Yoshida Style

Ball Jointed Doll Making Guide

**Original book by: Ryo Yoshida**

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This translation is for use with the Yoshida Style BJD Making Guide Book only. This is in no way intended for use without the book as a replacement for buying the book. You can purchase a copy from Japan Hobby Link, Japanese Amazon.com, Ebay, or other sellers. This is an English translation that was created thanks to the wonderful Cambird, Keanna, and others on a thread on the BJD forum Den of Angels. I have pulled together their writings into a single document minimal editing, so some sections may be roughly translated. Please give all credit to Ryo Yoshida who originally wrote the book, those who translated it, and be thankful for this gift. –Kafae Latte

## Table of Contents (With links to original Den of Angels Thread)

KEY: Chapter, Chapter Subsection, Tools , No Translation Needed, Steps Explained

1.Blank
2.Blank
3.Image
4.Publishing Information
5.Title Page
6.Forward
7.Contents
8.Tools8 Tools [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2123643&postcount=49)

**9.**Chapter I Base

10.Chp I-1 Drawing and Sketch Steps 1 to 2 [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2329717&postcount=64)
11.Step 2[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2329717&postcount=64)
12.Chp I-2 Make a core of the doll Steps 1 to 2[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2151915&postcount=56)
13.Step 2 to 3[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2152422&postcount=57)
14.Step 3[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2152422&postcount=57)
15.Tools- 6 Tools [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2152422&postcount=57)
16.Ch I-3 Make a base Steps 1 to 2[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2156497&postcount=58)
17.Step 2 to 3[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2156497&postcount=58)
18.Image

**19.**Chapter II Modeling

20.Chp II-1 Model a face Steps 1 to 2 [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2260645&postcount=60)
21.Step 2[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2260645&postcount=60)
22.Step 3[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2260645&postcount=60)
23.Image
24.Chp II-2 Make a body Step 1 [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2319249&postcount=63)
25.Step 1[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2319249&postcount=63)
26.Step 2[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2319249&postcount=63)
27.Image
28.Chp II-3 Make arms and legs [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2841896&postcount=91)
29.Step 2[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2841896&postcount=91)
30.Step 2[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2841896&postcount=91)
31.Image
32.Chp II-4 Make hands and feet Step 1 [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2845845&postcount=93)
33.Step 2[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2845845&postcount=93)
34.Step 2[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2845845&postcount=93)
35.Step 3[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2845845&postcount=93)
36.Step 3[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2845845&postcount=93)
37.Image
38.Image
39.Image
40.Chp II-5 Sanding Step 1 [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2857352&postcount=95)
41.Step 1[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2857352&postcount=95)
42.Image

**43.**Chapter III Joints

44.Chp III-1 Make ball joints Step 1 [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2953243&postcount=101)
45.Step 2[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2953243&postcount=101)
46.Step 3[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2953243&postcount=101)
47.Step 4[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2953243&postcount=101)
48.Image
49.Image
50.Chp III-2 Fix balls Step 1- [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2953978&postcount=105)
51.Step 2 to 3[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2953978&postcount=105)
52.Chp III-3 Make joint's saucers Step 1 [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2954820&postcount=108)
53.Step 2[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2954820&postcount=108)
54.Step 2[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2954820&postcount=108)
55.Image
56.Image
57.Image
58.Chp III-4 Set up neck joint Step 1 to 2 [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2961428&postcount=114)
59.Step 2[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2961428&postcount=114)
60.Image

**61.**Chapter IV Construction

62.Chp IV-1 Artificial Eyes Step [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2961823&postcount=117)
63.Step 2[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2961823&postcount=117)
64.Step 3[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2961823&postcount=117)
65.Step 4[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2961823&postcount=117)
66.Chp IV-2 Make artificial eyes and teeth Step 1 [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2963084&postcount=118)
67.Step 2[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2963084&postcount=118)
68.Step 3[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2963084&postcount=118)
69.Image
70.Chp IV-3 Set up to put together arms and legs Step 1 to 2 [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2966591&postcount=119)
71.Step 3 to 4[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2966591&postcount=119)
72.Chp IV-4 Setup up to put together wrists, ankles & head Step 1 [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2967151&postcount=120)
73.Step 2 to 3[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2967151&postcount=120)
74.Step 4[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2967151&postcount=120)
75.Image
76.Chp IV-5 Jointing Step 1 [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2968807&postcount=126)
77.Step 2[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2968807&postcount=126)
78.Image

**79.**Chapter V Painting

80.Chp V-1 Foundation coating Step 1 to 2 [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2969033&postcount=127)
81.Step 3[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2969033&postcount=127)
82.Chp V-2 Foundation coating (advanced)Step 2 [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2969581&postcount=128)
83.Step 2[---LINK--](http://www.denofangels.com/forums/showpost.php?p=2969581&postcount=128)
84.Step 2 to 3[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2969581&postcount=128)
85.Step 3[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2969581&postcount=128)
86.Chp V-3 Creating Skin Step 1 to 2 [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2970344&postcount=129)
87.Step 3[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2970344&postcount=129)
88.Image
89.Image
90.Step 4[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2970344&postcount=129)
91.Step 4([--LINK--](http://www.denofangels.com/forums/showpost.php?p=2970344&postcount=129)
92.Image
93.Image
94.Tools8 Tools [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2976220&postcount=130)

**95**.Chapter VI Hair

96.Chp VI-1 Put hairs on Step 1 [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2976650&postcount=132)
97.Step 2 to 3[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2976650&postcount=132)
98.Chp VI-2 Top of the head Step 1 [--LINK--](http://www.denofangels.com/forums/showpost.php?p=2977339&postcount=133)
99.Step 2 to 3[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2977339&postcount=133)
100.Step 4[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2977339&postcount=133)
101.Step 4[--LINK--](http://www.denofangels.com/forums/showpost.php?p=2977339&postcount=133)
102.Chp VI-3 Hair arrange Step 1 to 2(None Yet)
103.Step 2(None Yet)
104. Image

**105.**Chapter VII Shoes

106.Chp VII-1 Make shoes Step 1(None Yet)
107.Step 2(None Yet)
108.Step 2(None Yet)
109.Step 3(None Yet)
110.Step 3(None Yet)
111.Step 4(None Yet)
112.Image
113.Image
114.Image
115.Image
116.Image
117.Image
118.Image
119.Image
120.Image
121.Image
122.Image
123.Image
124.Image
125.Image
126.Image
127.Image
128.Image
129.Image
130.Image
131.Image
132.Image
133.Image
134.Shop List and Reference(None Yet)
135.Image
136.Afterward
137.Printing Information
138.Image

**Pg 8**

## Tools

Translation: **By Suzanne B.:**

**1. Bamboo Spatula**
1. The commonly sold bamboo spatula is the same as the one in the top of the picture. However, it is best to customize your spatula in a way that is easy for you to use, shown in the bottom of the picture. A bamboo spatula on its own should be adequate, but it is also a good idea to have a metal-handled plasticine spatula and/or a sculpting spatula available. If you choose to customize your own spatula, shape both ends differently so that one is long and sharp, while the other is more rounded like a cylinder.
**2. Art Knife**
1. The handle is slim like a pen, which makes it easy to use and grip in your hand, as well as cut around tight corners. It resembles a design knife; however larger art knives are used more often than cutter knives for the purposes of molding and sculpting. The blade is removable from the handle, so it is a good idea to set aside several replacement blades beforehand.
**3. Cutter Knife**
1. Along with the standard size cutter knife, it is convenient to also have a larger, industrial-sized cutter knife available. However, it is best to avoid using handle or ratchet parts, since these are unreliable in using with resin, which is easily changed with too much power/pressure. (VERY rough translation here.)
**4. Drill and drill bits**
1. This will be used for opening up small holes at specific sizes by hand. After carefully inserting the drill bit into the drill, turn the handle slowly while carefully pushing down to open up a hole to the desired size. The drill itself is simply a holder, and will not be any good on its own, so make sure to acquire your drill and drill bits as a set to work with and to achieve maximum results.
**5. G-Clear adhesive (clear-drying glue – rubber cement?)**
1. A rubber-type fast acting adhesive. This can bond many types of materials, including solid plastic and elastic items. This is the type of adhesive that must be applied to each side of the object to be glued, and held together for about 10 minutes to set. Make sure you push the two sides together as strongly as possible to make sure the adhesive sets.
**6. Carpenter’s Glue (Wood Glue)**
1. A water-permeable, vinyl-type adhesive that can be used for gluing paper, wood, fabric, and other similar materials. It’s white when wet, but turns clear as soon as it sets. Because it is water-based, it will not stain or damage your materials, which is the strong point of this adhesive.
**7. Fast-setting glue/Superglue**
1. A chemical-based adhesive. The glue reacts chemically with moisture in the atmosphere in order to solidify almost constantly. It can quickly and strongly bond together many types of materials. However, it is weak against strong impacts, so there may be cases when it is necessary to add reinforcement.
**8. Compound**
1. An abrasive material used for erasing small chips or fine damage, as well as polishing and cleaning up the surface. It can be used in either liquid or half-solid form by applying to a soft cloth. This can also be used to polish and finish off glass and acrylic eyes, as well as repairing small chips and damages to both sides of the eyes.

**Pg.10, 11**

## Drawing & Sketch

~(doll ratios may be inaccurate)~

(Brown arrows)
1. Make a rough sketch
2. Draw a paper pattern

(Main block of text)
When undertaking a project like this, first we will make a life-sized sketch. This is very important because the core will be carved on the basis of this sketch, and it will determine the degree to which it has a doll image  . The joints will be made at a later stage so please concentrate on drawing the body line without thinking about the joints. Even before the expression of the face, hands and feet, the most important thing is a figure with balanced body proportions. These image-making dolls can be real, distorted, slender or glamorous etc. I think it will be easy to draw if you decide on the doll’s age. The ratio between head and body proportions changes with age. Infants are 4~5 head lengths to body height, older children are 6~7 and adults are 7~8. In physique also, children’s shoulders are narrower, and as age increases shoulders become broader and sturdier. It would be good to consult sketches of people in art books. (See pg. 134 for references) Please find the image that you want to make and decide on the proportions to match it.

**Materials:**
\*Drafting paper
\*Ruler
\*Writing equipment
\*Tracing paper
\*Scissors

1>> **Make a rough sketch**

1. Decide on the head/body ratio for the doll that you want to make. Here, the head will be 9cm with 6 head lengths in the body making a 54cm tall young female doll.
2. Because this is a 3D sketch we are going to draw it from the front and side. First, draw the front mid-line.
3. Draw horizontal lines to match your chosen head/body ratio.
4. Please take care to draw each point (chin, shoulder, crotch, knee, elbow, wrist etc.) at the same level on the front and side view.

2>> **Draw a paper pattern**

1. When the sketch is finished, overlay tracing paper to make a pattern for the core. Start by drawing the mid-line.
2. Please draw the core line around 5mm inside the finished body line. This 5mm gap represents the thickness of the clay.
3. Draw half of the front-view head and body with the mid-line on the tracing paper overlaid on the mid-line of the sketch.
4. Fold the tracing paper in two along the mid-line and cut out. When you flatten it out this will make a pattern with left-right symmetry.
5. It’s OK if you only draw one side for the front-view arms and legs and all of the side-view parts. You can turn them over to make patterns for the opposite side.
6. Please arrange it so that the thickness of the clay is thinner at the wrists and ankles. However, ensure that it’s no thinner than 2mm.
7. Draw the arms to one side, so they don’t overlay the body. There’s no need to make a pattern for the hands because they will be modeled on wire and won’t have a core.
8. Because it will be a nuisance if the core sticks out onto where the front of the face will be sculpted, make the clay thicker here to make it easier to sculpt.
9. Cut out all the pieces and the pattern is finished.

**Pg. 12, 13, 14**

Making a Core of the Doll

(Brown arrows)
1. Cut the styrene foam into blocks
2. Cut the styrene foam out (following the paper pattern)
3. Shave the core

(Main block of text)
Carve a core to use in making the clay base. Use general-type soft styrene foam for making the core, which will be removed at a later stage. If you use hard styrene it will be more difficult to remove. You should make the styrene core at a smaller size than the final measurements. Using a styrene core will make it easier to get an even thickness when applying the clay. Also, removing the core after the clay is dried is an easy way to make the doll hollow. It is a bit difficult to carve accurately, but it is OK to carve a bit too much off. However, please try to concentrate! When carving styrene foam you’re going to get small bits floating around and sticking with static electricity. Make sure you have a vacuum cleaner on hand before you start.

**Materials:**
\* Saw
\* Keyhole saw
\* Cutter knife (Stanley knife in the UK, Craft knife in US, I think)
\* Woodworking rasp (See page 41)
\* Copying equipment (= pen and pencil)
\* Stainless steel fish skewers
\* Ruler
\* Styrene foam

1>> **Cut the styrene foam into 6 blocks**
1. Place the pattern pieces on the front and sides of the styrene block and mark out the cutting lines.
2. You should have marked out 6 blocks for the head, torso, the two arms and the two legs.
3. Cut out the blocks using the saw or cutter knife.
Point: Use the appropriate tool for the thickness of the blocks. It’s OK to use a styrene cutter even here.
4. You have cut out 6 blocks.

2>> **Cut the styrene foam out**
1. Use a marker pen to transfer each of the patterns onto each of the blocks. Start with the side patterns first.
2. When you have marked out the sides, cut them out.
3. Next, copy the front patterns on to the styrene you have just cut.
4. When you have marked out the front lines, cut them out.
Point: Hold the knife vertically whilst cutting. If you hold the knife at an angle the shape will be distorted.
Point: It is easier to cut around curves using a keyhole saw with a sharp, narrow tip. It’s especially convenient when making larger dolls.
5. The body is now cut out. In the same way, cut out the head following the pattern.
6. There is only one pattern for each of the arms and legs, so reverse it to make left and right, and cut them out.
7. Reinforce the easily-breakable arms and legs with fish skewers or thin bamboo skewers.

3>> **Shave the core**
1. Having cut out the styrene according to the pattern we will now refine the shape. Gradually shave off the corners with a knife.
2. Refine the shape by removing the corners and rounding off, removing any unevenness.
3. It’s fine to do this with just a knife, but I use a woodworking rasp.
4. Use a rasp to even out the whole of the front of the body as well.
5. In the same way, you should refine the arms, legs and head.
6. Carve the head. The deep hollow where the eyes will be becomes one point. (i.e. one long hollow)
(Orange box) The core of the head
If you want to make a cute, young face the position of the eyes is below the halfway point of the face. For older faces, in contrast, the position of the eyes is above it. Because the eyes, nose and mouth will be made of clay, there’s no point trying to make any fine details at the styrene stage.
7. There is more detail to make on the face than on the other parts, so the clay will be thicker here. Take care while carving the curve of the forehead and the curve from the cheeks to the chin.
-Pg 14-
8. The finished styrene core. Test it against the plan and make sure that the thickness of the clay will be correct.

(Right hand top box)
**Advanced methods: Reusable cores**There is also a way that you can remove the core without destroying it by using a harder material (like Styrofoam for example), so the core is reusable.

1. Wrap the styrene in plastic or vinyl wrap and secure it tightly with tape. Cover it with clay and mould it to shape.
2. When the outside of the clay is dry and the inside is half-dry, mark the center line of the sides of the piece.
3. Cut with a knife through the depth of the clay only, following the line, separate the front and back into two parts.
4. To prevent warping, allow the clay to dry whilst still on the core, then you can remove the styrene.
5. Apply soft, kneaded clay to both of the cut edges, and stick together to return it to its original shape.
6. When it’s dry, check the parting lines for gaps and cracks and firmly repair.
However, it is important to study the rough sketch before you carve the styrene. The styrene core is the foundation of the doll’s physique, posture and movement. If the core is not made properly, then the applied clay will also not look like a real human. If you reuse a badly made core, then you will get a badly made doll, so if the first core is a problem please carve one for each body you make.

Advice
When it comes to the core, you can make it carefully following the rough sketch, but it’s only when the clay is applied that the true shape is created. This method of breaking the work down piece-by-piece makes it, in the end, quick and easy. However, when it comes down to it, this is only the core. If you over-carve the core slightly this can be corrected at the clay stage, but if the core is too big, the clay will not be thick enough which will cause a problem when it comes to molding.

**Pg. 15**

Tools

**Styrene foam**
This indicates a general white material.  If you use adhesives or markers including organic solvents it can melt and corrode, so please take care. If you cut it with a blunt blade you’ll get terrible static, so always use a new blade in your cutter.

**Styrene ball**
A styrene foam ball. It’s hard work to carve a ball from a cube, but companies like Tokyu Hands sell ready-made ones in all sizes. It’s much easier to use these.

**La Doll**
This is the best modeling clay to use for doll-making. It’s a standard clay with a good balance of moldability and strength. It’s water-soluble and sands well. It is also appropriate for making bisque dolls and the like. You should knead well before use to soften up the clay fibers.

**La Doll Premier**
This is also strong, and is slightly more light-weight and has a finer texture than La Doll. However, care must be taken as it doesn’t take further applications of clay well once it has dried. It is also weak with water so make sure you use it thick enough. It is a clay that is often used mixed half-and-half with La Doll (regular).

**Artista Formo**
This modeling clay has more fibers and the texture is coarser than La Doll, but it’s cheaper to buy and easier to carve so lots of people use it for making the core. There are three types: white, brown and green, and you can mix any of the colors together. There is also Wood Formo that looks like wood.

**Wood clay**
Made of a mixture of natural wood powder and chemical glue. You knead the powdered wood with water to use it. This clay is light and strong, so it’s good for use in large dolls. Because when it dries it shrinks quite severely and cracks appear, it is mostly used mixed with (stone) clay.

**Pg. 16-17**

Make a Base

(Brown arrows)
1. Stretch clay
2. Wrap the core in clay
3. Put the final touches on the base

(Main block of text)
From here on we will be getting into more and more clay modeling. First we will make a clay base which will become the foundation of the doll. It will take some practice to get the hang of wrapping the clay neatly. You will get a good, neat shape to the base if you don’t rush and if you wrap the clay tightly so it doesn’t slip and lose its even thickness. A bit of slippage will be offset by shrinkage when the clay dries, so there is no need to be nervous. Because the styrene part will be removed later, try to ensure that the clay remains uniform at its thinnest. On top of this, gradually adjust the rough sketch. As far as possible, try to get the proportions right at this stage.

**Materials:**
\* Clay (La Doll)
\* Clay rolling pin (e.g. some plastic pipe)
\* Clay board (Something the clay won’t stick to easily like a plastic board or a vinyl sheet)
\* Splittable chopsticks
\* Clay modeling tools, bamboo spatula
\* Brush, toothbrush
\* Bucket (for the brushes to go in)
\* Scissors

1>> **Stretch clay**

1. Prepare your clay board, and roll out 1/2 a pack of La Doll to an even thickness.
2. You can use some splittable chopsticks or some thick wire as a guide to get an even thickness.
3. Fill the bucket with water and wet your bushes.
4. To make the clay as sticky as possible, brush the surface with the wet brush to smooth it out.
Point: If, when you wrap the core in the clay, they don’t stick together and a layer of air is formed, it will make it harder to model.

2>> **Wrap the core in clay**

1. As soon as you have smoothed the surface of the clay, place the core on it.
2. Wrap the clay around the core.
3. Cut off the overlap at the seam with scissors or a spatula/modeling tool and then rub the edges together well.
(Box) Joining clay together
When you are joining bits of of clay together, make sure that there is plenty of moisture in the clay and it is soft. Knead it well and the bits of clay will become like one piece. If a layer of air gets between the bits of clay this will cause cracks later and make it brittle. If both the bits of clay have been moistened when they are stuck together it will be much harder for a layer of air to get in.
4. If there isn’t enough clay and some of the styrene is sticking out, add some new clay.
5. Take care at this point that the clay on the seam is well rubbed together and that the edges have become like one piece.
6. Remove a circle of clay so that you can see the styrene at all the places where joints will be created later (shoulders, hips, wrists, neck).
7. Wrap the arms and legs in clay in the same way. They will be less likely to break if you work with the skewers still through the core.

Advice:
The clay, which was rolled out to an even thickness at first, will be too thick on the wrists and ankles. Gradually stretch and thin out the clay towards the ends of the limbs and then it will wrap well. Rub the seams together so that the clay becomes like one piece. (The leg says ‘leg core’ and the grey line says ‘clay cross-section’ underneath. The red writing says ‘gradually thin out towards the ankle’ ‘approximately 5mm/2mm’. )

3>> **Put the final touches on the base**

1. Check all the proportions against the sketch again, now that the styrene is wrapped in clay. If the clay is wrapped too thickly, it will end up looking bulky.
2. It will be clearer if you assemble all the parts. Adjust any parts where the clay has been over-applied. Try to get the proportions right as much as possible at this stage of the process.
3. When this stage of the process is finished, let the pieces dry out once. Don’t worry about sculpting all the detail in one go.

Advice:
Before you let them dry, be sure that each part is stood up and can get the air all the way round. Letting them dry on their side will lead to distortions.

**Pg. 20, 21, 22**

Model a Face

(Brown arrows)
1. Make a foundation
2. Model a nose, eyes and ears
3. Regulation the detail (!)

(Main block of text)
When faced with a doll, everybody unconsciously looks at the face first. The face can be called the life of the doll. The important thing in modeling a face is balance. As with the body, the proportions of the face change with age. To make a cute, young face you should model the face below the halfway point of the head. Furthermore, whilst the body, arms and legs are all expressive, the expression of the face is the most important. Human expressions become doll expressions. There are many expressions outside of the obvious smiling and crying. Each sculptor can make an individual doll based on their own thoughts.

**Materials:**
\* Clay modeling tools, bamboo spatula
\* Brush
\* Copying equipment
\* Clay, water

1>> **Make a foundation**
1. Try drawing the general image you wish to create. It’s also OK if you just start building up the clay without drawing, if you prefer.
2. Wet the surface of the dry clay and use well-kneaded clay to build up. Rub it firmly into the dry clay. Please do it so that the wet and dry clay become like one piece.
3. From the side, the jaw line is about halfway from front to back. Make it three-dimensional. You should make the overall mood of the face first.
Point: There is a tendency to concentrate on one area at a time, but take care over the bone structure, the position of the eyes, length of the nose, size of the mouth etc. to make sure the face is well balanced.

2>> **Model a nose, eyes and ears**

1. When the overall positions are decided, model each individual part. First, make the roundness of the eyes.
2. Later we will put artificial eyes in, but first we will model the eyes closed.
Point: The eyes (artificial) are spherical, so please give the eyelids a spherical feel.
3. Sculpt carefully using a spatula and a brush. The brush is more convenient for sculpting parts with roundness or depth (lips, inside of the ears).
4. When using a brush, use an oil painting brush loaded with water on clay with a wet surface.
Point: For a child-like face, make a short, upturned nose, and a small, pouty mouth. In adults, the nose is longer and the mouth is larger.
5. When each feature is finished, use a spatula to open the eyelids and make the eyeballs. Here, as before, take care to make the eyeballs spherical.
6. This is when you make the fold in the eyelids.
7. Model the inner corner of the eyes (inner canthus).
8. Make the corners of the eyes continuous with the lower eyelids.
9. Always take care to keep the eyeball spherical.
10. Next we sculpt the ears. The ear is positioned halfway across the head (from the side). The bottom of the ear lobe is in line with the jaw line. The place where the upper part of the ear attaches is higher than the cheek bone.
11. Attach the clay firmly and make the outline of the ear.
12. Sculpt the details using a spatula and brush.

3>> **Regulation the detail** (pg. 22)

1. Recheck the balance of the entire head and each of the individual features as you fine-tune.
2. Adjust the eyes, bridge of the nose, tip of the nose, roundness of the lips, shape of the mouth, cheeks etc.
3. You should use the right tool (bamboo spatula, brush or finger) for each area.
4. The final adjustments will be made with a file and sanding later on. (See pg. 40)

Advice:
Newcomers to sculpture tend to make the face too flat. It’s no good if you only look at it from straight on!! Please inspect it from left to right, up and down, diagonally and from all directions, and check whether it is symmetrical or not. Using slight exaggeration will give it a more three-dimensional feel. That is to say, rounded eyes, nose and mouth over a rounded bone structure.

**Pgs. 24, 25 + 26**

Make a body

(Brown arrows)
1. Adjusting the proportions (Regulation)
2. Make the detail

(Main block of text)
Of course there is expression in the body, just as there is in the face. Recently it has been said that the expression of the body comes from the body language used in dance and drama etc., but dolls have exactly the same degree of expression as humans. A good posture with a puffed out chest will give a completely different impression to a stooped or slouchy posture, and emphasizing the muscles will give a feeling of tension. The volume of the chest and hips is also important. Please think about the face and the whole body image together as you make it.

**Materials**:
\* Woodworking rasp
\* Cutter
\* Modeling tool, bamboo spatula
\* Brush, writing materials
\* Clay, water

1>> **Regulation**
1. Let’s examine the dried out body from back to front, up and down, left to right, and from all directions. It’s easier to make sure that you have good left to right balance and symmetry if you look at it in reverse using a mirror.
2. Check the back and sides too, and roughly mark areas that need adjusting in pencil.
Point: It’s easier to understand the twists and distortions of the upper and lower body if you look from above and below.
3. Adjust any distortions by filing with a metal woodworking rasp (See pg. 41).
4. File and sculpt any parts where you added too much or too little clay, and any distorted parts.
5. Also file and sculpt the stomach.
6. Adjust any distortions while looking from above.
7. Now you’ve smoothed out any distortions on the body and it's nearing the finished image.

(Orange box) **Repairing cracks**
When you leave the clay to dry a few cracks will appear due to the contraction. Fine cracks can be repaired by simply adding more clay, but, because the clay won’t reach to the bottom of the crack, widen the crack with a cutter knife first. After dampening the crack with water, press well-kneaded, soft clay in to fill. It is best to prepare the clay in advance, making it softer and wetter than usual. Avoid using wood glue or similar products to repair cracks. The glue is harder than the clay and will create a raised seam when it comes to sanding.
1. First widen the crack with a cutter.
2. After wetting the crack with water, fill it with well-kneaded, soft clay.

2>> **Make the detail**
1. When you have filed the body so the final shape is visible, add clay and sculpt the details.
2. You must moisten the surface of the dry clay and rub the wet clay in well so as to make a good bond and avoid creating a layer of air.
3. On parts that you wish to appear soft and round, you can quickly get a beautiful finish by using your fingers. The fingers surpass all else as a tool.
4. The deltoid muscles, which run from the shoulder to the arm and attach the arm to the body, are easy to sculpt.
5. Consult anatomical diagrams of muscles. The modeling of the shoulder is determined by the thickness of the arm and decisions about balance. You should aim to get the shoulder to this thickness (like in the diagram).
6. After you have sculpted the arm, cut it off again.
7. The modeling of the buttocks and thighs is determined by the thickness of the legs and decisions about balance. Again, after you have attached and sculpted the legs, you should cut them off.
8. You will adjust the details and resculpt while you do the sanding later. (See pg. 40)

Advice:
Ball-jointed dolls are made in parts. Because of this, if you sculpt each piece in a daze, no matter how well the details are made, the overall balance will be destroyed. Please align and check all of the parts together from time to time. (??? I don’t get this line here ^^; ) Please consult anatomy manuals for artists (See pg. 134) for sketches of skeletal and muscular structure.

**Pg. 28, 29 + 30**

Make arms and legs

(Brown arrows)
1. Model the arms
2. Model the legs

(Block of text)
Because regulating the arms and legs are delicate compared to the head and body, they are difficult parts to understand and model. On top of that, there is left and right to consider and you must take care with the symmetry, making it harder still. Take your time and carefully observe the human body, and with patience you can do it well.

**Materials:**\*Woodworking rasp
\*Cutter
\*Modeling tool, bamboo spatula
\*Clay, water
\*Writing materials

1>>**Model the arms**

1. First, check the balance of the whole body, and make the approximate thickness of the shoulders and deltoids.
2. Adjust the thickness of the part that attaches to the shoulder.
3. Compare the length of the arms with the body. They should be slightly shorter than thigh height.
4. The position of the elbow is below the halfway point of the arm. The top part of the arm is longer.
(Box) **Tendencies with arm length**Arm length varies between individuals. If you make the legs long, you should make the arms long as well. Here I am making average proportions. Please take care because the length of the arm will increase when you add the ball joint at the wrist. Human circular movement in the arms and legs is governed by the muscles that stretch between the joints. This time I’m aiming for a relaxed upright posture, so the elbows are at the back and the thumbs point to the front. In short, the arms hang slightly twisted from elbow to wrist.
5. Compare the two arms and adjust the length, thickness and muscle balance. First compare the length.
6. The left arm is longer. Mark it with a pencil and then saw off the excess.
7. Also compare the thickness and mark inconsistencies with a pencil.
8. Carve it with a cutter etc. to adjust the thickness.

(Orange box) **When the styrene comes through.**
There are times when you will expose the styrene core by carving or rasping. Also, there may be places where you made depressions in the clay with your fingertips and it is too thin. In this case, please carve the styrene down and add more clay.
1. Carve the styrene down.
2. Repair the clay
3. Adjust the shape.

2>> **Model the legs**
1. Align the legs with the body in the same way as for the arms, and check and adjust the balance.
2. Please check the thickness is in proportion from the waist to the thighs.
3. Next compare the two legs for length and thickness and adjust if necessary.
4. Check both legs from the front as well, and confirm the position of the knees.
5. Don’t forget to check that the parts where the legs attach to the body are the same thickness.
6. Carve to adjust the attachment places.
Point: Make the shins below the knee longer to create a slender and carefree impression.
7. Carve following the line of the sartorius muscle in the inner thigh.
Point: The line of the legs viewed from the front at the inner thigh and around the knee creates the difference between left and right and so is very important. (Sartorius muscle, rectus femoris muscle, vastus lateralis muscle, vastus medialis muscle)
8. Check that the inside of the knee overhangs and the outside is indented. Please make sure there is a difference between the lines of the inside and outside of the calf.
9. Carve the inside of the calf with a cutter or rasp etc.
10. Carve under the knee in the same way.
11. Take care that the knee doesn’t stick out too far when viewed from the side.

Advice:
Joints are intersections where muscles cross. The ball joints will be added later, but please make sure that the muscles are modeled properly first. It’s complex, but modeling will become easier if you understand the muscles and their structure.

(Orange box) **The structure of muscles**
The muscles of the arms and legs are complicated. Try to be conscious of the flow of the muscles as much as possible when you sculpt. The lower front side of the deltoids with the upper arm biceps and the back of the upper arm triceps. The brachioradialis muscle that runs down from the elbow with the flexor carpi radialis muscle and the flexor carpi ulnaris muscle etc. Try to keep all these complicated muscles in mind as you sculpt, but if you understand them from the beginning there shouldn’t be a problem. If you emphasize the muscles of the arms almost unlimitedly you will create a burly, wrestler-type body. Please refer to a number of naked photos and anatomical drawings first.

**Pgs. 32, 33, 34, 35 + 36**

Make Hands & Feet

(Brown arrows)
1. Make cores for the hands
2. Wrap the hand cores in clay
3. Model the feet

(Main block of text)
Next to the face, the hands and feet are the easiest parts of the body to make expressive. Looking at the famous brand antique dolls which history has left to us, we can see that the hands and feet have been modeled with just as much care as the face. Because fingers are easily damaged we model them around a wire core. As for the toes, we can model them without leaving spaces between them. Because of this, they are less easily damaged and we can use clay with a styrene core instead of wire. Modeling the hands and feet, and especially the fingers and toes, is very delicate work and requires a lot of patience, but when you dress the doll, next to the face, they are the parts that most draw the eye. Let’s take our time and make them carefully.

**Materials:**
\*Aluminum coated wire (1.5mm diameter, larger-scale dolls will need thicker stuff.)
\*Pliers
\*Absorbent cotton
\*Wood glue
\*Instant glue
\*Thread (Embroidery thread, cotton no. 8 for example.)
\*Rasp
\*Clay modeling tool, bamboo spatula
\*Brush
\*Clay, water

1>> **Make cores for the hands**

1. Cut 10 pieces of aluminum wire 1.5x the length of the face.
2. First prepare a number of sections of absorbent cotton, by lightly stretching them.
3. If the wire is bent, roll it under a board or some other flat surface, until it is straight.
4. In order to cover the wires with cotton, thinly apply wood glue.
5. Lightly cover the glue-covered wire with cotton.
6. Roll the wire around to cover it with the cotton.
Point: This is groundwork to make it easier for the clay to stick. Please take care not to wrap the cotton too thickly.

(Box) **Hand cores**
The thickness of the wire should suit the size of the doll. You should use thicker stuff for a larger doll. Stainless steel wire is also good. Please avoid using iron wire, because in a few years you will get brown rust spots appearing on the surface of the clay. If you are making extremely small or cloth-stuffed dolls you can simply build up the cotton to the right thickness and model the hands without any clay.

7. Decide on the size of the hands.

(Box) **Hand size**
In comparing the hands with the face, the distance from the palm of the hand to the tip of the middle finger is the same as from the chin to the forehead. The size varies between individuals, with age and the image you want to achieve, but small children and cute dolls should have smaller hands, and adults or dolls you want to make look strong or forceful should be larger.

8. Adjust the balance of the finger lengths. Tightly tie a thread at the wrist position.
9. The thread should be good and strong, but please don’t make it too thick. Saturate the knot with instant glue to reinforce it.
10. Look at it again. If the balance of the fingers is wrong, cut the tips off with nippers. This completes the core.

2>> **Wrap the hand cores in clay**

1. First make the palm of the hand. Thinly cover the core in wood glue to make the clay stick better.
2. Wrap the palm in clay.
3. Adjust the shape of the palm. Please take care not to make the palm square.
4. Give expression to the finger cores. Familiarize yourself with the muscles of the fingers and how they move. Please move the fingers with narrow pliers.

(Box) **Finger expression**
Straight fingers give a hard, stiff impression, so I think it’s better to have some movement. Try putting your own hands in the same position as the doll’s and learn to recognize a forceful expression from a relaxed one. Let’s please try to avoid impossible, broken-bone sorts of postures.

5. Attach the hand to the arm and check the thickness of the palm. Make sure it has a good balance and isn’t too thick or thin.
Point: The joint of the thumb is in a different position from the rest of the fingers. The distance from the wrist to the finger joints varies, the little finger is closer than the index finger.
6. Make flat pieces of clay to wrap the fingers in. If you thin out the clay at the tips of the fingers now, it will make it easier to get a nice finish later.
7. Apply glue to the fingers.
8. Wrap each finger from the palm side.
9. Once you have wrapped the finger, use a spatula or a brush to model, bearing the muscles in mind as you do.
10. When you have attached clay to all five fingers and modeled the muscles etc. check the overall balance and expression again.
11. Adjust the balance with a bush or spatula. Model them as completely as you can.
Point: If you find the tips of the fingers and fingernails difficult to model in soft clay, please leave them to dry and then carve with a knife or add more clay to model.
12. Model the other hand in the same way, comparing it with the first.
13. Compare the sides.
14. Compare the backs of the hands. Compare the two from all directions and finish the second hand.

3>> **Model the feet**

1. Roughly model bases for the feet in clay. When they are dry, shape them with a woodworking or rough metal rasp.
2. Draw on the ankle, the achilles tendon, the arch of the foot and the heel with a pencil and adjust these areas with a rough rasp.
3. Wet the areas you want to add clay to with a brush.
4. Apply soft, kneaded clay.

(Box) **Foot size**
Compared with the hands, in proportion to the toes, the foot is bigger. Please decide on the age and image you want. There are differences between individuals, just as with the hands. If the hands are big, then the feet should be too to create balance.

5. Model each of the toes with a spatula, keeping an eye on the balance as you do. Let’s make it look as though each toe is separate.
6. Let’s try to model the sole of the foot so it looks as if each of the toes is separate from there too.
7. Let’s make some expression by modeling the muscles and creating soft, rounded toes with a wet brush.
8. Model the muscles and roundness with a wet brush on the sole as well.
9. Let’s compare the two feet in the same way that we did with the hands as we model the other foot.

Advice:
A line on the sole of the foot which extends from the big toe bone makes the inside of the foot high, and the outside low. Viewed from above, the tip of the foot is lower than the heel, and the toe joints get lower towards the little toe. Look at the features of your own feet, be aware of their shape when they are standing flat on the ground and take care not to make them look unnaturally large. It is important to compare the left and right frequently.

(Orange box) **Advanced level: Making cores for the feet**You can also model each of the dolls toes separately. In that case, you should make a wire core for each of the toes in the same way as for the hands, to protect against damage. Please refer to the finger instructions for how to make them. First, prepare wires that are twice as long as the distance from heel to toe tip.
1. Wrap them in absorbent cotton, tie and fix a thread around the arch of the foot. The two on the right are foot cores, the two on the left are hand cores. Because the length of the toes is more even than that of fingers, the wires are lined up from big toe to little toe in order of length.
2. Bend the arranged wires at the point that will become the inside of the heel.
3. Cut the bent wires at a point short of the toe joints.
4. Please bend the wires being aware of thickness at the inside of the top when it is wrapped in clay.
5. Cover the wires in glue as you did with the hands. Wrap them in clay and make the top and sole of the foot.
6. Make the top of the foot in the same basic way.
7. Cover the toes with glue in the same way that you did for the hands, apply flat pieces of clay from the sole and then model.

**Pgs. 40 + 41**

Sanding

(Brown arrows)
Metal rasp
Sanding sponge
Sandpaper

(Main block of text)
You should sand each part of the doll as you model them. No matter how neatly you model the surface of the the clay, it will still be essential to make adjustments by sanding after it has dried. Sanding isn’t simply polishing the surface, it carves the clay and therefore is part of the modeling process. You will get a smoother shape if you use a rasp first. You may think you it will be okay to go straight in with sandpaper, but think again...

**Materials:**
Metal rasps
\*Woodworking rasp (half round)
\*Fine-toothed metal file for polishing (half round etc.)
Sanding sponges
\*Medium (#120~#180)
\*Fine (#240~#320)
Sandpaper
\*#80, #120, #240

**Sanding**
1. When polishing comparatively simple surfaces, start out using a coarse-toothed metal rasp.
2. Even out the surface.
3. You can quickly get a smooth surface if you use a coarse-toothed rasp.

(Box) **The sanding process**
Always start sanding using a coarse-toothed rasp. If you miss this stage out and go straight for the fine sandpaper, you won’t even out the inconsistencies properly and will end up with a smooth, but wavy finish. You will then have to go back and start over with the rasp, and will have wasted a lot of time.

4. The coarse-toothed rasp has left scratches.
5. Let’s even out these scratches with the more gentle sandpaper (#120) and sanding sponges.

Advice:
You should use the coarse-toothed rasp for modeling. Use a vacuum cleaner and a damp cloth to get rid of the clay dust as you work, so you can easily inspect the surface for scratches and parts that still need sanding.

(Top orange box) **Metal files/rasps**
Because you can get delicate files to suit each part that you are sanding, it’s probably a good idea to invest in a set with several types in it. Fine-toothed ones are convenient for delicate parts, but because the teeth are fine they will need regular cleaning with a wire brush or similar to stop them getting clogged. When it comes to larger ones, gently tapering half-round woodworking rasps are the most suitable.
**Picture:**
Top left = Woodworking rasp (half round)
Top right = Woodworking rasp (round)
Bottom = Fine-toothed metal file for polishing (half round) <—or it might be metal polishing file?
Other picture:
An example of how to use the fine-toothed metal file (half round).

(Middle orange box) **Sanding sponges**
I recommend sanding sponges, which are soft and allow you to feel the shape of the body. Aside from simply using them flat to polish, you can use the corners, or they can be folded in two to create a rounded edge. They are soft on the hands, and highly durable, making them a very user friendly type of sander.
Picture 1 shows a medium sanding sponge.
Picture 2 says “An example of how to use them flat.”
Picture 3 says “An example of how to use them folded in two.”

(Bottom orange box) **Sandpaper**
Sandpaper is the best thing to use for sanding the delicate parts such as the face, hands and feet. Cut it to suit the shape of the part you want to sand, fold it to make corners, roll it up like a toothpick, or stick it to a flat board..., it can be used in many different ways. However, please take care not to over-sand and lose delicate expression.
1. Cut a small piece of sandpaper and fold it up.
2. Make the tip into a point.
3. Use it on the delicate parts.

**Pgs. 44, 45, 46 + 47**

Make ball joints

(Brown arrows)
1. Setting up and cutting the joints
2. Preparing the sockets
3. Making balls
4. Wrist and ankle balls

(Main block of text)
There are lots of opposing views about how to joint dolls. Even in antique dolls there are many different types of BJDs. In Japan, there are the uniquely-jointed ‘Mitsuori ningyo - three-fold dolls’, which have been made since the Edo period. In 18th century Europe, jointed bodies were applied to bisque dolls, and from then until now they have continued to be made from all kinds of materials. The doll we are making now has 13 joints: at the neck, shoulders, elbows, wrists, hips, knees and ankles. The neck, shoulder, elbow, knee and hip joints will have styrene cores, but the wrists and ankles will be solid clay. The clay in the wrist and ankle joints needs to be thick enough to embed wire in.

**Materials:**
\*Styrene balls
\*Writing materials
\*Saw
\*Knife, graver/chisel
\*Nippers
\*Woodworking rasp, file
\*Modeling tool, bamboo spatula
\*Clay, water

1>> **Set up & cut the joints**

1. We are going to cut the center line of the knee, ankle and elbow joints.
2. Mark the cut lines, making sure that the lengths are the same on the left-hand and right-hand parts.
3. Cut the knee at the center line of the knee.
4. Cut the ankle at the center line of the ankle.
5. Cut the elbow at the center line of the elbow.
6. Here they are with one side cut. Now let’s cut the other side as well.

(Orange box) **Choosing the ball size**
The size of the balls is even more important than getting the lines in the right place. If the ball is large, and the socket small (a lot of the ball is visible), it will only have a narrow range of movement. For ‘balls that follow the line of the body’ (here that’s the hips, ankles, shoulders and wrists), we use slightly larger balls, and for ‘balls that move towards the inside of the body’ (that’s the elbows and knees) we use slightly smaller balls. This time, for the purpose of teaching, I have used a mixture of both types, but once you get used to them and with a bit of effort you can choose the joint size for the image you are trying to achieve.
Left picture: Following the line of the body
Right picture: Moving towards the inside of the body

2>>**Preparing the sockets**

1. For the knees and elbows, you want to get the balls in place without changing the length of the parts. In this case, use a ball that is slightly smaller than the cross-sectional diameter of the knee or elbow. (We will make the balls at the next stage.)
2. In short, we are going to set up a ‘balls that move towards the inside of the body’-type ball joint.
3. First, mark the center lines of the knees with a pencil. Do the same on the elbows.
4. Draw lines on the cross-section of the knee between the center lines you just drew. (The orange bit in the picture is labeled “The thickness of the knee.”

(Box) **Positions of center lines**
Ensuring that you leave at least 2mm thickness all round (not including the thickness of the kneecap), draw a circle, taking the point where the center lines cross as the middle. The diameter of this circle will be the diameter of the ball.

5. The back half of the knee joint will be cut diagonally, so draw this line on. Draw one on the thigh side as well.
Point: The angles that you cut here will be the angles that the knee and elbow joints can move through.
6. Carve the back half of the knee up to the center line with a woodworking rasp, and following the diagonal lines you just drew.
7. Let’s make it so that each part is a 45º angle, making 90º of movement when they are together.
8. Try bending the joint to make sure there aren’t any irregularities. Please make the elbow in the same way. If there isn’t enough movement in the joint, please adjust the angles so that more of the ball will be visible.
9. Next, extract the styrene core. This is to make cavities to thread the elastic through later.
10. Use a cutter or coarse-toothed round metal rasp.
11. Pull out the styrene core from the other parts as well, bit by bit.
12. Carve into the front part of the knee to match the curve of the ball using a round graver/chisel.
13. The knee has been carved. Let’s carve the shoulder, elbow and thigh joint sockets in the same way.
14. Adjust the shape to fit the ball, maintaining the minimum thickness all the while.

(Box) **How to carve the edges**
Adjust the edges so that the finished ball line and the line of the body part become one part in outline. You should do it so the ball doesn’t rattle. If we carve away the places marked in red on the diagram where the edges are thick, the curves of the ball will be held stable. However, because we are going to stick the ball in with new clay, please make sure the walls aren’t so thin that they will break when wet. It’s important that the clay isn’t so thin you can see through it when you hold it up to a light.

3>> **Make balls**

1. Use ready-made styrene foam balls for the cores. You don’t need to carve them from left over styrene.
2. Prepare styrene balls that are smaller than the finished diameter of the ball joints. The size of the finished balls varies between joints.
3. Roll the clay out flat in the same way as you did when making the body.
4. Wrap the flattened clay around the styrene balls.
5. Make delicate adjustments, while comparing the sides of the ball with each joint surface, until it approaches a perfect ball shape.
6. Make it so that the knee ball fits the previously made inside of the knee joint.
7. In the same way, make sure the elbow ball fits the inside of the elbow joint.
8. This is the elbow. Make it so the ball is hidden.
9. For the neck, make the ball so it is slightly larger than the neck cross-section.
10. So that the hip balls follow the line of the body, make them the same diameter as the cross section of the thickest part of the thigh.
11. In both the shoulders and hips, if you make the balls the same diameter as the thickest part, they will follow the line of the body.

4>> **Balls of wrists & ankles**

1. First, carve out the clay around the aluminum wire of the hands.
2. Use nippers to cut the aluminum wire down as short as possible. If you don’t cut it very short now, the wire will stick into the ball and cause problems at later stages of the process.
3. Fill the wrists with soft clay and make round hemisphere shapes.
4. Check and adjust the size so that it makes a natural line with the arm from the front and side. If it’s hard to build up clay on to the hemispheres, it’s OK to make them just with clay in the same way as for the ankles.
5. Carve the foot down with a rasp until level with the center line of the ankle.
6. Hollow out the inside edges with a round chisel.
7. Make the ankle ball with just clay.

Advice:
The center line of the joint is the center line of the ball!! Let’s make all of the joints so that, as far as possible, the center of the ball will become the center of the joint.

8. Please fit to the leg and decide on the size of the ankle ball, taking note of the line of the leg from the ankle.

**Pgs. 50 + 51**

Fix the balls

(Brown arrows)
1. Fix the hip joints.
2. Fix the elbows and knees.
3. Fix the shoulders

(Main block of text)
We have made balls of the appropriate size for each joint. Now we will fix the various balls into one side of the joints. The balls for the joints are fixed-type, there are also completely unfixed independent-type ball joints, but this time we will simply fix the leg balls in. If it’s important to have movement, you should make slots or enlarge the holes in the balls to loosen the tension of the elastic threaded through them. In this case the slots will move in the wrong direction if the ball is not fixed. There are 13 joints altogether, but because each one is basically the same, I am only explaining the essential points. Please proceed being consciously aware of where the center line of each ball will come. Let’s do it so that the hip joints’ center line is at the hips, the elbows and knees are on the cut lines and the shoulders are at the point where the side of the body and underarm meets.

**Materials:**
\*Chisel/graver
\*Bamboo spatula
\*Writing materials
\*Clay, water

1>> **Fix the hip joints**

1. Align the ball with the thigh-side of the joint, and mark the join position. Let’s do it so that the bottom third of the ball is in the socket.
2. Open a hole in one part of the ball. Please maintain a 5mm overlap where the ball will be fixed in.
3. Using a round chisel, let’s open up as big a hole as we can.
4. Dig out the styrene.
5. Fix in the hip joint ball. Moisten the hip joint you are going to fix to with water and then apply soft, kneaded clay.
6. Also moisten the hip joint ball with water and apply soft, kneaded clay.
7. Rub in to fix.
8. Please neatly remove the excess clay with a bamboo spatula.
9. We have fixed the hip ball to the thigh part. Now fix the other hip joint in the same way.

2>> **Fix the elbows and knees**

1. Adjust the ball so that 1/2 is above the center line and 1/2 is below.
2. Align the center line of the knee with the cut part of the front side, and mark the join line.
3. Decide on the position of the hole, leaving an overlap, and then open it up.
4. Dig out the styrene core.
5. Rub soft, kneaded clay on to the parts to be stuck together. First, do the lower leg.
6. Rub clay onto the knee ball as well, realign the ball and knee joint center lines and fix in place.
Point: Push the ball into the front of the knee as much as possible. This is to stop the kneecap getting too thick.
7. Remove the excess clay with a bamboo spatula.
8. Let’s also remove the clay from the top of the knee with the spatula.
9. Let’s fix the elbow balls to the lower arms in the same way as for the knee joints.

3>> **Fix the shoulders**

1. The center line of the shoulder joint comes at the point where the sides of the underarm and body meet. Decide on the position of the hole with surrounding overlap.
2. Let’s make sure we haven’t made a mistake in marking where the hole will be.
3. When fixing the shoulder ball to the upper arm, first mark it at one point.
4. Align the red mark with the lower arm and, as you fix in place, gradually move the ball until the hole is pointing downwards.
5. Rub clay over the portions to be joined and fix in place. Please take care not to apply too much clay as you will fill in the hole.

(Box) **The holes in the shoulder balls**
Please take special care when fixing the shoulder balls, as the direction of the holes in the these balls is different from the others. If you fix on the shoulders with the holes on opposite sides of the cross-section, as on the other joints, you will not be able to thread elastic through later. Let’s gradually turn the large hole towards the wrist as we fix the ball in.

**Pgs. 52, 53 + 54**

Make sockets for the joints.

(Brown arrows)
1. Adjusting the contact points.
2. Making the sockets.

**Materials:**
\*Woodworking rasp, file
\*Modeling tools, bamboo spatula
\*Clay, water

(Main block of text)
Once the hip, elbow, knee and shoulder balls are fixed in place, we will make the sockets (the holes on the opposite side of the joints that the ball fits into.) The stability of the doll depends on this stage of the procedure. If the sockets aren’t a tight fit, the joints will rattle and the doll won’t be stable. This stage is very important in creating a doll that can stand on its own. Let’s do it carefully.

1>> **Adjusting the contact points**

1. Try fitting the parts with the balls in to the upper hip joint and check for gaps.
2. If there are gaps, the joint will rattle and be unstable, so let’s carve down the sides of the socket holes as thin as possible.
3. This is me carving the shoulder part. Please remove the remaining styrene core.
4. Adjusting the thickness of the the hip sockets.
5. Test fit the hip joints with the body, and adjust them so that the center line of the balls is at the hip position. (Picture: the arrow points to “Center line of the balls”, and the horizontal dashed line is “Hip position”.)

(Box) **On the size of holes and balls.**
Please take care over the size of the holes and balls of the hips, ankles and wrists. If you make the holes different sizes on the left and right sides, the ball will go deeper into the larger hole and less deep into the smaller one, and this will be reflected in the length of the limbs. Particularly in the case of the hips, if the sockets are different sizes on the left and right, the body will lean over both when standing and sitting. Let’s make it so the center line of the hips, and of the ankle and wrist joints come at the center line of the balls.

6. Make the size of the holes on the left and right equal. Check them from the front.
7. Let’s also check them from the back. If it’s uneven, adjust by adding more clay and carving away the edges as on pg. 46.
8. Please also check from the sides. Please verify the elbow, knee, wrist and ankle sockets in the same way.

2>> **Make sockets**

1. First, let’s make the knee sockets. Apply a layer of kneaded clay around the thigh hole.
2. Moisten the lower knee ball. Take care because the ball must be completely dry and fixed in for this to work.
3. Keeping the axis central, press the ball into the clay while turning it left and right.
4. Let’s remove any excess clay with a bamboo spatula.
5. Pull the joint apart while turning it left and right on the same central axis.
6. It takes skill, but I think with a bit of practice you can do it well. After it’s dry we will adjust it again.

Advice: If you wet the ball part of the joint with plenty of water, push it in while twisting it and pull it out while twisting it, it will go well. When making the socket part of the joints, take into account the fact that the clay will shrink. After it’s dry, you will need to add more clay to the parts that have shrunk. Please proceed carefully here as well.

7. Please make sure that when the ball is in the inside of the knee, the cut surfaces fit together accurately. (Picture: “Fits together here”)

(Box) **Getting the joints straight**
When making the sockets for the knees and elbows, please persevere until the knees and elbows are completely straight when in a stretched out pose. For the legs this is an erect standing posture. If you establish the socket shape by pressing the balls in with the joint in a bent position, you will end up with gaps when the limbs are stretched out. Particularly with the knees, if you have gaps, this is the number one cause of joints rattling and the doll having trouble standing, so please take care.

8. The knee socket is finished. Please make the elbow sockets in the same way.
9. Next is the hip joints. Make them in the same way as for the knees. Let’s apply a layer of kneaded clay to the holes in the body side.
10. Moisten the ball on the thigh-side of the joint. Take care because the ball must be completely dry and fixed in for this to work.
11. The angle between the body and thigh mustn’t be more than 90˚ when viewed from the side, or the doll won’t be able to sit independently. It will fall over.
12. If the range of movement is too limited, please carve away the places where the body and thigh meet (marked in red in the photo) to increase the degree of movement.
13. The socket of the hip joint is finished.
14. Make the ankle and wrist sockets in the same way. You can carve away slightly from the front and back of both and still preserve the appearance and range of movement.
15. The shoulder sockets are made in the same way, but please press the place where the ball is fixed into the arm (i.e. the upper part of the arm) into the body.
16. Adjust it so that the body, ball and arm flow naturally without any steps in the shoulder line (marked on the diagram). Let’s take care that there aren’t any gaps in the sides.

**Pgs. 58 + 59**

Set up the neck joint

(Brown arrows)
1. Carve the joint surfaces
2. Fix in the ball

(Main block of text)
All the body ball joints are finished. Let’s finish the remaining neck joint. We will set up the neck joint by putting a ball in between the head and neck. We will fix the ball to the neck-side of the joint, making sure the neck is the right length with the ball in place. It’s also OK to fix the ball to the head-side of the joint, so I will explain how to do that as well. Please refer to the previous section for how to fix the ball in and make the socket.

**Materials:**
\*Woodworking rasp, chisel/graver
\*Modeling tools, bamboo spatula
\*Clay, water

1>> **Carve the joint surfaces**

1. Carve the inside of the head and neck, which the neck-joint ball will fix to.
2. When carving the hole on the head side, please take care to do it without losing track of the center.
3. Please place the ball and head on the neck, and check the length. Let’s make the length of the neck with the ball in place look natural.
4. At this point, let’s check it from the side to see if the center of the head and neck are aligned.
Point: The joint will move well if the ball is slightly larger than the cross-sectional width of the neck. Let’s move the head around and check its action.

2>> **Fix in the ball**

1. As with the other joints, mark the hole position, leaving an overlap, open up the hole and dig out the styrene core.
2. Rub soft, kneaded clay around the edges of the neck and ball holes.
3. Fix the ball in, rubbing it firmly into the neck. Please neaten by removing the excess clay with a bamboo spatula.
4. Because we fixed the ball into the neck, we will establish the socket on the head side. Let’s be sure to do this stage after the ball is thoroughly dried and fixed in. (See pg. 53 for details)
Point: Make the joint so that one third of the ball is in both the neck and head sides. The scope of the remaining middle third of the ball creates the range of movement of the head.
Point: If you hollow out part of the jaw on the outside of the socket (marked in red), taking the throat area into account, you can create a better nodding movement.

(Orange box) **Position of the neck ball joint.**
Choosing whether to fix the ball in to the head or neck side of the joint will change the overall design, to some extent. If you fix the ball to the head, you can still create a better nodding movement by hollowing out the jaw, taking the neck area into account, as with the ball fixed into the neck. You can also make the neck as a separate part, with balls fixed at both the top and bottom. Please choose how you would like to make it. If you join a circular ring to the ball (a ring with a diameter smaller than the diameter of the ball), and glue it in so there are no gaps no matter what position it’s in, the ball will move freely. If you understand this, for ball joints, the connection between a ‘round socket’ and ball will make for the most stable movement. The most common reason for unstable, rattling heads is that the contact surfaces of the ball and socket are warped and there are gaps at the join. This is usually because the top of the neck has been molded into a hemisphere, and for some reason or other this makes it exceptionally difficult to make an accurately round sphere at the joint. Accordingly, here we are making the ball separately, for accuracy, and fixing it to the neck. If you wish you can mould the neck without making a separate ball.

1. This is how to fix the ball into the head. In the opposite way to how we did it before, establish the ball so that one third of it is inside the head.
2. Open the hole in the ball, remove the styrene core, apply clay and fix to the head.
3. Make the socket on the neck side, in the same way as for the other joints.

**Pgs. 62, 63, 64 + 65**

Artificial eyes

(Brown arrows)
1. Open up the head
2. Open the eyelids
3. Put the eyes in
4. Close the head

(Main block of text)
Putting the eyes in brings so much more life to a dolls expression. This an important stage for breathing life into the doll. The eyes I use are generally foreign-made doll’s eyes, which are imported or sold over the internet. The size of the foreign-made eyes depends on the individual maker, but the diameter of the eye, including the whites, generally goes from 6mm to 32mm in 2mm increments. In my experience, the size of the pupil in most eyes is around half the width of the eye plus 1mm. Let’s choose the right ones for the image we’re going for. Please refer to the next section if you wish to make your own eyes.

**Materials:**
\*Design knife
\*Japanese chisel (Senpan-maru nomi = reverse tip round chisel), chisel/graver
\*Pin vice, router, electric drill with flexible shaft

(Box) **Types of artificial eye**
(Picture: from left to right - Silicon eye, blown glass eye, paperweight (pure glass) eye, acrylic eye)
When it comes to the types of doll's eyes that are currently in production, there are silicon, acrylic and glass ones. Aside from the spherical eyes, you can also get almond-shaped ones. Japanese-made glass eyes are not something you can easily pick up in craft stores, I think there are probably only a few makers in existence.

1>> **Open up the head**

1. Please mark the size of the pupils that you would like with a pencil on to the eye-part of the head. Determine the eye size from this diameter.

(Box) **Eye size**
The pupil size I want for the doll I am making here is 9mm, so I take off 1mm to get 8mm, then double it to get an eye size of 16mm. If I wanted to make a cuter, larger pupil, it would probably be good to go one size up. This time, I am going to prepare 16mm gray ones and 18mm green ones.

2. If you make the opening too narrow, it will make it hard to work, so draw a cut line with a wide cross-sectional area, just above the level of the ears.
3. The top part that is going to be cut off will be returned to the same position later. Before you cut, let’s make an alignment mark on the head.
4. Cut off the top part of the head with a saw, following the line that you drew.
5. Dig out the styrene from the inside.
6. Let’s dig the styrene out of the upper part as well.
7. This is what it looks like with the styrene all gone, and the excess thickness gouged out.

2>> **Open the eyelids**

1. I will carve the eye sockets from the inside, but first, I make some holes in the target position from the face-side.
2. Make the holes with a router. It’s probably OK to use a pin vice instead.
3. Carve the part where the eyes will go from the inside of the head, so that the eyes will sit securely. You can easily carve if you use a rounded chisel. I favor a curved-tip Japanese chisel which is broader than a Western one.
4. Prepare the outline of the eyes, from the front, with a design knife.
5. Check how the eyes fit, by putting them in the sockets. If the eyes don’t sit well, readjust.

Advice: If the eyelids are too thick in places, then the eyes won’t look right. It is easier to carve the back of the eyelids as thin as possible now, and then adjust the thickness with the clay you will use to stick the eyes in later.

(Box) **Carving with a router**
Routers are small electric drills that have lots of types of interchangeable bits, and are used for detailed work. Usually this is sufficient, but when using a large, powerful drill or if you are carving in a narrow space, attach a flexible shaft into the end of the extended small grip, instead of any drilling or sanding bits. The flexible shaft’s grip is smaller than the main drill, and as it is narrower and lighter it is easier to hold and so very user-friendly for delicate work.
(Pictures: Left labeled “Main drill”, “Bits” and “Flexible shaft”. Right labeled “Router”.)
1. When using a router, dust is a problem, so fix the nozzle of a vacuum cleaner into a vice near where you are working, to serve as a dust extractor.
2. I use the flexible shaft in class for delicate work.
3. Let’s carve out the back of the eyelids with a spherical bit.

3>> **Put the eyes in**
1. Please moisten the back of the eyelids with a brush.
2. Let’s apply soft, kneaded clay and block up the eye.
3. Turn the eye towards the front and push it towards the outside (i.e. forwards).
4. The excess clay has been forced through to the outside of the eye.
5. Let’s remove the excess clay with a spatula.
6. Remove the last traces with a wet brush, and adjust the eye direction from the inside. Stick the other eye in in the same way.
7. Here the left eye is 18mm and the right is 16mm. You can decide which you prefer. This time I am going with 16mm.
Point: Take care over the eye position and direction, and the thickness of the eyelids, and get the left and right symmetrical. Here I have made an upturned-eye position.
Point: The left eye line is crooked. The easiest way to check the direction of each eye is to look from the bottom of the face.
8. When you have them in the position you want, let them dry like that.
9. When they are dry, build up more clay at the back of the eyes to stop them slipping.

4>> **Close the head**
1. When you have fixed in the eyes and teeth (see pg. 68), close the head. Moisten the cut edges of the head and apply a thickness of clay.
2. Let’s moisten and apply clay to the top-part of the head in the same way.
3. Line up the marks you made at the beginning on the head parts and push them together.
4. Neaten with a spatula and return it to its original shape.
5. Here, the head is finished.

**Pgs. 66, 67 + 68**

Make artificial eyes & teeth

(Brown arrows)
1. Make the pupils
2. Make the whites of the eyes
3. Make artificial teeth

(Main block of text)
Eyes from foreign makers come in a wealth of colors and irises, but I will explain how to make simple artificial eyes for those who want a more individual style. Glass hemispheres are the best thing, but they are hard to get hold of, so here I will use resin hemispheres. These are foil-backed spangles that you can get from craft or bead stores. If you are making an open-mouthed doll, you may want to have the teeth showing. The teeth are made using the same polymer clay as we will use to make the whites of the eyes.

**Materials:**
\*Polymer clay (FIMO semi-transparent -014)
\*Glass or resin hemispheres
\*Polishing compound
\*Clay
\*Clear nail polish
\*Tweezers
\*Paints

1>> **Make the pupils**

1. First, prepare the resin hemispheres that will become the corneas.
2. Apply some fine-grade compound (for polishing) to a cloth and scour the foil backing off the hemispheres.
3. Please polish them until they are completely transparent.
4. Trace the outline of the hemisphere on to some paper.
5. Paint the pupils using the outline as a guide, with whatever materials and colors you like.
6. Paint the subtle features of the pupil and then place the hemispheres over them to check how they will look.

(Box) **Finishing the eyes**
The hemispherical lens effect will enlarge the pupil you have drawn, and so the finished colored pencil, water color, oil paint etc. colors, thicknesses and drawing style will change quite a bit.

7. When the pupils are drawn, stick them to the hemispheres. First, cut out the pupils.
8. Paint the edges of the pupil with clear nail polish.
9. Use tweezers to place the hemisphere on the pupil and stick it down.
Point: During this stage, the tiny pupils are difficult to hold. If you lightly press the pupil on to a piece of fabric packing tape that has been rolled up inside out, it will be easier to hold as you work.
10. Check that it hasn’t slipped by looking from the sides.
11. The pupils are finished.

2>> **Make the whites of the eyes**

1. Next I will make the whites of the eyes. Take a piece of polymer clay which is the appropriate size for the pupils.
2. Roll it in the palm of the hand to make a ball the right size for the pupils.
3. Make both whites of the eye at once by cutting the ball in half with a pallet knife or similar.
4. Push the hemispherical pupil 1~2mm into the clay white of the eye to stop it slipping out of place.
5. Neaten the edges of the pupils.
6. Cook to harden the polymer clay. This time I am using an electric oven toaster.
7. If it’s too hot it will burn and blister, so please first prepare a test piece of polymer clay and check the cooking time.

(Box) **Regulating the cooking**
The cooking time changes depending on the oven output, how long it takes to heat up from cold, and if the clay carries on cooking afterwards. After it has heated up, cook for about 1~2 minutes. You can also cook with the waste heat. It will cook on the waste heat for 3~4 minutes if you leave it in the oven after it has been switched off. If it didn’t get hot enough, please repeat the process.
NB: Cooking polymer clay can be dangerous, so in case I have got this wrong (and I might well have), please follow the instructions on the packet.

8. When the eyes have a translucent feel, they are done.
9. Paint the whole of the finished eyes with clear nail polish.
10. Finished. You can also coat the eye with stronger epoxy or urethane varnish, but nail polish is cheaper and easier.

3>> **Make artificial teeth**

1. Roll the polymer clay in the palm of your hand to make the length of the teeth.
2. Flatten one end of the clay with your fingertips, to make it into the shape of a front tooth.
3. The number of teeth to prepare depends on how many you would see at a glance, I think about 4 is good.
4. I cook them in an oven toaster using the same cooking instructions as for the whites of the eyes, but because they have a smaller volume, it will be enough to cook them for just a few 10s of seconds. If you overcook them they will burn and blister like the teeth on the left-hand side of the picture.
5. Make the gum out of clay (regular, not polymer).
6. Insert the finished teeth into the gum to fix in place.
7. Using a wet brush, please fine-tune the gum to give it a natural look.
8. Paint the gum pink, and when it has dried, overpaint with clear nail polish to create a wet feel.
9. Finished. If the gum is completely invisible it’s OK not to paint it.

**Pgs. 70 +71**

Preparing the arms and legs for assembly

(Brown arrows)
1. Draw on the center lines
2. Prepare the hip joint
3. Prepare the elbows and knees
4. Prepare the shoulders

(Main block of text)
We will prepare each of the parts for assembly. Usually dolls are assembled using taut elastic cords, joining the head to the feet, and one wrist to the other. If you only want the doll connected so it can stand upright, it’s OK simply to make holes and thread the elastic through, but this will produce the inconvenience that bent knees and elbows will spring back to their straight positions under the tension of the elastic. To make each joint stable when bent, it is necessary to control the direction of the elastic’s pull. To this end, you must make slots in the balls of the joints. Basically, stretched elastic runs in a straight line between two points, therefore you must make slots so the elastic can only move along a line at an angle from the ball’s center line. Because the width of the slots should match that of the elastic, please first choose the thickness of elastic for the size of doll you are making.

**Materials:**
\*Saw
\*Router
\*Writing materials
\*File
\*Chisel/graver
\*Clay, water

(Box) **Types of elastic**
Here I am using fabric-covered ‘4-strand’ round elastic (approx. 2.2mm width). Let’s choose the thickness of elastic to suit the size of doll. Small dolls need around 2mm thick stuff, while 1m-class dolls need around 5mm. Fabric-covered elastic is good for being in close contact with the body, but please choose moderately strong stuff.

1>> **Draw on the center lines**

1. Draw where to make the slot in the ball. We will make the slot over the ball’s center line, so first I mark the center of the knees and elbows.
2. Having done this, it becomes easy to decide on the slot's position and angle.

2>> **Prepare the hip joint**

1. Using the center point of the knee as a guide, please mark the center line of the hip joint ball. Here, the joint has 90˚ of mobility.
2. Mark where to make the slot so that it will move forwards from the just above vertical position. When viewed from the side, this gives a slot of 90˚ +∝ (where ∝ is the thickness of the elastic, in this case 3mm). (Picture: At the top “Elastic thickness.” On the side “The +∝ part”.)
3. Make a hole in the end of the slot, using a router with a bit the same thickness as the elastic you’re using, here that’s a 3mm one.
4. Let’s also make a hole at the front-side end of the slot.
5. Use a saw to open up the slot in between the two holes. Do it so that the width of the slot is slightly wider than 3mm.
6. If you find it hard to control it in your hand, it’s probably OK if you place it on the edge of the work bench.

3>> **Prepare the elbows and knees**

1. Mark the center line on the elbow joint ball in the same way you did for the hip, using the center of the elbow as a guide.
2. Make holes in the ends of the slot using a router with 3mm bit attached.
3. As the elbow joint ball is small, continue to use the router to make a few more holes in the slot. The bit size is 3mm here as well.
4. Lay the router on its side and use the side of the bit to carve out the clay between the holes.
5. Neaten the slot line with a file.
6. Make the knee in the same way as for the elbow. Let’s mark the center line using the center of the knee as a guide and open up the slot.

4>> **Prepare the shoulders**

1. As living bodies have rotational movement in the shoulders, here we will correspondingly make a large hole rather than a slot.
2. As for the other joints, draw on the center line, mark the hole you will make, and then carve it out using a round chisel.

Advice: It’s easiest to do all of the jobs of the same type in one go. First let’s mark all of the joints, then make all of the slots.

**Pgs. 72, 73 + 74**

Prepare the wrists, ankles and head for assembly

(Brown arrows)
1. Prepare the ankles
2. Prepare the wrists
3. Make hooks
4. Prepare the head

(Main block of text)
The wrist and ankle joint balls need wire embedded in, to which attach hooks that take the elastic. If the underside of the wire is completely embedded in the clay, you won’t be able to connect the hook and the joint won’t be able to move, so please use an S hook with some space around it so it can move. The wire has a lot of force acting on it, so let’s make it carefully. You will also need to connect the elastic to the head, but here we will attach a straightforward hook. For the ankles, wrists and head we will use stainless steel wire. Please don’t use iron wire such as piano strings, because in a few years you will get brown rust marks coming to the surface. Let’s choose the appropriate thickness for the size of doll. Large dolls will need 1.5mm thickness at least. As for small dolls, if you’re using wire less than 1.0mm thick, please choose the relatively hard stainless steel ‘spring wire'. Let’s take care because stainless steel gets softer at thinner widths and will stretch and break under the tension of the elastic.

**Materials:**
\*Stainless steel wire
#16 (approx. diameter 1.5mm)
#18 (approx. diameter 1.1mm)
\*Instant glue
\*Router
\*Writing materials
\*Pliers
\*Art knife

1>> **Prepare the ankles**

1. We make slots in the ankle joint balls in the same way as the elbows and knees. Please take care not to make the slot in the wrong direction.
2. Make the slots in the ankles slightly wider than the width of the wire. Let’s make a hole at the end of the slot with a router and 2mm drill bit.
3. In the same way, make a hole at the other end of the slot. Continue to make more holes along the line of the slot, as we did on the elbows and knees.
4. Lay the drill bit on its side and join up the holes to make the slot.
5. Mark the position for a hole on the side of the ball, slightly above the center line. For large dolls, make the hole on the center line.
6. Let’s drill the hole using a router. Push some wire though this hole.
7. I am using stainless steel wire #16. Push the wire through the hole to determine its length.
8. Cut the wire short, so that its end will not be visible when it is embedded.
9. Thread the cut wire into the hole and apply instant glue to the outside.
10. Let’s also apply instant glue to the inside.
11. After the glue has dried, fill the hole with clay to return it to its original shape.
12. This is how it looks with the wire embedded and returned to its original shape.

2>> **Prepare the wrists**

1. Let’s make slots in the wrists as we did in the ankles. Mark the position, taking care over the slot’s direction.
2. Make several holes along the slot.
3. Lay the drill bit on its side and join up the holes to make the slot.
4. Embed the wire. Make a hole in the side of the ball, slightly above the center line.
5. Determine the length, cut the wire and then insert into the hole. Apply instant glue from the outside.
6. Also apply from the inside. After the glue is dry, fill the hole with clay to return it to its original shape.

3>> **Make hooks**

1. Make hooks to attach the elastic to the embedded wires.
2. Bend the #18 stainless steel wire into an S-shape with pliers.
3. Let’s make 2 hooks each for both the wrists and ankles, that’s 4 in total. When they are done, hang them on their respective wires.

4>> **Prepare the head**

(Box) **Preparing the hole in the neck joint.**
We will make a hole in the neck joint. Whether you attached the ball to the head or neck-side of the joint, you make a big hole with a round-bladed chisel. The elastic will be threaded through this hole, so if you have as large a hole as the surface allows, it will create a wide range of movement.

1. We will fix a hook into the head that the elastic will attach to. Mark a hole position on the very top of the head where the hook will be.
2. Make the hole using a router and 2mm drill bit.
3. Bend some #16 stainless steel wire into the shape in the photo and thread it in.
4. Make it so that the hook position is around the front of the ear.
5. Mark the wire at the point where the top of the head comes with a pen.
6. Cut the wire 2cm longer than where you marked it.
7. Bend the wire into a right angle 1cm from the end.
8. Next, bend another right angle at the marked position.
9. Let’s insert the bent wire.
10. Make a hole to insert the bent wire. Please use a router and 2mm drill bit.
11. Carve a channel between the two holes with a design knife or similar, so that the wire will lay flat.
12. After fixing with instant glue, apply clay and flatten the surface to neaten.

**Pgs. 76 + 77**

Assembly

(Brown arrows)
1. Prepare the elastic
2. Assembly

(Main block of text)
Let’s assemble all the parts and make the doll able to stand independently. You get asked “Are there weights in the feet?”, by people who think it’s strange to see a doll standing without a pedestal. If the doll has been made precisely to plan, whether it’s fixed pose or ball-jointed, it will be able to stand independently. However, for ball-jointed dolls there is an even greater necessity to make the joints reliable. You can also use stands to help, but really you need to make the doll able to stand by itself. To this end, let’s string the inside of the doll with elastic to assemble it. As I mentioned before, the type of elastic I'm using here is called ‘4-strand round’. Raw elastic will degrade quickly and soon break, so please use fabric-covered stuff.

**Materials:**
\*Elastic
\*Stainless steel wire #18
\*Pliers

1>> **Prepare the elastic**(Box) Elastic threading tool
Make an elastic-threading tool from the #18 stainless steel wire that you used to make the hooks for the wrists and ankles. Please cut it about 20cm longer than the length of the body parts. Use needle nose pliers to bend one end into a hook which will easily snare the elastic, in the same way as you did for the S hooks.

1. First, make an elastic-threading tool as shown in the left-hand photo. Next, prepare the elastic which will connect the arms and legs. For the arms, prepare a loop from a piece of elastic that measures twice the distance from one elbow to the other.
2. For the legs, let’s make loops from pieces of elastic that measure twice the distance from the center of the head to the knees. This makes two long loops for the legs, and one shorter one for the arms.

2>> **Assembly**
1. Hang the two loops of elastic that will attach to the feet from the head hook. Let’s ensure the knots are placed inside the head and aren’t threaded through the joint slots.
2. Assemble from the head to the legs. Use the threading tool to pull the end of the elastic through the body and thigh of each leg.
3. Pull it through the shins.
4. Finally attach the loop to the ankle hooks. Let’s attach the other leg in the same way.
5. Both arms are assembled using one loop of elastic. Hook on the elastic with the knot at one of the wrists.
6. In the same way as for the legs, pull the elastic through the left and right arm parts with the body between, and hook it to the opposite wrist.

Advice: Now all the parts of the doll are assembled. Let’s try standing the doll up straight. It will be a success if it can stand and sit without support. If there are gaps in the joints or shakiness, the doll’s posture won’t be stable and it won’t be able to stand alone. Also, it will give a feeling of being uncomfortable and unnatural. Let’s make the final adjustments before we turn towards the coating stage!!

**Pgs. 80 + 81**

Foundation coating

(Brown arrows)
1. Wipe with a cloth
2. Prepare modeling paste
3. Coating (brush painting)

(Main block of text)
In the last chapter we assembled the doll once to check the symmetry and state of the joints. Don’t you think delicate adjustments are a good idea? This is where we finish working with the clay and start coating. First it’s important to do a foundation coat. Even though this is only the foundation coat, the right materials to use are gofun or modeling paste. For beginners, I recommend modeling paste which can be easily obtained from art shops, is easy to use and makes a durable foundation coat. As for how to paint, if you’re working at home or have limited resources it’s fine to paint with a brush. The foundation coat will serve to round off the surface of the clay and conceal any minor blemishes, protect the sculpt and help to make the colored paint take effectively.

**Materials:**
\*Oil paint strainer (Fine straining net, 120 mesh)
\*Brushes
\*Cloth
\*Mortar, pestle (Or you can substitute a bowl and spoon)
\*Mixing saucer
\*Water color paints
\*Modeling paste
\*Gesso
\*Spoon

1>> **Wipe with a cloth**

1. Wipe the surface of the clay with a damp cloth to smooth the clay fibers down.
Point: Wiping with a cloth gives the surface a smooth finish and makes it easier to make sure there are no conspicuous sanding marks.
2. As you finish wiping each part, stand them in a wrapped straw bale (Makiwara) using splittable chopsticks or similar. This is in preparation for drying after they have been painted.
Point: If you don’t have a makiwara I think it would also be OK to hang them from a washing line on thick wire.

2>> **Prepare the modeling paste**

1. Let’s add 300cc of modeling paste to a mortar. It’s OK to substitute a bowl and spoon for a mortar.
2. Next add 50cc of gesso.
3. Add about 150cc of water and stir well.
4. Please mix well until smooth and all the lumps have gone.
5. Add acrylic or watercolor paint to make the base color you want. Mix each color in a little at a time. (Picture: “Yellow ochre”, “Carmine”, “Terre verte”)
6. Add watercolor carmine.
7. Put the watercolor paint in a mixing saucer and dissolve it thoroughly. Please mix in the color a tiny bit at a time. Let’s take care not to make the color too dark.
8. Next add watercolor yellow ochre, a little at a time.
9. Let’s mix it thoroughly with each little bit we add. Here I have made a bright tint that will make for easier finishing.
10. When the paint has reached the desired color, strain through an oil paint strainer. This will remove all the lumps and impurities from the paint.

3>> **Coating (brush painting)**

1. Transfer the prepared modeling paste to a painting saucer.
2. Dip the brush in the paint, and wipe off the excess on the edge of the saucer. It’s probably good to use a flat brush with soft bristles that you are accustomed to using.
3. On the first coat please paint so that the paint adheres firmly to the clay surface.
Point: Paint thoroughly and take care not to leave brush marks. If the paint is thick it will be more likely to leave brush marks, so let’s adjust the thickness.
4. After it’s dry, paint 4~5 coats to make a solid foundation.
5. Finally, polish away the brush marks with superfine sandpaper, and wipe with a damp, strongly wrung cloth to finish.

Advice: Brush painting needs a lot of sanding and takes much time and effort. It might be good for when you want to create a textured surface. A soft-bristled brush is less likely to leave brush marks. If there is unevenness in the painting, it will be reflected in the feel and coloring of the top coat of oil paint.

**Pgs. 82, 83, 84 + 85**

Foundation coating (Advanced)

(Brown arrows)
1. Knead the gofun

**{Gofun** is a traditional coating of Japanese dolls made from galvanized oyster and clam shells that have been crushed into a powder and mixed with glue.
It gives a porcelain-like finish to the surface of the doll and has a very white luster.
Today, however, most doll artists tend to use a type of air-dry liquid called ["**Cloth Clay**"](http://www.miniworlddolls.com/Goodstuff/TipsClothClay.htm) to make the surface of their creations smooth.}

2. Dissolve the gofun in a blender/ 2. Dissolve the gofun in a mortar
3. Painting (Spray painting)/ 3. Painting (Brush painting refer to pg. 81)

(Main block of text)
In the last chapter I explained how to paint the foundation coat using easily available materials, for ease of work in one’s own home. But as for me, I use gofun, and paint with a spray gun rather than a brush. Gofun has been used in Japan from antiquity to paint dolls’ skin. The makers of pretty much all dolls, e.g. Hina matusri dolls, Boy’s festival dolls, Ichimatsu dolls etc, finish the skin by painting it with gofun (fine-powdered shells) and nikawa (gelatine-based glue) kneaded together. (By the way, here in Japan there is also a technique called ‘gofun carving’ where the gofun is painted on very thickly and then the eyes are opened and the nose and mouth carved with a knife.) I only use gofun for the foundation coat. The top coat needs complex tints, so I use oil paints for that. There are two ways of dissolving the gofun, either in a blender or a mortar.

**Materials:**\*Gofun
\*Wood glue
\*Oil paint strainer
\*Mortar and pestle (Or you can substitute a bowl and spoon.) or blender
\*Painting saucer
\*Watercolor paints
\*Brush
\*Spoon
\*Water

1>> **Knead the gofun (shell powder)**
1. We will knead the gofun. Add the appropriate amount of gofun to a mortar.

(Box) **Gofun** —> Pg. 94
The highest grade gofun comes boxed and is called ‘Suihi gofun’. It is fine grain, pure white and very expensive, but it’s not suitable for foundation coating. Use comparatively coarse-grained gofun for foundation coating, making a thick layer of paint to protect the sculpt and give a soft texture to the skin.

2. For a doll of the size I am making here, add 3 rounded tablespoons of wood glue to the gofun. Wood glue is a substitute for nikawa glue.
3. The volume of the completed liquid gofun is determined on how much glue you add. Use about 40~50 grams of gofun for each rounded tablespoon of glue.

(Box) **Nikawa**In this explanation I am using easy-to-use wood glue as the adhesive. Nikawa hardens at a low temperature, and during the winter months, it takes effort to keep it dissolved in a hot water bath. Also, if you use it in careless manner, it will crack and so it takes skill.

4. Drench the pestle with glue, and stir with it raised off the bottom (Don't grind it, I think?). Continue to mix until the gofun and glue are combined.
5. If you stir too hard the glue will break into pieces. Please mix it so it becomes one lump.
6. When the glue and gofun are mixed and have formed a lump, pound the gofun into the lump in the same way as you would for making mochi (rice cakes).
7. Let’s knead the gofun by folding it in two, and then continuing to pound.
8. It’s also fine to knead with the palm of your hand.
9. When it’s kneaded to this degree, turn and stretch the gofun in both hands.
10. Stretch as in the photo,
11. fold in two,
12. and then turn and stretch it in both hands again. Let’s repeat in this way.
13. If you grip the firmly kneaded gofun lump and it comes away with your thumb like this, you have a lot of glue and not enough gofun.
14. Please pound and knead the gofun until it’s well-kneaded, and doesn’t stick to your hand.

2>> **Dissolve the gofun in a blender**
1. Prepare the blender. Break the gofun lump up into small chunks and put it in the blender.
2. Add about 50cc of hot water (50˚C), and run the blender for 2~3 mins to get a creamy consistency.
3. Dissolve watercolor paint in a painting saucer, and mix in a small amount at a time.
Point: Please take care not to add a lot of paint in one go. You can make quite a dark color with just a small amount.
4. Please make the desired color by running the blender after adding each little bit of paint. Let’s take care not to make the color too dark.
5. Please make the thickness about the same as creamed soup.
6. Strain the liquid gofun through an oil paint strainer (fine net 120 mesh) to remove impurities.

Advice: Using the blender to dissolve the gofun is simple, but makes a lot of bubbles, so you should paint it on with a spray gun. You can also paint on the gofun with a brush. In that case, you really don’t want to make bubbles, so please dissolve it using a mortar.

2>> **Dissolve the gofun in a mortar**

1. Break the gofun lump into suitable-sized pieces and put it in the mortar. Soak them in hot water for 10 minutes until soft.
2. Throw away all the hot water. Pound and grind with the pestle to break up all the lumps.
3. Continue until it becomes fluid.
4. Gradually add hot water with a spoon and mix.
5. It will be finished when it’s a creamy fluid.
6. Mix in watercolors to make the color you want.
7. Let’s mix in a little at a time and take care not to make it too dark.
8. Strain the liquid gofun through an oil paint strainer to remove impurities. Finished.

3>> **Painting (Spray painting)**

(Box) **Spray gun** —> Pg. 94
Spray guns are extraordinarily expensive, but it’s the best way to coat dolls. You can use it with both the modeling paste and gofun. The spray gun aperture should be 1.0mm. Air brushes which have narrow apertures of around 0.3mm will soon get blocked. I made a painting space in my doll classroom. Let’s do it in a well ventilated area.

1. The simple painting space I have in my doll classroom is underneath a household kitchen ventilation fan, and surrounded by planks and cardboard.
2. Don’t make the paint you’re using for the foundation (modeling paste or gofun) too thin, use it with the consistency of thickish creamed soup.
3. Hold the spray gun 20~30cm away from the parts as you paint them, and move it up and down to coat.
4. Turn the parts slightly and coat them again. When you’ve painted one full turn around the part, spray it from top and bottom as well.
5. Let’s spray from every direction so there are no missed spots. Paint each part in turn, let it dry in the makiwara, and then repeat.
6. Please give each part 4~5 coats to build up thickness and roundness.
7. Soften the paint which has stuck to the eyes with a wet brush.
8. Let’s remove the sodden paint with a bamboo spatula.
9. Please erase any drips, rough patches or brush marks with sand paper.

Advice: To get a smooth finish, it’s best build up the paint in layers. If the spray gun is too close, the coat will be too thick and it will run and drip, and the air current will leave marks. Conversely, if you hold the spray gun too far away, the coat will be too thin and the skin will be rough. Whether you paint with a brush or a spray gun, if you get irregularities, they will be reflected in the texture and color of the oil paint top coat. Let’s paint the layers evenly.

**Pgs. 86, 87, 90 + 91**

Create the skin

(Brown arrows)
1. Mix the colors
2. Apply the foundation color
3. Apply the subtle tones
4. Paint the details

(Main block of text)
What color is skin? If you take a close look at your own skin, you will find it is complicated. Even if you only look at the surface of the skin, there are differences between sun-tanned places and places which don’t get the sun. Underneath the skin there are blood vessels and fat, and differences in complexion, so I think that painting ‘skin-color’ with just one color of paint is too simplistic. If we work on how to make the foundation and top layers of the doll’s skin and consider how the colors are overlaid, it is possible to create a varying and individual skin. You can use pastels, watercolors, acrylics or oils on clay dolls, but here let’s use oil paints to color the skin. In the previous section we painted the foundation, but the top coat colors will also change depending on the foundation color. Here, let’s try to make slightly pale, translucent skin.
 **Materials:**
\*Oil paints
\*Oil painting medium
\*Sponge
\*Brush
\*Paper palette
\*Palette knife

1>> **Mix the colors**

1. Prepare a small amount of oil painting medium (painting oil) in a painting saucer, and some oil paints on the paper palette.

(Box) **Paints**The paint colors I am using here are rose grey (dark and light), mist green, 1-day dry foundation white (fast-drying oil paint), raw sienna, raw umber and davys grey. I think these colors are right for the image of the person I am making, so please consider the colors in the utmost detail.

2. First mix the white with the rose grey to make a strong pink. We will make enough to paint the whole body, so let’s mix it with a palette knife.
3. Consider how thin you want the paint, and mix in the oil painting medium. If you mix too much it will get glossy and will take longer to dry.
4. Next, mix together the mist green, white and oil painting medium to create the paleness (lit. blue-white in Japanese).

2>> **Apply the foundation color**
1. As a foundation color, apply the green paint that you made with a sponge. Apply it thinly, by lightly dabbing.

(Box) **Sponges**I am using cushion sponge that is sold in craft stores, which I cut into an easy-to-use size. I think make up sponges would also be OK.

2. On the smaller parts, such as the between the finger and toes, and the slots, let’s start painting with a brush.
3. After you’ve applied the paint with a brush, please use a sponge to disperse it well.
4. In the same way, let’s paint the slots of the joints with a brush first, and then disperse it with a sponge.

Advice: Let’s paint on the foundation so that the colors seem transparent. Please take care not to apply the colors too thickly, whilst creating variations in the color strength. When overlaying colors, paint them considering the red tones that we will add in the next stage. In the end, this is only the foundation layer, and it doesn’t matter if it doesn’t yet look like a human skin tone.

3>> **Apply the subtle tones**

1. Now we will overlay the red tones that will revive the skin’s complexion. Apply the pink made from rose grey and white in the same way as for the green.
2. For parts where you want a stronger red color, apply pure rose grey (not mixed with white!), thinned with oil painting medium.
3. Let’s apply the pure rose grey to the eyes, cheeks, chin, chest, buttocks, knees, elbows, ankles, wrists, fingers and toes; all the places that we want a stronger red tone.
4. On delicate parts, please use a brush to graduate the paint, and give a natural feel.
5. Similarly, paint pure rose grey on to the parts you want redder, and graduate it with a brush.
6. Let’s paint the chest in the same way.
7. Also graduate the shaded places in this way.
8. Let’s create the appropriate look for each place. It’s convenient to paint the joint sockets with a flat brush.
9. On wide areas, graduate with a sponge to create a natural feel.
Point: Take into account the balance with the colors you painted previously. It’s probably OK to overlay color lightly over all the remaining pale parts.
10. When it’s competently painted, let it dry.

Advice: To first-time oil painters in particular: please let the green paint dry completely before painting the pink on. Because I used quick-drying white paint, I would usually expect it to take 1~2 days to dry. It’s also OK to mix in some drying oil. Oil paints can create various types of expressive finishes, but here we absolutely want to express doll’s skin. Please aim to use it thinly dispersed. If you paint thickly or mix in too much oil, it will need a long time to dry and further down the line you will get cracks or other annoyances, so let’s take care.

(Orange box) **Creating skin tones**
When it comes to expressing human skin with paints, it’s really helpful to refer to the masterpieces of the great artists of history. Leonardo da Vinci, Raphael, Renoir, Egon Schiele...I think these artists who painted people, put so much hard work into expressing the skin tone for each individual. If you use oil paints thinly, and allow the foundation color to show through, it’s possible to express the subtleties of skin with the overlaying of colors. You can paint the foundation in whatever color you like (e.g. blue, green, purple or red etc) to give a feeling of translucence. With this in mind, let us aspire to these great works and create an original skin color.

4>> **Paint the details**

1. When the paint is dry, we will draw on the details of the face and body. Add color the fingernails with a fine-point brush.
2. Let’s color the toenails using a fine-point brush as well.
3. Let’s color the nipples using a fine-point brush in the same way. It’s necessary to be familiar with how to paint with a fine-point brush, so first you should practice painting on paper.
4. We will also paint the eyebrows and eyelashes with a fine-point brush. Please match the color to the hair color. First, mark the position of the eyebrows by lightly shading along their lines. Using a cotton swab works fine.
5. Paint shadows on the eyelids with whatever color you like.
6. A lot of the expression is decided by whether the eyebrows go up or down at the outside of the face, so please prudently take this into account. Draw the eyebrows and under eyelashes on with narrow brush strokes using a fine-point brush.
7. After it has dried, draw on more lines in a slightly darker color.
8. This is delicate work. Let’s draw on the lines, turning the head in whatever direction makes them easiest to draw.
9. Let’s color the lips to suit the image we’re going for.
10. To finish, remove any traces of paint from the eye using a cotton swab with a bit of cleaning fluid on it.

(Orange box) **Using pastels**Having applied the foundation skin color as usual, you can grind the pastel onto a piece of paper, and use this powder with a makeup brush or similar to color. There’s no need for drying time, so it’s a very quick way of working. Its weaknesses are that it’s difficult to get a depth of color and to get the colored powder to stick, but it’s easy and recommended for beginners.

Advice: Painting is like applying makeup. It’s probably OK to think of the paints as make up as you use them. This is an everyday thing for women. Depicting lips and nails naturally is quite like applying lipstick or nail polish, don’t you think...? If you want to create wet-looking lips, or you need a very glossy finish, it’s effective to apply a coat of clear nail polish after the paint is dry. Please enjoy adding the finishing touches.

**Pg.94**

## Painting materials

**Acrylic gesso**
This is a white acrylic polymer emulsion which can be used as a base with all sorts of paints. It helps with the coloring and getting the paint to stick. However, if you use it over oil paint or on oily surfaces, it may flake off. This is what cheap, commercially-bought canvases are primed with.

**Modeling paste**
This is a water-based acrylic polymer emulsion product, a white paste of the consistency of strongly sticky putty. It is used for foundation coating and for building up. It has excellent pliability and durability.

**Gofun**
A fine powder made from pure sea-shells, this is the characteristic painting material of Japanese painting. It’s not only used as a white paint, but also for foundation coating. In my work, I use foundation-type gofun, but this is not usually sold in small quantities. I think you should be able to get hold of Ijirushi (伊印) and Yukijirushi (雪印)-type bagged gofun in stores that deal in Japanese arts supplies.

**Watercolor paints**
With opaque, non-glossy watercolors mixed with water, you can express a depth of color and lightness that approaches that of oil paints. Also, you can build up layers of vivid colors without it cracking and letting the under-layers ooze through, so it makes for relaxing painting.

**Acrylic paints**This can be used when you want an opacity that completely covers the lower layers of paint. Generally, it’s probably fine to think of it like opaque water color paint. It’s water-soluble, but when dry it becomes waterproof. It gives a non-glossy finish. Here, I am using it for coloring the foundation coat, for the top coat and the makeup.

**Oil paints**
There are various color ranges, from transparent to opaque. Its pluses are that you can build up layers of paint to create a depth and uniquely translucent feel. Water won’t stick on to oil, so if you’re using various types of painting materials, you should use oil paints last of all. Use it for the top coat and the makeup.

**Pastels**
These are solid sticks of pigment that are used for finishing the makeup. Scrape with a cutter or similar to make powder which you can apply with a cloth or brush. Its flaw is that even if you coat it, it still comes off easily, but in its favor, it’s doesn’t take long to recover from mistakes and it’s easy to create natural graduations and lively colors.

**Spray gun**
This is a tool for spraying paint. It sprays paint in a mist, by blowing air from the nozzle at the tip. Spray guns cost around ¥12~13,000, but you will need a separate compressor to supply the air. Even the simplest types of these cost several tens of thousands of yen and the professional-types are very expensive at around ¥1,000,000

**Pgs. 96 + 97**

## Stick the hair on

(Brown arrows)
1. Prepare to stick on the rows
2. The first row
3. The second and third rows

(Main block of text)
There are many hair-like products that can be used for making doll’s hair. It’s fun to dye the hair material of your choosing to be the color you want. Basically the way to stick on hair is in radial layers going from the bottom to the top of the top of the head. With short hair, the skin color will show through easily, so stick on lots of layers. Let’s stick on the hair in a way that suits the hair style we’re aiming for. The technique I’m using here is one I learned for sticking the hair on to Ichimatsu dolls. The delicate technique of rooting each hair one by one, such as old makers used on iki ningyo (lifelike dolls) and wax dolls, will only serve to frighten you. I think you’d find it interesting to do a bit of investigating and try copying how the old masters did it. Another way of doing it, if you want lots of hairstyles, is to order wigs to use.

**Materials:**
\*Hair
\*Wood glue (Quick-drying stuff)
\*Writing materials
\*G Clear (= some sort of clear glue in a tube, probably like Bostik all purpose)
\*Scissors
\*A tile
\*Brush, comb, mini iron

1>> **Prepare to stick on the rows**

(Box) Hair to use for dolls
The photo shows hair which is sold for use in doll’s hair making. From the left: wavy wefted dolls hair, straight wefted dolls hair, mohair, straight silk thread (black/white), synthetic dolls hair (polyester/rayon) and a dolls wig. Recently it has become easy to get dolls hair-making materials over the net, by mail order. Here, I used a product called dolls hair ‘weft’. (In Japanese weft is mino (蓑), which is the same word as straw raincoat.) A ‘weft’ is a product where one edge of the hair has been machine sewn. If you’re using loose fibers, you will need to make them into wefts (see pg. 98).

1. First check the image by placing the hair on the doll’s head. Here I’m going for a symmetrical style with a parting and a whorl on the back of the head.
2. Basically, we will stick the hair on in 4~5 belt-like rows. Here I am going to stick on 5 rows up to the center parting on the top of the head.
3. Let’s draw some guidelines on the head for where to stick the hair and the whorl.
4. Measure the length of the weft along the guide line.
5. Cut two pieces at this length. It will be too thin with just one weft, so you must cut two and overlay when you stick them on.
6. Now you have cut two pieces for the bottom row, let’s cut two pieces the length of the next row in the same way.
7. Cut two pieces for the third row in the same way. In this case, I am going to stick 2 pieces of weft to each of the bottom three rows.
Point: The hair on one side of the machine-sewn part is shorter than the other. The shorter side is the back of the hair and the part that you glue.

2>> **The first layer**

1. First, spread wood glue lightly over the row with a brush. Please paint the glue on up to the point where the hair starts at the nape of the neck.
2. Stick the first piece of weft along the line. Let’s make sure of which side is the front and which is the back before sticking it on.
3. Here the weft is back to front and the shorter hair is sticking out.
4. Neaten the flow of the hair before the glue dries.
5. Paint a layer of glue immediately above the first piece and stick the second piece (of the first row) on.
6. Please stick it on avoiding the machine-sewn part of the first piece.

3>> **The second and third rows**

1. Stick the second row on. Let’s spread the glue as far as the machine-sewn part of the first row.
2. Stick the first piece of weft for the second row on. Please overlay and stick on the second piece as for the first row.
3. Let’s stick on the third row in the same way as the second.

**Pgs. 98, 99, 100 + 101**

Top of the head

(Brown arrows)
1. Make wefts
2. Stick on the fourth row
3. The parting
4. The whorl

(Main block of text)
We have finished gluing the bottom three layers of wefts on. Now we will work on the fourth layer and the fifth layer which is on the top of the head. As the fourth and fifth layers are made with wefts, they will be easy to see through and the machine-sewn edge may stand out. Because of this, it is necessary to rebuild the wefts to make them thicker. We will use these rebuilt wefts to create the parting on the top of the head. The whorl on the back of the head will be a bunch of hair that we glue on with G clear glue. This is the way we usually do it at the Pygmalion Studio. You may also make the parting and whorl by making holes in the top of the head. In that case, mark the parting and whorl and make the hole in advance, then stick the hair bunches into the hole and glue in place.

**Materials:**
\*Hair
\*Wood glue
\*Writing materials
\*G clear glue
\*Scissors
\*A tile
\*Brush, comb
\*Electric mini iron, soldering iron or similar

1>> **Make wefts**

1. First fold a 30cm piece of weft in four and cut off the machine-sewn ends.
2. Remove the shorter hairs with a brush or comb to make a uniform thickness.
3. Here I am evening out the thickness with a brush.
4. Arrange the front edge of the hair on a tile, and use a spatula to repeatedly spread wood glue very thoroughly into the part above the line (marked in red).
5. Set with an electric craft iron or soldering iron. It will take time, but you will get the same result if you leave it dry naturally.
6. Spread glue on to the back as well, and set it in the same way. If the glue hasn’t permeated well, you will get some hair falling out. Let’s take care.
7. Cut the edge margin down to about 5mm.
8. Cut both ends diagonally. If you apply the glue in a perfectly straight line, you will end up with a neat finish like this.

2>> **Stick on the fourth row**

1. Stick on the completed hair wefts to make the fourth row.

3>> **The parting** (This bit is quite complicated, so read it through carefully before you start )

1. Glue the parting. Apply glue to both sides of the center line that marks the parting.
2. Apply a particularly thick weft along the parting line, in the opposite direction to that which you have done so far.
3. Set the glue with an iron, or you can let it dry naturally.
4. Apply glue to the margin of the weft you glued in the opposite direction.
5. Stick another weft on top of this, in the normal direction.
6. Fold the weft you glued in the opposite direction over to the right side.
7. Place a cloth over the folded-over parting and iron. It’s OK to use a regular iron for this.
8. Let’s finish the opposite side in the same way. First, apply glue.
9. Stick the weft on to the parting line, again in the opposite direction.
10. Apply glue to the margin of the weft you glued in the opposite direction.
11. Let’s stick another weft on in the right direction and iron to fix.
12. Fold the hair on the parting line. This completes the parting.

4>> **The whorl**

1. Tie an appropriately-sized bunch of hair with an elastic band.
2. Please cut the end off just outside the elastic band, so it’s neat and flat.
3. Apply G clear to the cut end.
4. Also apply G clear to the whorl position on the head.
5. Gently push the glued surfaces together. Now, without letting them stick, pull them apart and let them dry.
6. Once they are dry enough that they won’t stick to your hand, firmly press in. After it’s dry, cut the elastic band off and spread the bunch open.
7. Make the whorl by pressing the center of the whorl with your finger.
8. Comb the hair to settle it in place.

Advice: If you pay attention to how hair grows and the direction of the flow of the hair you need for a particular hairstyle, you will end up with a more natural feel.

(Box) **Embedded-style**
Embedded-style hair making is when you make a slot and hole at the parting and whorl positions, insert the bunches of hair and glue them in. Apart from the top of the head, the process is the same as on pg. 96. With the embedded style, the skin will show through clearly if you don’t use thick enough wefts. Please stick thick wefts on either side of the slot as well. If you also want to embed the whorl, make a hole at the whorl position on the top of the head and then finish in the same way. Embedded hair is more likely to stick up, so first please brush to neaten, then apply a cloth and iron to regulate it.
\*The photos are only to explain how to make the parting, in reality you should have stuck the lower rows on.
1. Make a 2~3mm wide slot along the parting line. Please refer to pg. 71 for how to make slots.
2. Make a thick weft the same length as the slot. (See pg. 98)
3. As before, cut both ends diagonally so they don’t get in the way.
4. After you’ve stuck on all the hair apart from the parting, apply glue to the slot and insert two wefts.
5. Split the inserted hair to create the parting.
6. Neaten the hair to finish.

**Pgs. 102 + 103**

## Hair styling

(Brown arrows)
1. Styling
2. Eyelashes

(Main block of text)
When you’ve finished sticking on the hair, you’re going to want to style it to suit the image you’ve chosen. It’s fine to do it in the same way as for humans as long as you are aware of the characteristics of the materials you’ve used, such as weakness to heat etc. Take care not to make the eyelashes too even, let’s cut them a bit randomly. It gives a natural feel to cut the length of the lashes to suit the curve of the eye.

**Materials:**
\*Hairdressing scissors
\*Thinning scissors
\*Razor
\*Comb
\*Hair iron
\*Hair styling products
\*Kitchen paper holder (to use as a stand for the head)

1>> **Styling**

1. First apply a small amount of water or hair mousse and neaten with a comb or brush. Please take care not to get the skin dirty.
2. Cut it to the desired length.
3. At the moment the hair is too thick, so I think I will take a bit off. First, clip the hair out of the way.
4. Thin down the hair with a razor, moving from the inside to the outside.
5. Arrange the ends of the hair with thinning scissors.
6. This is how it looks after being arranged with scissors.
7. Cut the hair that frames the face shorter.
8. Let’s use a hair iron to make curls and straighten out any kinks.
9. Here I’m in the process of crimping.
10. After making final adjustments, it’s finished. Please style to suit the image you have chosen.

2>> **Eyelashes**
1. Here I’m using commercial doll’s eyelashes and I will stick them to the upper eyelid. If they are too long, I will cut them down. Please take care not to make the lengths too even.
2. Adjust the lengths so that they follow the curve of the eye to make it look more natural. If you want to make more detailed adjustments to the length and curl, you can stick each eyelash in one at a time in a more scattered way.
3. Apply wood glue to the inside of the upper eyelid and stick it in. Eyelashes are very delicate and have the habit of bending or getting kinked. It’s easier to do it with tweezers.

**Pgs. 106, 107, 108, 109, 110 + 111 §1**

## Make shoes

(Brown arrows)
1. Make the pattern
2. Make the parts
3. Assemble
4. Stockings

(Main block of text)
The most important thing about making shoes is to make the toe-part neatly. If the toe-part is out of shape, crushed, and covered in wrinkles the shoe will be no good for anything. Here I am making the toe-part out of stone clay and then gluing leather on top of it. This method automatically creates a toe-part template, and if you use thin, soft leather, it won’t lose its shape. If you want to make lots of shoes of the same design, you can make a wooden mold as you would for making human shoes. First let’s decide on the overall design. Here I am making short, lace-up boots with a narrow toe.

**Materials:**
Leather (0.5mm thickness black tanned cow’s leather/ 2mm craft saddle leather (for the sole)/ ~0.2mm leather of your choice (for the lining)
\*Eyelets (approx. 1.5~2mm)
\*Leather cord (100cm)
\*Clay (a little)
\*Pliers
\*Hard rubber pounding board (for punching)
\*Eyelet setting tool
\*Hammer
\*Scissors
\*Cutter knife
\*Wood glue
\*G clear glue
\*Craft or regular iron

1>> **Make the pattern**

1. Wrap the foot in vinyl and secure the end with sellotape.
2. Trace the outline on to cardboard. Let’s decide on the design of the whole of the shoe.
3. Decide on the shape of the sole and make the cardboard inner sole. Choosing the shape of the sole automatically determines the shape of the toe.
4. Place the finished inner sole on the bottom of the foot matching the heel positions. Fix it tightly to the foot by wrapping a turn of sellotape around the instep and arch of the foot.
5. Apply clay to make the shape of the toe.
6. When the clay is dry, neaten the shape with a file (or sponge paper!).
7. Check that the shape and thickness are the same on the left and right sides.

(Box) The shape of the toe
The shape of the toe is the most important point in the design of the shoe. Please carefully check the line of the toes from up and down, left and right. Let’s particularly make sure there isn’t an extreme step in the line from the instep and the toes.

8. Make the pattern according to the design. First draw on the vinyl with a magic marker. Use this to make the pattern.
9. This is the toe part. Here I am making a paper pattern, but I think it would be better to make a cloth pattern which you could tack together.
10. This is the tongue, which goes under the laced-up part.
11. This is the side. Really, the inside and outside are subtly different in shape, but this is a beginner’s level explanation so I’m using the same pattern.
12. This is how it looks with all the pattern pieces lined up.

2>> **Make the parts**

1. First cut out the leather for the outer sole. The pattern for the outer sole is the same one that you used first for the inner sole. Use thick craft leather.
2. Let’s cut it out carefully using scissors, a cutter knife, leather knife or similar. Cut out the heels larger than the actual heel size. Prepare 3 pieces for each side, that’s 6 in total.
3. Use thin leather for all the parts except the sole. Use the patterns, adding a 5mm seam allowance, and cut out 4 side pieces, 2 tongues and 2 toe pieces. Let’s make the seam allowances which attach to the sole at least 1cm.
4. Sew the leather for the sides. If you’re using a regular sewing machine, it may be difficult to feed through, so copy the pattern on to a different piece of paper and sandwich the leather between this and another sheet of paper to sew.
5. This has been sewn along a line 2mm inside the lines I copied. (<—Here he is making decorative topstitching it’s not really structural.)
6. Align the two pieces, right sides together.
7. Sew the back seam line.
8. Trim the seam allowance down to about 5mm, and apply wood glue.
9. Open both sides and stick them down.
10. Prepare pieces of leather about 1cm wide to reinforce the parts that will have eyelets and be laced up, and to the shoe mouth (you know... the hole you put them on through!).
11. Apply wood glue to these reinforcing pieces.
12. Stick the reinforcing pieces to the inside so that they cover the stitching.
13. Cut it down from the right side, to 2mm from the line of stitches.
14. Here it is in its cut state. Next let’s make holes in the side piece pattern to mark the position of the lace-up holes.
15. Using this pattern, make holes for the eyelets in the leather with a punch. Let’s take care not to put them in the wrong position.
16. Punch eyelets into the holes.
17. Use a setting tool on the reverse side to fix the eyelets in place.
18. All the eyelets are fixed in. With this the lace-up part is finished.
19. Make the outer sole. Here I have made the heel from three pieces of the thick leather I used for the outer sole.
20. Use G clear to glue together the three pieces of leather which you previously cut out larger than the heel pattern.
21. Here are the three pieces stuck together.
22. Cut off the front edge of the heel with a cutter knife, and then flatten it off with sandpaper.
23. Stick the heel to the outer sole.
24. The heel is too big, so trim it to match the line of the heel of the outer sole with a cutter knife.
25. Cutting curves is difficult, so let’s be careful.
26. When it’s cut, neaten the sides using sandpaper.
27. Cut the sellotape holding the inner sole to the foot with scissors, and remove it (the sellotape).
28. Cut a piece of thin leather slightly larger than the inner sole pattern.
29. Stick it to the inside of the inner sole with wood glue.
30. Cut off the excess with scissors, from the reverse side. This inner layer is only for show, and so it’s OK to omit it.

3>> **Assemble**

1. Stick the tongue to the reverse side of the toe part with wood glue.
2. Put the inner sole on the foot. Apply wood glue to the outside of the inner sole toe, and stick on the toe-part with the tongue attached. Let’s take care that the foot doesn’t get stuck to the shoe.
3. Stick it to the inner sole with G clear. First apply G clear to the surfaces to be joined on the cardboard sole and the leather.
4. Dry both sides and then stick. Pull the toe part on to the inner sole so it doesn’t wrinkle.
5. Make and glue together a number of pleats on the inner sole. If you’re using hard leather, soak it in water to soften and it will become easy to eliminate wrinkles.
6. Trim off the parts you pleated with scissors.
7. Flatten the sole using an iron.
8. Thread the leather cord through the eyelets and close the front up.
9. Align the back seam with the center.
10. Pull it towards the front side and make sure of the balance of the design.
11. Apply wood glue to the leather toe part.
12. Make several pleats on the sole-side and apply G clear to the surfaces to be glued. After letting it dry, lay the pleats flat and stick.
13. At this stage, please take care that there are no wrinkles around the heel as you stick it down.
14. Apply G clear to the outer sole and the main part of the shoe.
15. When the G clear has dried, stick them together.
16. Take the foot out, and it’s finished.

Advice: If you want to make the sole and the rest of the outer leather the same color, I think it would be fine to dye it with acrylic or alcohol-based leather dye and then coat with a clear medium or water-based varnish. Working with leather takes some getting used to, but once you have, you can make realistic shoes.

4>> **Stockings**

(Box) Stockings
It’s hard to find socks and stockings that fit just right. When using extremely thin fabric like stocking fabric, if you hand sew and sew paper along with it, you will get a neat finish. Please give it a go because it’s surprisingly simple.

1. Make a pattern to match the legs. Use thin sock or stocking fabric, make the front-part of the stocking in one piece and sew up the back seam. Next sew the toe seam line, and finally fold over the top edge and sew.

**Pg 80 pictures**

2>>
Picture 1 says "Add 300cc of modeling paste to a mortar. It's OK to use a bowl and spoon instead of a mortar and pestal."
Picture 2 says "Next add 50cc of Gesso."
Picture 3 says "Add 150cc of water and stir well."
Picture 4 says "Please mix well until smooth and all the lumps have gone."
Picture 5 says "Add acrylic or watercolor paint to make the base color you like. Mix each color in a little at a time."
Picture 6 says "Add watercolor carmine."
Picture 7 says "Please mix the paint well in the mixing saucer and then add very gradually. Take care not to make the color too dark."
Picture 8 says "Next gradually add watercolor yellow ochre."
Picture 9 says "You should add the color very gradually and mix properly. Making a bright tint now will make finishing easier later."
Picture 10 says "When the paint is the desired color, strain through an oil paint strainer. This will remove all the lumps and impurities from the paint."

Pg. 134
Shop List
**Doll item shops**

The tools and equipment that I have introduced in this book are mostly all things that can be bought in Tokyu Hands, DIY shops and general tool shops. However, there are some things like artificial eyes and doll’s hair that are especially hard to get hold of. For these I recommend the specialist shops and mail order companies listed below.

PADICO
<http://www.padico.co.jp/>
Address: Tokyo, Meguro ward, Higashiyama 3-2-4
Tel: 03-3710-3011 (charge)
The famous padico which sells Ladoll and all sorts of clay. As well as a wealth of different types of clay, they sell a wide range of hair and some of the basic tools that I used in this book. They sell nationally and internationally.

Kiki Doll
<http://kiki.cool.ne.jp/>
mail: afford@a.email.ne.jp
Shop: Hokkaido, Sapporo, West ward, Miyanozawa 1, 4-12-11
Tel: 011-667-9511
Artificial eyes, mohair, and other doll making materials. The actual shop is in Hokkaido.

Nishijin thread shop
<http://www.savageblue.com/kaminoke.htm>
Limited company Yoshikawa shouji hair for doll’s hair
Headquarters: Kyoto prefecture, Kyoto, North ward, Kamigamo Sakurai town
Tel: 075-722-7155
Fax: 075-722-7161
Straight silk thread (Kinu sugaito = for traditional Japanese doll’s hair) can be bought here. First let’s look at the thread color samples. The actual shop is in Kyoto.

Public company Kawamura wig shop
<http://www.kkkatura.co.jp/>　(The wig shop is actually here: <http://www.dollhair.jp/>)
Headquarters: Osaka prefecture, Osaka, Higashinari ward, Main street 1-11-17
Tel: 06-6972-0515
You can get doll’s wigs and human hair here. They have shops in Umeda, Tokyo and Uwajima

Mikuni Bisque Dolls
<http://mikuni.cc/>
mail: mikuni-bd@nifty.com
Address: Tokyo, Nerima ward, Sekimachikita 2-27-11
Tousen Sekimachi building 3rd floor
Tel&Fax: 03-3929-9396
They specialize in items for bisque dolls, but they have a broad range of doll items such as artificial eyes, hair, dress fabric and lace, stands, utensils and books. The actual shop is in Tokyo.

Reference
**Reference books**

Here I am introducing a few materials to refer to for human body sketches and sculpting muscles. They are all things that can be bought over the net. (As of 2006)

Figure Drawing For All It’s Worth (Called easy portrait painting in Japanese: [http://www.amazon.co.jp/%E3%82%84%E3...pd\_sim\_b\_img\_1](http://www.amazon.co.jp/%E3%82%84%E3%81%95%E3%81%97%E3%81%84%E4%BA%BA%E7%89%A9%E7%94%BB-%E3%83%BB%E3%83%AB%E3%83%BC%E3%83%9F%E3%82%B9/dp/4837301037/ref%3Dpd_sim_b_img_1))
This is a book for people who are aiming to become professional artists, but the explanations of the structure of bones and muscles are easy to understand.
Author/ A. Loomis (Maar, ¥1890)
ISBN 4-8373-0103-7 (<—Japanese edition)

Drawing the Head and Hands (Called how to draw the face and hands easily: [http://www.amazon.co.jp/%E3%82%84%E3...pd\_sim\_b\_img\_2](http://www.amazon.co.jp/%E3%82%84%E3%81%95%E3%81%97%E3%81%84%E9%A1%94%E3%81%A8%E6%89%8B%E3%81%AE%E6%8F%8F%E3%81%8D%E6%96%B9-%E3%83%BB%E3%83%AB%E3%83%BC%E3%83%9F%E3%82%B9/dp/483730107X/ref%3Dpd_sim_b_img_2))
A manual full of anatomical plans of the head and hands of males and females at all ages and the differences in ratios etc. intended for artists.
Author/ A. Loomis (Maar, ¥1890)
ISBN 4-8373-0107-X (<—Japanese edition)

A Manual of Fine Arts Anatomy (Nyumon Bijutsukaibougaku: [http://www.amazon.co.jp/%E5%85%A5%E9...5804461&sr=8-1](http://www.amazon.co.jp/%E5%85%A5%E9%96%80-%E7%BE%8E%E8%A1%93%E8%A7%A3%E5%89%96%E5%AD%A6-%E9%AB%98%E6%A9%8B-%E5%BD%AC/dp/4263453719/ref%3Dsr_1_1?ie=UTF8&s=books&qid=1205804461&sr=8-1))
A book on basic human form and structure, that centers on describing the skeletal and muscular systems.
Author/ Takahashi Akira (Ishiyaku publishing co., ¥3990)
ISBN 4-2634-5371-9

An Atlas of Anatomy for Artist
Listed because it includes explanations and illustrations of human anatomical skeleto-muscular structure and movement.
Author/ Fritz Schider (Dover, $12.95)

Modeling the Figure in Clay (Practical craft books)
And finally, a book which shows you how to reach perfection in clay, from the skeleton, through the muscles and putting on the skin.
Author/ Bruno Lucchesi (Watson Guptill, $19.95)
ISBN 0-8230-3096-2