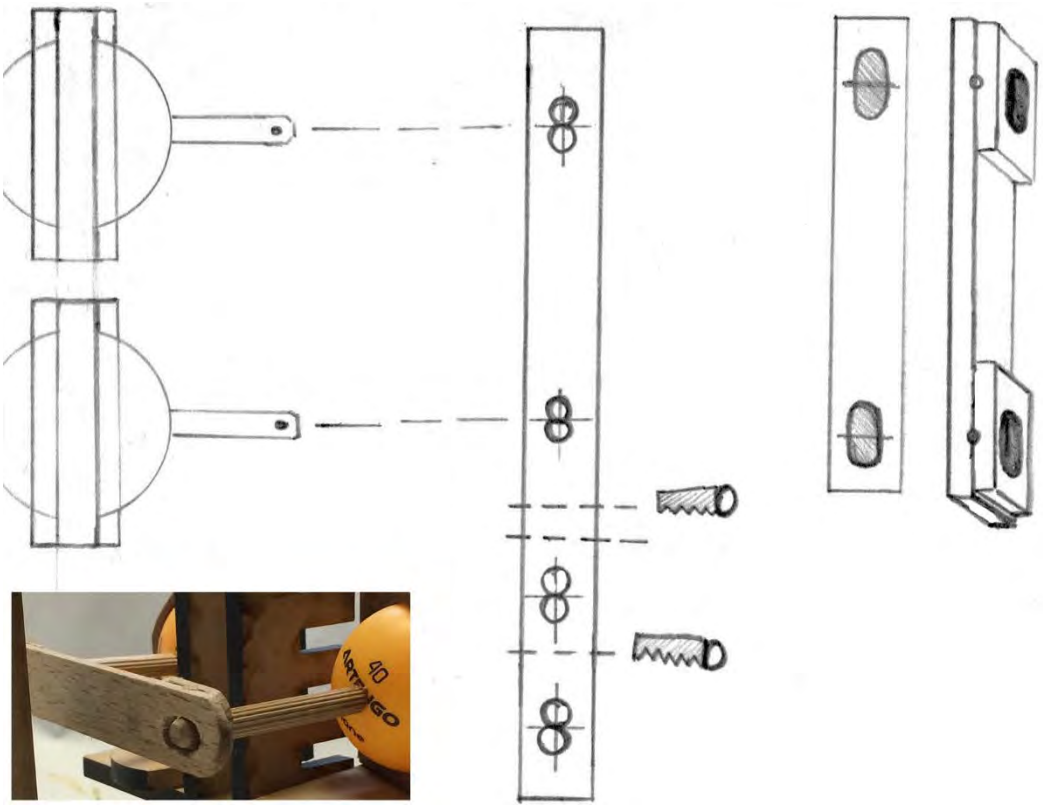

Each eye is housed in a narrow frame or box that consists of three layers of material. While the central layer only lightly holds the ball but leaves room for it to move freely, the outer layers hold the ball in place. The inner edge of these outer layers need to be sanded to fit the ball and allow for eye movement. They are cut with an oval shape that gives ample room for left-right movement, while they pinch the ball at the top and bottom. If an up-down movement is prefered, the outer layers are simply attached accordingly turned on their sides. Frames are marked ”up” in the top left corner for easy orientation.

While we used very thin sheet material (image above right) for the outer layers, it is easier to fashion these outer layers from the same sheet as the rest of the kit (image above left) – please note that the box becomes more stable this way, while the ball’s setting gets deeper. Depending on the construction of the puppet’s face, the eyes need to sit deeper in the head than possible with thin outer layers! If the outer layers get broken under sanding, they usually can easily be glued together again when fixed to the central frame of the eye-box.



Of course, puppets and controls with only one or more than two eyes can be build! The mechanism for conneting the eyes' rods might get a bit more tricky in the process. The most simple way to connect the eyes is by drilling the dowel at its far end vertically and connect the eyes with a stiff wire bent into shape (image above). A loop in the wire provides a grip for steering the eyes and allows for adjustments to the eyes' axes. By adjusting the length of the wire from the eye, possible cross-eyedness or other disalignments of the eyes can be changed or created.



For our puppets we built a wooden steering bar instead (images above), it is more solid. For this purpose, a strip of wood is marked in the distance of the eye's dowels. It is then drilled immediately to the left and right of each of these marks with a drill of the dowel rod's diameter. The holes for each rod are connected and turned into oblong cuts. Two additional oblong holes / cuts like these are drilled into the surplus length of the wooden strip. Only

after drilling, the strip is cut into the needed parts: the bar for connecting the eyes and the two short bits. These are glued in front of the bar's holes. Then they get drilled in their centre following the edge between the wooden bits with a 2 mm-drill. To not force them apart with the drill, they are held together while drilling with a clamp screwed tight.

The two plates for the jaws need to be cut and sanded into shape to fit and support the upper lip / jaw of the puppet and provide for the movability of the lower jaw's / lips, respectively. Depending on the style of play and demand on stability of the puppet as a whole, additional small supports can be glued into the head's shell to provide more connection between the controls and the head.

The upper jaw is glued into the slot provided at the bottom of the controls once it has been shaped according to the form of the puppet's head and after it has been taped to the lower jaw. The jaws do not need to shut tight onto each other, if the puppet is not intended to do clapping sounds with its jaw-plates. Tape the jaws end on end from the inside of the mouth, fold them on top of each other so that the puppet's mouth is shut and tape their rear ends to each other. In this way, the inner taping is stabilised by the outer taping (s. images below).

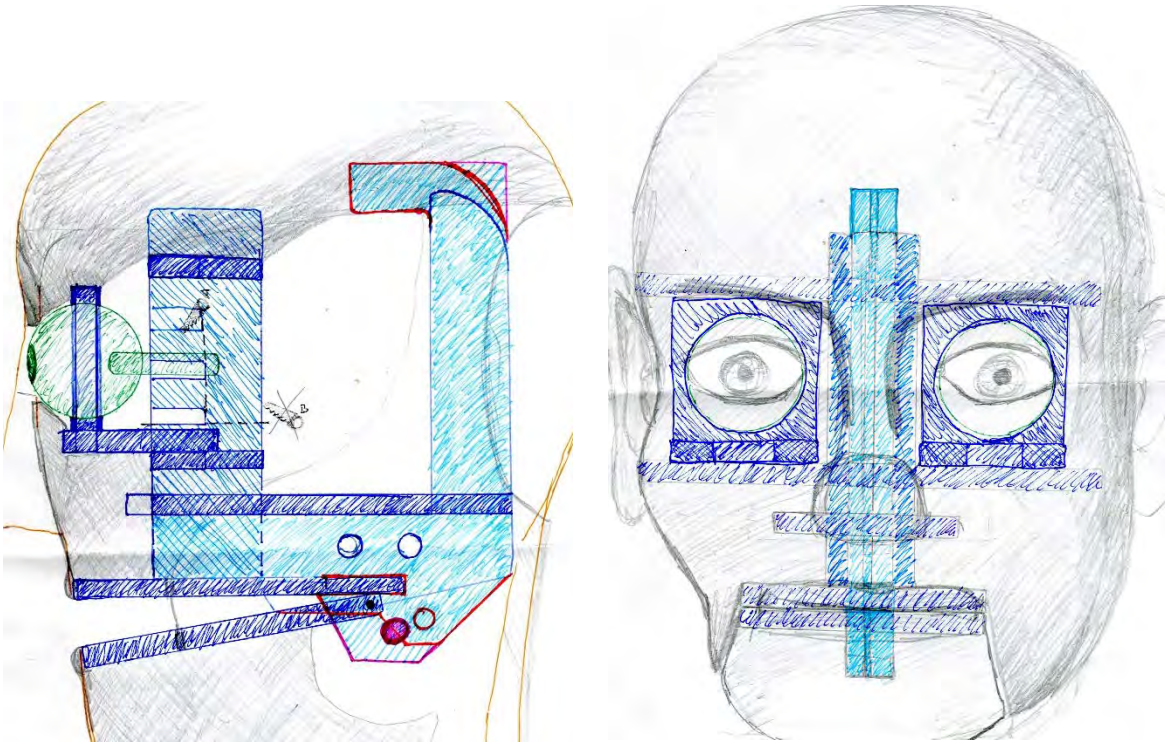



The upper jaw is provided as square plate, while the lower jaw has a cut-out to move freely over the control's slot for the upper jaw. They are prepared with holes to make the lower jaw move with some fishing line, nylon, or other thread. Depending on the form of the puppet's head, new holes need to be drilled after shaping the jaw-plates. Make sure to make massive knots into the end of the line / thread underneath the lower jaw and glue or tape it into place. The knot should make it impossible for the line to go through the hole in the lower jaw – if this happens after the head has been fully assembled, it might get very tricky to re-adjust and fix this...

The image above shows the placeing of the controls inside a head constructed from a 25 cm long cardboard Easter egg. It has an extra wide mouth and an extra plate to close it glued onto the lower jaw. Also, the horizontal bar has been glued into the forehead instead with the eye-boxes glued directly into the face for closest possible fit.

Advanced options:
Of course, you can adjust the basic form of the controls to get a lower neck-joint or to provide more supports for the head's shell at the upper end of the grip (see sketches below). For light heads built from cardboard shapes like large Easter eggs etc., these extra supports are not needed.

As described earlier, a second copy of the horizontal bar can be added to the existing two uprights of the control to stabilise the head even more and connect it even more to its controls. If more room for the connection of the eyes is needed at the same time, the front teeth of the uprights can be removed to keep the upright usable for supporting the top of the head (s. cut-marks in the drawing).



Below follows an image of the laser-cut sheet with added names for all parts of the building kit. The source file in correct size is available for download separately.