

Making furniture from cardboard (Lesson 1)

Learning intentions (for Lessons 1 and 2)

You will learn how:

- other people have used cardboard as a construction material for furniture
- to design a product with the aim of making it from cardboard

Success criteria

You will show your understanding by:

- analysing cardboard furniture created by other people
- Sketching and planning design ideas for a piece of furniture you will make next week

Task 1: Cardboard as a creative and structural material

Most of us think of cardboard as a disposable material - something that is used for packaging, and then recycled after use. It usually isn't valued very much. But some of the special qualities of cardboard have been used by designers to make furniture, some that are temporary, others that are expected to last for a long time.

Cardboard has characteristics / qualities that are good (useful) and bad (problematic) for making furniture. Describe them.

Useful characteristics/properties of cardboard for furniture	Problematic characteristics/properties of cardboard for furniture

Task 2: Cardboard Furniture made by designers

Cardboard furniture is an inexpensive and light alternative to traditional furniture. Many designs create the necessary stability through insert and folding techniques. Gehry chose a different method, which gave birth to sturdy cardboard furniture like cardboard sculptures: "One day I look in my office at a pile of corrugated cardboard, the material I normally used to make architecture models, and I began to experiment with it, to stick it together and to cut it into shape with a hand saw and a penknife."
Designed in 1982 - recent cost at auction: approx. \$10,000



In 1972, renowned architect Frank Gehry created the "Easy Edges" series (above). His chairs require around 60 layers of cardboard to become as sturdy and solid as they are.



These pieces of furniture become softer and more comfortable the more they are used.



Creative design studio Lazerian in Manchester, UK, does some amazing cardboard creations such as the Bravais Armchair. Available in a limited edition of 50, it was inspired by patterns in nature like microscopic sea organisms and wasp nests. The chair's making took more than 200 pieces, which had to be hand-cut and glued.

In India, the children who are able to attend school often don't even have chairs to sit on or desks to write on. To address some of these problems, Aarambh, a not-for-profit organisation based in New Bombay, created a dual-purpose portable flat pack desk made from recycled cardboard boxes



Chairigami founder Zach Rotholz wants to "save the world, one cardboard chair at a time."



What do you see?

From the pictures above, identify 3 ways that these pieces of cardboard furniture have been constructed to give them strength

From the pictures, identify 3 things that you thought were appealing or surprising

From the text, identify three things that have been written about the furniture that discuss the reasons for the product, or the process of making.

Sydney Olympics Case Study (optional)

Ramler Furniture was the official furniture supplier for the Sydney Olympic Games supplying around 400,000 items. Part of their range is a line of recycled cardboard products, including tables, chairs and filing cabinets.

Visy Industries supplied the raw materials for the cardboard furniture. Ramler Furniture had the contract to supply 400,000 pieces of furniture for the Sydney Green Games and a sizeable proportion of that product was be recycled and recyclable.

In an interview just before the games, Managing Director of Ramler Furniture, Garry Ramler explains.

Garry Ramler: *Well the Olympic Games are going to have a big problem because the organisers know that after the games are over that we're going to have 400,000 items of furniture that they have to dispose of and move away and the problem was how to move this without flooding the market in all furniture sectors. So we came up with the idea of using recycled cardboard because basically at the end of the games we pulp up by the recycling companies back into newsprint.*

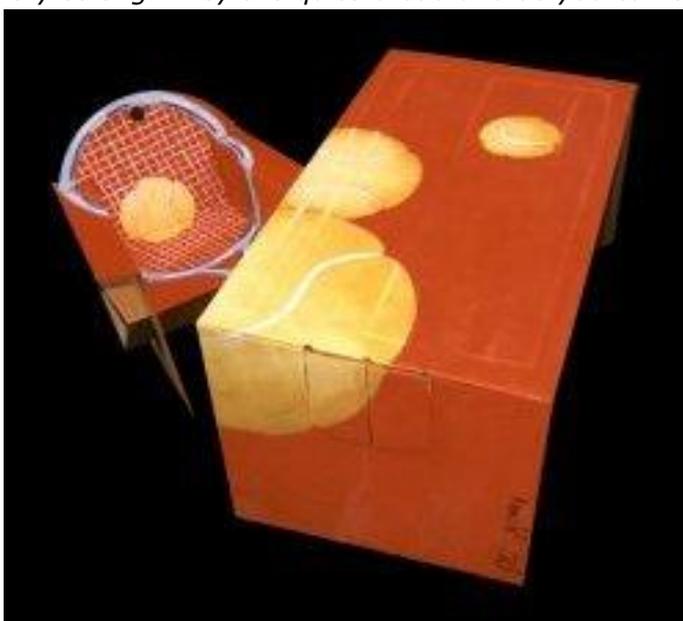
So virtually it comes from recycled paper to start with and all ends up as recycled paper at the end of the games.

Question: *What sorts of paper products will you actually supply for the games?*

Garry Ramler: *Well there are cardboard chairs, there are tables especially, in the filing cabinet area as well, we want to replace a lot of the steel filing cabinets with archive boxes and archive shelving made out of cardboard. Because only it has to last for two weeks and after the two week period they can be sent back to Visy for recycling.*

Question: *What sort of weight can one of these chairs hold because with athletes you are often talking about fairly sizeable, strong bodies?*

Garry Ramler: *Actually yeah, we've tested that out. Because we were concerned that it's OK for the average person to use but will the larger bulky athlete be comfortable. And they're very comfortable. They are well designed pieces of furniture. They are based on triangular geometry so they are very, very strong. They are quite broad and as you can see from the samples in front of you and they take a lot of pressure a lot of beating to be able to be comfortable for those circumstances.*



Question: *And how long will a chair last?*

Garry Ramler: *Well they've been on the market now in Europe where we first saw the idea about two or three years. And they've been very well accepted there and been used in people's homes for two or three years without any problems whatsoever. The rough and tumble exposure and wear that they'll get in the commercial market at the Olympic Games will be quite a challenge for them but we wanted them to last for three weeks and after that we'll probably go and pulp them afterwards and dispose of them in that way.*



From the Olympic Games Case Study

Answer the following questions:

Question	Your responses
What was special about the Olympic Games design situation that made cardboard a good choice for furniture?	
How long did the furniture need to last, and what happened to them at the end of the Games?	
How are the chairs designed to be strong and comfortable?	

Your cardboard design challenge

(Lesson 2)

You need to design cardboard chair for a child of about 3-4 years old

- the sizes of a child that age are given below
- the chair needs to be designed and made from cardboard boxes
- you will be making the chair full sized - this will be done next week
- the chair needs to be strong and sturdy - you will test the chair by loading it with 4kg of weight (2 large bags of sugar or flour)
- you can only use sticky-tape or masking tape to join your pieces (no cloth tape)

Task 3: Design analysis

From your reading above, particularly looking at the construction of these existing pieces of furniture:

identify three construction shapes or methods you could use to make your design strong
identify three different visual features or ideas you could use in your design to make it appealing to young children

Task 4: Design sketches

Draw **3 different design ideas** for a child's chair

- try to make your drawings look realistic and in proportion
- show the colour and texture of the cardboard material
- show the major dimensions on your drawings
- write comments next to each drawing identifying its good/bad features

Choose your best design idea

- write a detailed comment explaining why it is the best idea

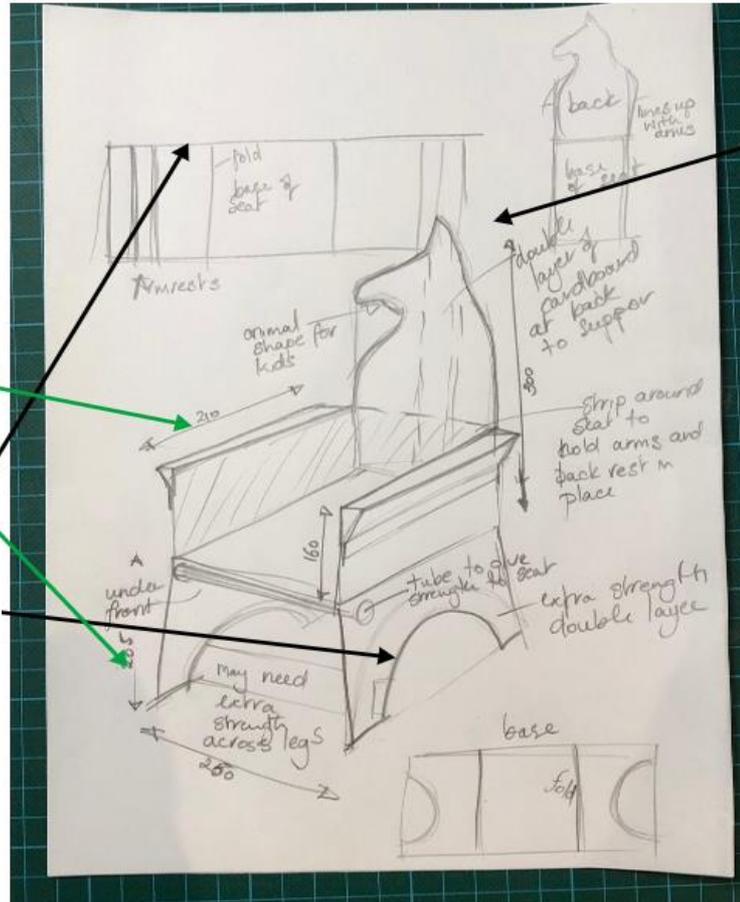
This task should take you at least 30-50 mins to complete - take your time and create some interesting, well drawn ideas

Example sketch

notice the detailed comments that explain the design

the main measurements are included

notice that the cardboard shapes of the design have already been thought about



the chair has a feature that makes it interesting for kids – the animal head

Structural strength

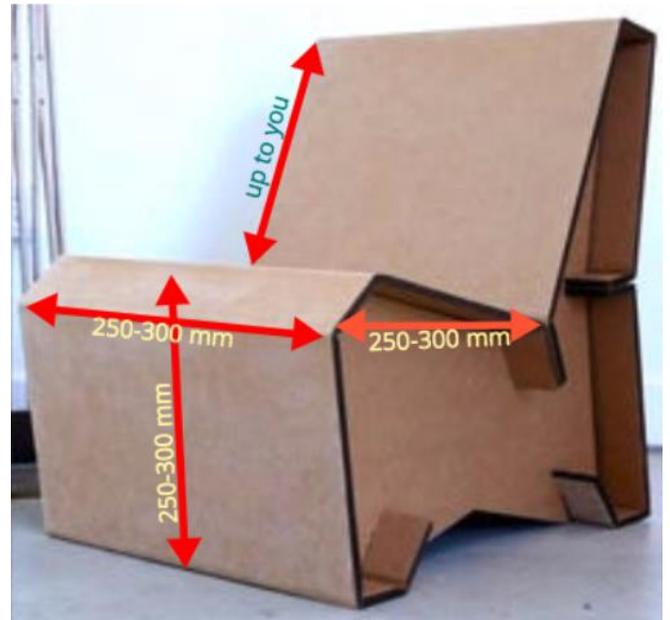
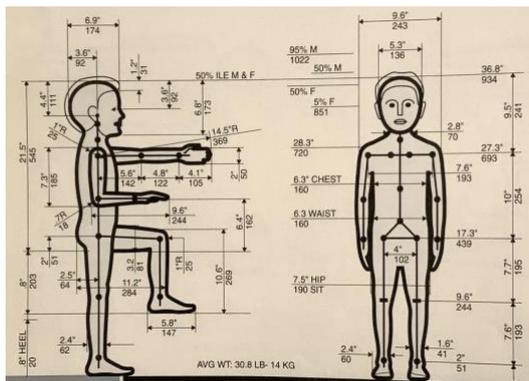
there are folds for the arm rest and a reinforced curve and tube to support that legs, and a folded ridge of cardboard behind the back to give strength

There is also a piece of cardboard around the arms and behind the back to hold these pieces in place and to give them support.

Example drawing

Recommended sizes

It is good to use the measurements of children to work out the size of your chair – so it fits them well. The recommended sizes on the right are calculated from the drawing below (from "The Measurements of Man and Woman:")



Early modelling

You might like to try out your ideas using paper:

- Cut out basic shapes
- fold and bend to create 3D forms that might work for a chair structure
- make cylinders, tubes and folded forms to create support structures for

Use these as a basis for your drawings.

Cardboard Chair Paper Model

(Lesson 3)

Learning intention:

- You will learn to interpret your drawings into flat pieces of paper that can be folded into a 3D chair model

Success criteria

You will show your understanding by:

- taking your design from last week apart visually in your mind, and turning it into flat shapes that can be cut out of paper
- accurately cut the paper shapes, adjusting as you go to make the pieces fit together
- creating strengthening sections under the seat, on the legs on armrests and the back, that gives stability and strength to the chair structure
- putting the chair parts together to make a strong paper chair model
- considering an aspect of the chair that makes it interesting and engaging for a 3-4 year old child

Task: Make a small paper model of your chair design

When making a model of your design, remember this:

- **every time you cut cardboard, you lose strength**
- **every time you fold cardboard, you gain strength**

Take a good look at your design from last lesson. Can you turn it into flat pieces of paper to make a small model?

Here are some suggestions:

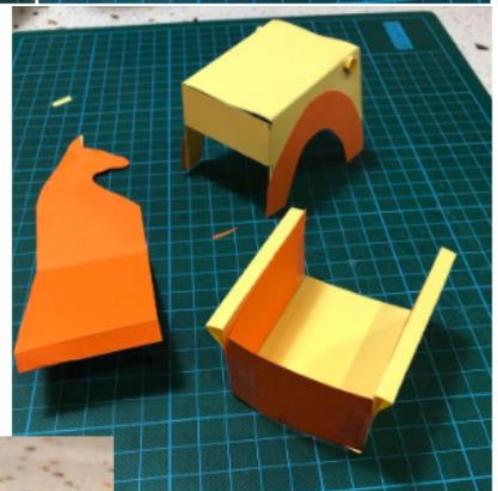
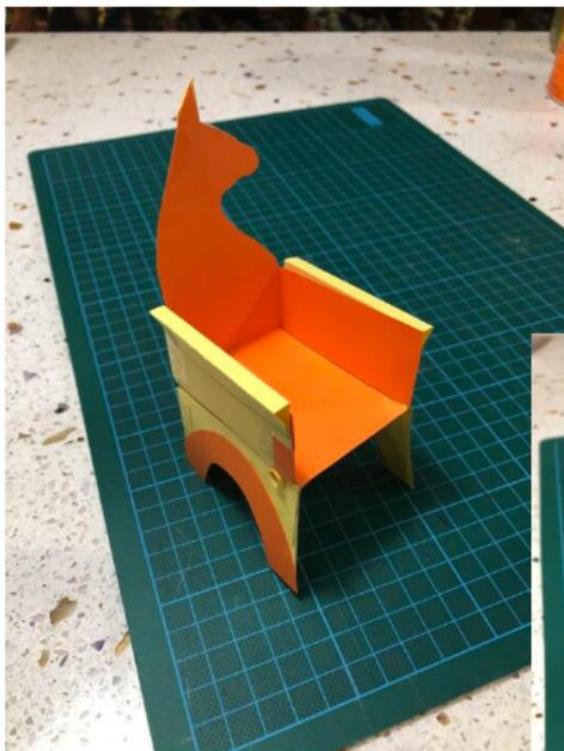
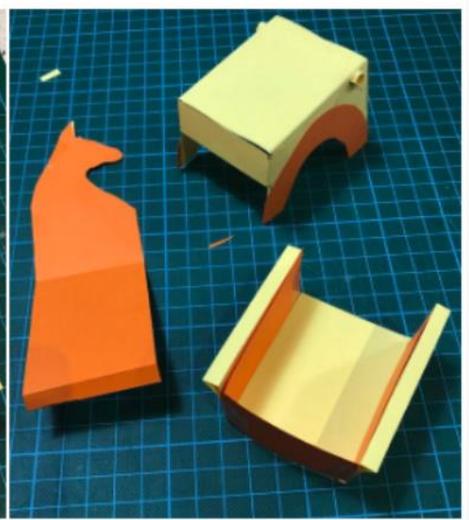
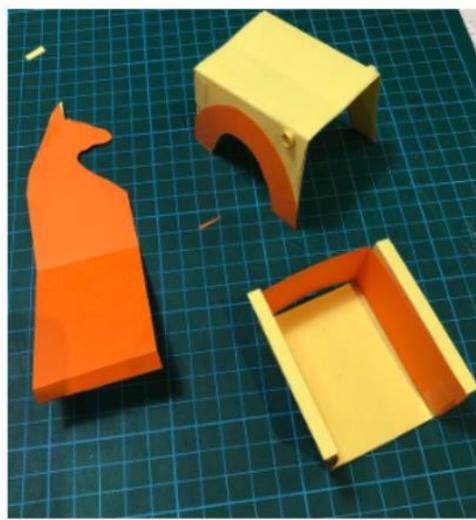
- Look at the example design drawing from the last lesson - it shows you how you can start thinking about your design in terms of flat shapes that can be folded into 3D shapes
- It might be useful to **think of your chair in 2-3 sections**:
 - the leg structure
 - the seat and back structure
- Start cutting pieces of paper to **recreate your best idea in flat pieces**
 - this might take a few goes to get the right shapes that can be folded into your chair form
 - i. **try, try, try again** until you get the folds and the shapes working well
 - **limit the cutting** in your design (see the red text above) - try to think of your shape as a folded design, rather than different sections cut and stuck together
- **Score the fold lines** in your paper (either use the corner of a ruler, or the blunt edge of scissors to create a crease line, be careful not to cut through)
- If your design idea doesn't work - **change your design** until it does
- Using **different coloured paper for different parts** helps you and me) to see the structure sections better
- Your paper model doesn't need to be to scale, but needs to have roughly the right proportions. (just to give you an idea - my paper model is 70mm from front to back, 80mm up to the arm rest, 60mm across the seat, and 140mm from the ground to the top of the backrest)

Steps:

1. Draw and cut flat pieces of paper to match your design ideas
2. Score your fold lines
3. Trial the shapes to see if they fit together and create the 3D shape
4. Adjust the staples to make the design fit and work better
5. glue and sticky tape your pieces together to make your paper model chair

***Take at least four photos as you create,** so others can see the process of your design development.

Here are some examples:



Cardboard Chair – final construction

(Lesson 4)

Learning intentions:

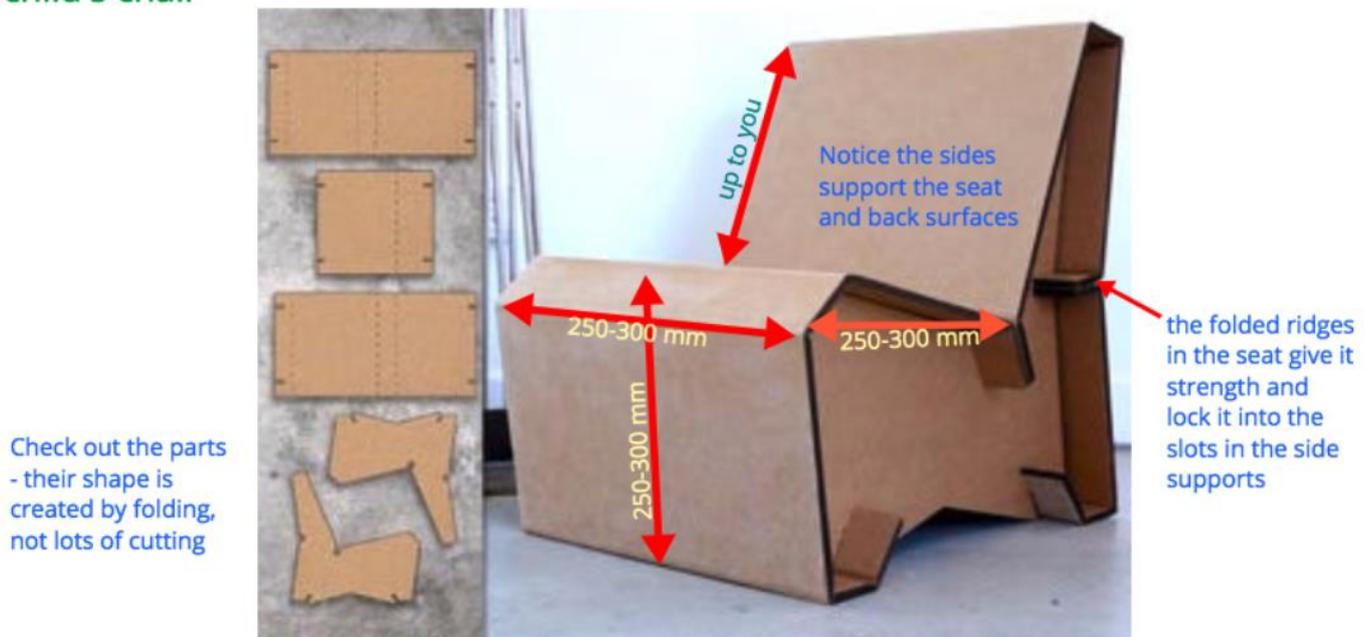
- You will learn how to use accuracy and basic construction skills turn a paper model chair into a full-sized child's chair

Success criteria:

You will show your learning by:

- identifying the parts you need from your paper model
- measuring and marking out those parts
- cutting them out accurately
- scoring and folding them
- joining them together with a minimal amount of sticky tape

Critical measurements for your child's chair



From: *Handmade: A Hands-On Guide: Make the Things You Use Every Day* - Asa Christiana

Task 1: Making your chair - Steps for construction

1. Use your paper model to work out the parts you need:
 - now is the time to change your idea to make it stronger and to join parts together (to change cuts into folds)
 - make sure there is some overlap between the parts if possible, so that you join a flat part to a flat part, rather than an edge to an edge (not very strong)
2. Measure and mark your parts onto cardboard:
 - try to position your chair parts on the cardboard so that any folds that occur in your cardboard box won't reduce the chair's strength
3. Cut out your parts:
 - it is easier to do this with a stanley knife, but **be very careful**. Always keep your fingers away from the blade and the cutting line.

- Use a ruler for marking and guiding the cuts of all your straight lines.
 - always cut on a protected surface - use a mat or something under your cutting area so you don't cut into a table or the floor (or do this outside).
4. Score your fold lines:
 - use the back of scissors (not the cutting edge), the corner of a ruler, or even a pen line to mark the fold lines. This will help you to fold accurately
 5. Put your pieces together without any sticky tape to check that your shapes fit properly - this is called a dry check (joining without glue)
 - make any minor adjustments to make the parts fit together better
 6. When you are happy with how it fits together, use sticky tape and a glue stick to put your chair together:
 - If you are using a glue stick to join 2 flat pieces together, make sure the cardboard doesn't have a shiny surface, and you might need to hold the parts together with a clothes peg until the glue dries.
 - Try to use a minimum amount of sticky tape - it should be there to hold pieces in place, not to provide structure and strength.

Don't forget to take at least 3 photos of your chair as you build it - and one of your finished chair. Or you could do a stop-motion video.

Task 2: Testing your chair

Learning intentions:

- You will learn how to use the things you have around you to test and evaluate your chair

Success criteria:

You will show your learning by:

- testing your chair (as systematically as possible)
- accurately recording your observations and findings
- thoughtfully evaluating your chair design and your design and construction process

***Make sure you have taken photos of your finished chair before your test it!**

Place objects on the seat of your chair to test how well it carries weight.

- Put weight on the seat of your chair in increasing amounts. Start off with 500gm - then add another
- You could use packets of sugar or flour, fruit juice - most of these objects have the weight marked on them
- Add up and record the weight after each addition
- **take a photo after each addition**
- keep adding until your chair collapses - or you reach 4-5 kg (you can keep going if you want!)
- do this in a controlled and safe way - you don't want to have flour or sugar spilt all over the place. Please don't use anything that is breakable

Take a video of your testing process

Get everything ready before you start filming

Answer the following test questions

Question	Your response
What was heaviest weight your chair managed to hold without breaking or buckling?	
What was the weight that caused your chair to break or buckle?	
Which part of your chair was the weakest (buckled or broke first)	
What did you use as your weights	
How do you think you could strengthen your chair so that it could hold more weight	
Do you think the way you tested was accurate and valid? Why/why not?	

Task 3: Final evaluation questions

Question	Your response
What did you enjoy most about designing and making the chair?	
Which aspect of design or construction did you find the most challenging ?	
What part of your chair was most successful ?	
What part of your chair didn't work well ?	
Explain a specific way you could improve your chair design or construction	
Explain a specific way you could improve your chair design or construction	
What helped you get through steps or stages that were really hard?	