

Appendix 10: Learning to See by Sketching

Online Supplement for “How to Become an Expert Engineer”

James Trevelyan, January 2014

These pages explain how you can acquire the ability to see things that you would never have otherwise noticed by learning to draw, freehand, with only the simplest of equipment. Not only this, you will also gain confidence, be able to access your creative abilities more easily, improve your visual presentation skills and be able to interpret and use drawings more effectively.

You will also learn that 'seeing' is an active process that you can improve by training and practice. It is a state of mind that requires discipline and the ability to put aside distractions and preconceived ideas. These abilities are very helpful for any engineer.

Many of the ideas for this course came from Betty Edwards' books¹ and others have recognized their importance as a critical aspect of learning to be an engineer.² I developed these ideas in 1992 for a voluntary class for students to learn visual skills, particularly learning to see. Subsequently this material became a core part of the mechanical and, for a while, the civil engineering curriculum. However, while most engineering skills encourage students to learn visual skills, they miss the critical basic skill..... learning to see. Without that, visual skills have limited value.

Equipment required

You can purchase what you need at leading stationery and art shops:

- An A3 sketchpad with cardboard back (size 42 cm x 30 cm)
- Sheets of grey drawing paper (at least 6)
- Bleed proof paper – paper on which you can use marker pens without the ink spreading
- Wood pencils (2B, 4B, 6B)
- A clutch pencil (0.5 mm, 2B lead)
- Thin and thick marker pens (Black, 0.5mm, 1mm, 4mm)
- Pencil sharpener (with container for shavings)
- One large and one small paintbrush
- Black ink
- Eraser
- Mouldable (kneadable) eraser

If you are particularly keen, these will also be useful:

- 2 or 3 other paintbrushes
- Selection of charcoal pencils
- Colour pastels (dry or oil-based)
- Spray fixative

¹ (Edwards, 2012a, 2012b)

² See, for example, chapter 7 in (Beakley, Evans, & Keats, 1986).

If you have a sketching app on a tablet or touch screen or a basic version of Photoshop with a digitiser tablet on your computer, you can do all the drawing exercises in this course without using paper or pencils.

In this course of exercises, you will learn to see accurately. Once you can do that, you can easily master any form of technical drawing by following conventions used by your respective engineering discipline.

You will learn tricks for doing this like drawing upside down and drawing the spaces which are not part of the object that you want to draw. These tricks help your mind to connect with what your eyes are actually seeing. Once you can do that, your visual perception skill will be greatly improved. You will also be able to draw well.

There is no absolute standard of achievement for this course. You will be the judge of your own performance. You will keep all your drawings as a record of your progress. As you work through the exercises, you will start to see significant improvements provided you put in the time and effort. You will need about 20-30 hours of practice to do this.

The Internet abounds with images that are wonderful subjects for drawing. You can also use your own camera, even a phone camera, to capture images from which you can prepare your drawings. Drawings of people, transparent and reflective objects, and the objects that you encounter in your everyday life as an engineer can provide wonderful images for drawing practice.

Towards the end of the course, we will cover techniques that are useful for engineering drawings and illustrations. However in the early part of the course, we will focus on perceptual skills without any apparent relevance for engineering. Stick with it: everything will become clear in the end.

Program (by session)

1. Introduction: shape and outline following
2. Further outline skills: drawing plants and objects without outlines.
3. Negative spaces
4. Drawing man-made structures
5. Drawing texture and shading, clothing and shoes.
6. Drawing trees as examples of natural structures.
7. Reflective and transparent objects – perceiving shades
8. Art Gallery exercise: drawing and art – expression or representation?

Session 1 part 1: (up to 2 hours) Evaluate your seeing skills today

The most basic requirement for drawing is a suitable environment. Remember that learning to draw is all about learning to train your mind in new ways of thinking and perception. It would be much easier if you can reduce distractions to a minimum. You need a quiet room with good diffuse lighting, preferably free from sharp edged shadows. You need a comfortable chair and music may help you concentrate. Some psychologists have found that certain classical music can increase concentration – works by Mozart and J. S. Bach in particular.

Before you start each session, take a few minutes to relax and let go of the tensions and distractions of the day so far. We will explore techniques for this during the course.

You should first complete the evaluation exercise in the book– to record your drawing skill at the start of this course. (reproduced here for reference)

This serves only as a private record so that you can look back and see your improvement as the sessions go by.

You will do four evaluation drawings. Take no more than 30 minutes for each and be sure to write your initials and the date on each of them.

Drawing 1:

- Draw a square, a circle, and a rectangle, side by side. Write your name immediately below.

Drawing 2

- Draw a person sitting in front of you: either the whole figure or just ahead. If you're in class, draw a fellow student. If you are alone, use a mirror to draw a self-portrait. If you can't get access to live figure, draw a portrait by working from a photograph of a person.

Drawing 3

- Draw your own hand.
Place your left hand (the right hand if you are left-handed) on one side of an A3 sheet of paper, and prepare a drawing of your hand on the opposite side of the paper.
If you think you might be interrupted, lightly trace around just the tips of your fingers before starting so that you can return your hand to the same position on the paper.

Drawing 4

- Place a shiny metal spoon on a book and draw them together.

Take a short break.

Session 1 part 2: (60 minutes) Evaluate your improvement potential

Now judge the results. You are probably much more satisfied with your square, rectangle, and circle than you are with your portrait, perhaps even with the drawing of your hand.

You managed to write your name? What this shows is that your ability to move the pencil is not an issue. The only reason why the other drawings were not as good is that your eye and brain is not yet allowing you to move the pencil in appropriate ways.

How well do the shape and shading of your portrait correspond to the person? Would you recognise the sketch as your hand? Can you see the reflections in the shiny metal parts of your drawing of the spoon? Can you see the texture of the binding of the book?

The shortcomings in your sketches demonstrate that your ability to see can improve. When you can see accurately, you will be able to draw accurately!

In her book, *Drawing on the Artist Within*, Betty Edwards described how she stumbled on the idea of drawing upside down as a way of picking your brain to help disable your powerful habitual recognition process. This is what Daniel Kahneman refers to as 'thinking fast'.³ It is essential for survival. As you walk across the road, it is this process that tells you that there's a car heading in your direction and roughly how fast it's travelling. It helps you quickly pick out the face of a friend or loved one in the crowds at a football match or on a city street. Your brain is constantly working with the visual images coming from your eyes, recognising complex patterns almost in an instant.

While this instinctive capacity for recognition is essential for survival, you have to learn to disconnect it when you need to accurately observe all the relevant features of an object or person: the subject of your drawing. Learning to draw is one way to do that. It is the equivalent of what Daniel Kahneman calls 'thinking slow'.

One way to disconnect your recognition engine is simply to copy an upside-down drawing. Now you are going to try this for yourself.

Resist the temptation to turn the drawing or your copy right way up until you have finished. This is very important.

Choose the drawing of the woman with a shawl or the wheeled robot, depending on your preference. Only choose the robot if you have a particular objection to attempting a drawing of a person.

Draw a frame with similar proportions to the one around your chosen reference drawing.

Copy the drawing, starting anywhere you like. Most people prefer to start at the top of the upside-down drawing and work downwards.

Draw smaller, complete pieces, one at a time. Do not draw around the complete outline first and then fill in the middle.

Even if you manage to recognise parts of the picture, try and suppress these thoughts. Just focus on the actual shape of each of the lines, and copy that shape to the paper: pretend to be a photocopier.

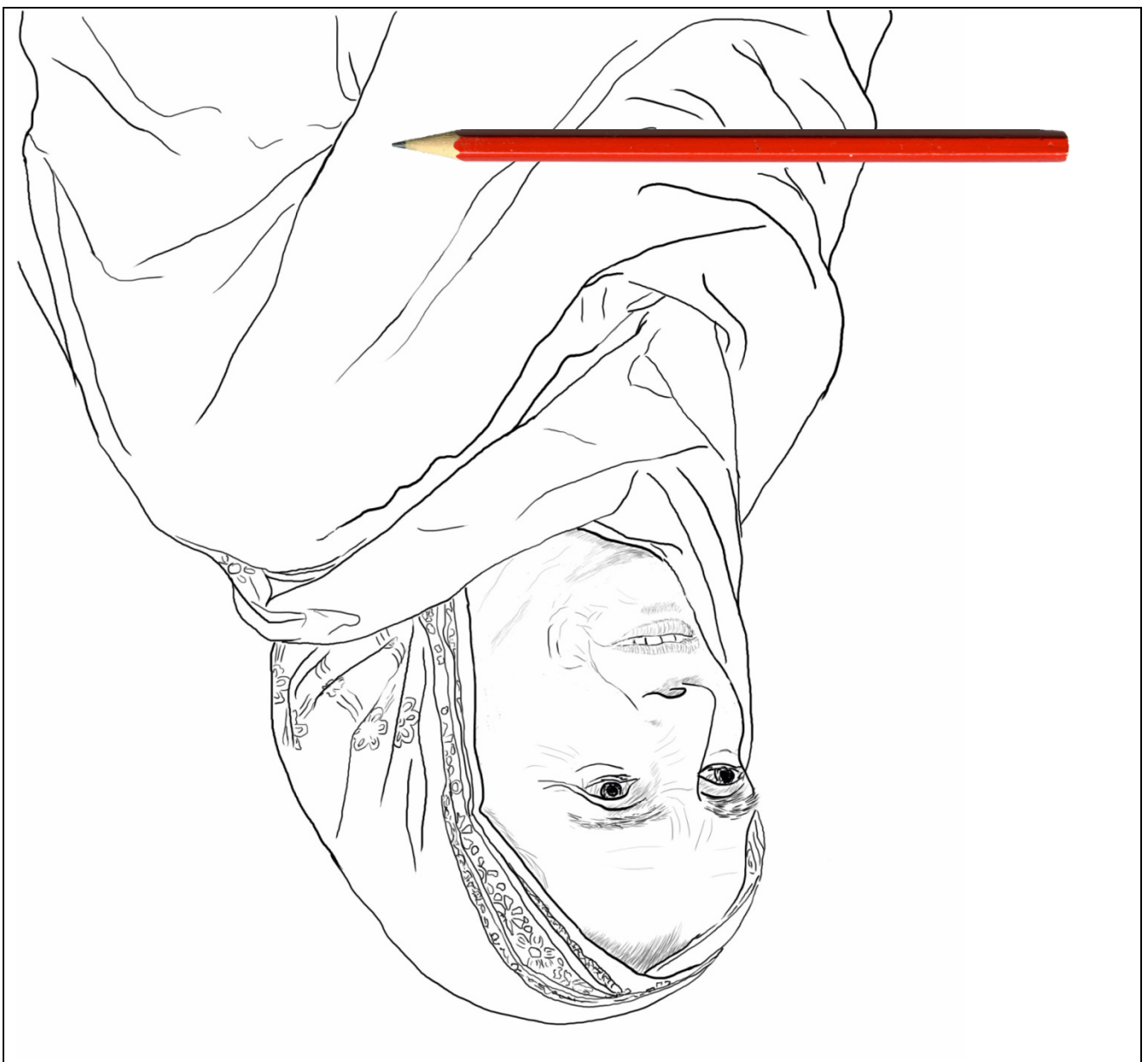
³ (Kahneman, 2011)

Try not to think of anything except how the lines fit together. Ask yourself, "What angle does this line make with the horizontal or vertical?" "Where is this corner in relation to other parts of the drawing?"

Use your pencil as a gauge to see where a particular part of the drawing is in relation to other parts. Observe which points lie vertically with respect to each other, and which lie horizontally.

Finish the body of the woman before you start on her head. Before drawing her head, construct a faint rectangle to serve as a guide for size like the dotted rectangle just above. Then, faithfully copy the lines and dots that make up the head. Focus on each line and copy it, without trying to work out whether it is part of an eye, hair line or clothing.

Be careful not to draw missing lines which you think should be there!



Drawing skills – important ones to practice are in italics

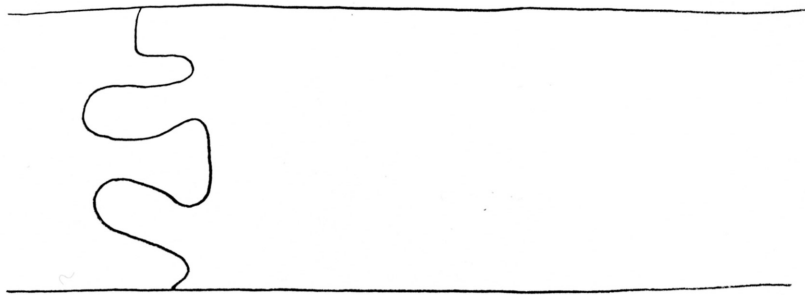
- Frame the drawing to help with proportions
- Draw each section one at a time, piece by piece
- *Learn to see slopes, angles, corners and distances*: be particularly careful with sloping straight lines on man-made objects.
- Work no faster than it takes you to see the details.
- *Use your pencil as a gauge to check the relative slopes and distances.*
- Look for vertical and horizontal relationships and check them using a pencil.
- *Avoid drawing recognizable shapes – if copying from a photograph or image, turn it and your drawing upside down and then continue.*

Next, we are going to refine a basic skill for drawing – outline following. This will reinforce your skill in moving a pencil in response to what you see with your eyes.

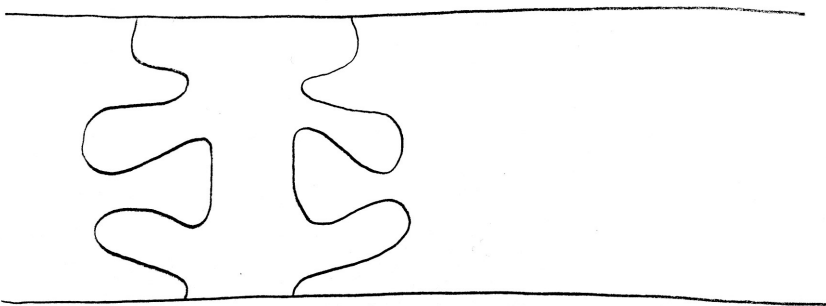
Session 1 part 3: (20 min)

This is an abstract copying exercise which can be more difficult than it seems. It is a good one to try in idle moments and can be the basis of some entertaining games if you are prepared to use your imagination.

Draw two lines, roughly parallel, across the top of a fresh sheet of paper like this. Form a curved wiggle from the top line to the bottom.



Now, copy the wiggle just beside the original, but as a mirror image like this.



Keep the pencil on the paper all the time. Look at each section of wiggle, then draw it, then look at the next section, and so on. Draw a new and different wiggle, and copy that one too, as a mirror image.

Keep doing this, filling up your page for about 15 min.

It's hard at first, but as you improve, you will be able to try more and more elaborate wiggles.

Keep practising for the remainder of the session. Create more and more complex shapes, and then copy them as a mirror image.

Make sure you have written your name and the date on all the drawings you created.

To practice before the next session, repeat the last exercise as many times as you can.

Session 1 part 4: (90 min) Annotated Sketches

Find some engineering components used in your discipline. Avoid assemblies or finished artefacts. Broken or junked household items usually contain plenty of suitable components, ranging from a used tap washer to electronic circuit connectors.

Photograph and draw one of these components as best you can, using any combination of freehand sketching or technical drawing that seems appropriate to you.

Prepare 2-4 pages of sketches and photographs, and annotate each sketch and photograph with comments that explain:

- Intended function of component;
- Size, weight, material(s), dimensions of critical sections of the component;
- Condition of component: new? used? worn? damaged?
- Specific manufacturing artefacts (e.g. locating holes); Surface finishes;
- Evidence on how the component was manufactured; and
- Observations pertaining to the component design: Explain why is it shaped the way it is. Explain why the choices of the materials are (or are not) appropriate.

Practice drawing similar engineering components every week, using the skills that you have acquired by following these instructions. This will build up your tacit knowledge and you will notice details in these components that you never noticed before. Write notes to yourself recording observations such as ways in which the components were manufactured or assembled, the materials they are made from, the surface finish, etc.

Session 2 Outline Skills

If you're at home, you will need a selection of leaves and cuttings from trees, plants or flowers from your garden or the nearest park. Weeds will do just as well, and won't annoy the person caring for the garden.

Warm up exercise

The purpose of the warm up exercise is to help your mind start to let go of the tensions and distractions you have accumulated during the day. Probably you need to unwind a highly constrained thinking pattern has dominated your mind in the last few hours.

Make sure you have 15 min free from interruptions. Read the instructions first, then do the exercise. Have paper and a pencil ready.

For about 2 – 3 minutes, sit upright, close your eyes and focus on balancing your upper body on your seat, and your head on your shoulders. Breathe in deeply and slowly for about three seconds, then relax and let the air go out quickly, and then relax a few seconds before breathing in again. Repeat this a few times, gradually more gently.

Draw a simple, aimless squiggle. Copy the squiggle slowly. Don't use a rubber to correct mistakes – just keep drawing because the main aim is to relax.

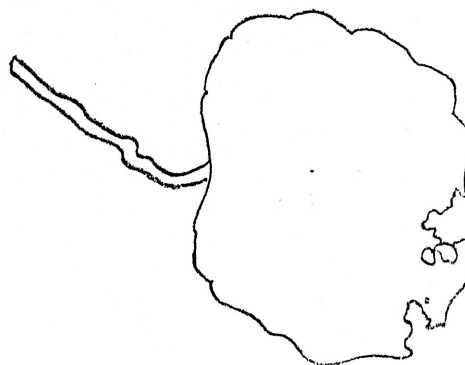
Once you start to feel relaxed, start drawing anything handy, or even a leaf you have collected. Draw in any way you feel comfortable, to feel more relaxed. Don't worry about what you draw or how.

Session 2 part 1: (20 min)

Find a leaf or a broken twig. Place it on a fresh sheet of paper, and draw just the outline. Read the instructions first, then start.

You will draw one unbroken line right round the outline, pausing to look at each section of outline in turn.

Look at the outline which extends from your starting point. Is it straight, curved, wiggly? What angle does it make with the horizontal or vertical? Once you have figured this out visually, draw this first part of the outline in one single movement, keeping your pencil on the paper all the time. Do not let your pencil lift off the paper.



Now pause, keeping your pencil on the paper, and look the next section of outline. If the first section was straight, this might be curved. Does it curve in or out, sharply or gently, and what angle does it end at? After working this out, resume drawing just this one section of outline and finish by keeping your pencil on the paper once again. Do not lift the pencil from the paper.

Repeat this process until you have completed the entire outline. Do not correct mistakes: just go back and redraw them.

Don't draw any of the internal details of the leaf or twig – just draw the outline.

Write your initials on the drawing and date.

This is a training exercise which is designed to help you develop the skill of seeing the outline and noticing tiny details that might escape a casual glance. You need to spend some time just looking at each section of outline to see them.

Many people who start drawing spend most of the time looking at the pencil, making marks on the paper.

Instead, you need to be looking for long enough at what you are drawing to see the shapes that need to be drawn.

Try to remember that we can all make marks on paper quite easily. The difficult part is seeing the shapes that need to be drawn. Practice taking much more time to do this first, and before you start drawing. It will be slow and tedious at first, until you build up your skills. That's just like anything you need to learn: take it slowly and easily at first. Then it will become easier with practice.

If the finished result looks strange, you're normal! This is a practice exercise, and all that counts is the practice. It doesn't matter what the result looks like. Your results may improve quickly with practice, but don't worry if they do not seem to improve immediately. You will improve eventually. Keep up the practice.

Session 2 part 2: Practice (40 min)

Repeat the part 1 exercise for at least 8 – 10 different leaves and plant cuttings. If you need some variation, add some internal details or shading if you wish.



Session 2, part 3: Drawing blind (20 min)

This exercise reinforces your new (and hopefully sustained) habit of looking carefully at each part of the subject you are drawing before you draw it. In this exercise, you will only look at the subject. You will not look at the pencil or the paper. You will need two leaves and a mask consisting of a sheet of paper or cardboard. Leaves with sections eaten by insects make excellent subjects for this exercise.

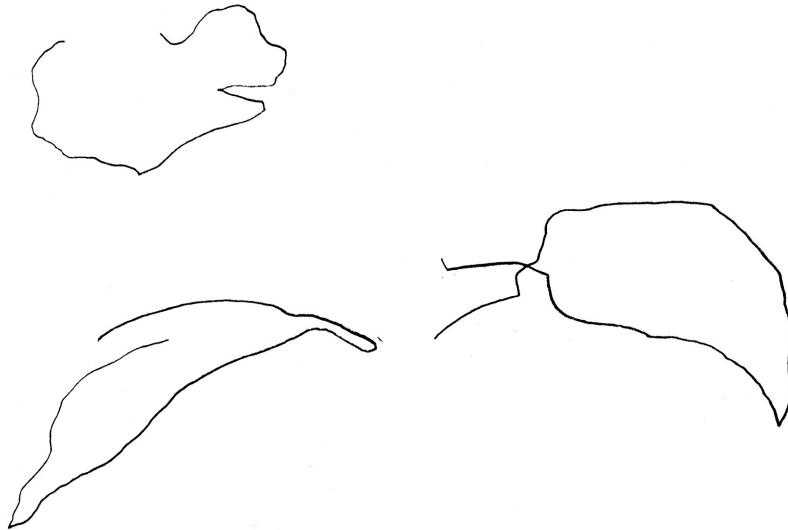
Lay two different leaves on one side of a fresh sheet of paper. Prepare to draw on the other side of the piece of paper: hold the pencil there, ready to start drawing. Hold the mask so that you cannot see the pencil tip: it must hide your drawing, but still allow you to see the leaves.

Draw the outline of the first leaf, just as before, but without looking at your pencil behind the mask.

Do not lift the pencil from the paper or look at the drawing until you finish one leaf.

Write your initials and the date on the drawing.

Once again, the result doesn't matter – it's the practice that counts. If you manage to keep such accurate proportions that the end of the outline is close to the start, you can gloat with pride. Otherwise, have a laugh or two at your own expense.



Results of drawing blind.

Repeat this for about 20 min. Do not expect improve: the aim of the exercise is to train your eye to spend most of the time looking at the subject you are drawing, that's all.

Session 2 part 4: (30 min)

Choose a picture of a plant or flower. Use an image from the Internet, or the picture below.



Review the skills we have developed so far in the box below and tick the ones you have consciously used in your drawings so far. The two skills we have focused on in this session are seeing slopes, angles, corners and distances, and working no faster than it takes you to see these details.

You may wish to add shading. If you do, try to think about the skills that might be appropriate and note them down.

You may find that drawing from a photo is easier than drawing from real life. Some people find it harder to work with three-dimensional subjects directly. Remember this. Later you may find it useful to work from photographs taken on site: your mobile phone may contain a good enough camera.

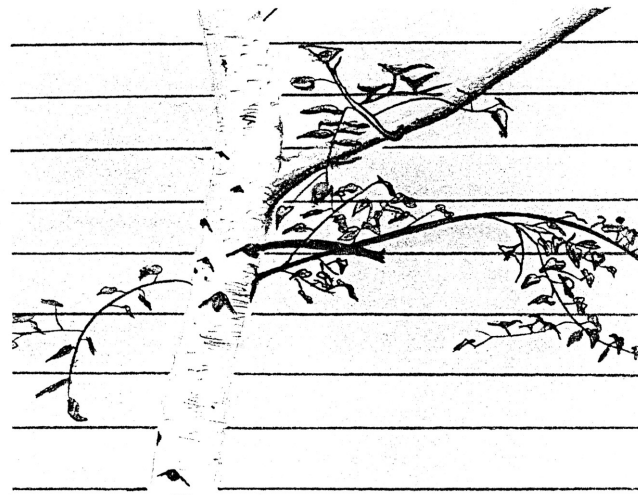
When using your own photograph or image, you can draw reference lines or squares on the original to help you keep the correct sizes and proportions.

Drawing skills

- Frame the drawing to help with proportions
- Draw each section one at a time, piece by piece
- Learn to see slopes, angles, corners and distances: be particularly careful with sloping straight lines on man-made objects.
- Work no faster than it takes you to see the details.
- Use your pencil as a gauge to check the relative slopes and distances.
- Look for vertical and horizontal relationships and check them using a pencil.
- Avoid drawing recognizable shapes – if copying from a photograph or image, turn it and your drawing upside down and then continue.

Session 2 part 5: (60 min)

Here is a drawing of a small birch tree standing in front of a white brick wall. Look at the image carefully. The tree stands out prominently, yet large parts of the outline are missing – why?



So far, when we have started drawing, we have emphasised the idea of drawing outlines. Yet, we don't need outlines to see well defined objects. Often, drawing a dark outline is neither necessary nor helpful. This is one of those examples.

Use the image of the tree provided on the next page. Frame a section of the trunk with a rectangle.

Draw a similarly proportioned frame on a fresh piece of paper.

Very lightly, draw the outline of the trunk within the rectangle. Also, very lightly draw the outlines of any branches.

Using a soft pencil (4B) and a ruler, draw the horizontal lines of bricks in the background wherever they are visible behind the trunk or branches.

Using a medium pencil (2B), carefully add short lines wherever there are blotches in the bark on the trunk of the tree.

Add other details such as leaves and branches.

Do not complete the outline of the tree.

Write your initials and date on the drawing.

Notice how, in this exercise, you have only drawn the dark parts of the original drawing – no more. You have acted like a black and white photocopier and you have simply transferred the dark parts of the image to your drawing without trying to add meaning.

Congratulations: you have been working entirely from your eyes and ignoring the image that the pattern recognition engine in your mind created for you that clearly shows the outlines of the trunk and branches.

Of course, we didn't quite do it this way. We first lightly copied the outline of the tree trunk and branches very lightly. We had to do this to make it easier to add the brickwork.

You may be more aware now of a changed state of mind that you enter when you are drawing by copying what your eyes are seeing. Some people talk about this as a kind of dream or 'detached' state of mind.

Session 2: Practice

Once again, practice the mirror image squiggle copying exercise from session 1. If you want something slightly harder, copy the mirror image shapes of the leaves that you used at the start of this session. If you can bear it, try the blind drawing exercise at least once again.



Session 3: Negative Spaces

By now you will begin to understand that drawing unrecognisable objects is easier. Objects which we see every day, like our faces and hands, are the most difficult to draw. You can understand this by thinking about the fast pattern recognition that the brain performs. If the recognition is strong, the picture that is already in your mind obscures the image that your eyes are actually seeing. Then your hands reproduce the image that is strongest in your mind: this can be quite different to what the eyes are actually perceiving.

Today we are going to learn another trick for suppressing our inbuilt recognition process – negative spaces. The trick is to focus your attention on the spaces around a familiar object, not the object itself! The shapes of the spaces around a familiar object will not be nearly as familiar, and therefore the brain will not be able to impose its own preconceived version. The image from your eyes can then dominate, and your hands will draw that shape reasonably accurately.

Here is a warm-up relaxation exercise. Learn to do this at the start of each drawing session. Have a pencil and paper ready and a piece of scrap paper.

Make sure you have 15 min that will be free from interruptions.

For about 2 – 3 minutes, sit upright. Close your eyes and focus on balancing your upper body on your seat, and your head on your shoulders. Breathe in deeply and slowly for about three seconds and then relax and let the air go out quickly. Then relax for a few seconds before breathing in again. Repeat this a few times, breathing deeply at first, and then gradually more gently.

Try to let your mind go blank. Some people can do this by imagining a dark curtain being drawn across your eyes. Others choose to focus on a peaceful image such as a small candle flame.

Once you have completely relaxed, screw up a piece of scrap paper and draw parts of it. The shape of each part will be quite unfamiliar to you so this will be easy. But remember, the main aim of this exercise is to relax. Look at the bow on the shoe shown in page 28: drawing the knot would be a great warm up exercise.

Section 3 part 1: (25 min)

The concept of "negative space" is to focus your mind on the space which is not the object you wish to draw, so that you can form shapes which are not recognisable. One of the most recognisable objects is our own hand. We see it for much of the time. Try this exercise to reveal the negative spaces around your hand.

Place a white card, about 20 cm x 15 cm on the desk beside you. (I assume the desk is a darker colour than the card: if the desk is white, use a black or coloured card instead.)

Place your left hand (or right hand if you are left-handed) on the card, palm side down.

Make light marks round the ends of your fingers so if you move your hand by mistake, you can replace it in exactly the same position.

The card coloured space near your hand is the negative space that you are going to draw.

Focus on this space with your mind, tracing its edge slowly. When you have traced around the complete space, copy the shape of the space using a pencil on your piece of paper.

Now, change the pose of your hand on the card, maybe changing the positions of your fingers or your thumb, or perhaps rotating your hands lightly. Once again, make light pencil marks around the ends of your fingers so that you can reproduce the position of the hand in case you accidentally move it.

Repeat the exercise, focusing on the card-coloured space around your hand, and then drawing the shape on another piece of paper.

You have now drawn the negative spaces around your hand. Write your initials and the date on both of your drawings.

Sometimes this is not as easy as it seems. Maybe as you drew the hand, you may have noticed your concentration leaving the card coloured space and refocusing on your fingertip or some other part of your hand.

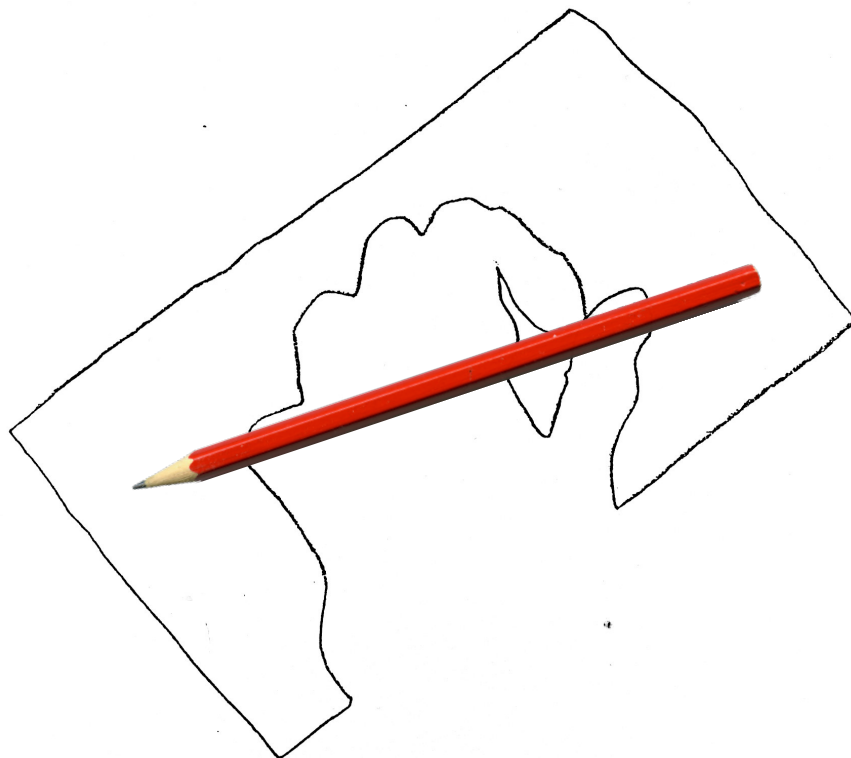
Try and practice. Keep concentrating on the card coloured negative space, piece by piece, observing the shapes of each part of the space and drawing them.

Section 3 part 2: (25 min)

There are some interesting analogies here.

When trying to solve a conflict between people, one useful strategy is to focus on all the parts of the situation that do not contribute to the disagreement between them. In other words, focus on all the areas of agreement, where there is no dispute between the parties.

Sometimes when you're solving a difficult problem like this, the right solution will present itself when you are not thinking about the problem itself. It is almost as if thinking about the problem inhibits the production of a solution.



Remember you can use your pencil to gauge how different parts of the picture relate to each other.

In this exercise, by drawing the space which is not our hand, we can more accurately reproduce the shape of our hand.

The next exercise takes this concept one step further.

Change the way your hand rests on the card so that you can see some clear gaps or "holes" between the fingers. Curl your fingers and thumb so the tips touch.

Repeat the previous exercise, drawing the negative spaces.

Look at the first piece of negative space and focus on that. The card coloured next to your hand. Do not work any faster than the time it takes for you to see the shape of the negative space.

When you have finished the card-coloured negative space, switch your concentration to another kind of negative space. Take the largest and most visible "hole" – probably this will be the one between your thumb and forefinger. You may even be able to see the inside of your fingers through this hole. Now treat these dark, pieces of 'inside finger' as negative spaces, spaces that are not part of the outside of the hand. Because the shapes of these sections are unusual, being formed by other parts of the hand that obscure the inside finger sections, you can draw these as negative spaces.

Next look at some section of the outside part of your hand, not the whole but just a small part of it. Focus on this and observe the shape carefully. Now draw this piece, adding it to your picture that started off with a negative space around your hand.

By repeating this, drawing one part of the hand at a time, you can complete an accurate picture of of your hand, without having focused on the hand as a whole.

Write your initials and the date on the drawing when you have finished it.

If you finish early, you might like to try the same exercise, drawing faster. You will need to look closely at the subject (the hand) for a minute or two first, and then remember the shape before you draw it. Try drawing this as fast as you can, just to see what happens. Do not use an eraser for corrections: draw lighter lines at first until you build your confidence and then draw firm lines over your mistakes.

Section 3 part 3: (2 periods of 15 min each)

For this exercise, you need a volunteer partner who can pose for you while you draw. In class, we take one or two volunteers at a time from a group of about 15 and ask them to pose in front of a large window or door so they are framed by the building structure. The volunteer's body forms a silhouette against the background: the silhouette will be black if the person is standing in the window on a bright day.

If you are working at home, ask your volunteer to pose in a doorway, or against a plain and featureless section of the wall of your room, or even the open door of a full height wardrobe.

This is fun, particularly as you can ask your volunteer to take up an interesting pose. But, please remember the volunteer has to hold the pose for about 15 min. Be reasonable.

Prepare your paper and pencils before you ask your volunteer human subject to pose.

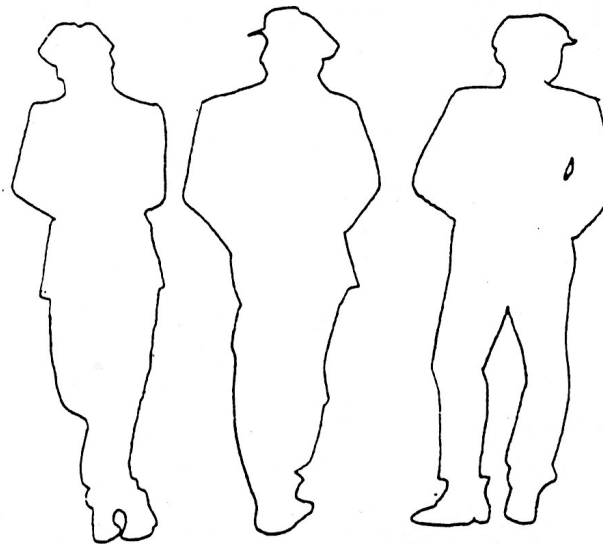
Draw (in light pencil) an outline of the pose space: the window, the doorway, or the wall.

Ask your subject to move into the space and adopt his or her special pose.

As before, focus on the negative spaces, the parts of the window, doorway or wall that are not obscured by your volunteer subject. Draw them, piece by piece, and draw them one at a time.

Once again, do not use an eraser. Draw light lines at first and draw firm lines over your mistakes.

Work consistently but not too slowly. Remember you only have 15 min. Just take enough time to see the negative spaces and concentrate on them.



Why is it important not to use an eraser for some exercises?

There are two reasons.

First, the process of doing the exercises more important than achieving a correct results. Pausing to erase mistakes will distract your mind from observing the negative spaces and copying them.

Second, the places where you have reworked your lines demonstrates your progress and the improvement in your ability to recognise the negative spaces. The reworking of the lines is part of the creative process. Keep it.

Section 3 part 4: (45 min)

Choose a striking picture of a fashion model from a magazine, even an advertisement in a local newspaper.

Revise the added list of skills in the list below, and mark the ones you are using.

Drawing skills

- Frame the drawing to help with proportions
- Draw each section one at a time, piece by piece
- Learn to see slopes, angles, corners and distances: be particularly careful with sloping straight lines on man-made objects.
- Perceive and draw the negative spaces around the most easily recognised features such as eyes, mouth, faces, hands etc.
- Work no faster than it takes you to see the details.
- Use your pencil as a gauge to check the relative slopes and distances.
- Look for vertical and horizontal relationships and check them using a pencil.
- Avoid drawing recognizable shapes – if copying from a photograph or image, turn it and your drawing upside down and then continue.
- When drawing objects with parallel straight lines, locate the vanishing points (even if they are off the edge of your paper) and use these to judge slopes more accurately
- Look carefully at shades: light and dark spaces. Cover or obscure other spaces to be able to perceive shades more accurately.
- Distinguish the boundaries between successive shades and transfer the boundary shapes to your drawing before shading in.

Now proceed with the last exercise.

Create a drawing using the skills you have learned so far.

Draw the negative spaces of the picture first, the spaces around the parts that are easily recognised.

In other parts of the picture, look for abstract shapes, study them piece by piece, and then draw them one by one.

Check which skills you are actually using, if you can.

When you have finished, compare the results with your first portrait drawings. Even by now, the improvements may be slight, but you have learned the important skills that will be the foundation for accelerated improvement still to come.

Session 3 practice

Starting with one or two of the negative space drawings you created, convert them into a black/white poster silhouette. For example, using a black marker, or paintbrush with black ink, fill in the negative spaces in the first hand drawing or the 'positive spaces' in the second human figure standing in the window. You may surprise yourself to see how good the finished result looks.

Session 4: Drawing Man-made Structures

Man-made structures often have parallel lines and right angles so that might seem to be easier to draw than human figures. Surely it is easier to draw straight lines than curves? Let's see.

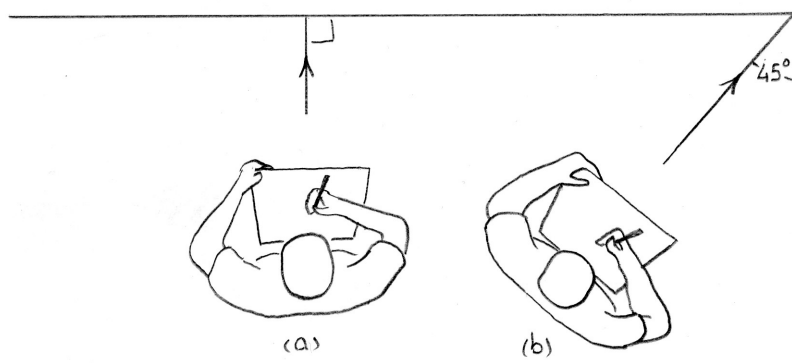
By now, you should be realising the drawing is all about seeing. Sometimes it is harder to see the angles between straight lines than seeing curved shapes.

This session starts with two simple exercises.

First, start with the same warm up relaxation exercise as you did in section 3.

Session 4 part 1: (20 min)

Find a place to sit and draw part of the wall in your room. Take your drawing pad with you and sit with your pad immediately in front of you. Your line of sight (or line of you) should hit the wall at a right angle as shown in (a) below, looking down from above.



Carefully draw the part of the wall immediately in front of you. You only need to prepare a simple outline drawing, including any pictures that are hanging on the wall.

Do not use a ruler – straight lines do not have to be exactly straight. Do the best you can freehand.

5 min may be enough for you to finish, maybe a little more, depending on how many doors or windows there are in the wall in front of you.

Write your initials and the date on the drawing when you have finished it.

Now move your chair or school and draw the corner of your room. Sit with your pad immediately in front of you just as before. Now your line of sight (or line of view) should follow the 45° line bisecting the right angle corner of the room, as shown in (b) above.

Carefully draw the corner and part of the walls on each side.

Show the full height of the corner from the floors to the ceiling.

Only a simple freehand outline sketch is needed. Do not use a ruler.

Draw the corner as you see it from where you are sitting.

Allow yourself about 15 min.

Write your initials and the date on the drawing when you have finished it.

Now sit back and look at your second drawing. How does it look to you?

Responses from my students usually sound like this:

"It seems pretty okay to me"

"It is wrong, but I can't see why"

"That it's okay, but I stuffed up the ceiling"

Whatever you think of your own drawing, now take a ruler or a long pencil and still sitting at exactly the same spot, hold it up between you and the corner of the room. Use it as a gauge to judge the slope of the edge of the ceiling, or the floor, where it meets the corner of the room.

You can mark a grid on a transparent sheet to serve as a guide: hold the sheet up in front of your subject, and use it to judge angles and positions of lines. If you like, lightly draw a similar grid on your sheet of paper and draw what you see in each square, one at a time.

Now have another look at your second drawing. How well did you judge the slopes of the corner lines? Most students find they have made major errors in the drawings – a surprising result. After all, these are simple drawings using only straight lines.

What this demonstrates is that, for most people, judging the slopes of lines is quite difficult if the lines are not almost exactly horizontal or vertical. The physiology of our eyes and brains has a big influence here. In our visual cortex lying at the back of our brain, we have many specialized neural receptors that measure the slope of lines seen by our eyes. It is interesting that we have more neurons to measure the slope of lines that are nearly horizontal or nearly vertical than lines at other angles. That is why it is more difficult for us to appreciate the slope of lines that are neither horizontal nor vertical.

Perspective

Fortunately, there are relatively simple and easy rules of perspective that you can use to help you in these situations.

When seen at an angle, parallel lines tend to converge in the distance, eventually seeming to meet at a point called the vanishing point. Horizontal lines above the eye (such as the edge of the ceiling) tend to run down to the vanishing point. Horizontal lines below the eye (such as the edge of the floor) tend to run up to the vanishing point. Horizontal lines at the same height as the eye are also horizontal in the drawing.



Session 4 part 2: Drawing a building (75 min)

For architecture students, drawing buildings is an entire object of study in itself. Here it is a useful exercise in perspective and, if the weather is fine, it is pleasant to work outside the drawing office or your study for a while.

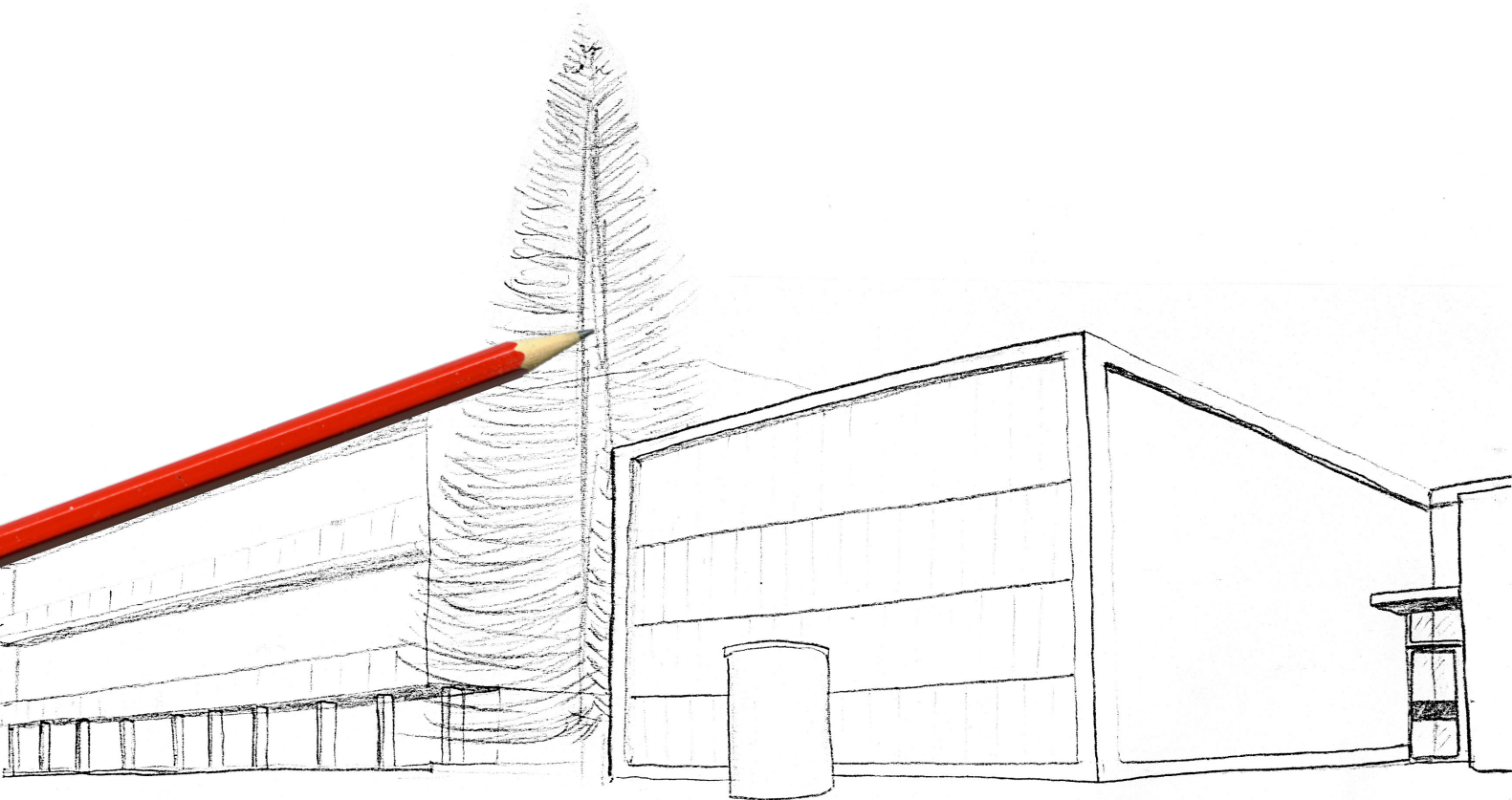
Choose your subject material:

A) interior (inclement weather):

Find an interesting part of your building which has a variety of features, but not too much intricate detail. A fireplace or kitchen makes an interesting subject. Repetitive features such as wood panelling and balustrades require special care. Staircases are rewarding but challenging subjects.

B) exterior (fine weather, not windy)

Choose a location close enough to the building to see some detail, and restrict your drawing to just a part of the building. You do not have time to draw the entire facade. Repetitive structures such as Windows require special care. Choose a view that reveals some perspective: a view looking at 90° to one of the walls usually results in a less interesting picture and may not allow you to explore the use of vanishing points.



Decide on one point which is to be the centre of your drawing. This is your reference point and determines your sight line and vanishing points. It should be at the same elevation above the ground as your own eyes.

Carefully judge the slopes of nearby parallel lines to estimate the locations of your vanishing points. These may be off the edge of your paper, of course.

Remember that the vertical lines may need a vanishing point as well: this will be needed if your reference point is some way above or below your eye level. Otherwise vertical lines in the world remain vertical in your drawing.

If you can, support your pad up at an angle, rather than keeping it flat on the floor, ground, or the table in front of you. It is best that your line of sight hits the paper at 90° when you are checking the slope of lines.

Try a quick sketch of the overall subject first to check that you have suitable vanishing points. If you are satisfied with this, keep going and add the details. Otherwise, change your subject or viewing position and try again.

Remember to use your other special skills – using the pencil as a gauge for slopes and distances, negative spaces, avoiding recognisable shapes, etc.

Use the transparency grid sheet if you wish. It makes it easier to judge the angles on the slopes of lines. (See example on next page)

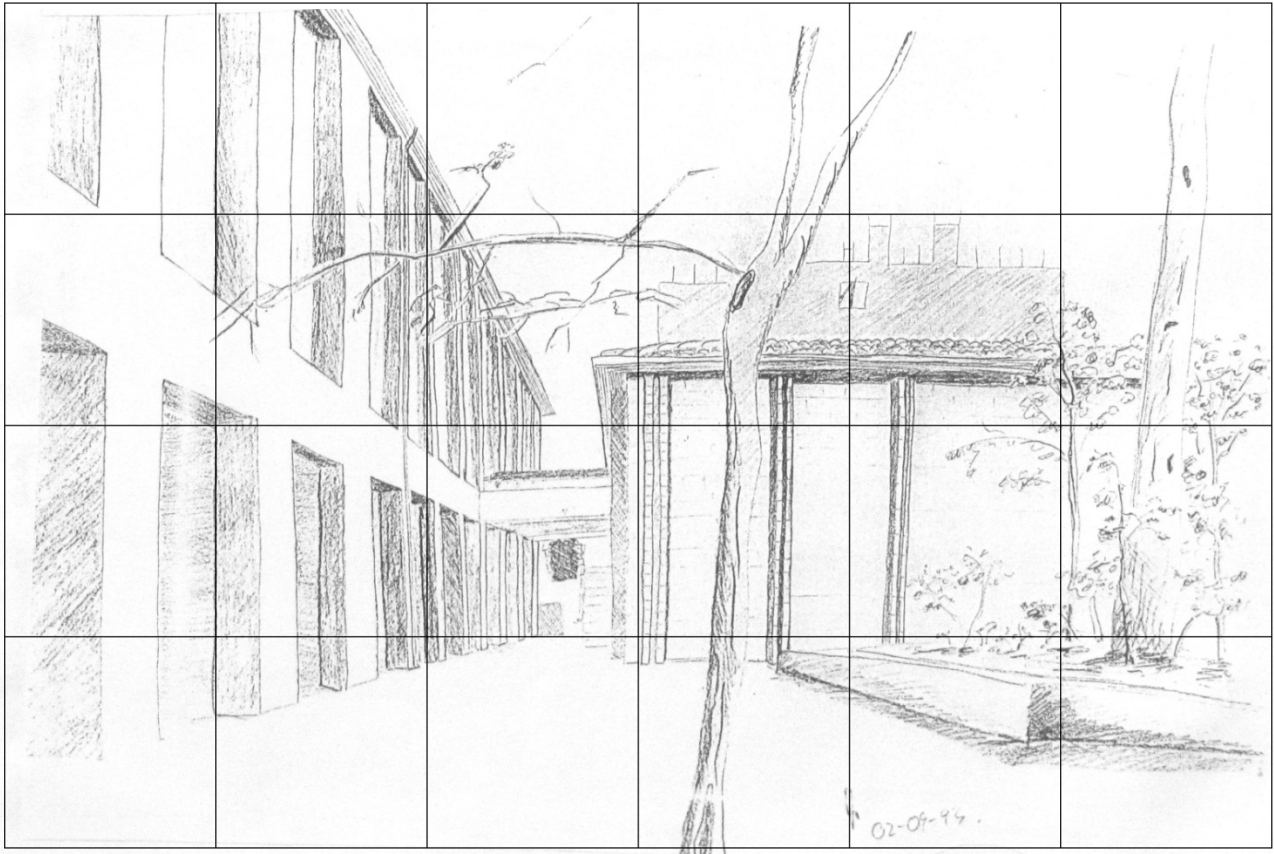
You can leave out obstacles such as trees or garden plants if you like. However, including these helps to make the drawing more interesting and the final result more appealing.

You may prefer to return to your study or drawing office to complete the final details in more comfortable surroundings. Just remember to take notes, or put in some of the detail before you leave so that you have enough to finish the job.

Write your initials and the date on the drawing when you have finished it.

Session 4 part 3: Furniture (60 min)

To do this exercise at home you may need to rearrange your room. Set up a table and one or two chairs between 3 and 4 metres away from you. The exercise is to draw the negative spaces in and around the chairs and table. It is sometimes difficult to focus on these spaces instead of the legs of the furniture.



Example of drawing using a transparent grid. Prepare your paper using a light pencil and mark off a grid with the same number of squares. Hold up a transparent sheet with a grid marked on it, and copy each square, one at a time.

Choose a sitting position so you can clearly see the table and chairs, and they are not at right angles to your line of sight.

If you like, place one or two simple objects on the table, and draped cloth or piece of clothing over the back of one of the chairs.

Be careful to keep your drawing pad between you and the subject. If it is off to one side, it is hard to be sure that you have the slopes of lines correctly portrayed.

Once again, if you can, support your pad up at an angle rather than keeping it flat on the table in front of you. It is best that your line of sight hits the paper at 90° when checking the slope of lines.

Review the skills listed in the box below before you start.

This can be a very difficult exercise. If you go too far wrong, start again. Don't erase large pieces of work: keep them as a record to show your improvement.

Write your initials and the date on the drawing when you have finished it.

This exercise sometimes proves to be very difficult for students, particularly those who have taken technical drawing or art subjects at school. There is a temptation to switch to a perspective or isometric view of the tabletop so the negative spaces underneath have to be distorted to fit. Some students seem to be quite confused by the apparent difficulty of this exercise.

Drawing skills – important ones to practice are in italics

- *Frame the drawing to help with proportions*
- *Draw each section one at a time, piece by piece*
- *Learn to see slopes, angles, corners and distances: be particularly careful with sloping straight lines on man-made objects.*
- *Perceive and draw the negative spaces around the most easily recognised features such as eyes, mouth, faces, hands etc.*
- *Work no faster than it takes you to see the details.*
- *Use your pencil as a gauge to check relative slopes and distances.*
- *Look for vertical and horizontal relationships and check them using a pencil.*
- Avoid drawing recognizable shapes – if copying from a photograph or image, turn it and your drawing upside down and then continue.
- *When drawing objects with parallel straight lines, locate the vanishing points (even if they are off the edge of your paper) and use these to judge slopes more accurately*
- look carefully at shades: light and dark spaces. Cover or obscure other spaces to be able to perceive shades more accurately.
- Distinguish the boundaries between successive shades and transfer the boundary shapes to your drawing before shading in.

Session 4: Conclusion

Some students become quite despondent at this stage of the course. Many of these have done well in art at school and they find this course more difficult than expected. Beginners, on the other hand, will not find these exercises any more difficult than the others but may be wondering if they will ever improve. The next session usually represents the start of the upswing for most people. It is the time when most people start to see some improvement in their drawing. Some experience a rapid improvement in proficiency. The subject matter has been arranged to help with this process, and to take advantage of rapid improvements in confidence that follow.

Session 5: Clothing – Texture and Shading

For this session we will be looking at man-made objects again, but with freer forms than before. Perspective is no longer so useful and we need close observation again for angles, relationships, negative spaces, and now shading as well.

Warm up exercise:

Relax, following the instructions for earlier sessions.

Screw up a piece of scrap paper and make drawings of parts of it. When you are doing this, remember that the main aim is to relax and focus your mind on copying the exact scene that you see in front of you.

Session 5 part 1: Making shades part 1 (20 min)

Everyone is used to making lines with the pencil so drawing outlines is easy, once you learn to see what needs to be drawn. Shading techniques, too, rely on perception skills, so learning to see shades is also important. But most of us are not used to making shades with a pencil so we will start with that first.

Many students start making shades of grey by using a finger to smudge pencil marks into a soft grey smear on the paper. This works for some soft subjects, but can be very difficult to control. Shading can be represented just by patterns of black lines as show below.



This requires some skill and practice. With some art papers, the surface texture of the paper can also help. When you use a soft pencil with light pressure, the result is a series of small black marks on the tops of the paper fibres. When you press harder, the marks are larger and darker, making up a greater proportion of the surface. This can give the impression of changing shades of grey just like the fine dots in a printed photograph.



Both of these techniques share a vital practical advantage. Because they represent shades of grey with the texture of black marks on white, the drawings can easily be reproduced by photocopiers without losing significant quality.

In the first exercise we are going to try different methods of shading.

In light pencil draw six squares, about 3 cm across, side by side, adjacent to each other.

Leave the first square white on the inside.

In the next square, draw thin dark lines, about 5 mm apart, using a clutch pencil or a fine ink marker.

In the next square to this, draw a similar set of lines but make them closer together this time, about 3 mm apart.

In the remaining squares, draw similar sets of lines, closer together still, with some lines crossing so that each square appears to be progressively darker than the previous one. Change the spacing of the lines to achieve a gradient of shading in one or two squares.

If you have performed this exercise with a pencil, repeat the same exercise with a fine black marker pen.

Session 5 part 2: Making shades part 2 (20 min)

This exercise requires some practice and confidence that it will work.

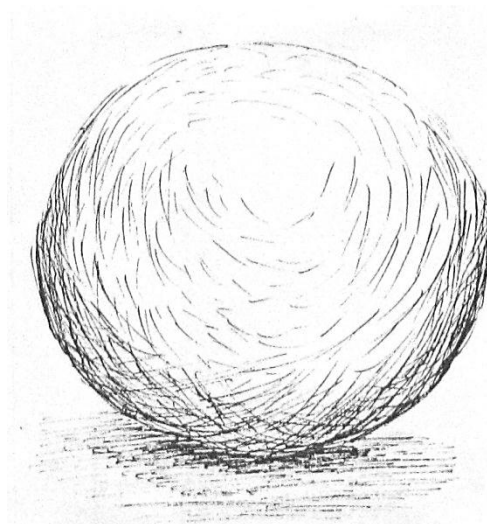
Start with a blank sheet of paper.

Using fine marker pen, start by lightly shading two rounded areas about 3 to 4 cm across.

To blur your vision, screw up your eyes and view your drawing from as far away as possible, while still be able to reach it. You should be able to perceive the shaded areas as two grey blobs.

Start adding more lines, keeping your eyes screwed up so individual lines become blurred in your vision. As you do this, the blobs we'll seem to gradually darken where you are adding lines. Keep on adding more shading to get used to this idea.

Next, start with a light pencil circle and add shading to make it look like a ball, like the one shown below.



Seeing shades

As with outlines, the key to good shading is seeing the darkness of different shades. Your recognition process is remarkably clever at creating false impressions. Look at a plain light colour painted wall in your room. Is it all the same shade... Or is it? Are there shadows, lighter or darker areas on the wall? It will be a very unusual room if the wall is precisely the same shade right across. Are there shadows that show on the wall? Even outside the well-defined shadows, you may be able to see gradual and subtle changes in shade, particularly if there are windows nearby.

Here is an illusion that you can readily create yourself.



Take a piece of light grey paper and folded across the centre. Lay it on the desk as shown above, with the light coming mostly from the left-hand side.

Most of the paper should be flat: just the part either side of the centre fold will be raised, as shown above.

Look at the paper with one eye: the right side will appear darker than the left side.

Now hold your finger in front of your eye so that it obscures the central part of the paper, where the fold is. Once you do this, both sides of the paper will appear to be the same brightness.

A computer display can show this illusion much more dramatically. But this simple demonstration shows that the eye is easily fooled.

To observe the shade difference between two nearby regions more accurately, use a grey card measuring about 100 mm x 200 mm and cut two holes in it, approximately 10 mm on each side. The holes should be about 100 mm apart.



Hold the card so you can see two regions through the holes. Tilt the card a little so the card shade seems about midway between the regions in brightness. Use the card to observe shades on the walls of your room. You will notice surprising differences in both shade and colour.

Why is the eye so easily fooled? We don't fully understand the reason. One explanation is that we perceive depth information from a combination of stereo vision (using both eyes to see objects in depth), motion and shading. Shading is a particularly powerful way of inferring depth from a flat image, and our eyes are used to doing this, rather than see the shades as they actually are. When we look at a flat object, we often do the reverse: we ignore the shade differences which are actually there. Look at that smooth painted wall again – your brain tells you that it is the same colour throughout. However, your eyes are trying to tell you that the colour and the shade change from one part of the wall to another. However, because your brain is strongly influenced by the idea that we paint a wall entirely with the same coloured paint, it overrides your eyes and persuades you that it is the same colour and shade throughout. The same applies when you look at a person's face: that's another of the reasons why faces are hard to portray with drawings.



Session 5 part 3: (45 min)

The picture below is from a fashion magazine. The texture of the clothing fabric (folds, wrinkles etc.) is revealed through the pattern of light and shade in the photograph. Although the picture contains possibly hundreds of different shades of grey, we can successfully draw this using just a few shades: white, a couple of grey shades and black.

On the part of the picture, using a thin black marker, practice distinguishing between light and dark shades by drawing a line to separate the two.



Here is a sample of what you should have done for yourself.

Notice how the picture seems to have changed as a result of doing this. The gradual shading changes have been replaced by apparently discrete boundaries, across which there is a sudden change in shade.

You should draw at least the clothing part of the picture. You can apply the same technique to the face if you wish, but remember to be especially careful if you do. Try not to draw recognisable shapes.



Draw the boundaries between dark and light on your paper, using the skills for outlines. Observe the shape, slopes, distances etc. Use negative spaces, pencil gauging etc.

Once you have a substantial area drawn like this, start shading the grey and black areas.

Use a soft pencil, and make the dark areas as dark as you conveniently can. Use a black marker if you like, or even charcoal.

Be careful to shade in a way which suggests an appropriate texture.

Some clothing texture has a regular pattern – for example knitting or seam stitching. Make use of this in choosing the style of shading patterns that you use.

Write your initials and the date on your work, even if it is incomplete and you run out of time.

Most students are surprised to see how effective this style of drawing can be. With the right subject matter, the results can be quite stunning. If you want to use your own choice of subject, choose a photograph with deep contrast between light and dark.

This style of shading is a departure from 'representational' reality. Much of the shading information has been suppressed by simplifying the image to this extent. The drawing has become an 'illusion' of reality. But then all drawings are illusions.

In his well-known book 'Art and Illusion' E H Gombrich (1969) made this observation and many more. However realistic we may think a picture looks, it is to some extent an illusion of reality. Often the illusion looks more realistic to the eye if we *leave out* information. The pattern recognizer in our human mind fills in the gaps and persuades you that the drawing looks 'realistic'!

While we are on the subject of art, you might like to try the following exercise. If you're not that interested or just need to move on, skip to part 4.

An Interesting Exercise: The Visual Language of Abstraction (30 min)

This exercise is a visual experiment which you may find interesting. The aim is to represent your feelings and emotions in abstract patterns. You may not see yourself as a person with strong feelings or emotions, but don't let that be an obstacle. There are no rights or wrongs in this exercise, and the results are as unique to you as your physical appearance.

Divide a sheet of A4 paper into eight sections by folding it in half, then in half again, and in half a third time. Alternatively, draw light pencil lines to subdivide the page into 8 squares.

Write the following words at the bottom of each section:

Happiness, peace, anger, depression, power, femininity, love

Choose one emotional feeling yourself and write it in the remaining section.

Prepare 2 pencils to work with.

For one or two minutes, close your eyes and recall the last time you felt that emotion. Let the feelings flow through your mind and down to your fingertips. Then open your eyes and start making marks – lines, patterns, shades etc. Do not draw any recognisable forms or pictures! No symbols are allowed such as hearts, lightning, clenched fist, etc.

The pattern that emerges in each rectangle is a representation of your unique feelings in your unique style.

Do not look at anyone else's patterns until you have finished yours.

When you have finished, if you are a student in a class, compare your drawings with those of the other class members. They will all be different but you might be surprised to see some of the similarities.

To the extent that they are similar, your patterns represent the visual language of abstraction. We see this in its purest form in pure abstract art which dominated visual arts in the last century. Yet it is present in all visual representations, often unconsciously, often deliberately. If you look carefully you will see that this language is an intrinsic part of advertising as well. If you are interested in learning more, refer to Betty Edwards book "Drawing on the Artist Within"

Session 5 part 4: (60 min)

Take off one of your shoes and draw a picture of it, using all the techniques you have learned so far.

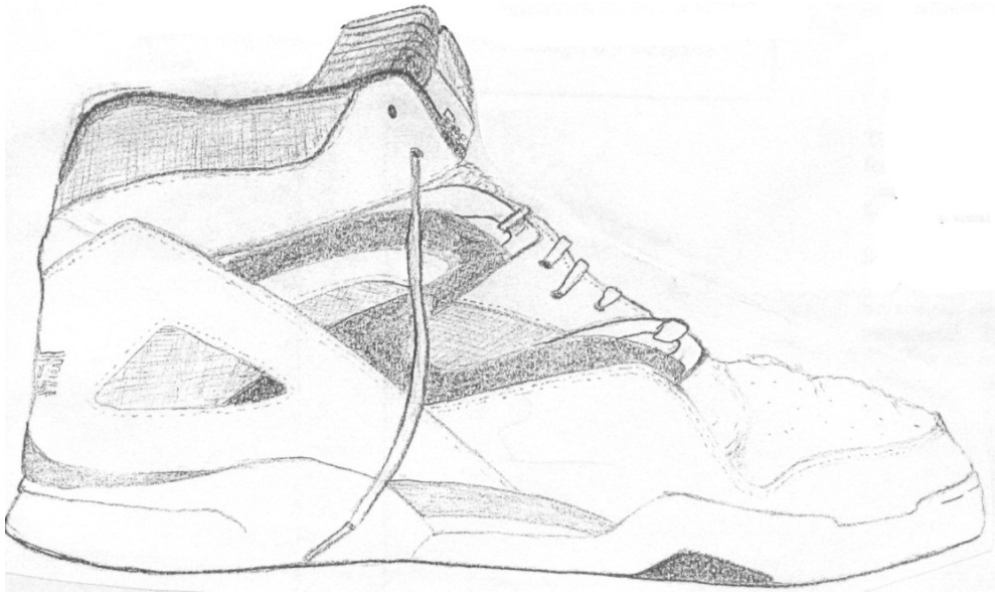
Old shoes are usually easier than new ones.

Practice seeing shades of darkness.

Sometimes screwing up your eyes will help you to distinguish darker shades from lighter shades.

Remember to just copy what your eyes are seeing – even the dirt and broken bits will add much to your work.

Remember to write your initials and the date on your work.



Once again, to remind you, here is our related list of drawing skills:

Drawing skills – important ones to practice are in italics

- Frame the drawing to help with proportions
- Draw each section one at a time, piece by piece
- Learn to see slopes, angles, corners and distances: be particularly careful with sloping straight lines on man-made objects.
- Perceive and draw the negative spaces around the most easily recognised features such as eyes, mouth, faces, hands etc.
- *Work no faster than it takes you to see the details.*
- Use your pencil as a gauge to check the relative slopes and distances.
- Look for vertical and horizontal relationships and check them using a pencil.
- Avoid drawing recognizable shapes – if copying from a photograph or image, turn it and your drawing upside down and then continue.
- When drawing objects with parallel straight lines, locate the vanishing points (even if they are off the edge of your paper) and use these to judge slopes more accurately
- *look carefully at shades: light and dark spaces. Cover or obscure other spaces to be able to perceive shades more accurately.*

– Distinguish the boundaries between successive shades and transfer the boundary shapes to your drawing before shading in.

Session 5: Practice

Most students observe some improvement at this stage of the course. You may be quite excited with your progress. This week, practice shading, particularly accurate observation of shading. Practice the skill of noticing shades: highlights on shiny objects, reflections, dark, light, and particularly instances where your recognition mechanisms may deceive you. Learn to use a card with holes in it or even your fingers to obscure parts of the scene in order to perceive shades more accurately.

Session 6: Natural Structures

In this section we will develop a study of a tree. A study is a series of drawings and notes that conveys several aspects of the subject. In essence, a study provides the results of a visual exploration and associations.

You need to choose a tree near which you can work in reasonable comfort for about an hour and a half.

You will focus on the mechanical and structural aspects of the tree while you are drawing. This will help you see many aspects of natural structures from which you can learn much about engineering design. Later, in your career, you can use the same techniques to draw designs by other people in order to learn about them and notice details that otherwise you would have missed.

Session 6 part 1: On Location (90 mins)

First think about the forces experienced by a tree, growing in the open without the shelter of surrounding trees.

Estimating the force caused by storm-strength winds

Estimate the approximate diameter and height of the tree you are going to study.

The sideways force exerted by the wind can be estimated from:

$$0.5 C_d A \rho v^2$$

where

ρ is the density of air (approximately 1.3 kg/m^3),

A is the area of the tree exposed to the wind (m^2), and

v is the wind speed (m/s).

C_d is a dimensionless coefficient – the drag coefficient.

For an open tree through which the wind can move relatively freely, use 0.3. For a tree with dense foliage, use 0.6.

You should allow for the wind speed 10 m above ground level to be a maximum of about 120 km/h (remember to convert to m/s!)

The force experienced by a large tree can be equivalent to the weight of several cars.



Now imagine a lamp post with this force applied to the top end. Most likely the lamp post would buckle at the base or break. However this does not happen to the tree. Why not?

The answer lies with the root system that not only feeds the tree but also forms a highly effective means of transferring the intense bending forces on the tree trunk into the comparatively weak soil around the tree. The bending forces are distributed among the roots. Hence the tree is firmly anchored in the ground even though the ground itself is relatively weak. The roots transfer the load to a large volume of soil.

Sometimes failures occur with dramatic results. I witnessed the toppling of about half of all the trees in southern England in 1987 when hurricane force winds swept across forests that had been soaked by steady rain for about four weeks beforehand.

The usually firm subsoil had turned to mud and the trees toppled one after the other. In towns and cities, cars parked under the trees were crushed as if they were made from aluminium foil.

Man-made structures often fail at the joints. It is not easy to design a joint that distributes a concentrated load from a strong member across a large part of an intrinsically weak member. An example is the join between the wings and cabin of an aircraft.

Think about this as you draw the tree.

Start with warm up exercises to relax your mind as you did the earlier sessions except that the warm up drawings will comprise small sections of the tree: start with a leaf, a twig, a nut, flower, a piece of bark etc.

The small drawings should take about 20 – 25 min.

Take notes and make a sketch that will allow you to draw a pictorial map of the immediate environment of the tree when you return to the drawing office or your study.

Next, draw the base of the trunk and the parts of the root system that you can see above the ground. As you do this, think of the wind forces that have to be transferred to the ground.

Choose a convenient position further back and sketch the whole tree, possibly in isolation from its surroundings if you would prefer.

You will not have time to draw the entire tree in detail. Instead, you should draw small sketches of important details to complete the tree later, if you want to.

This concludes the work needed "on location" and should take about 90 min. Now you can return inside to complete the tree study.

Session 6 part 2: At the drawing desk (90 mins)

Use a single A3 sheet of paper.

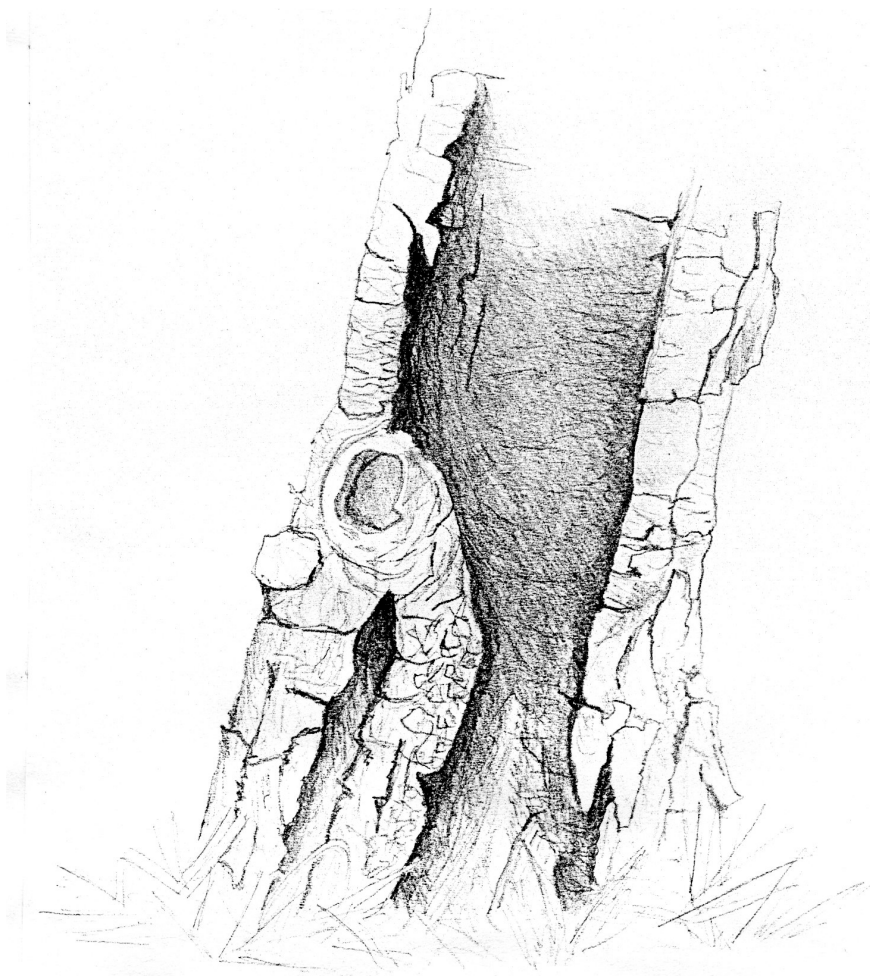
On the sheet, place a series of drawings as a pictorial map of the tree's environment and a summary of your wind force calculations.

Examine the drawings you completed on location. You may be happy with them as they are. If not, complete the page by filling in details from your warm up sketches.

Paste them onto the sheet.

Draw your pictorial map and any drawings that you would like to redraw from your notes and sketching on location.

Add some notes describing your experience doing the exercise. Write your initials and the date.



Session 7: Reflection and Transparency

For this session you will need:

- Round wineglasses
- Sheets of grey drawing paper
- White chalk or pastel
- Black pastel, charcoal or black marker

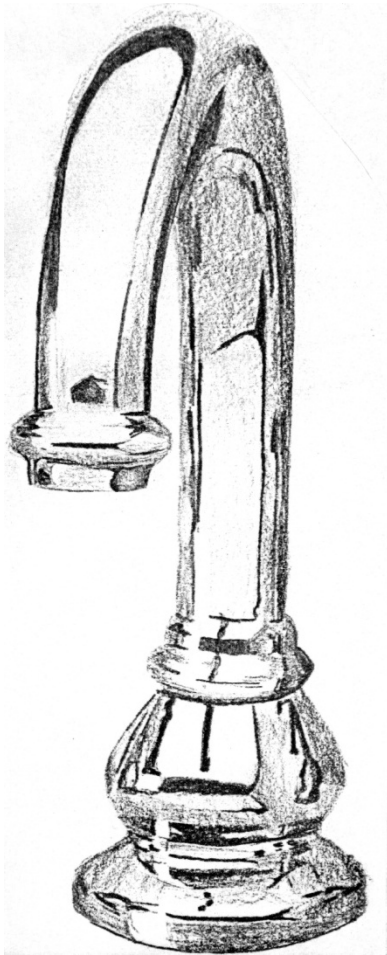
Commence with a warm up exercise as the earlier sessions.

Session 7 part 1: Reflections (50 min)

How do we see that an object is shiny? The answer, of course, is that we see the distorted reflections of other objects on its surface. This might suggest that drawing reflective subjects is hard. The opposite is the case, fortunately, as this exercise will show.

Draw the bathroom tap set shown in the photograph





Follow the same approach as we explored at the start of our work on shading.

Look at the image and subdivide it into two, three or four discrete shades.

Look carefully at the outline of each shaded area.

Draw these outlines lightly, and then shade them in appropriately.

As in the case of the session when you learn to draw the outline of leaves, be particularly careful with the shapes of the outlines of each shaded area.

Use tricks such as using your pencil as a size gauge, working out which slopes align with other spaces. Look for negative spaces. Concentrate on the shape that you have to reproduce.

If you are working from a printed copy of the image, try drawing a grid of light pencil lines on the printed copy. This may help you to reproduce the shapes more accurately.

Write your initials and the date on your drawing and then look at it from a distance.

Session 7 part 2: Transparency (40 min)

Transparent objects pose some interesting problems and challenges. A glass of water provides an excellent practice exercise. We are going to tackle this in two ways: first with detailed observation and shading, and second with minimal abstract form.

Half fill a wine glass with water and place it on a sheet of grey drawing paper so that the light refracted through the glass and water falls on the paper. Place the glass towards the nearest edge of the great paper.

Look carefully at the glass.

You should be able to see several bright highlights which you will draw in white. Look for deep shadows which you can draw in black.

The rest may be more or less the same colour as the paper.

If you screw up your eyes, making your vision blurred, it may be easier to see how some edges of the glass are almost invisible. We only see these edges because our minds have decided that we are looking at a glass of water.

Proceed first by squinting your eyes, screwing them up, so your vision goes slightly blurred. Carefully observe the different shades that you can see in the glass. Choose three or four shades to focus on. Carefully draw the outlines of each shaded, very lightly. If you like, label them white, light grey, dark grey, black.

Carefully use your charcoal or pastels to create the light and dark shades. Be careful to make some of boundaries quite crisp and sharp.

Notice how the outline of the glass emerges from these patterns of shades. There is no actual outline of the glass itself.

Don't forget to draw the patterns of light on the paper beneath the glass.

If you have time, do several sketches, each one quicker and simpler than the last.

Write your initials and the date on each one of them.

If you used chalk, charcoal or dry pastels, spray your drawings with fixative to preserve them.

Session 7 part 3: (20 min)

This time, as you look at the glass, screw up your eyes even more than before so that your vision becomes even more blurred.

Try and draw the glass using minimal representation, perhaps only one shade – white. Maybe you need just two shades – black and white.

You may find that just a few strokes of white pastel are sufficient to convey the result.

Try a series of sketches using black, white, or both to experiment with different representations.

Write your initials and the date on each one of them. Spray fixative if needed, to preserve them.



Session 7 part 4: The Face – Darkness and Light (60 min)

Now we are going to take shading to its abstract extremes. After the earlier exercises, you might think that the secret to accurate representational drawing is to learn to see and reproduce outlines and shading exactly. Nothing could be further from the truth! Drawing is an abstraction of reality: outlines are shapes imposed on reality. They are only significant as a result of our perceptual mechanisms and are structured so as to convey the right message to the observer.

Choose one of the images provided. If you would like to find one for yourself online, choose one that has very strong light and dark tones with much less detail in between.

As in the initial exercise, it is better to start drawing with your image and drawing upside down.

You can use white or grey paper for this. If the background or large areas are going to be black, consider using black paper with white pastel, or black ink with a paintbrush. Practice using them first, though.

Carefully look at the portrait and decide which shade of grey is to be your black/white threshold. Any lighter shades will be white and any darker shades will be black. It may help you to lightly pencil the division between light and dark on a printed copy of the image.

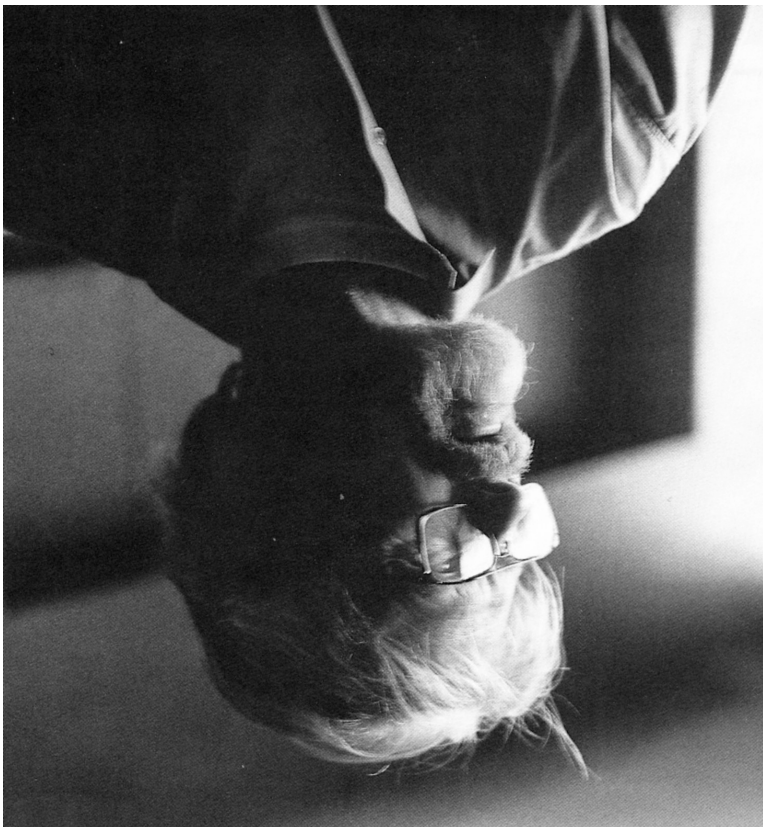
Draw the outlines of the black areas.

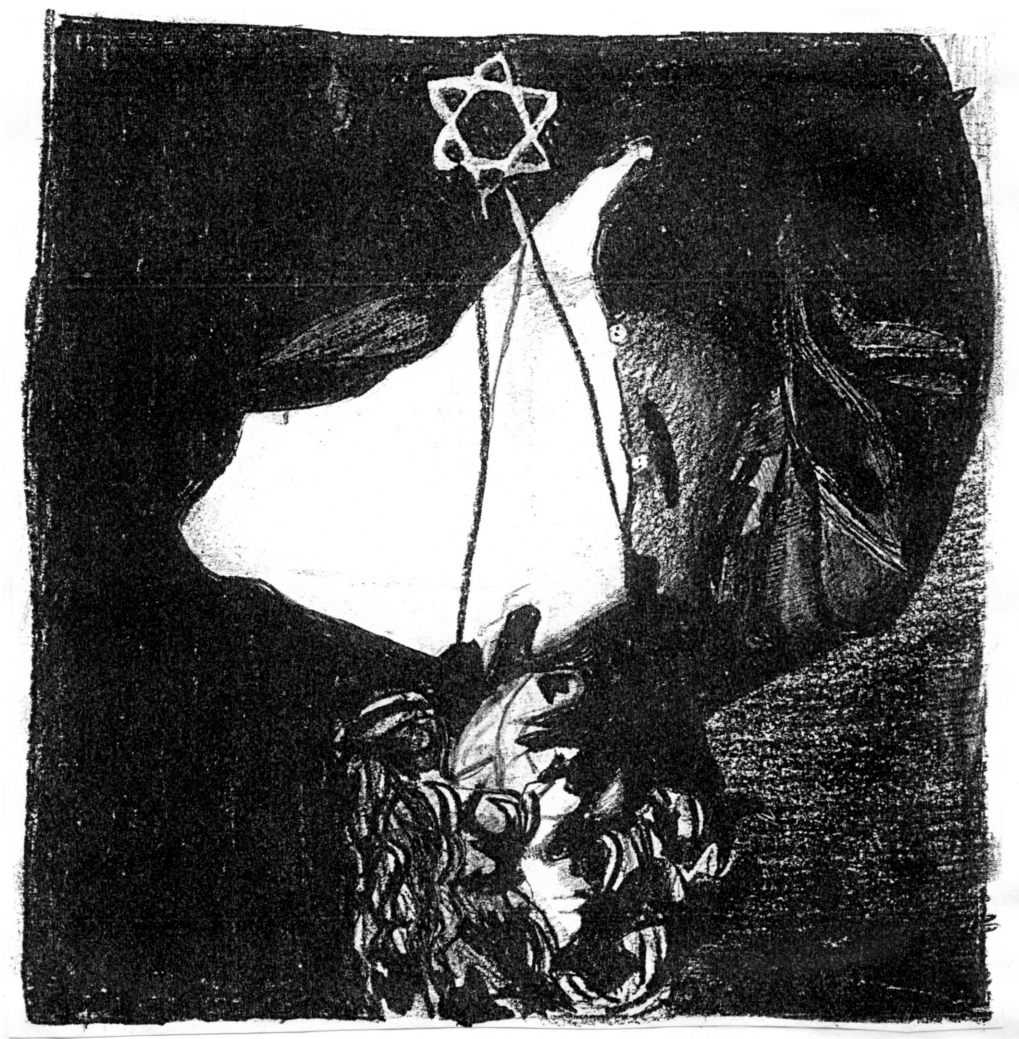
Hair often crosses the threshold between light and dark. You need to decide whether the hair is to be predominantly black or white. The textured pieces can now be completed using a fine marker pen or with practised brush strokes like the ones shown below. This takes a little time and care.



If you follow these instructions, you will find the result pleasing and surprisingly realistic. It's worth asking why such an apparently unrealistic reproduction style produces such a startlingly real result.

Part of the answer lies with the pattern recognition engine that we have in our minds. This is the perception mechanism that we have been trying so hard to suppress in these exercises. When you view these drawings, the pattern recognition engine snaps back into action and converts a seemingly unrealistic pattern of dark and light into a real human face. Thus, the abstract representation, even a simple outline drawing, can convey just as much reality as a faithful reproduction of all the light and dark shades.





Session 8: Visit to an Art Gallery

This course is about drawing and seeing. Art adds a different dimension, but creating it relies on many of the same skills. An art gallery or museum is an interesting building to visit and offers many opportunities to practice your drawing skills. Furthermore, it will always have interesting art and other displays and provides an opportunity to connect drawing with engineering understanding.



Take your camera with you: even a phone camera is sufficient. You may not have time to finish all the drawing that you would like to. A photograph or two can help you remember what you were drawing so that you can finish it at home.

Start with warm up exercises described in earlier sessions.

Session 8 part 1: (30 min)

Choose a picture or a sculpture displayed in the art gallery that demonstrates some of the visual skills explored in this course. For example, look for a painting that includes glasses holding a liquid such as wine or water. Remember session 7 when you practiced drawing wineglasses with water. See how the artist has represented the glasses.

Carefully draw this picture or sculpture. As you draw it, remember the different skills that you have used in the past and notice how the artist might have used some similar skills to create the picture or sculpture.

Write your initials and the date on your drawing.

Session 8 part 2: (40 min)

The art gallery has been designed as a space in which to exhibit pictures and sculptures. It provides visitors with different ways to see what is on display. Visitors can walk through the spaces quickly, perhaps looking here and there for an interesting exhibit. People can walk right up close to most of the exhibits if they want to. They can also sit further back and rest for a while, or just relax and focus on one of the exhibits. Students like yourself can draw pictures or sculpture on display.

Choose any of the interior spaces of the art gallery and prepare a drawing showing of a view of the space.

Remember to use vanishing points to help gauge the slopes of parallel lines accurately.

Check the list of accumulated seeing skills at the end of session 5.

Look for negative spaces. Think about the different parts of the space that visitors would use and portray them in your drawing.

When you have finished your drawing, write your initials and the date on the drawing.

Now prepare a view of the space from above. Imagine that you can position yourself high above the centre of the space, looking down. Draw a sketch of what you would see if you were able to do this. If you can, imagine the perspective from that viewing point: all the vertical lines would converge towards the vanishing point right underneath you, in the centre of the floor at the middle of the space.

You can even imagine the view with the floors above and the roof removed.

You can't actually reach that point so you have to use your imagination. The aim is to capture a reasonably accurate view of the space looking down from a point far above.

When you have finished, write your initials and the date on the drawing.

Session 8 part 3: The Gallery as a Structure

The gallery is part of a much larger structure around it. It is a building that functions effectively because there are service roads around it, possibly an underground car park, a basement store for the pictures and objects that are not on display and services like air conditioning, bathrooms, cloakrooms etc. Most people take these latter features for granted and would not notice them unless they were missing.

Take a few minutes to explore as many parts of the gallery as you can and try and work out where some of the service areas might be located. Ask some of the attendants to help you. Estimate the overall size of each space. If you are about 180 cm tall, a long pace is about 1 metre: count the number of paces it takes to walk along each wall, and adjust for your height.

Prepare sketches to show how the building fits into its surroundings and how the building incorporates all these services. Imagine that you are going to have to explain all these details about the building to someone at home who has never visited it. Think of the diagrams that would help them understand.

It might be helpful to imagine that you could cut the building apart with a knife and slide one half of the building completely out of the way so that you can stand back and draw the other half with the cut surface nearest to you. This way, you could reveal parts that would be normally invisible.

At this stage, do not be too concerned with scale or with fitting everything into the drawing. It is easy to miss judge the size of the building and its location on the paper and then run out of space. Don't let that worry you at this stage.

When you have finished, write your initials and the date on all of your drawings.

We are now focusing on an engineer's view of the building, as a fully functioning structure, incorporated with other features in the city surrounding it. We can no longer take the services in the building for granted. They all have to be shown so that we can appreciate their real significance.

Your drawing will take on quite a different character because it will no longer attempt to be a portrayal of what you can actually see. It goes beyond what you can see. However, you will prepare the drawing by using your powers of observation and you will imagine that you actually can see what you are going to draw.

If you would like some examples, search online for images that show “cross section” or “cut-away” views. Remember to use the quote marks in your search terms.

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