Design Sketching approaches sketching technique in a unique and inspirational way by showing sketches from all phases in the design process. The broad collection contains sketches varying both regarding degree of difficulty and type of product displayed. The main purpose of *Design Sketching* is to help readers find ways to better visualize their ideas, in a way that suits their personal style. Moreover, it aims to serve as a source of inspiration and as a complement to more theoretical sketching books.
Twenty-four talented and creative students from one of Europe's best design schools, the Umeå Institute of Design, have contributed to the diverse material in this book. The collection consists of sketches taken from authentic course assignments and degree projects completed by students at the Advanced Product Design, Interaction Design, Transportation Design, and Bachelor Programmes. The book is separated into 5 chapters containing:

• Basic Theory
This section covers the most important aspects of sketching theory, (such as material, perspective, shading, etc.) with areas specifically selected for their relevance to industrial design.

• Investigative and Explorative Sketches
This chapter shows investigative and explorative sketches, which are seldom shown in books and papers, despite the fact that they are normally produced in the largest quantity during a design project.

• Explanatory Sketches
The ability to communicate the function or form of a product is essential to a designer. This chapter shows sketches created in order to illustrate concepts or proposed design solutions, often for the purpose of presentation and discussion.

• Persuasive Sketches
The expressive sketches shown in this chapter don't stop at explaining function or form, but further convince an audience by conveying the mood and emotional values of a product.

• Step-by-Step Tutorials
Instructional step-by-step tutorials reveal the creation process of six sketches that cover a broad range of complexity, from initial outlines to advanced reflective surfaces.

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Design Sketching

Including an extensive collection of inspiring sketches by 24 students at the Umeå Institute of Design

Erik Olofsson • Klara Sjölén

Design Sketching

Erik Olofsson • Klara Sjölén

Alexander Nemtsov • Eric Gunnarsson • Floris Wiegerinck • Fredrik Nilsson • Hirash Razaghi • Ida Ristner
Jarno Sundell • Jens Andersson • Joakim Sällberg • John Andersson • Jonas Samrelius • Jonathan Hicks
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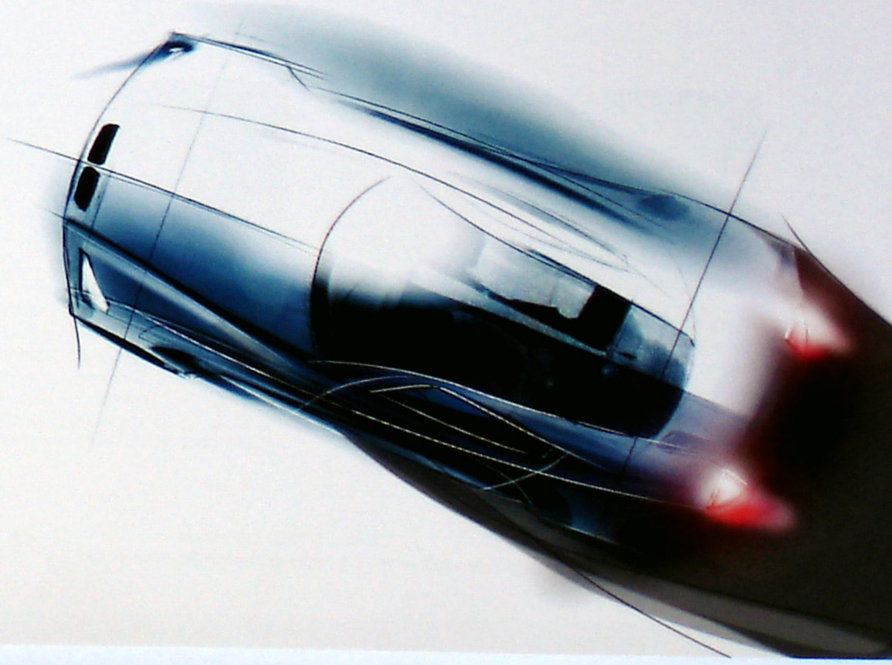


Preface

The book you are now holding in your hands was first envisioned during our final year at the Bachelors' program at the Umeå Institute of Design. Throughout the whole of our educational period, we had looked for, but could not find, a modern book on sketching techniques that focused on Industrial Design – giving us the idea to make a book that could inspire and teach sketching by presenting the large variety of sketches that are useful in the design process. We could not have been in a better position to turn such a book into reality! At the Umeå Institute of Design, we were surrounded by creative and talented students skilled in sketching. The Institute is one of Europe's most prominent Industrial Design schools, providing 4 academic programs: one Bachelor's Programme and three Master's Programmes within the areas of Interaction-, Product- and Transportation Design.

Our selections from the different areas of the Institute have resulted in a unique collection of sketches from all phases in the design process, which show various degrees of difficulty and represent a large number of different products. Since personal sketching style can vary greatly amongst different designers – and no right and wrong really exist – sketches have been chosen with style variety in mind. Furthermore, they are taken directly from real projects; the sketches included have not been made expressly for this book. We would have been glad to see a more even representation of the sexes among the sketch contributors for this book though. The truth is, the proportion of male to female contributors roughly reflects the ratio of male to female students enrolled in the International Master's programmes at the Institute at the present time. Nevertheless, we hope and believe that both women and men will feel equally addressed by the contents of this book.

A lot of time and effort is required to accomplish a thorough and well-thought out design project – a designer's ability to sketch is merely a small part of the skills needed during the overall process! But the fact is, even a great design concept still has to be visualized successfully in order to be both communicated and sold to others, in which the sketch most often plays a great part.

Design Sketching was written to serve as a source of inspiration as well as help you improve your sketching skills and find ways to better visualize your ideas in accordance with your personal style. We hope that it will give you many valuable tips, release your creativity and fuel your urge to sketch!

Enjoy your read!

Erik and Klara, Umeå, August 2005

Klara Sjölén was born in 1980 in Sundsvall, Sweden. She is currently completing her Master's Degree (2006) in Industrial Design Engineering at Chalmers University of Technology, specializing in Materials Science and Transportation. She has a separate Bachelor's Degree (2005) in Industrial Design from the Umeå Institute of Design. During internships abroad she has developed an interest in Public Transportation.

Erik Olofsson was born in 1978 in Umeå, Sweden. He graduated with a Bachelor's Degree in Industrial Design from Umeå Institute of Design in 2005. Erik has a special interest in Entertainment Design and Conceptual Art, and is currently pursuing a number of different entrepreneural business projects.

Sketching – the Designers' Visual Language

The ability to sketch is one of the most valued skills among industrial designers, their co-workers and clients – and it is not without reason. Sketching has proved over the years to be one of the fastest ways for a designer to *define problems, explore ideas and develop form* whether using paper, digital media or combined, of which you will see many examples in this book.

The term *sketch* has generally the meaning of a rough or unfinished drawing, and the activity *to sketch* is to give a brief account or general outline of something. The English word originates from the Italian *schizzo*, in turn based on the classic Greek term *skhedios* signifying 'done extempore - spoken or done without preparation'. One of the basic cognitive benefits of sketching is that the mere acts of formulating a mental image in a concrete way on paper makes it possible for the designer to reflect over the concept at once and almost instantly develop it further into a new concept, a so called *iteration*. When working in teams, sketching is a valuable tool for creative group activities such as brainstorming and concept evaluation. In professional design practice, sketching has proven to have multitude of purposes which can be summarized under four headlines – investigation, exploration, explanation and persuasion:

Often, the *investigative* function of sketching is tightly connected to the early research phase of a design project. The designer is examining the problem space, and sketching helps analysing the context while the problem and its components are emerging.
Explorative sketching is often used when proposals of design solutions are generated and evaluated. These sketches are produced in large numbers, are often very rough and do seldom make much sense for others than the people directly involved in the design process.
Explanatory sketches have to communicate a clear message to others than the designer and the team, in contrast to the explorative sketches mentioned above. These sketches describe and illustrate proposed concepts in a neutral and straight-forward manner, and are often created in the later phases of a project, to get valuable feedback from users, clients and external experts.
Persuasive sketches are the most artistically impressive type of images, often called renderings and takes much more time to finish than the other types. The main purpose with these drawings is to 'sell' the proposed design concept to influential stakeholders, such as CEOs or Design Managers.

Of course, many of these purposes coexist in the same sketches, and the different types of sketches often appear repeatedly during the many iterations of a successful design project, especially explorative and explanatory sketches are the most frequent types.

Enjoy this rich collection of sketches made by talented design students of Umeå Institute of Design presented in this book, and I hope it will inspire and stimulate you to further explore the visual language of design.

Niklas Andersson
Director of Studies
Umeå Institute of Design

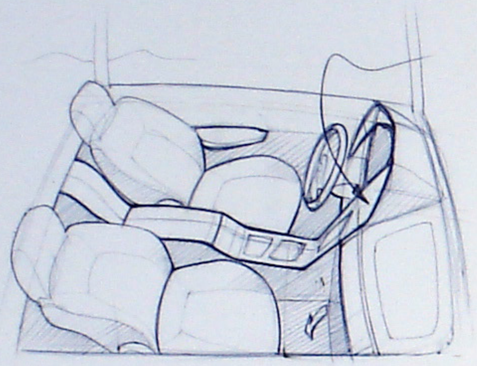
Basic Theory

It takes a great deal of practice to become good at sketching! Aside from the essential ability to draw, a good knowledge of basic illustration theories like perspective and shading is required to create credible and attractive sketches.
The following theoretical section includes a summary of areas or subjects deemed important specifically when drawing industrial product design sketches.

For more experienced readers, these pages can act as reminders, while for the beginner, they can serve as an outline of the most important drawing techniques and also as a checklist of areas to gain greater knowledge of. For a list of literature that covers these areas more thoroughly, please consult the literature tip *list on page 104.*

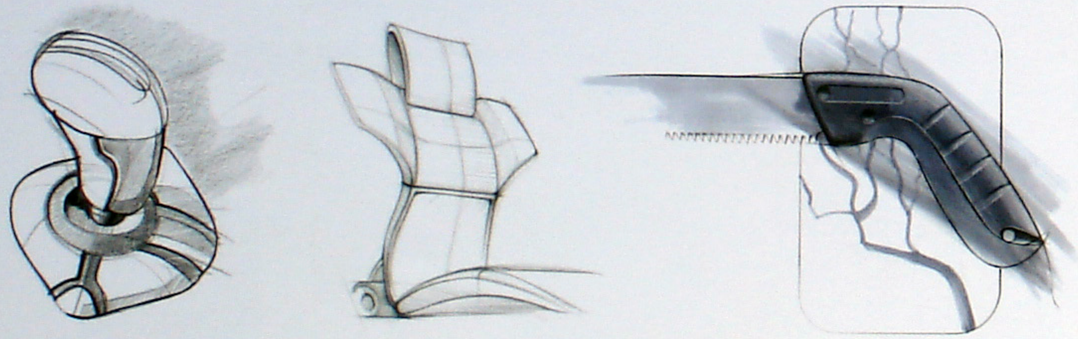
Sketching Media

This section shows examples of materials used to create the sketches in this book. Experiment with these and other media to get a sense of their characteristics and discover personal favourites. Specific brands are only mentioned as examples and should not be considered recommendations.

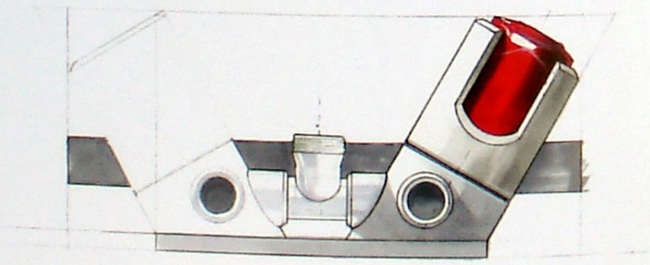


► **Ballpoint Pen** The sketch to the right was drawn using a ballpoint pen designed to create thin and exact lines of ink. Usually, pen shadings are created by filling fields with parallel slanting lines. Because the ink has a tendency to bleed when marker is added over it, marker is sometimes combined with ballpoint pen to create shading. To avoid this effect when using markers over ballpoint pen line art, try using a different mix of marker and pen brands. (For example, *Bic Orange Fine* ballpoint pens do not bleed with *Copic* markers.)

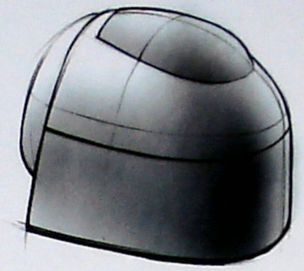
▼ **Coloured Pencils** Many brands offer coloured pencils in a multitude of colours and hardnesses. These pencils are less reflective and have higher pigment saturation than graphite pencils. Coloured pencils are used both alone and in combination with other media. Hard pencils give thin and exact lines and are often used for foundation sketches, while softer ones can create high-light and extra-powerful outlines. Black and white coloured pencils can be useful for creating quick planar views, possibly on coloured backgrounds or coloured paper. Many of the sketches in this book were made with *Sanford Prismacolor* (soft) and *Sanford Verithin* (hard) brands of coloured pencils, frequently in black, white and indigo blue.



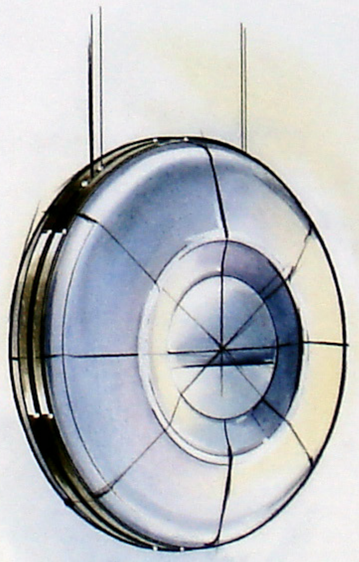
► **Marker** This is a type of felt-tipped pen, available in a wide range of colours. Marker can be applied in one or more layers; layering strokes of the same colour will darken an area with saturated colour. To create a smooth surface, marker ink must be applied quickly and liberally, covering the whole surface before it has dried.
It is a good idea to buy markers in pairs, i.e. two of the same colour, but with differing lightness/saturation. They can be used together to colour the different surfaces of an object that are hit by light or in the shade respectively. The most frequently used brand of markers in this book is *Copic*.



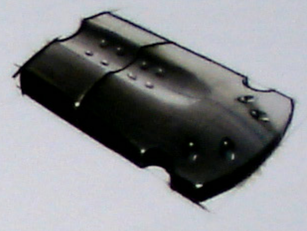
▼ **Airbrush** Airbrushing creates shading with a very smooth gradient. To create sharp edges, it is necessary to mask off (cover) areas that are not to be coloured. Masking is used for many media, but is especially important for airbrushing, since airbrushed fields cannot be erased.
There are many airbrushing systems available, from the traditional to the more modern ones that involve a simple marker pen attachment, like the *Copic* or *Tria* marker airbrush systems.



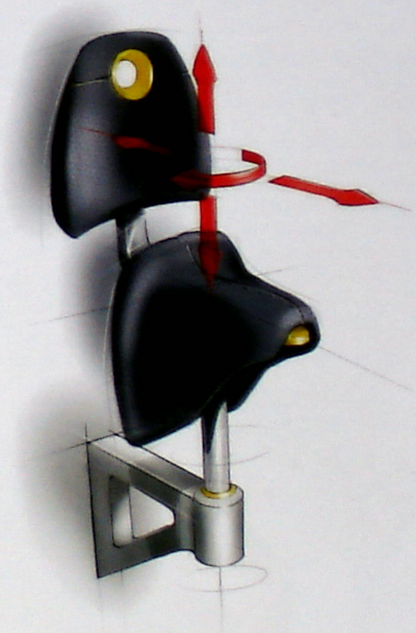
▼ **Pastel** Pastels are often used to create gradients, or for covering large areas like backgrounds. They can be used to express light reflections or shiny and transparent surfaces such as glass and displays. In order to achieve an evenly filled surface, either draw past the lines of a part, using an eraser to remove redundant pastel, or mask off the area before adding the pastel. To create the impression of a lit or shiny surface; simply erase the pastel from the area meant to appear lit.
To enable a smooth application, pastel blocks can be scraped to obtain a powder, which is then mixed with baby powder and applied to a sketch with a soft pad or cotton wool. Pastel powders of different hues can be mixed to create the desired shade.



▼ **Gouache** This is an opaque and water-soluble coloured paint often used for vibrant highlights. It is normally mixed with water (retaining coverage) for a more easily controlled and fluent consistency. Gouache is applied to a sketch with a fine-tipped brush.



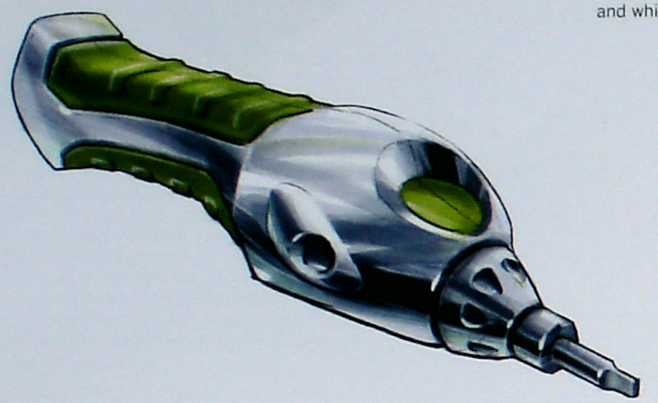
▼ **Digital Software** It is also possible to sketch with the aid of a computer and graphic software. A digital pen and drawing board is preferable to using a mouse, since the pen allows for more accuracy and control. Many limitations of traditional media can be overcome when working digitally, for example, a sketch can be reworked or re-coloured indefinitely without destroying it. Digital media is often used on scanned hand-drawn line art, to add separate layers of colours and effects. The most commonly used software for working digitally on sketches in this book are *Photoshop* and *Painter*.



Paper The paper can influence the performance of some media. A paper's grain or smoothness will determine how fine and clearly lines can be drawn, and can affect the appearance of coloured pencil or ballpoint pen sketches. Markers are often used on 'bleed proof' paper, a kind of paper that doesn't allow marker ink to seep through. This protects underlying surfaces from getting stained, and prolongs the life of the marker pens. When marker is added liberally, bleed proof paper's low-absorbency allows for more exact marker fields. A brand of marker paper commonly used for sketches in this book is *Letraset*.

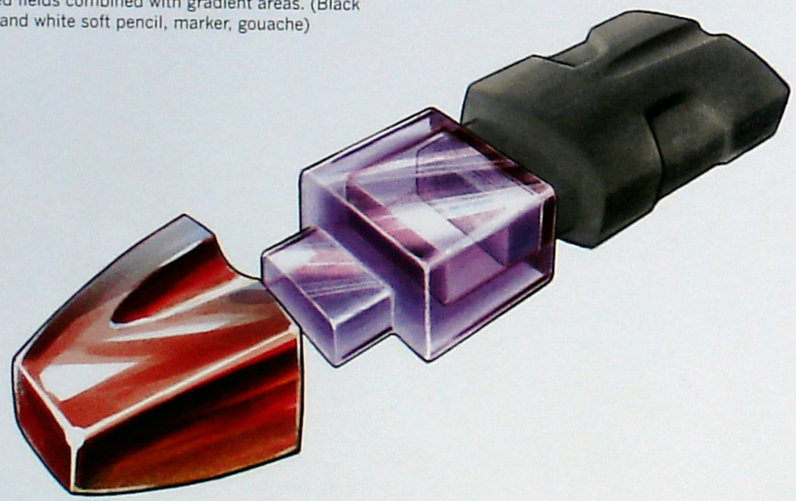
Material

The sketches below show only a few of the many ways that materials can be illustrated. Rendering skills can be improved by observing the way that materials and textures reflect light, and by trying to replicate these effects using different sketching media and techniques. A general principle to keep in mind, concerning all materials, is that an object's shape will also convey a material. Because of the design limitations of some materials, small details such as the size of edge radii reveal what kinds of material the object is made of.



▲ **Matte Plastic** Matte plastic has been illustrated here (the green parts) using smooth and soft shading, with very vague or no reflections. (Black and white soft pencil, marker)

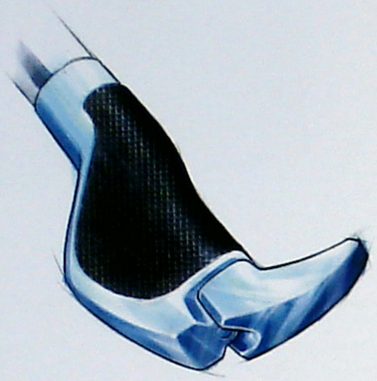
▲ **Metal** Any highly reflective material should appear to mirror its surroundings on its surfaces. In this example (above), a rough illustration of the reflection has been created using highly contrasting and defined fields combined with gradient areas. (Black hard pencil, black and white soft pencil, marker, gouache)



▲ **Varnished Surface** A varnished surface has been illustrated here using rough reflections created with marker and a liberal application of highlights. Smooth gradients of a slightly different colour have been made with pastels, indicating reflections of different colours in the environment. (Black hard pencil, white soft pencil, marker, pastel, gouache)

▼ **Textured Material** The technique used here (see the black grip surface) is called *frottage*, and is used to indicate textured surfaces like grips or cloth. A drawing tool (e.g. a pencil) is used to make a "rubbing" over a textured underlay, thus transferring a textured appearance to the paper. Many different surface textures can be tried to achieve a desired effect, for example, by using plastic folders, metal screens, notice boards, etc. (White soft pencil, marker)

▼ **Shiny Plastic** In this case, a saturated blue colour has been chosen, in order to avoid the risk of confusing the plastic with materials that are typically rendered in shades of grey, such as metal or rubber.
The more contrasts and defined reflections there are on a surface, the shinier the material will seem. (Black hard pencil, black and white soft pencil, marker, gouache)

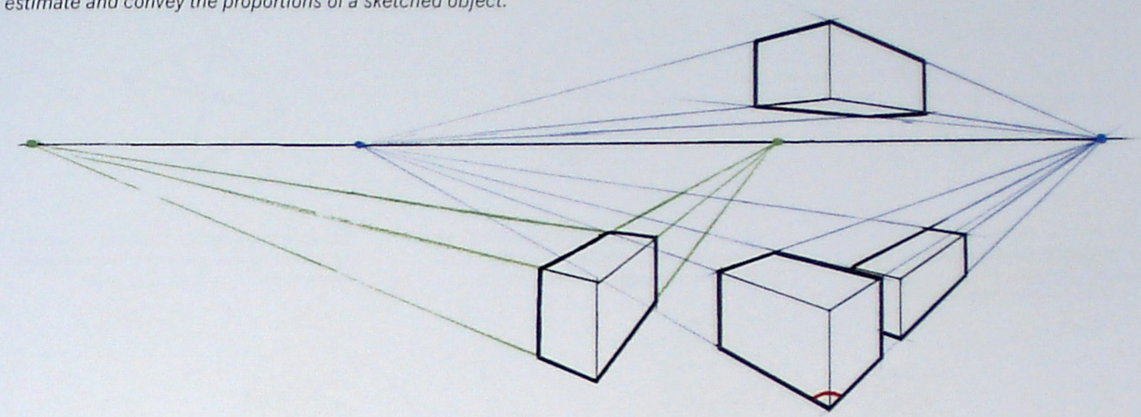


▼ **Rubber** Rubbery materials are characterized by surfaces with soft gradients and very low contrasts. These effects have been produced here using pastels and coloured pencils over a layer of dark marker. (Hard and soft black pencil, white soft pencil, marker, pastel)

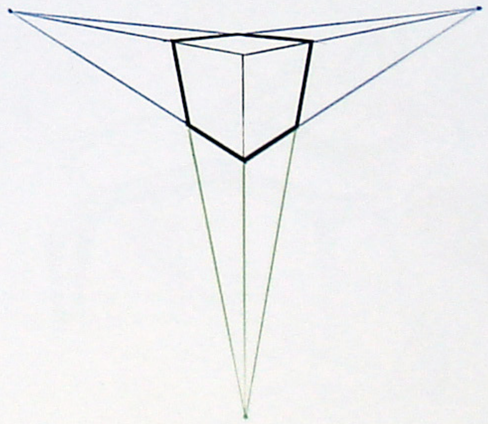
▲ **Transparent Material** Tinted transparent materials have deeper colour intensity where the material is at its thickest. Clear transparent parts often contain complex refractions that can be too time-consuming to illustrate if they're not simplified (catalogue photos of transparent products can be studied to get a reference on how to make controlled and simplified refractions). The illusion of a transparent material in a sketch can be enhanced by drawing something behind the object that is visible through the material. (Black hard pencil, white soft pencil, marker, Photoshop)

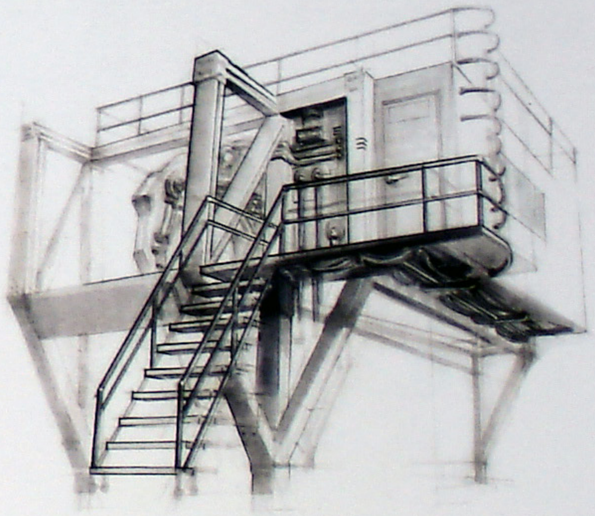
Perspective

In order to create believable sketches, it is imperative that a designer has an understanding of perspective theory. An audience will instinctively know when a sketch has been drawn 'out of' perspective, even without knowing perspective rules. Correct perspective is also vital for the designer to be able to estimate and convey the proportions of a sketched object.



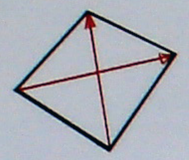
▲ **Two-point Perspective** The sketch above illustrates the rules of two-point perspective. Notice that all vertical lines on the boxes are parallel to each other, and perpendicular to the horizon line (i.e. the horizontal line drawn across the picture that indicates eye level). Parallel horizontal lines on the actual object are not parallel in the sketch, but meet at a specific 'vanishing point' on the horizon line (blue and green dots). These vanishing points are arbitrarily placed by the designer. To better understand the effects of vanishing points, the object can be drawn several times with variations in the placement of the points. Placing the vanishing points too close together results in a distorted or 'warped' perspective. To avoid this effect, make sure that a perpendicular front corner (marked here in red) of an object creates a substantial angle between the vanishing points. This angle should exceed 90 degrees.



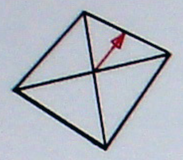


▲ **Three-point Perspective** This perspective is based on the same principles as the two-point perspective, but includes a third vanishing point placed above or below the object. Vertical lines (drawn parallel in two-point perspective) now converge at this third point. A three-point perspective will make a small object appear closer to the viewer's eye or a large object seem more monumental, giving a sense that the object is being seen from high above or far below (often used in architectural sketches).

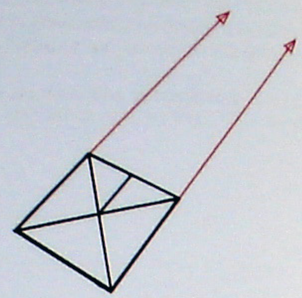
▼ **Keeping Proportions in Perspective** Described below is a method used to draw the correct proportions of two or more equally sized objects in perspective. This example shows how a second square (dashed lines in last illustration) is drawn proportionally to the original square.



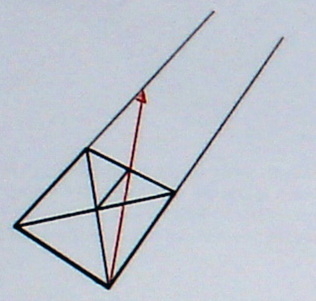
1 Mark out the centre of the first square by intersecting the lines drawn between opposing corners.



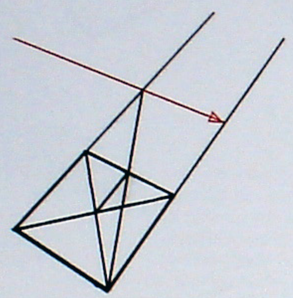
2 Find the centre of the side line by drawing a line from the first square's centre towards the right vanishing point.



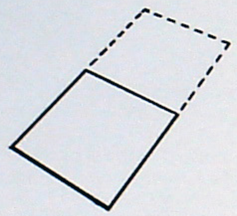
3 Create the sides for the second square by extending the sides of the first square towards the right vanishing point.



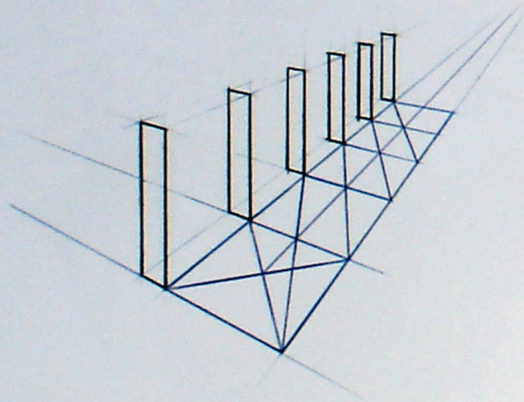
4 Find the furthest corner of the new square by drawing a line from the closest corner of the first square, through the centre of the side (2) and reaching the side extension (3).



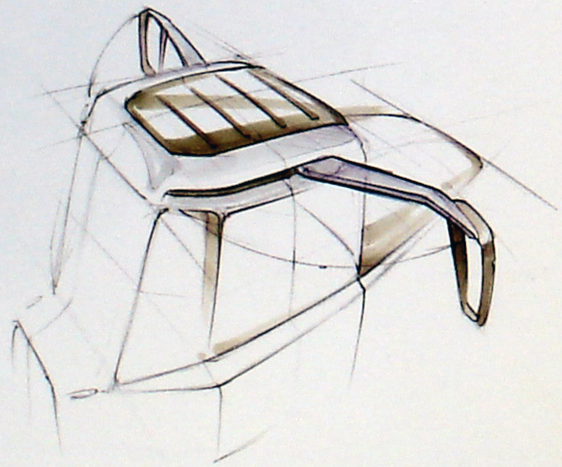
5 Create the last side of the new square by drawing a line from the left perspective point, through the furthest corner (4) and to the right side extension (3).



6 All sides of the square to be duplicated are now defined.



▲ These rectangles were drawn to appear the same size and equally spaced in perspective, using the method above to keep their proportions correct.
Keep in mind that distortions can occur when this method is repeated many times in a two-point perspective. In these cases, the result should be double-checked using the eye. The distortions appear because the two-point perspective is only a simplified representation of reality, which is seen by the human eye in three-point perspective.



▲ **Construction Lines** Starting a sketch by making some leading perspective lines helps to define the space the object and its different parts will occupy. These construction lines help the designer sketch with greater confidence and can also make the finished sketch more readable.

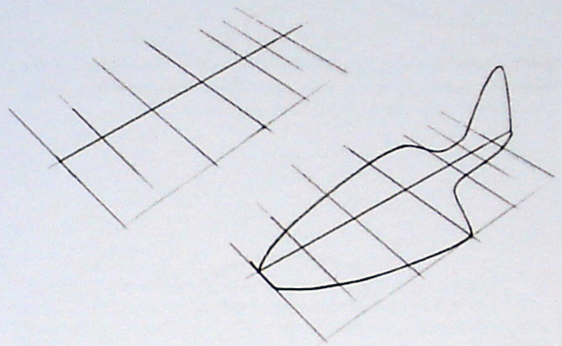
Complex Forms in Perspective

It takes some effort to draw a complex symmetrical form correctly in perspective. The method described below can be practised to improve one's ability to illustrate these forms.

Once a better understanding of perspective shapes is attained, this process can be simplified.

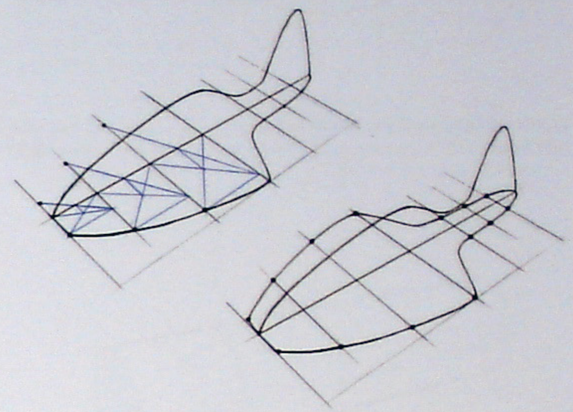
1 First, a perspective grid is set up, onto which the form will be built. Next, contour lines of the side view and the near half of the top view are drawn.

2 To create the correct shape of the top view outline, chosen points on the near half of the top view are mirrored across the centre line using the *"keeping proportions in perspective"*-method (see page 10). The mirrored points are then connected with a line, completing the top view contour. When the entire top view contour is defined, the perspective and contour lines are traced onto a fresh page to keep the sketch from becoming too cluttered.

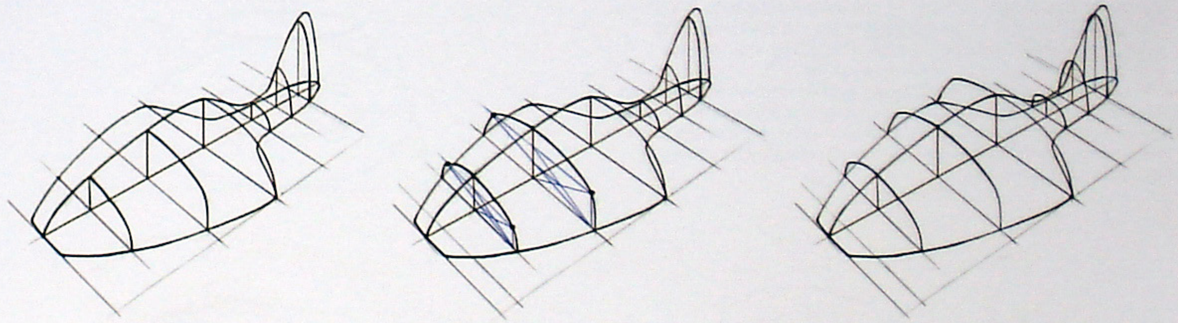


3 Front view cross-sections of the near half of the form are drawn, defining its shape.

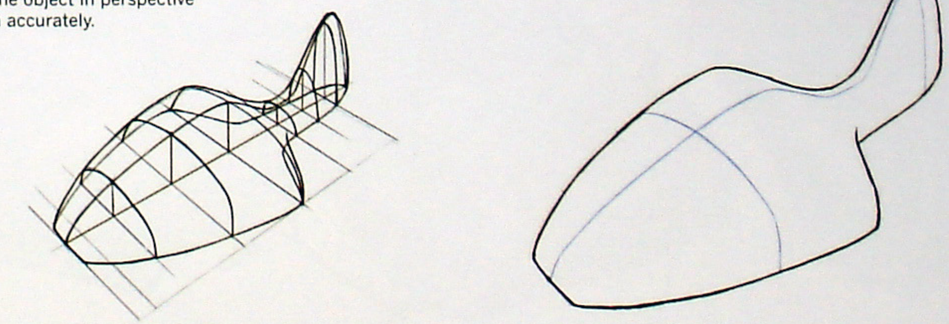
4 The cross-sections are mirrored across the centre line. The method for *"keeping proportions in perspective"* is repeated as necessary to find support points mirrored to the other side of the centre.



5 All of the completed cross-sections make up a shape-describing 'skeleton' that shows the correct form in perspective.

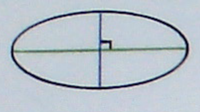


6 With the cross-sections in place, the contours of the object in perspective can be drawn accurately.

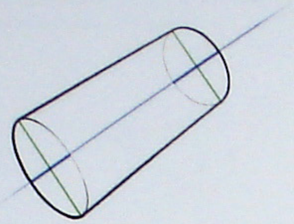


Ellipses

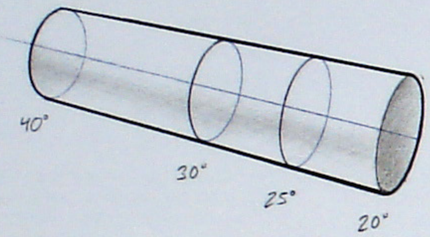
Circular shapes exist in many objects, therefore it is important to understand how they are drawn in perspective as ellipses. It is a common mistake to draw ellipses in an incorrect perspective, but they can, in fact, easily be drawn correctly when basic theories are understood.
Drawing ellipses by hand is tricky at first, but gets easier with practise. To achieve perfect ellipses, guides can be used.

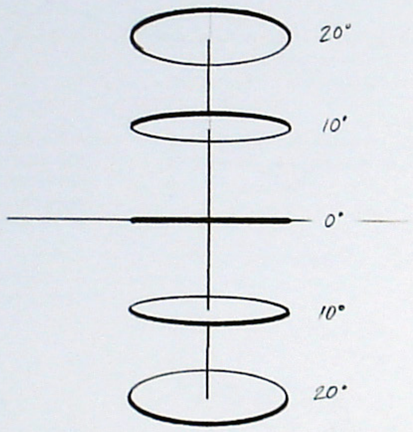


▲ **The Ellipse** An ellipse is symmetric along two axes; the minor axis (blue) and the major axis (green). These axes are always perpendicular to each other.

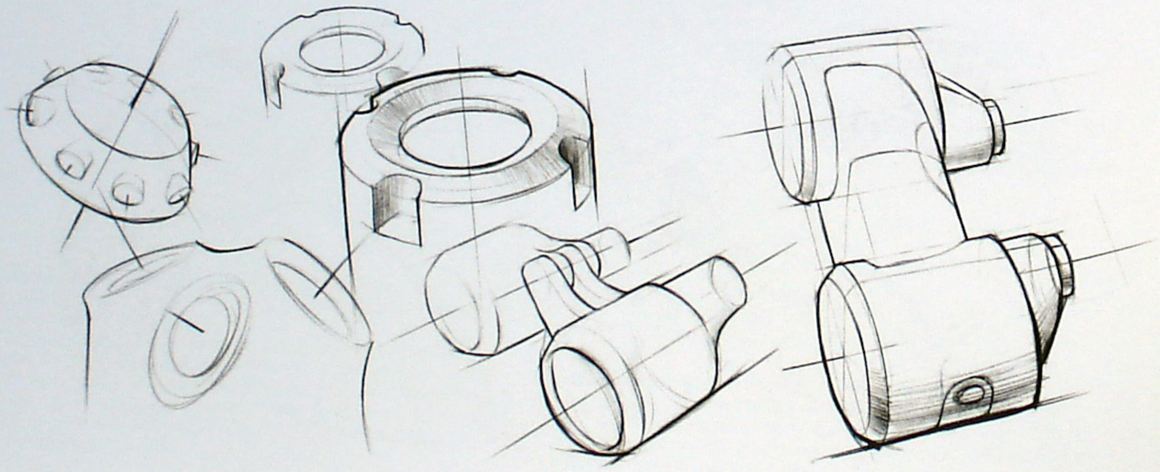


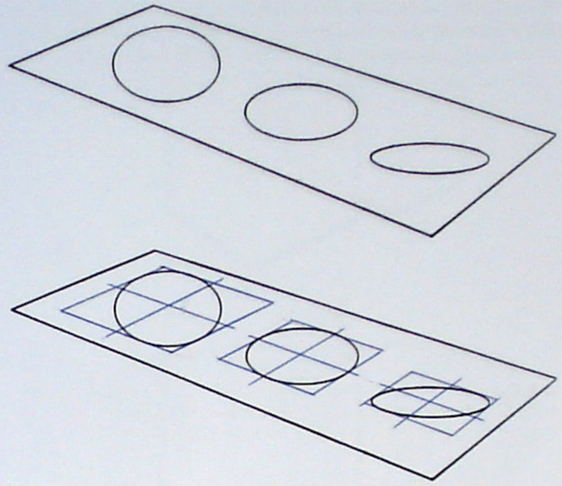
▲ **A Cylinder in Perspective** The minor axis of the ellipses at the ends of a cylinder must always coincide with the central axis of the cylinder, and point to the same vanishing point.



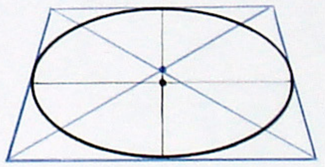


▲► **Values of Ellipses** Ellipses of differing value or degrees appear on the section surfaces of the cylinder (above). The values state how much of the circular area is seen at that point. The lower the value, the closer to perpendicular the view and the shorter the minor axis of the ellipse will be.
The same rules apply to horizontally placed circular areas (right). A circle viewed perpendicularly from the side appears as a line (corresponding to the value 0). Note that both illustrations show the circular planes as parallel, with their minor axis pointing in the same direction.

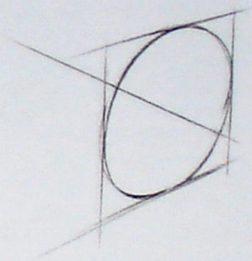




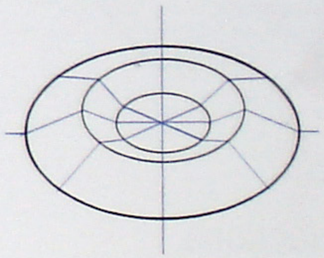
▼ Centre of the Ellipse The centre of a circular area shown in perspective, an ellipse, does not coincide with the point of intersection between the ellipses' minor and major axis (blue respectively black dot) This is due to foreshortenings, since just the circle is shown in perspective.
The centre of the circular area will instead be found by placing it on a square surface. The centre of the circle is the point of intersection between the square's diagonals.
A very important thing here is to draw the square so that it is situated in the same plane as the circle is!

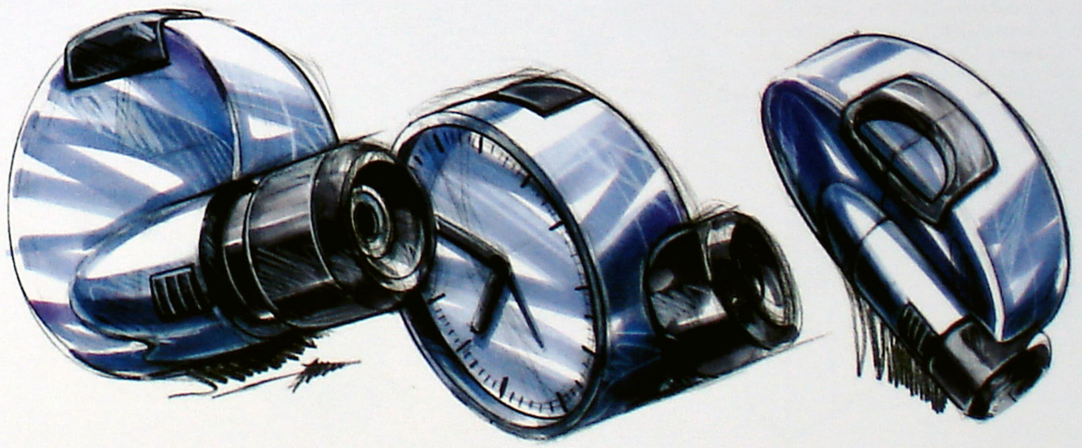


◄▼ **Choosing the Ellipses' Value** Take a look at the three ellipses drawn on the rectangular surface (to the left). Obviously, only one of them represents a circle corresponding to the perspective of the rectangle, whilst the other two have incorrect values. While the eye can often chose the correct value, guides can be helpful when drawing an ellipse.
A useful guide can be created by drawing a square in the same perspective, placed on the surface on which the ellipse sits. An ellipse that can be placed with sides touching the centre points of this square will have the correct value. Note that when using a two-point perspective (as opposed to a three-point perspective), this method has its restrictions. The best guidance square is placed approximately at an equal distance to the left and right vanishing points. However, if the guidance square is closer to one of the two vanishing points, the ellipse will be too warped to fit into the guidance square.



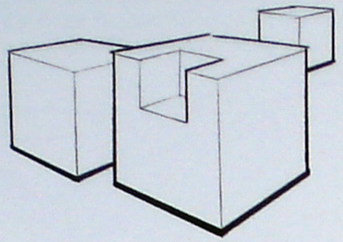
▼ Concentric Ellipses When two or more ellipses are placed within each other and displaced along their minor axis, concave or convex forms are created (below).
If the ellipses are instead placed with coinciding centre points, they are kept on the same plane.

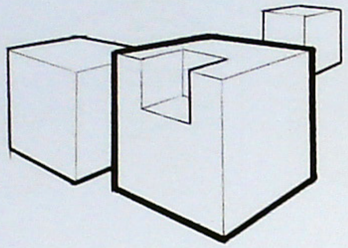




Line Weight

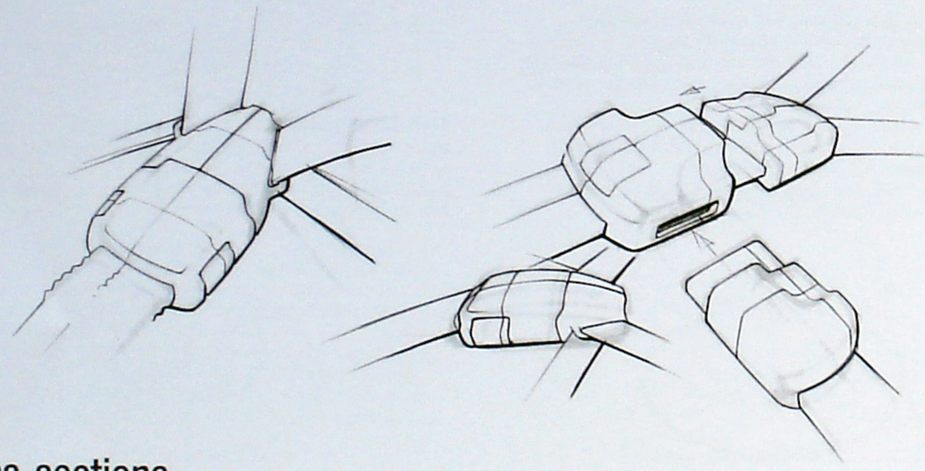
Using lines of differing thickness can help clarify a form and add dynamics to a picture. Line weight *can be used in a variety of ways to emphasize chosen parts of an object, strengthen the perspective and create depth.*





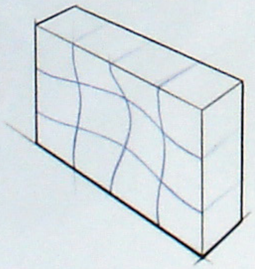
► **Basic Line Weight** The upper right hand image shows a basic line weight treatment. The thickest lines are used for the baselines (lines describing surfaces on which the object rests – in this case, a ground plane), the second thickest lines are used on edges that have air behind them (note that these are not only contour lines, but can occur within an object), while the thinnest lines describe edges that point towards the viewer.

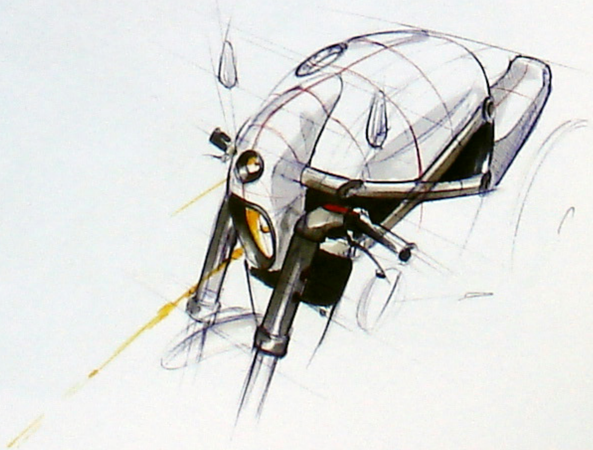
► **Exaggerating the Contour Line** Exaggerating contour lines can 'pop' an object forward, pushing the other objects further into the background and adding depth to the picture. This treatment of contour lines is often used to distinguish objects of importance.
There are other line weight effects one can use to enhance the overall quality of the sketch as well. Two examples (not shown here) include showing lightning by thickening shadow-side edges and using thinner lines on light-side edges, or enhancing perspective by decreasing the line weight as the lines stretch further from the viewer.



Cross-sections

▼ **Cross-sections and Part Lines** *Cross-sections* are lines that follow the surface of an object to help the eye 'read' a form. These lines are often thin or of a different colour, making them easily discernible. Rounded and complex shapes are more easily described using cross-sections.
Part lines appear between the different parts or materials that a product is composed of. When placed correctly, part lines make an object look more realistic, and they are often drawn in sketches to serve the same function as cross-sections in describing form. One common example is the line between a battery door and the rest of a plastic casing.

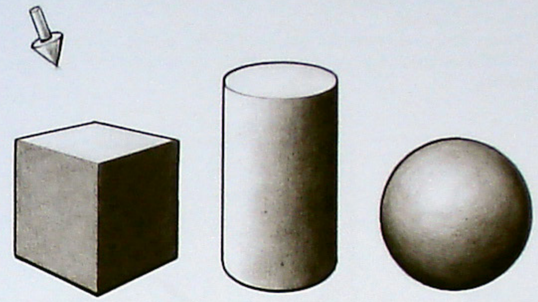




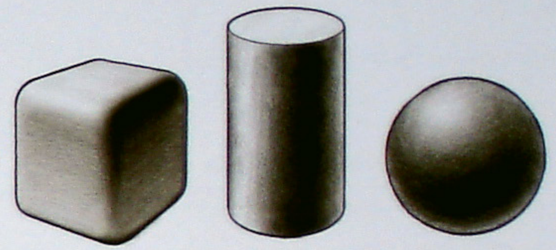
Shading

Dark shading appears on an object in areas where the lighting is blocked or indirect. Before shading an object, the direction of the lighting should be chosen wisely, as the shadows it produces can help to describe the object's form and/or create a specific mood.

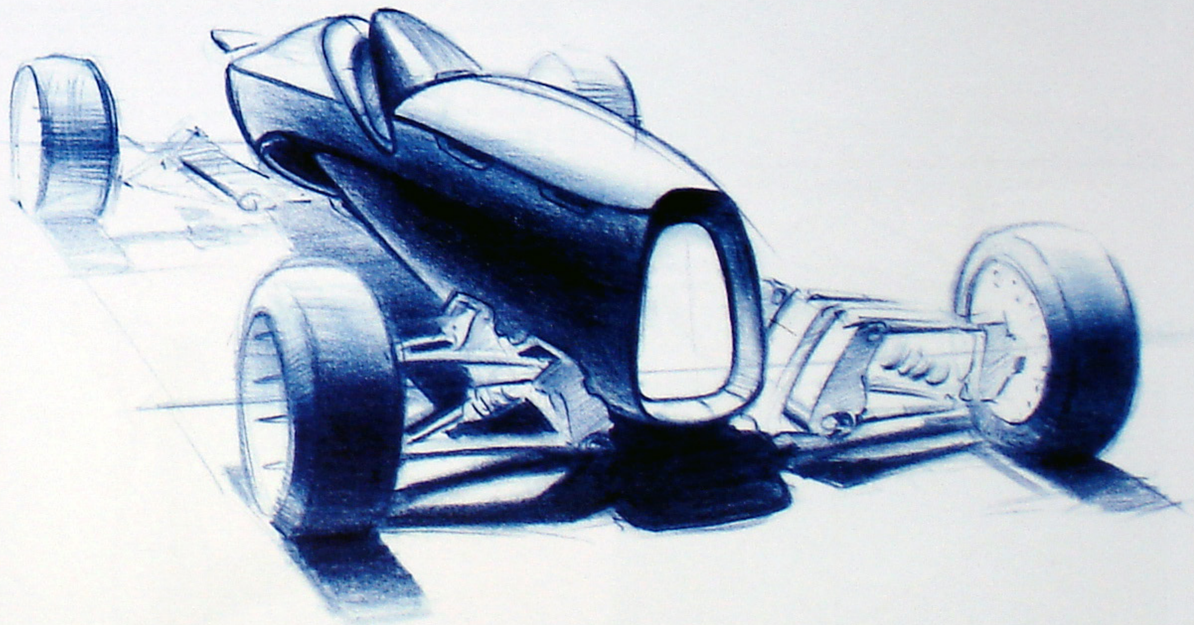
In the following two examples, the lighting has been chosen to make simple forms appear clearly. However, the positioning and angle of the light sources should be considered a mere recommendation. For objects and compositions with greater complexity, the lighting that creates the most suitable shades for describing the object's form will vary.



▲ **Basic Lightning** The arrow next to the cube indicates a light-source direction commonly used for design sketches. This lighting scheme makes the top surface of the cube the brightest, its right side the darkest, and the left side a shade in between. This lighting has also been applied to the cylinder and sphere. Rounded forms have smooth gradient shading.



▲ **Core Shadow** An object is seldom lit by a single light source, but usually by several lights and/or light reflected from surrounding surfaces. When a curved surface is lit from two opposing sides, a dark core shadow will appear along the radius of the curve. Lighting that creates this kind of shade is most suitable for describing rounded shapes.
These objects (above) are lit using the 'basic lighting' described to the left, but are also hit by light being 'bounced' from the ground. The cylinder shows how a core shadow is produced vertically, being lit from the right by a second light source or light bouncing from the environment.

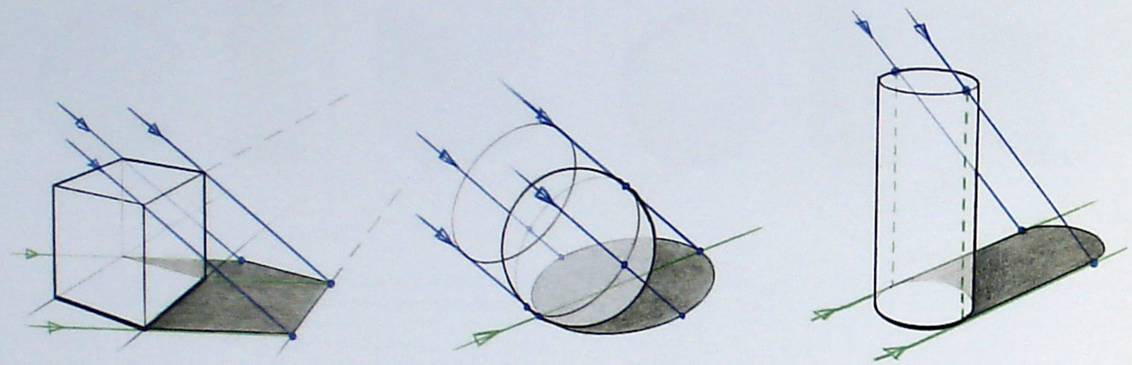


Cast Shadows

The type of shadow that an illuminated object casts on another object is called a cast shadow. It can help describe not only the form of the object casting the shadow, but also the form of the object that is hit by it. For example, a rear-view mirror on a car can cast a shadow along the side of the car, working like a cross-section following the car's form. Shadows also give the sketch life and contribute to the realism of the picture. When a designer knows the basic theories of how shadows are cast, it is possible for him/her to draw a simplified, time-saving cast shadow that still serves its purpose, possibly adding an artistic dimension to the sketch.

▼ Choosing the Light Source The most common way to treat lighting for cast shadows is to imagine a light source endlessly far away, resulting in perfectly parallel light beams.
In order to construct a cast shadow, two things must be decided first:

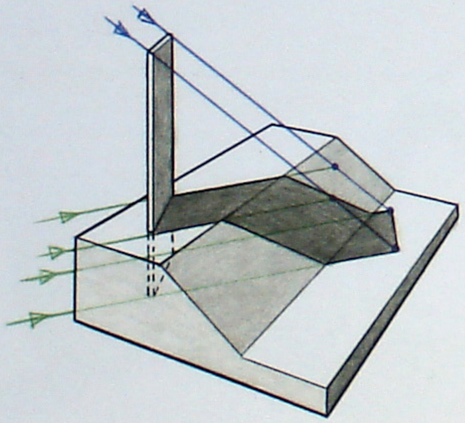
1 The angle of the light source in relation to the horizontal plane (the direction of the green arrows, affecting the direction the shadow is cast in).
2 The vertical placement or apparent height of the light source (vertical direction of blue arrows, affecting the length of the cast shadow).



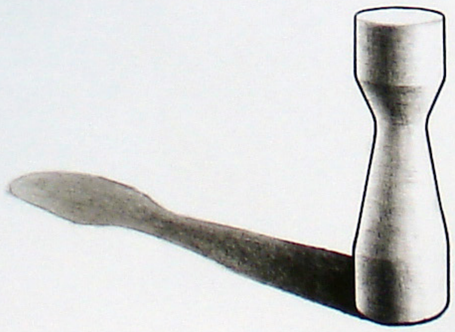
▲ Shadow Cast by a Cube Here, the cube's shadow was begun by sketching the green lines along the direction of the shadow. This was followed by sketching the blue lines. The outlines of the cast shadow were drawn between the intersections of the green and the blue lines.
Note that the upper edge of the cube and the edge it creates in the cast shadow converge, pointing towards the same vanishing point (see their dashed extensions). Even cast shadows are bound by the rules of perspective. Using perspective lines and vanishing points, together with the blue or green lines is another way of constructing the cast shadow.

▲ Shadow Cast by a Sphere To understand this shadow, imagine a cylinder – with the same diameter as the sphere, and with its axis aligned in the same direction as the light – cutting through the ground plane. The elliptical cutting area on the ground plane coincides with the form of the shadow.

▲ Shadow Cast by a Cylinder In this case, the elliptical part of the shadow is vertically placed between the top and bottom of the cylinder. This will give the elliptical part of the ellipse in the cast shadow, furthest away from the observer, a value somewhere between the values of the top and bottom ellipses of the cylinder.



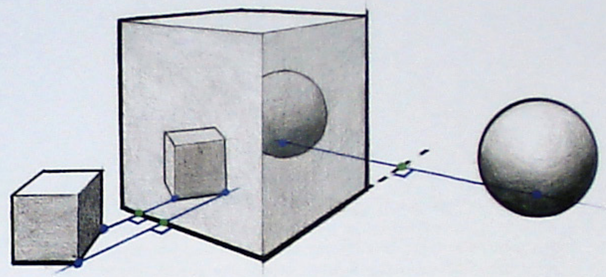
◄ Shadows on Non-planar Surfaces The illustration on the left was begun by drawing the part of the shadow that hits the top surface. Next, an imaginary downward extension of the object casting the shadow was drawn, ending at the bottom surface (dashed lines). This made it it possible to cast the shadow onto the bottom surface. The shadow was completed by connecting the outlines of the top and bottom shadows, creating the shadow that falls over the tilted plane.



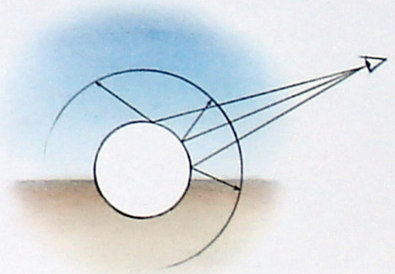
► The Shadow Because light naturally tends to 'bounce' from surfaces in an environment, cast shadows normally exhibit a darker core that fades the further it falls from an object.

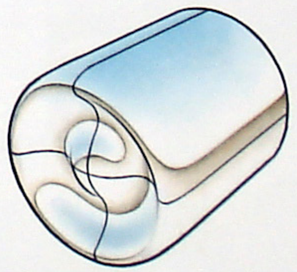
Reflections

▼ Reflection in Perspective This illustration shows some basic principles of reflection. Due to perspective, the distance between the object and the mirror is no longer the same as the distance between the reflected object and the mirror, meaning that the green points of reflection are not placed in the middle of the blue reflection lines. The reflected objects also become smaller than the originals. Their proportions and placement in the mirror can be found by using the "*Keeping proportions in perspective*"-method (see page 10). Note that the reflection always occurs along a line perpendicular to the mirroring surface.
The sphere is most easily mirrored by first mirroring its resting point and then drawing the reflected sphere.

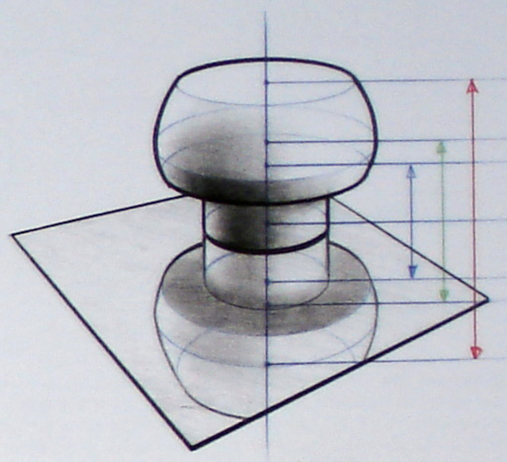


▼ Reflection of Surroundings in Non-planar Objects A common way to show that an object is highly reflective is to place it in an imaginary desert environment, resulting in reflections of blue and yellow gradients describing its form.
The inset sketch, showing an eye 'seeing' the side view of the cylinder, helps to explain the distribution of the reflected scene. Light from any point in the environment will hit the reflective surface with an angle of incidence equal to the angle of reflection. Note the behaviour of the reflections on the convex and concave shapes at the end of the cylinder.
Environment reflections are often rendered in a very simplified manner and can be shown in any colour, depending on the chosen environment (see the car sketch below).





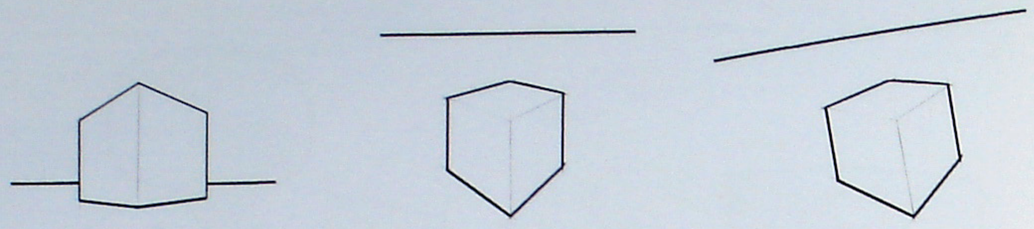
▼ Notice that the ellipses and their reflections do not have the same values. The lower the ellipses are placed in the reflection, the more circular they appear.
This vertical reflection is created using a two-point perspective, so the mirrored object will not be smaller than the original.



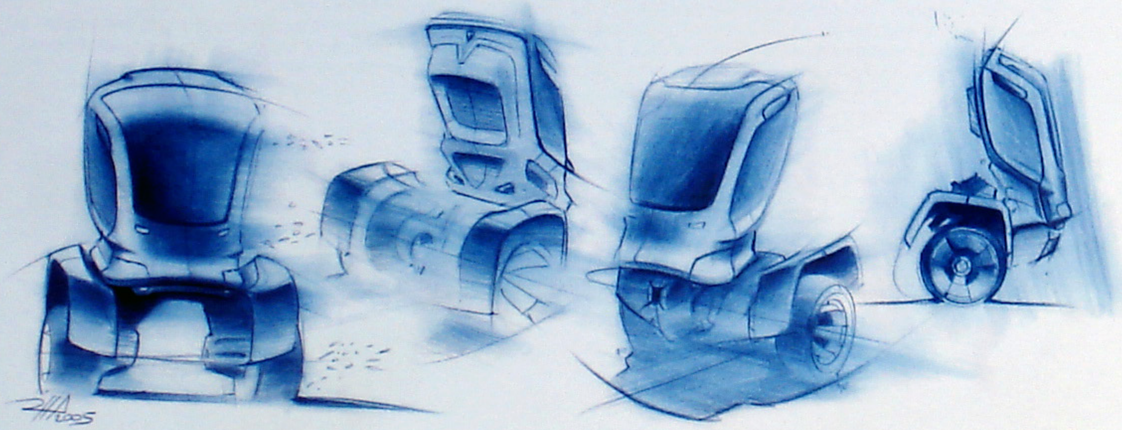
▼ Highlights Highlights are particularly strong reflections of light, appearing on sharp corners or edges such as those of part lines. Highlights are small details that at first might seem insignificant to the overall impression. However, they are important because they add a great deal of life and bounce to the sketch.

Composition and Backgrounds

▼ Choice of Perspective When choosing a perspective, it is important to consider not only which viewing angle will best explain the product, but also what feeling you want the object to convey. Using a 'frog's eye-view' (low horizon) makes an object appear powerful and mighty, and the viewer small. (Naturally, this effect depends on how the specific product is normally seen).
Using a 'bird's eye-view' (high horizon) places the object below the observer, giving the viewer a sense of survey and control.
One way to make a sketch more dynamic and interesting is to use an oblique horizon.

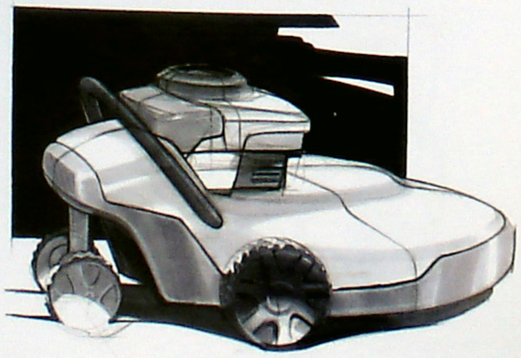


▼ Directions When drawing several objects or views of an object in the same composition, their directions should be taken into consideration. Direction can refer to a course of motion (in the case of a moving object, such as the truck below), if the object has 'active faces', or indeed if there is a perceived 'direction' distinguishable by the object's shape (e.g. if it is easy to identify one part of the object as its 'front').
Objects pointing outward near the edge of a page can sometimes feel uncomfortable and having all objects in a composition aiming towards the same point makes the sketch feel stiff. A balanced composition can be achieved by varying the directions of the objects, as well as their sizes and perspectives.



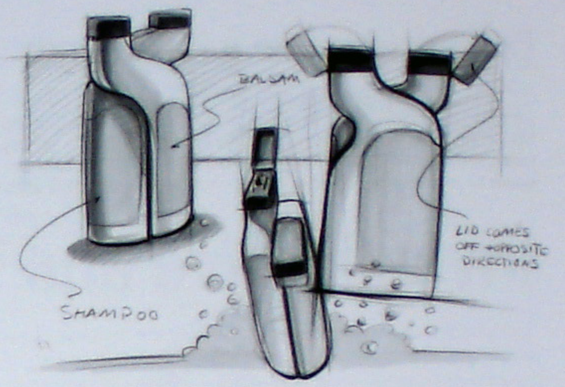
▲ Focal Points Focal points are used in sketches to lead the viewer's eye to the most important areas of a product, or to details in a design that the designer chooses to point out. Focal points are created by making certain areas purposely rich in detail, strong in colour intensity or high in contrast.

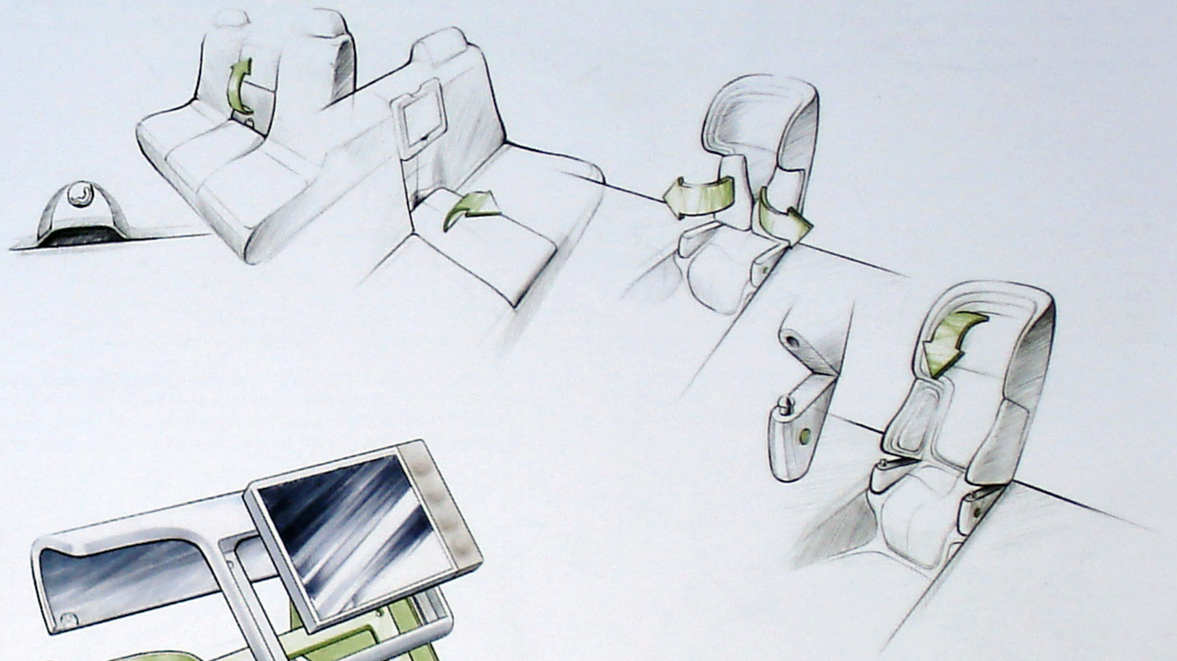
► Background Box A background box is often used to 'tighten up' a sketch by covering old sketching lines and colour fields drawn outside the lines of the object. The box can also serve as a background, adding more contrast and making the product stand out.
Notice that when the bottom edge of a background box ends below an object, the object appears to float. Conversely, when the bottom edge is aligned with the resting plane, as shown in the sketch to the right, it can be interpreted as the edge of a surface or a table top.

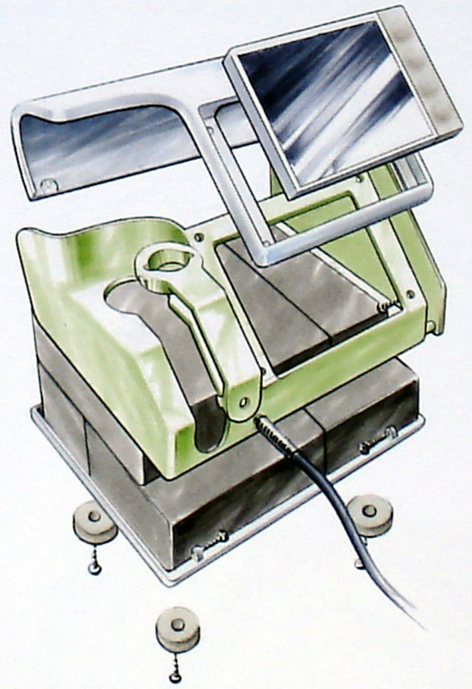


► Tying the Composition Together A few minutes of extra work can create a more composed and 'finished' sketch. Experiment with different ways to tie a composition together, using colour or just a few lines.
Framing the composition can also be used in an illustrative way, as in the sketch of the shampoo bottles (right) where the bubbles suggest the product's environment.

▼ Explaining a Course of Events A series of events – such as how something collapsible folds or what happens when a button on a product is pushed – can be explained by using step-by-step illustrations. Sketching a product in this explanatory way is often an effective way to give the audience a quick understanding of a product's functions.







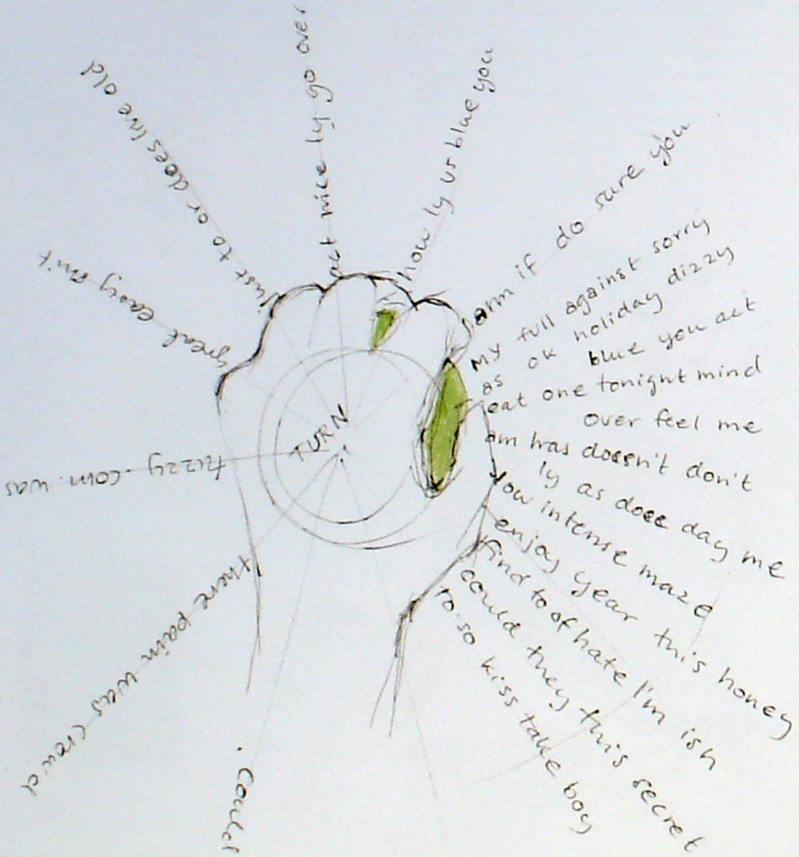
▲ Exploded Views Exploded views like the one above show a product's components, offset from each other and spread from the centre. These views serve to demonstrate a product's component parts, explain a product's assembly and also help to clarify form and function.

▲ Logotypes Whenever a real logotype is used in a sketch on a product or as part of a composition/presentation, it should be reproduced in a way that does not offend the commissioner. The logotype is an important symbol for a company and should not contain careless spelling mistakes or have its idiom changed. If applicable, use an underlay of the logo for a sketch or rendering. Any corporate logotypes have been removed digitally from all sketches in this book (this was done to present the sketches in a more neutral way and to prevent any chance of trademark infringements).

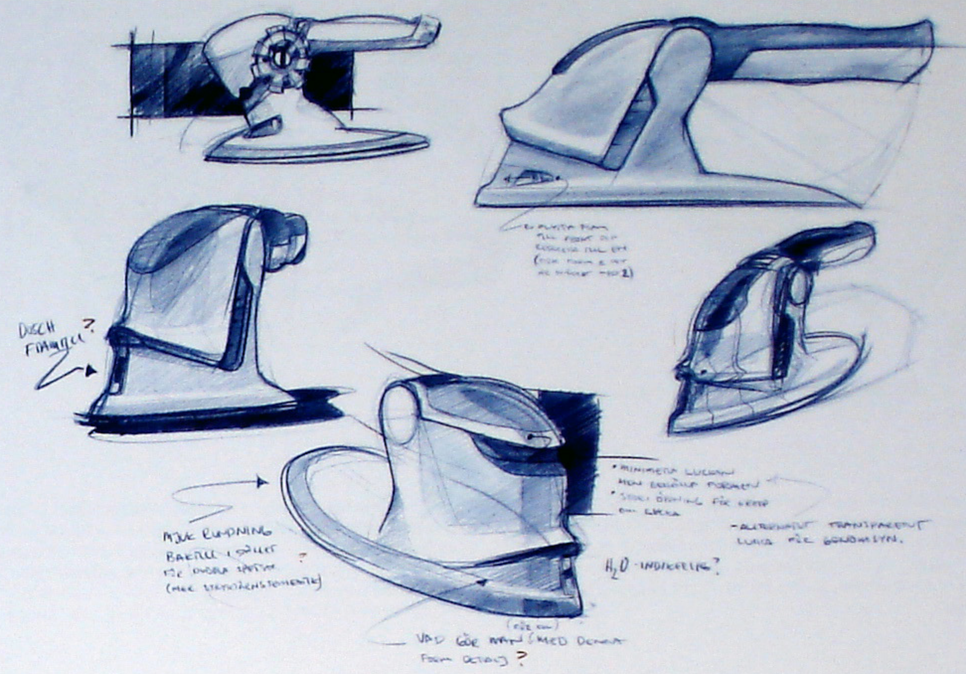
In the next three chapters, sketches are grouped into families according to their functional roles in the design process. The different families are: Investigative and Explorative Sketches, Explanatory Sketches, and Persuasive Sketches. There are no specific borderlines between these groups; in fact, many sketches defy categorization. A sketch is often created for more than one purpose, or may have the capacity to be used for something other than what it was intended for – as you will notice, several sketches in this book could have served as examples for aspects presented in more than one of the different chapters.

Investigative and Explorative Sketches

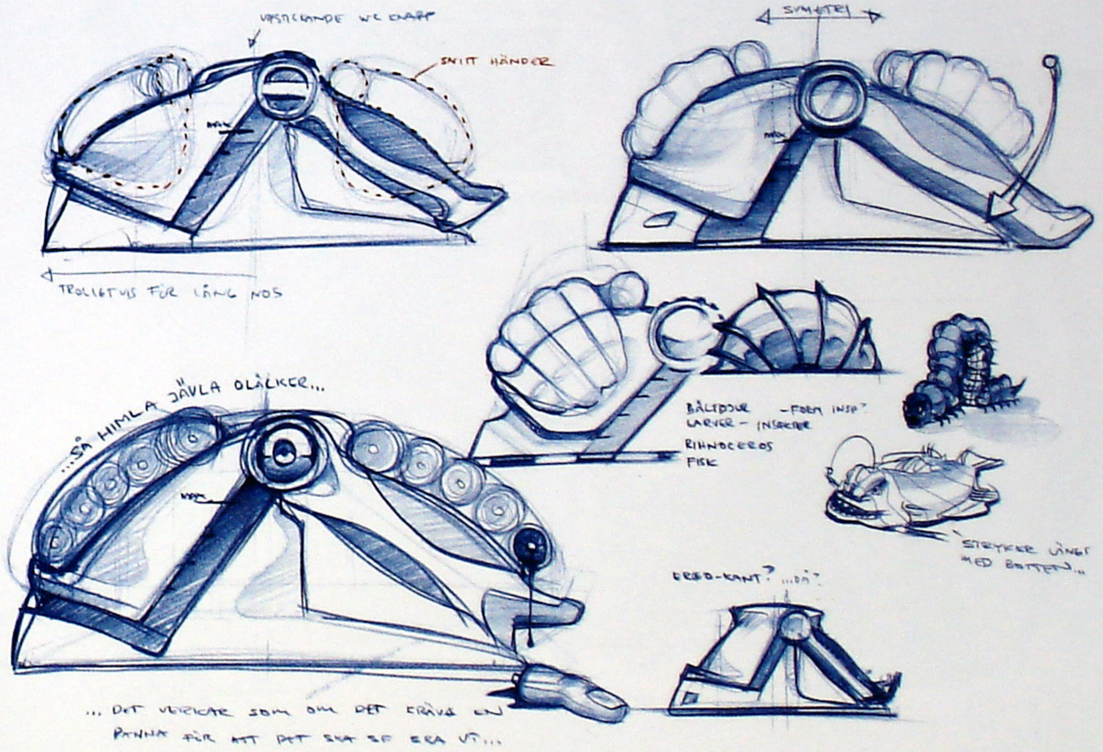
This chapter contains sketches created in the ideation phase of the design process, i.e. sketches used to structure and understand a problem, as well as to generate and explore solutions; functions or forms.
These types of sketches are often drawn quickly with a loose hand and are created for the designer's use or for use within a design team. Readable ideation sketches can play an educational role later in the design process because they illustrate the basis on which decisions have been made and explain a sequence of work to others.
The often quick nature of these sketches makes it possible to generate a large quantity of drawings, allowing for many solutions to be tried out and evaluated.

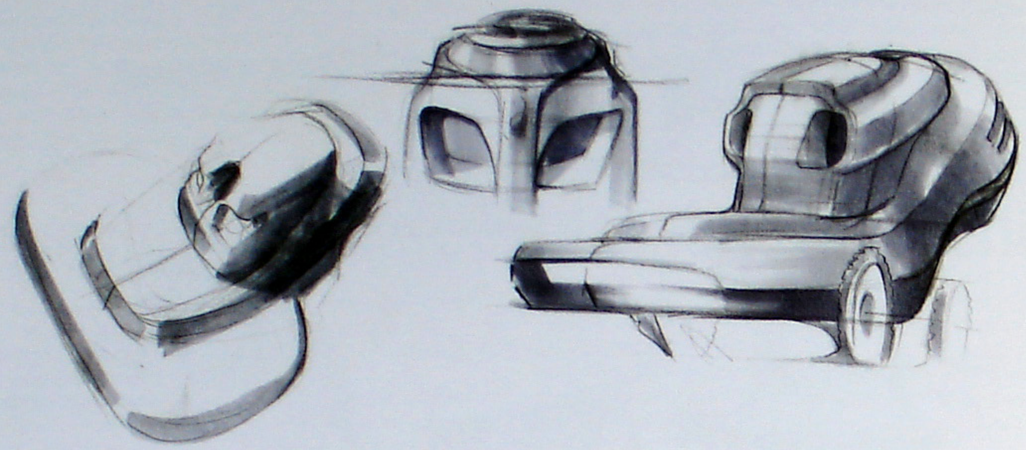


Poetry in Motion A rapid ideation sketch, made to explore and show functions. (Black soft pencil, ballpoint pen)



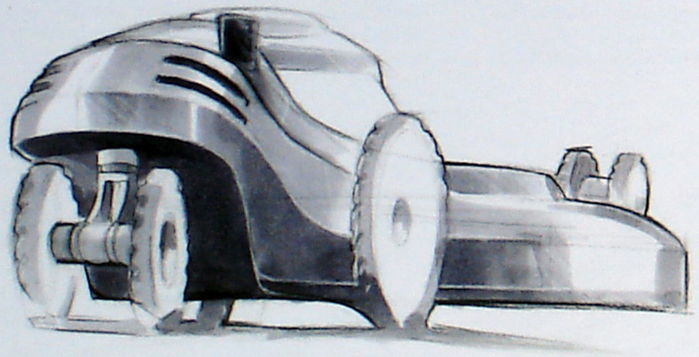
Iron, Universal Design In ideation sketches, it is often useful to add small text notes to ensure that new thoughts and ideas that arose during the sketching process are not forgotten. Objects that serve as form inspiration, such as the fish and the caterpillar in the example below, may also be included in the sketch as small reminders of the exploration process. The sketches thereby become more characteristic and enjoyable to look at. (Blue soft pencil)

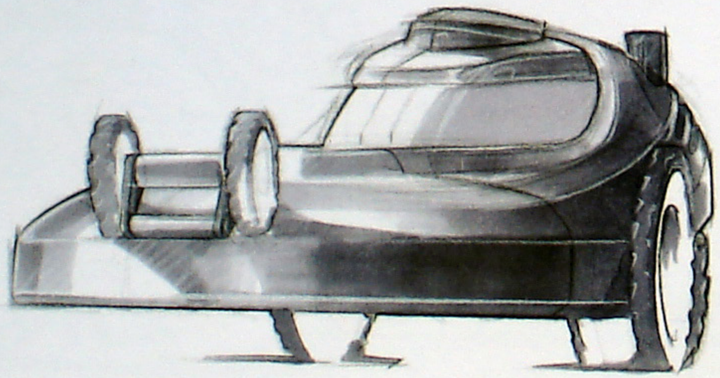


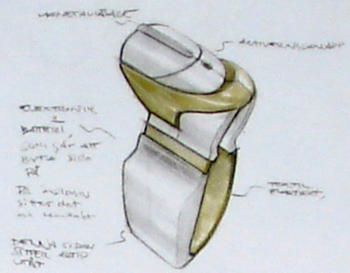


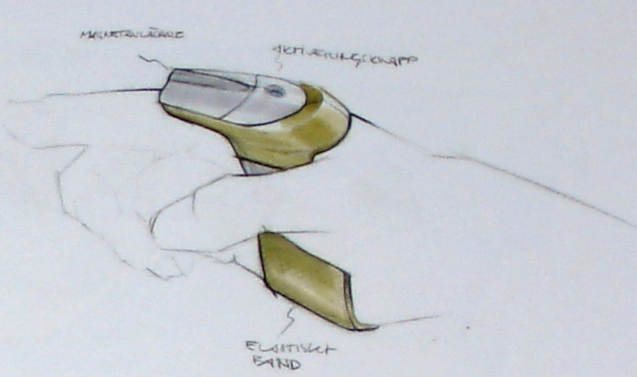
Lawn Mower The marker fields do not necessarily represent realistic reflections and shadows, but can instead be used to communicate the object's form. A tip from this designer is to never treat your sketch as if it were sacred in itself – the most important thing is to continually develop the form during the sketching session.

Another useful tip is to start by sketching the basic shape, gradually adding details as the session progresses. This way, it is possible to stay focused on developing the form, rather than getting involved with minor details too early in the process. (Black hard pencil, white soft pencil, marker)



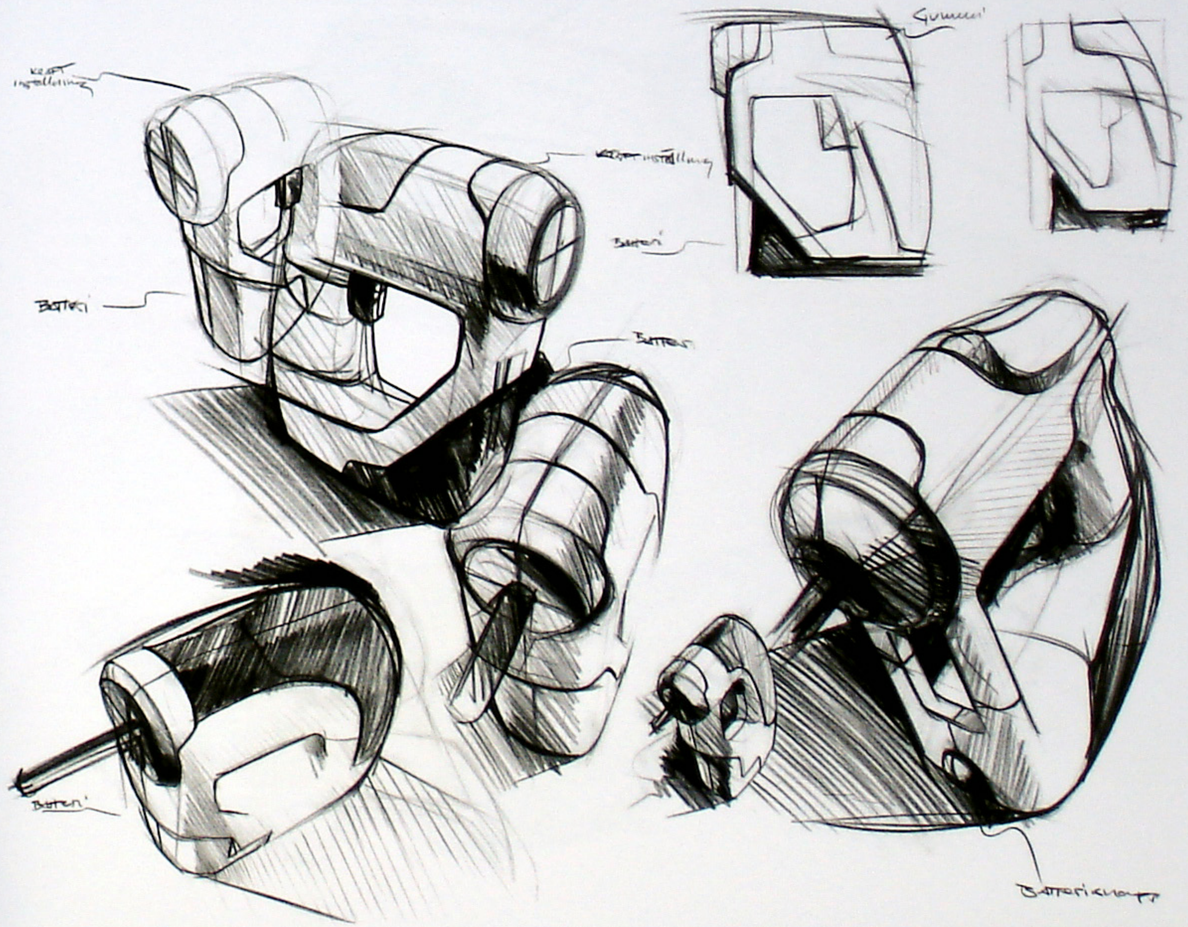


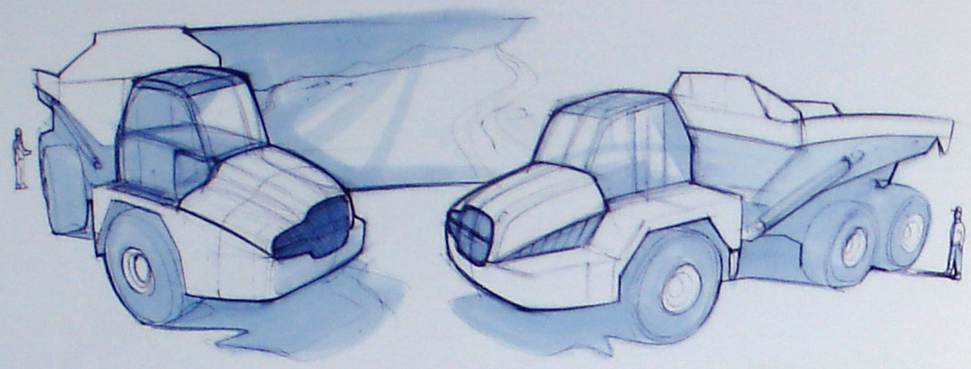




▲ **Orientation Tool, Library Project** These sketches were created to explore form. This designer first sketches quick side views to discover a form worth exploring further, and then shows the object in a perspective it is normally observed in (as seen above). Form is further defined by sketching the object in a variety of different perspectives. (Black hard pencil, soft white pencil, marker)

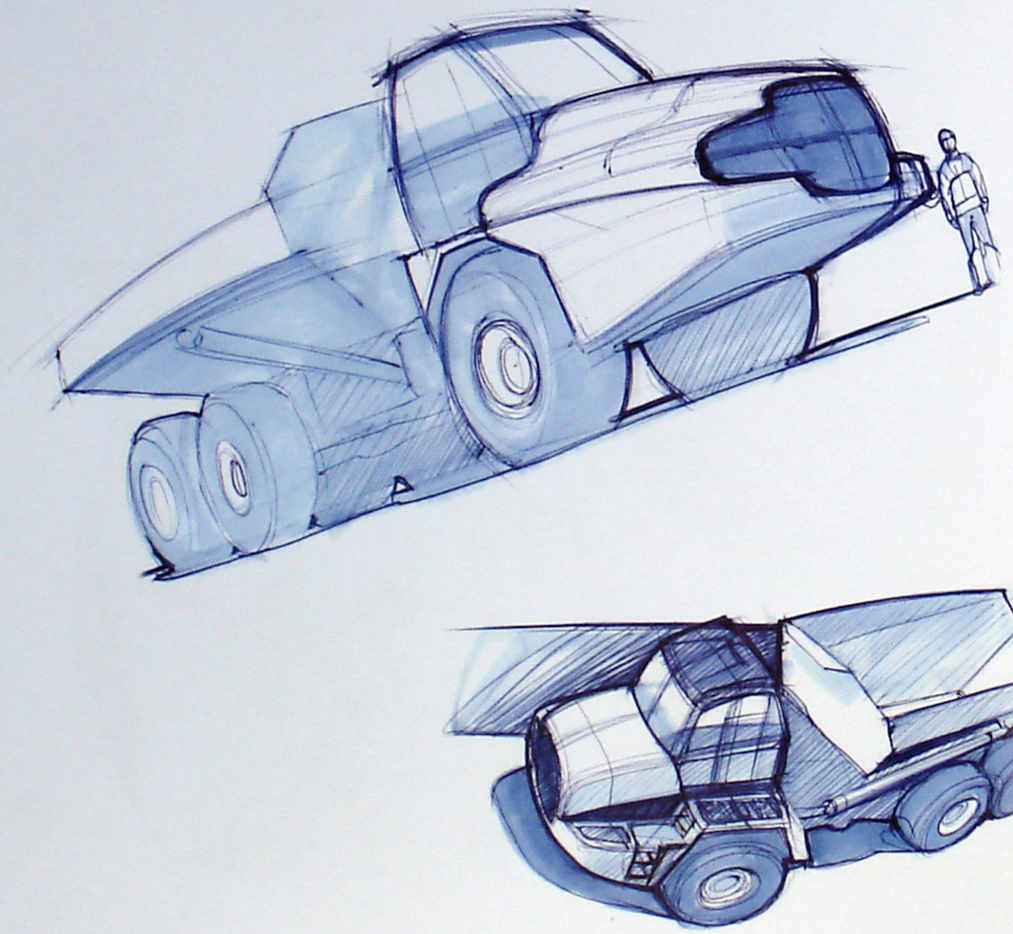
▼ **Hand Drill** The series of sketches below explore the object's form from different points of view. (Black soft pencil)

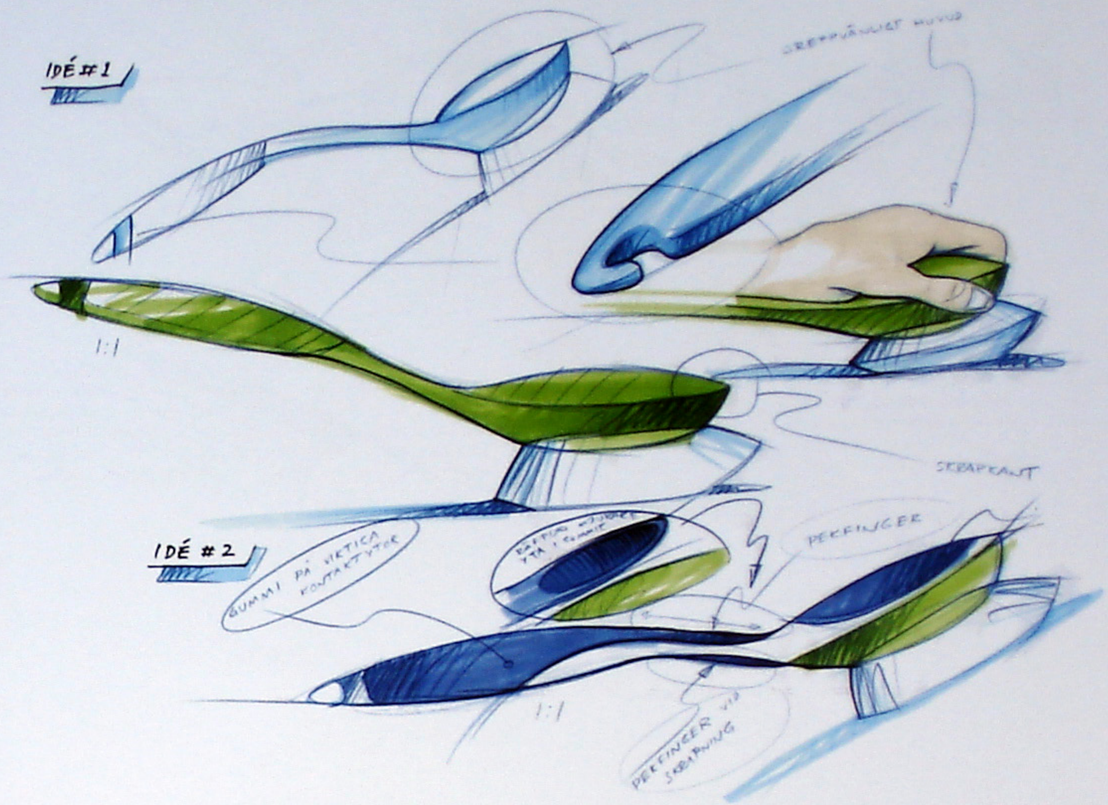




Articulated Dump Truck Many A3s (11"x17" sheets of paper) were filled with these ideation sketches, which explore the development of a truck from different angles. Construction parts and technical details have been hidden in shadow in order to save time and to ensure that the level of detail is kept relevant to the current development stage. The addition of human figures gives both the designer and the viewer a clearer sense of the truck's scale.

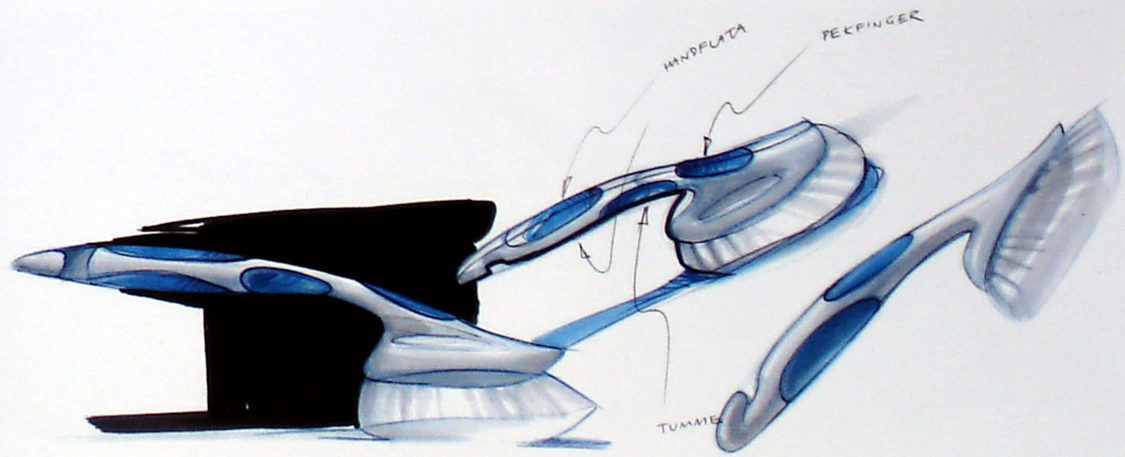
These sketches were created initially with ballpoint pen, followed by marker and then finished with another heavier layer of ballpoint pen to sharpen and define lines. Heavy ballpoint lines have a tendency to smear when marker is applied over them, hence their application after the marker for these sketches. (Ballpoint pen, marker)

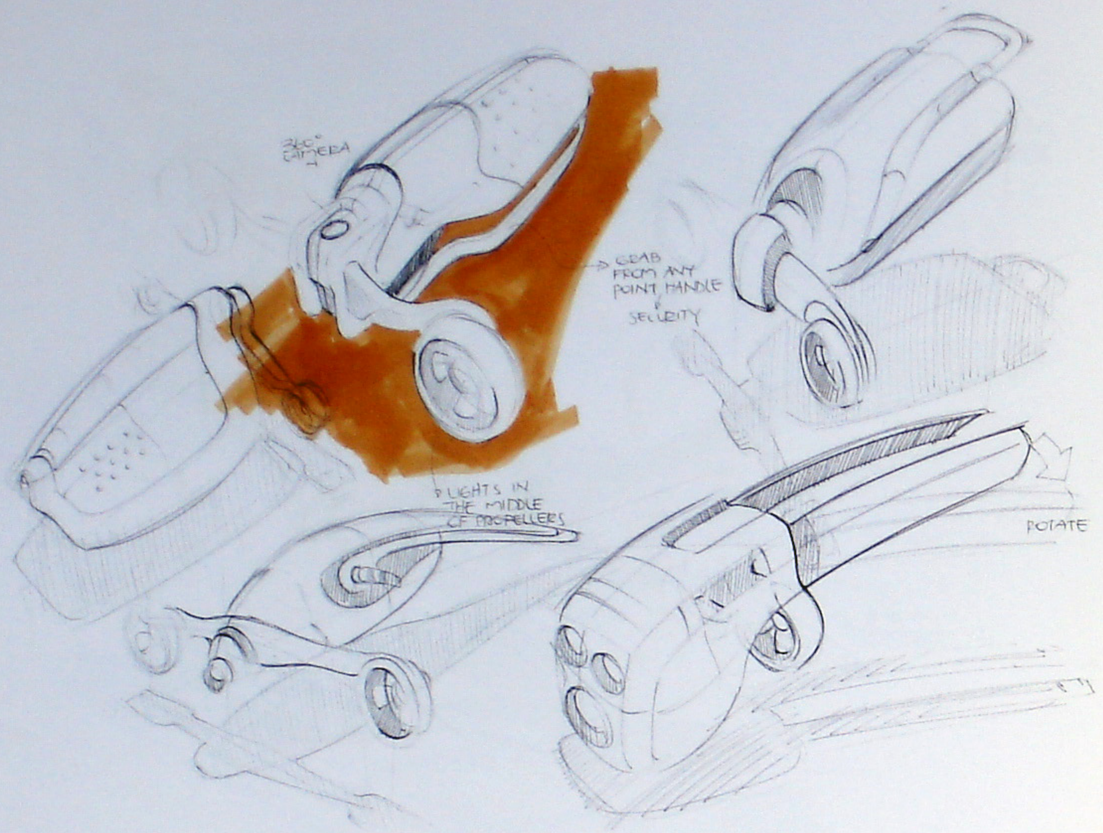




▲ Dish Brush Elaborations have been made in the sketches with the aid of text and by enlarging a section, shown encircled beside the original. An arrow links the enlarged part to its position on the object. A hand serves as scale reference, simultaneously showing how the brush is to be handled. (Hard and soft blue pencils, felt-tip pen, marker)

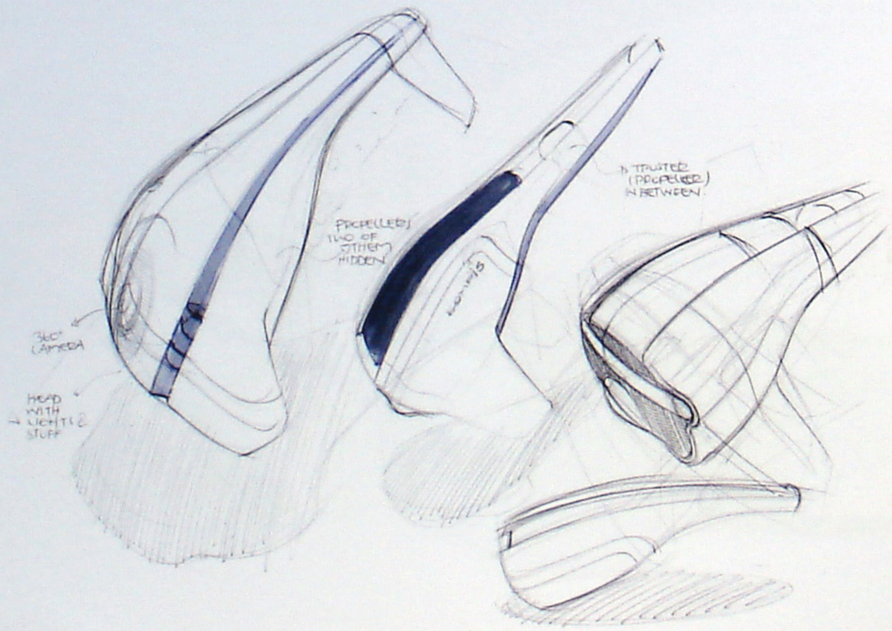
▼ Rough sketches can help to define the basic concept for a product. When this has been achieved, sketches with a higher level of detail are needed to clearly communicate and define details such as part lines, materials, textures etc. This higher level of detail makes it easier to evaluate the proposed design both as a whole and in detail. (Hard and soft blue pencils, ballpoint pen, marker)

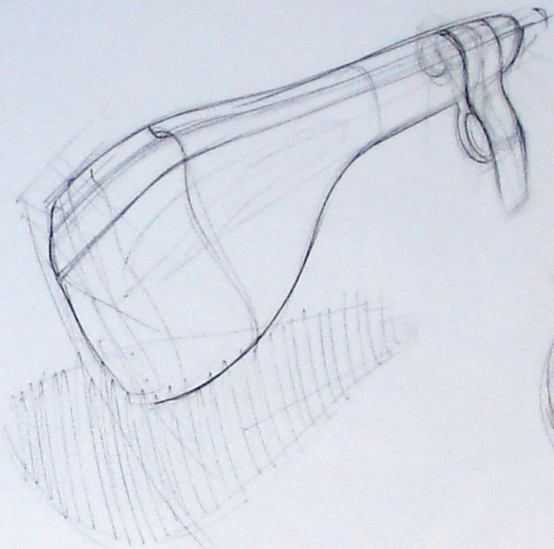




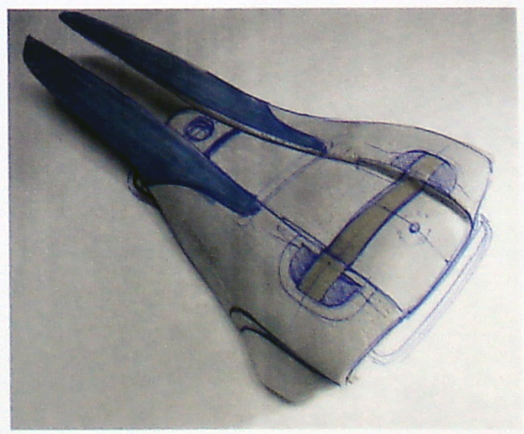
▲ Underwater Entertainment Robot This designer used rapidly drawn faint lines to help keep these sketches in perspective. In the cluster of sketches above, a favourite design has been highlighted with a marker background. (Ballpoint pen, marker)

▼ Shadows were used to lift these objects from a ground plane, creating the impression that they are floating. The marker fields add contrast and separate surfaces of differing materials from each other. (Ballpoint pen, marker)

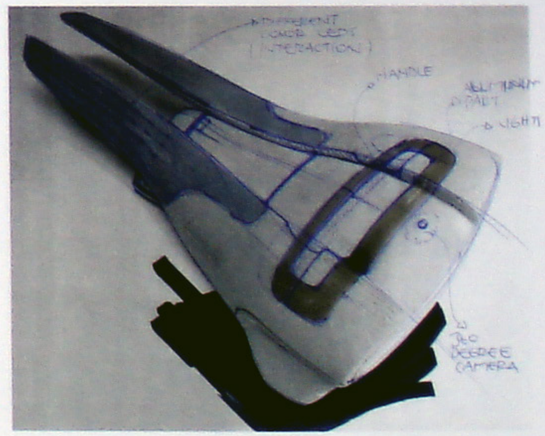


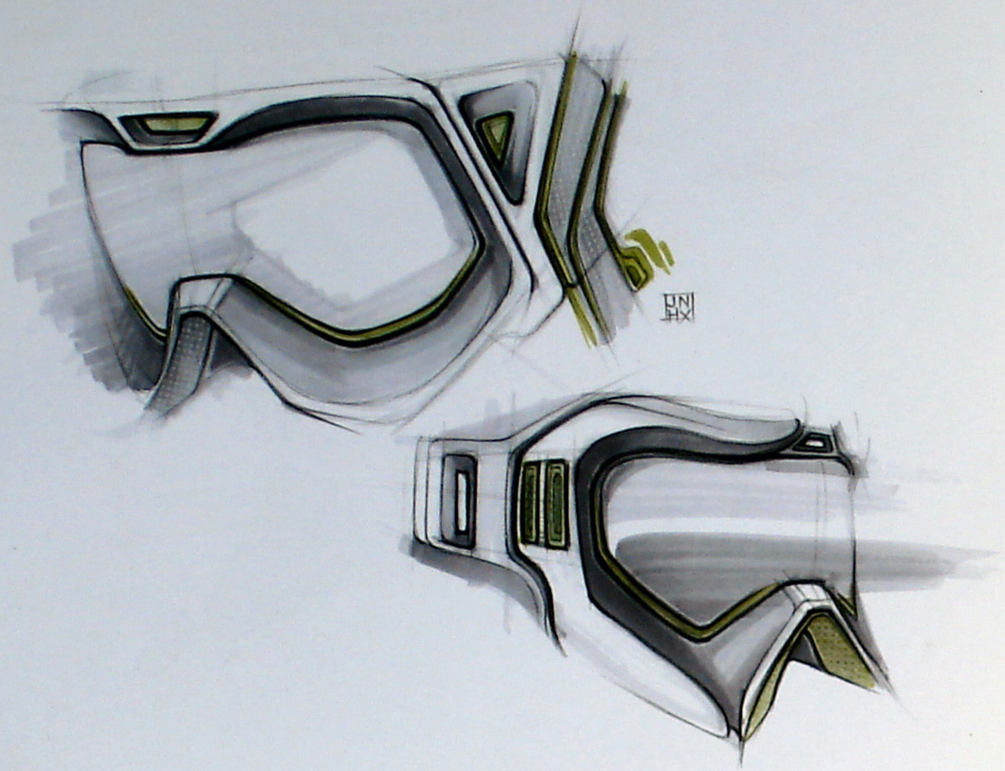


▲ The designer found one line art sketch of the robot particularly interesting, and used Photoshop to quickly explore further shape and colour possibilities. (Ballpoint pen, Photoshop)



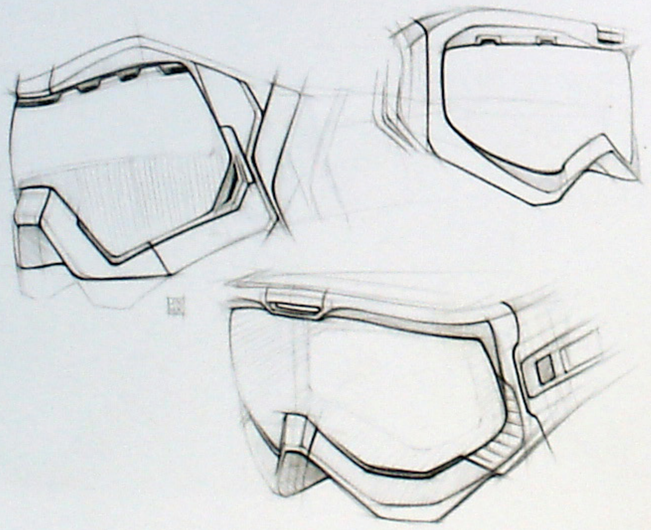
▼ Ballpoint pen lines were drawn directly on a printed photo of a foam model. This is a common sketching method for working through a design. Best used in the later stages of a project, this method allows for exploration of details such as the placement of part lines and graphics. (Ballpoint pen, marker)



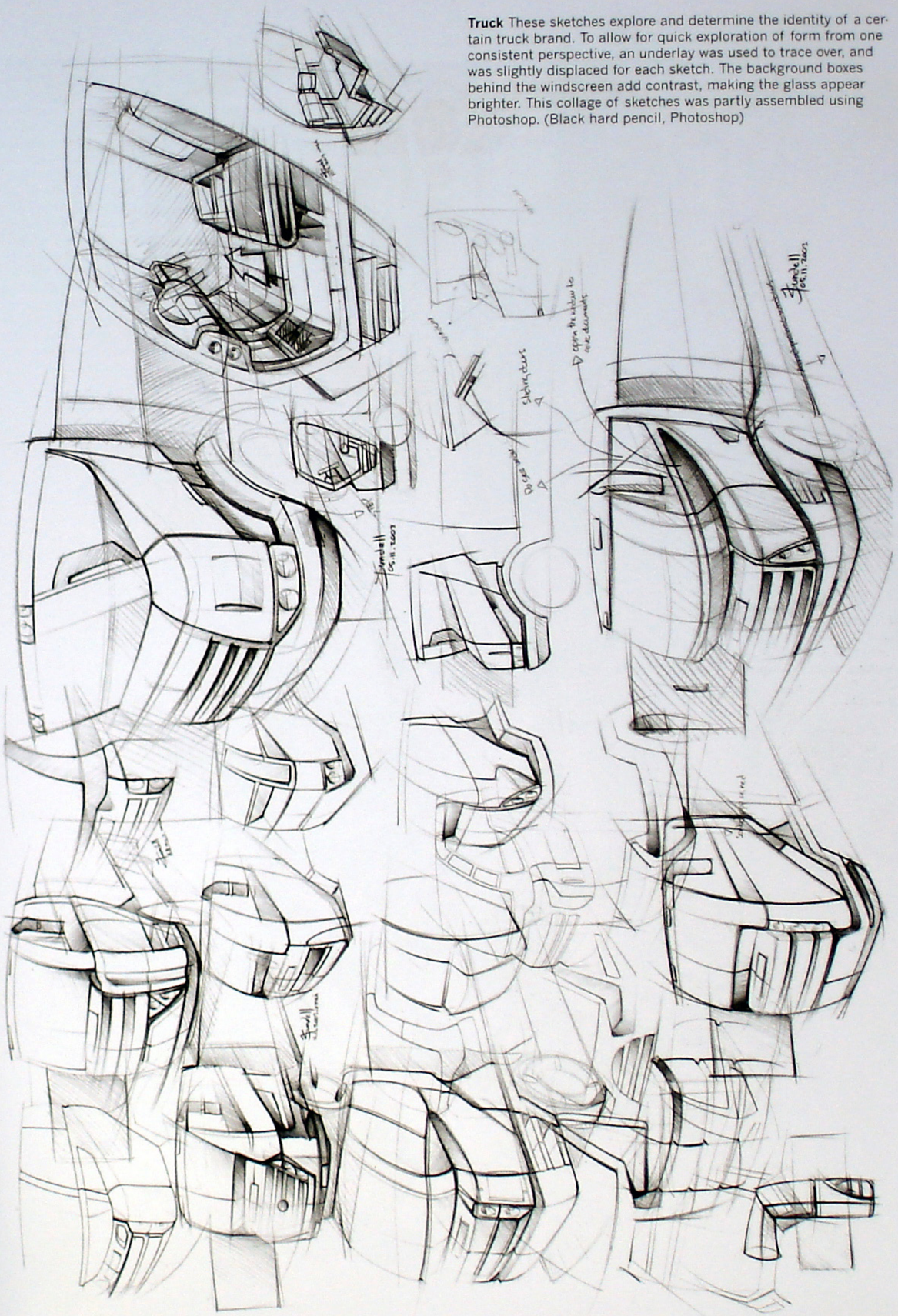


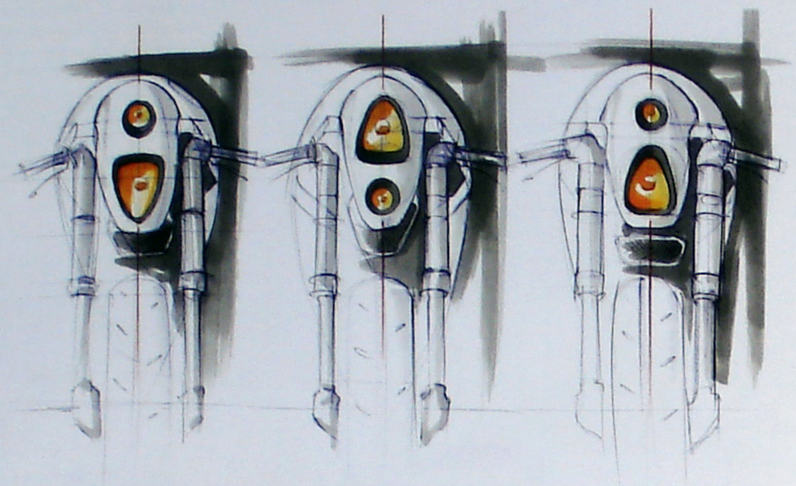
▲ **Goggles** Here, the designer used a centre contour line (or cross-section curve) to describe the symmetrical plane of the form and to define the surfaces. The sketches were left vague, leaving room for interpretation – a trick used at the conceptual stage to leave more options for the designer later in the design process. Since this sketch is of a sports product, extra looseness was used to add speed, movement and life. The impression of texture around the nose was created using a special textured underlay and rubbing a soft white pencil over the sketch. (Black hard pencil, white soft pencil, marker, textured rubbing surface)

▼ With the aid of pronounced contour lines, the designer has clarified the surfaces of an otherwise loosely defined sketch (see the goggles' glass sections). Contrasts in line weight are used effectively to emphasize or fade parts of the design respectively. (Black hard pencil)

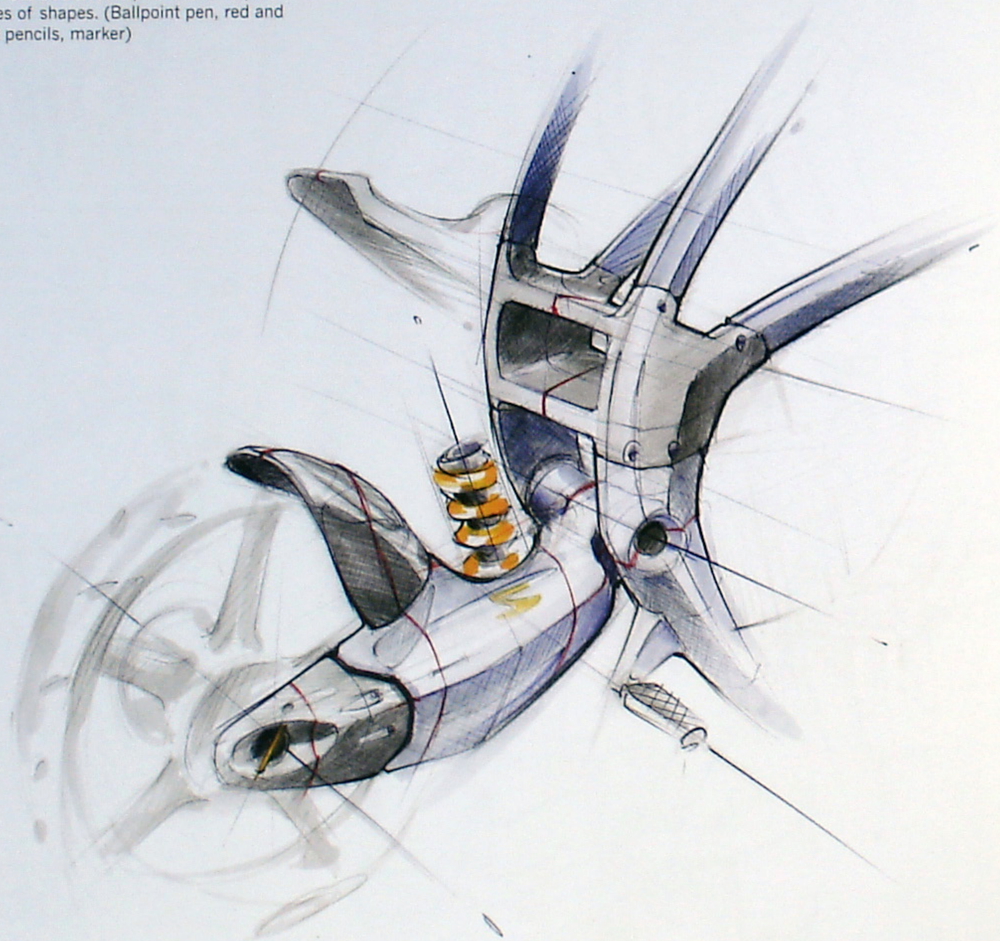


Truck These sketches explore and determine the identity of a certain truck brand. To allow for quick exploration of form from one consistent perspective, an underlay was used to trace over, and was slightly displaced for each sketch. The background boxes behind the windscreen add contrast, making the glass appear brighter. This collage of sketches was partly assembled using Photoshop. (Black hard pencil, Photoshop)

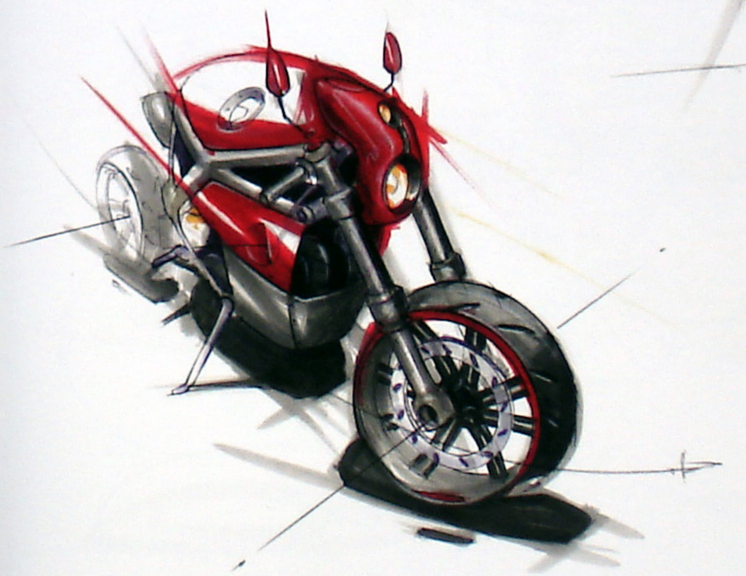




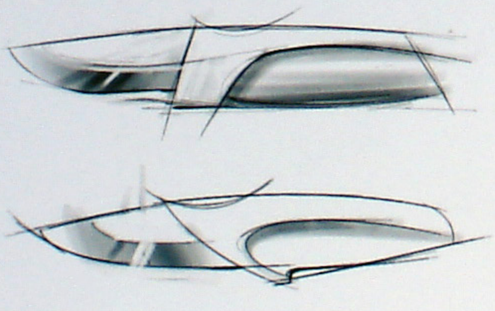
Motorcycle Different parts are here made distinct from one another using contrasting cold and toner grey markers. Red sectional lines give the sketch attitude and help to further explain the profiles of shapes. (Ballpoint pen, red and white soft pencils, marker)



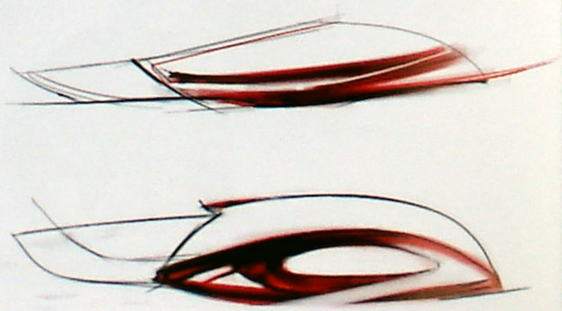
These sketches are deliberately expressive, exploring the emotional characteristics of the motorcycle. It is common to create a focus point in a perspective sketch by building detail and contrast on the part closest to the observer. However, with this method it is also possible to draw attention to a chosen area on a flat view of an object (right). Because of the impression created of motion and speed, this technique can be an asset when used on sketches of vehicles and other mobile objects. The perspective chosen for the motorcycle sketch below gives the illusion of it being observed through a wide angle lens, and is often referred to as "fish-eye perspective". The curved guide lines have been kept visible, revealing the choice of perspective. (Black hard pencil, black and white soft pencils, marker refill, marker, ellipse guides)

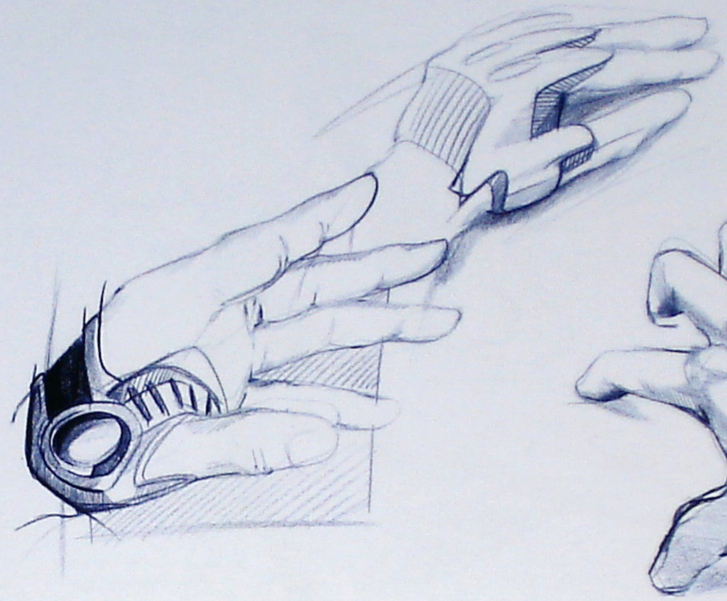


▲ **Knives** Extreme perspectives can sometimes make a sketch less obvious to understand – however, they are often inspiring to work with and can help to capture the character or sense of the product being designed. The chromatic effect was created using high contrasts. (Painter)

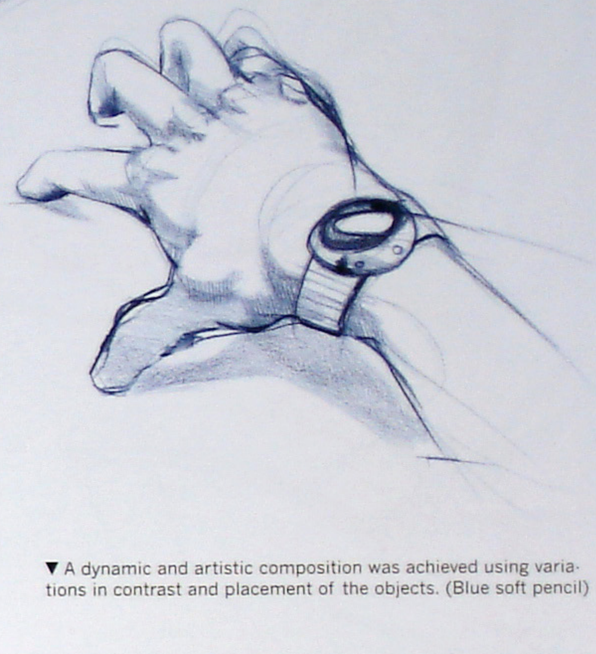


▼ When ideating form, simple profile sketches can be quick and efficient studies that allow for a fast comparison of different designs. (Painter)

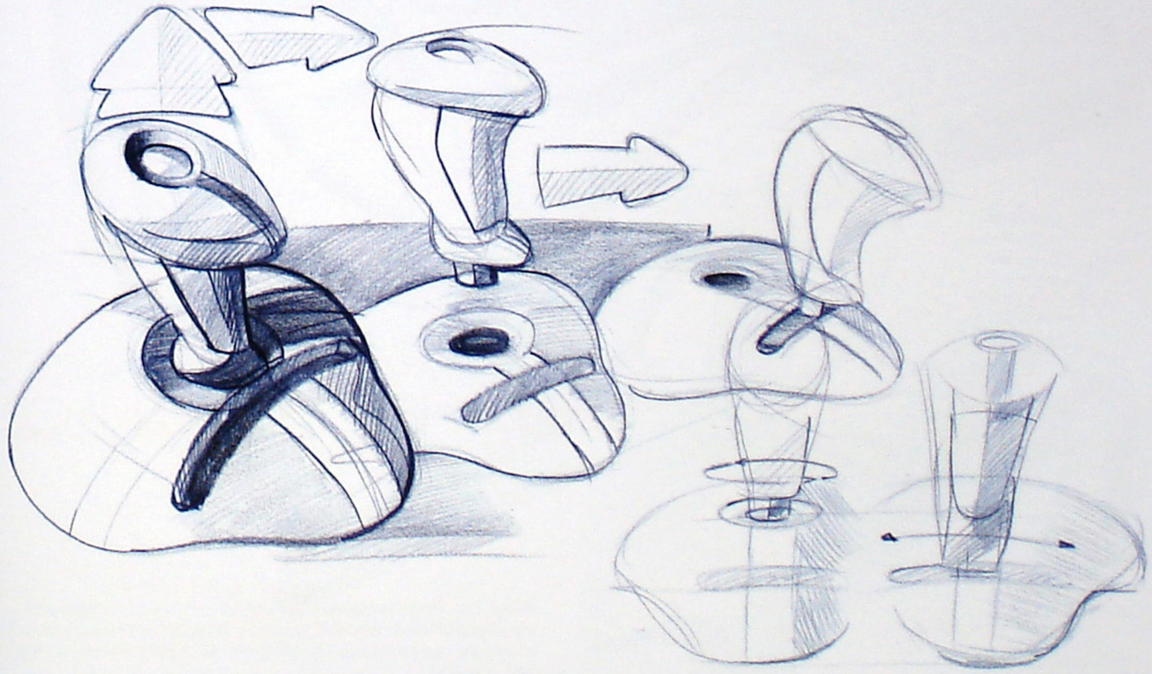


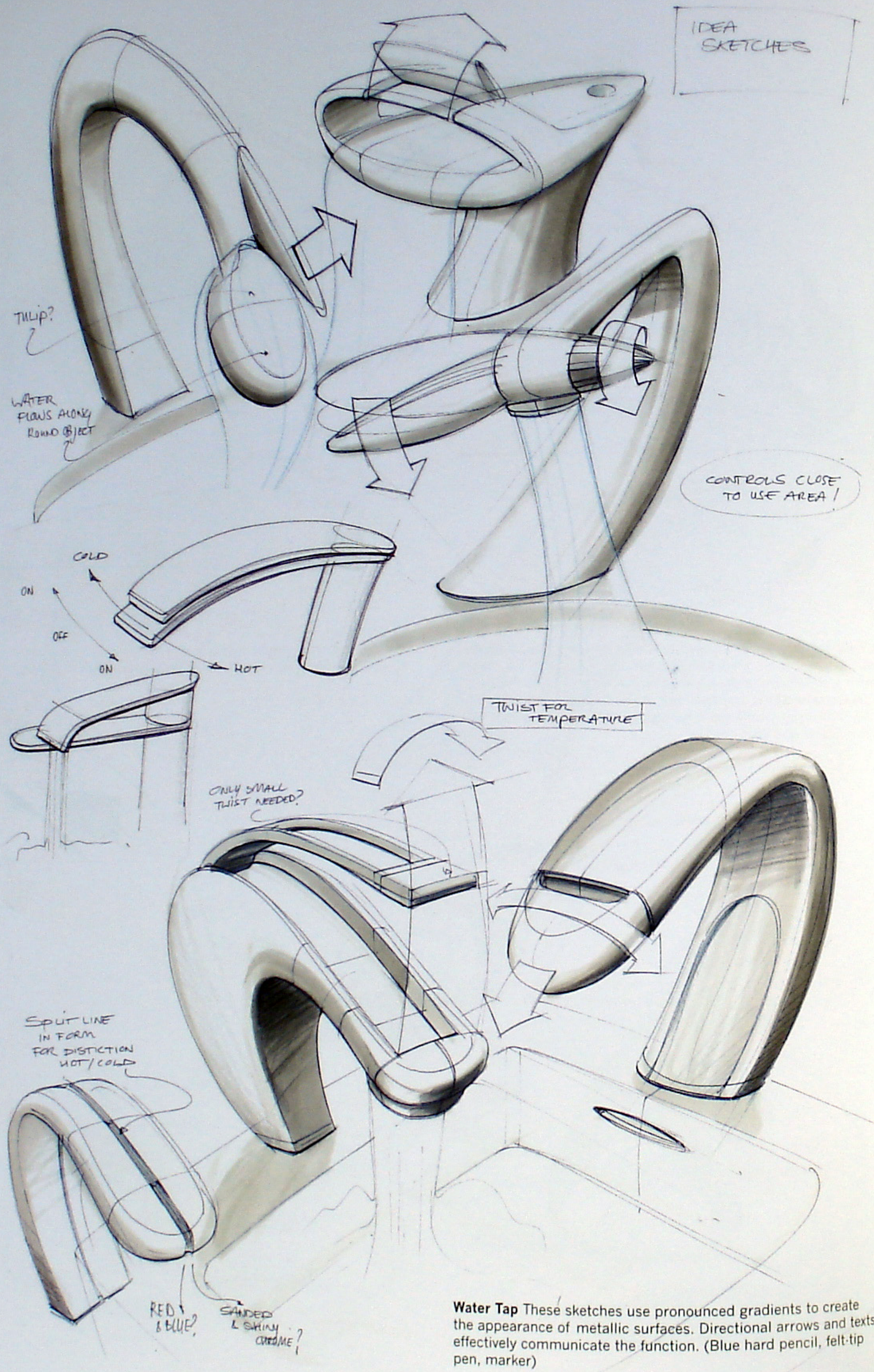


▲ **Hand Training Tool for Disabled Children** When describing the environment around a sketched object, it is helpful to use shadows or contrasting boxes. Above, the shadows dropped beneath the hands show that they each rest upon a surface, while the box behind the hand on the far left suggests that it is being held in the air. (Blue soft pencil)

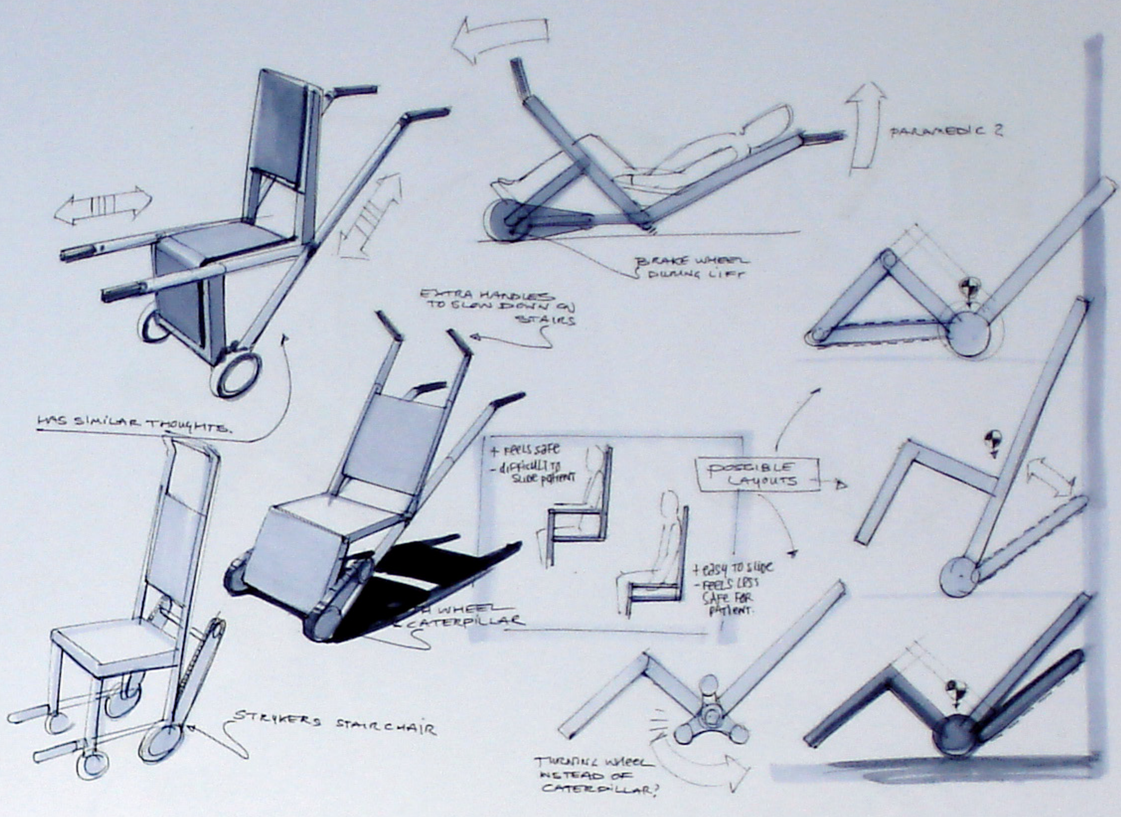


▼ A dynamic and artistic composition was achieved using variations in contrast and placement of the objects. (Blue soft pencil)



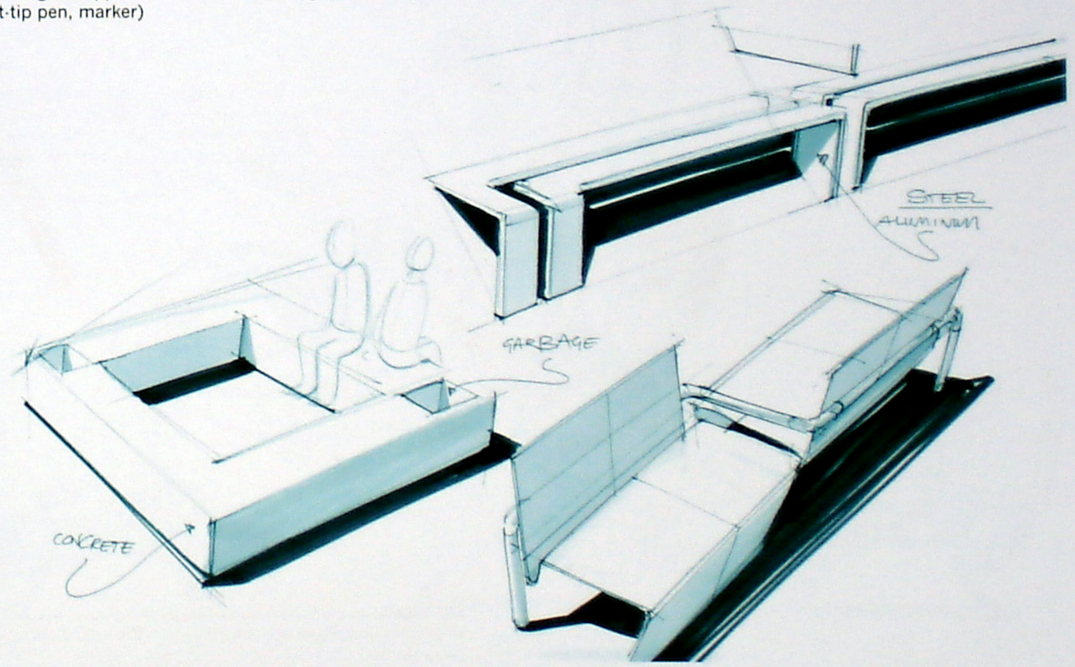


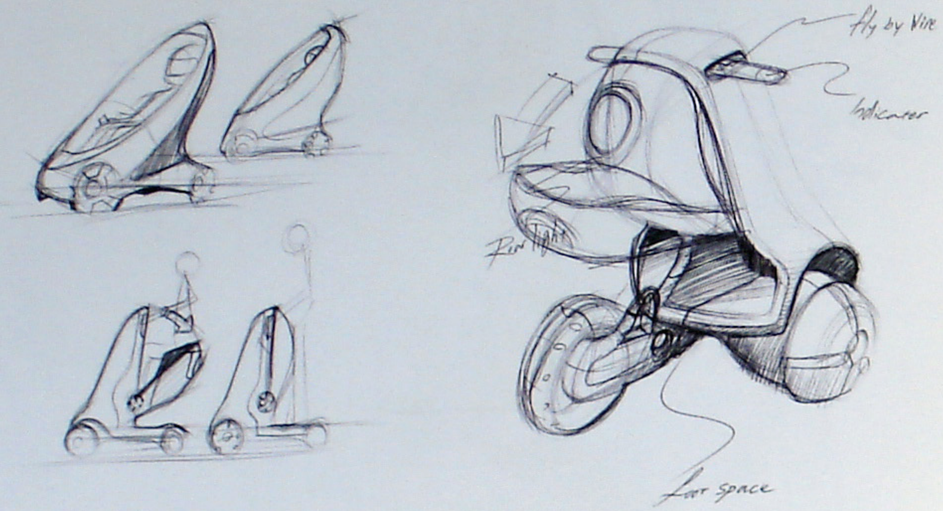
Water Tap These sketches use pronounced gradients to create the appearance of metallic surfaces. Directional arrows and texts effectively communicate the function. (Blue hard pencil, felt-tip pen, marker)



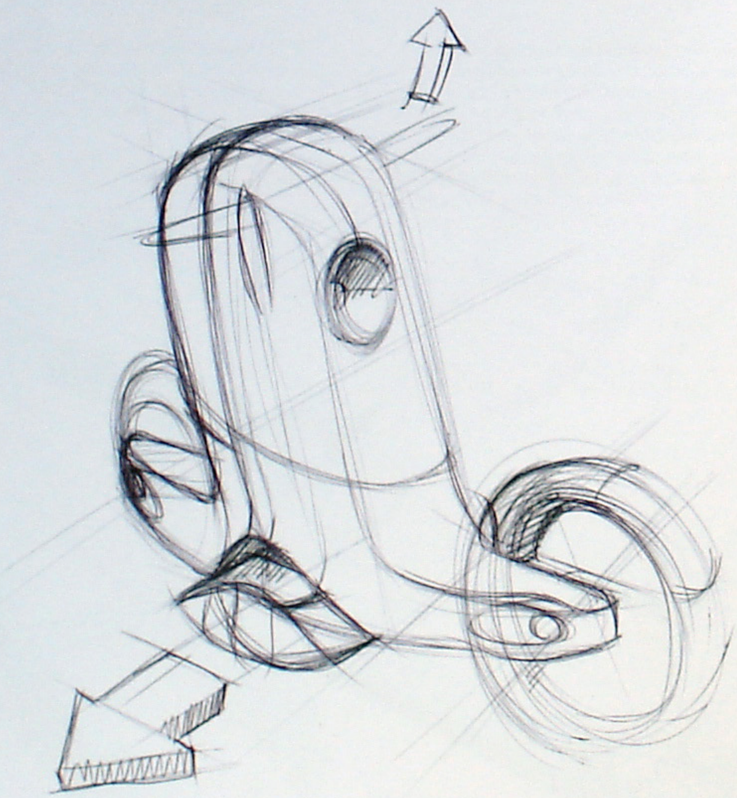
▲ Ambulance Stretcher When sketching objects containing wheels or other circular shapes, this designer suggests that you try to draw the ellipses freehand, without the use of ellipse guides. First "draw" the ellipse a few times in the air just above the paper, and then drop the pen to the paper when the arm has found the correct shape. Also, guiding perspective lines can be drawn straighter and more subtly by using the motion of the full arm – including the upper arm – when sketching. (Black hard pencil, felt-tip pen, marker)

▼ Public Seating Changing the hue of a sketch can affect the impression that it makes. The sketch below was originally created in grey marker and adjusted tonally in Photoshop. (Black hard pencil, felt-tip pen, marker, Photoshop)



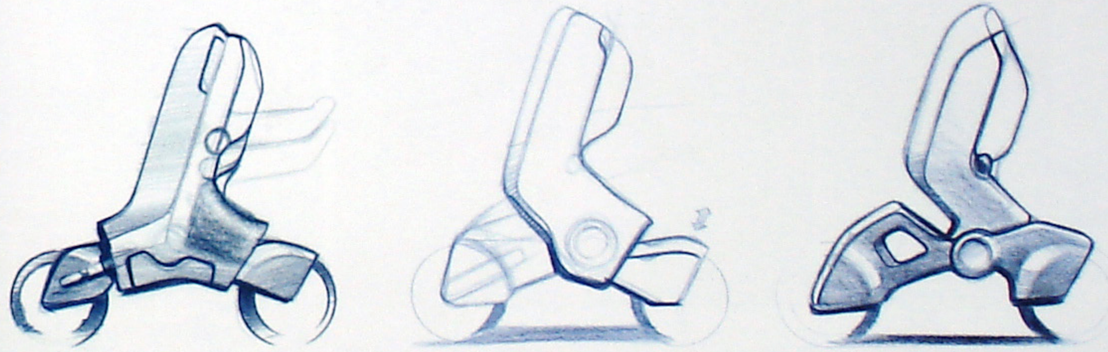


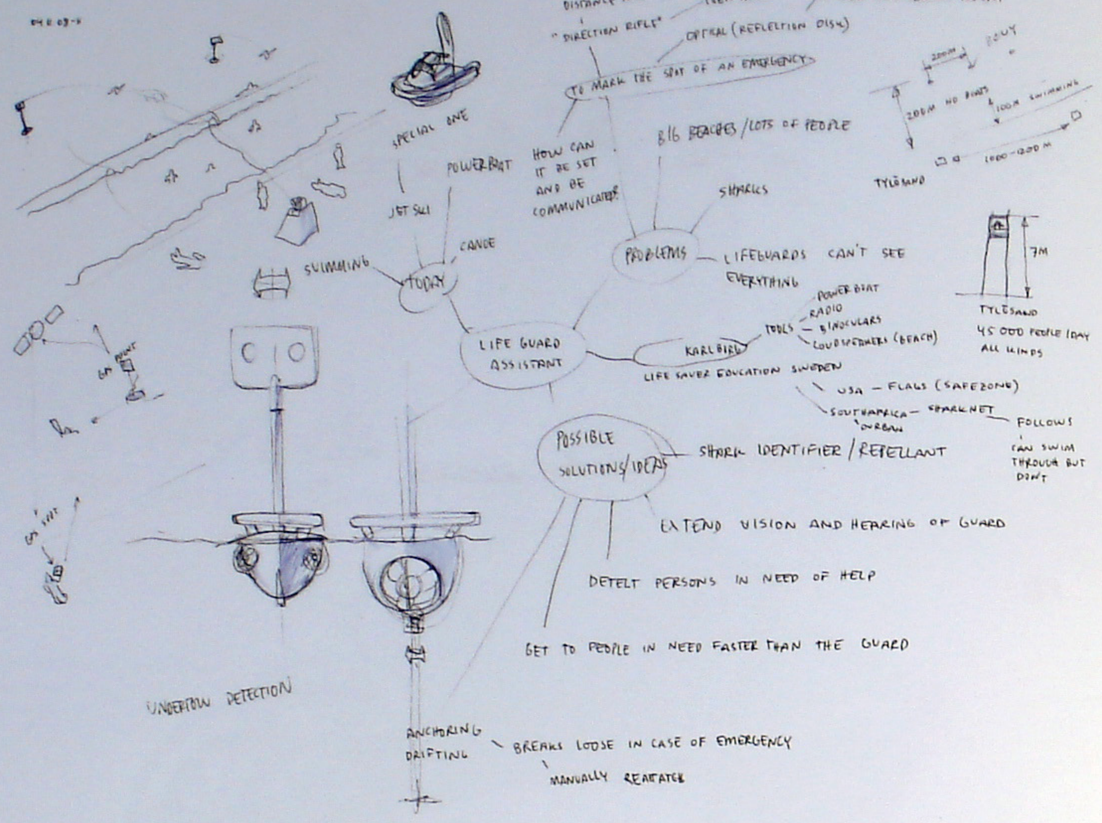
Form Project The primary goal of these sketches was to generate and record form ideas quickly. The designer commented that in this case, correct perspective and overall accuracy of the sketch had lesser significance. (Ballpoint pen)



▲ This more detailed sketch combines interesting elements from previously drawn sketches like the ones below. Because this sketch is developed to a more rendered level with colour, shading and part lines, the design proposal is more easily evaluated by both the designer and others. (Black soft pencil, ballpoint pen, marker, circle templates)

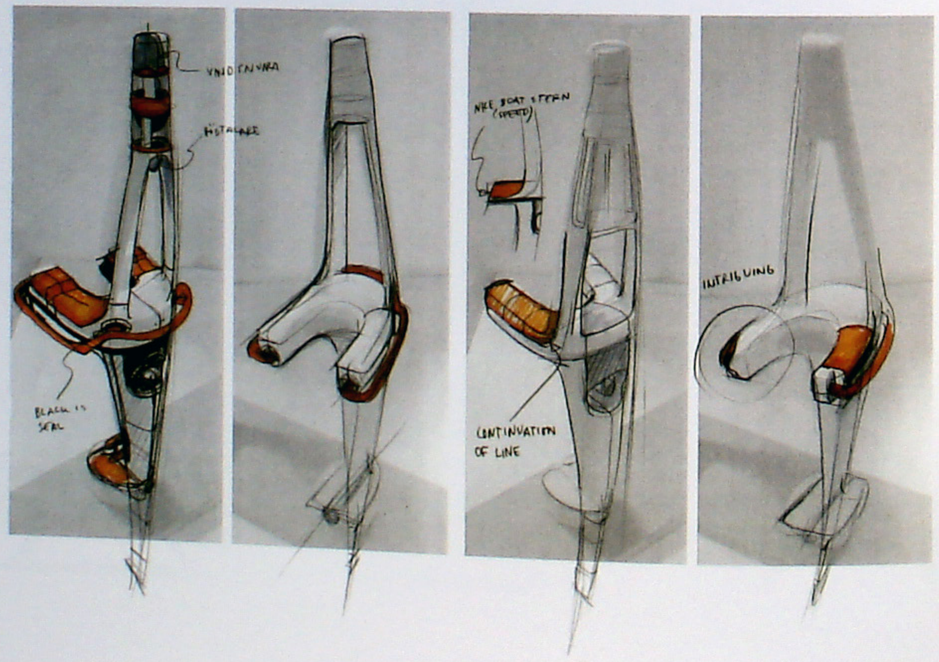
▼ These sketches were drawn to establish an attractive side view. Shading was added to explore undefined and/or interesting areas. (Blue soft pencil, circle templates)

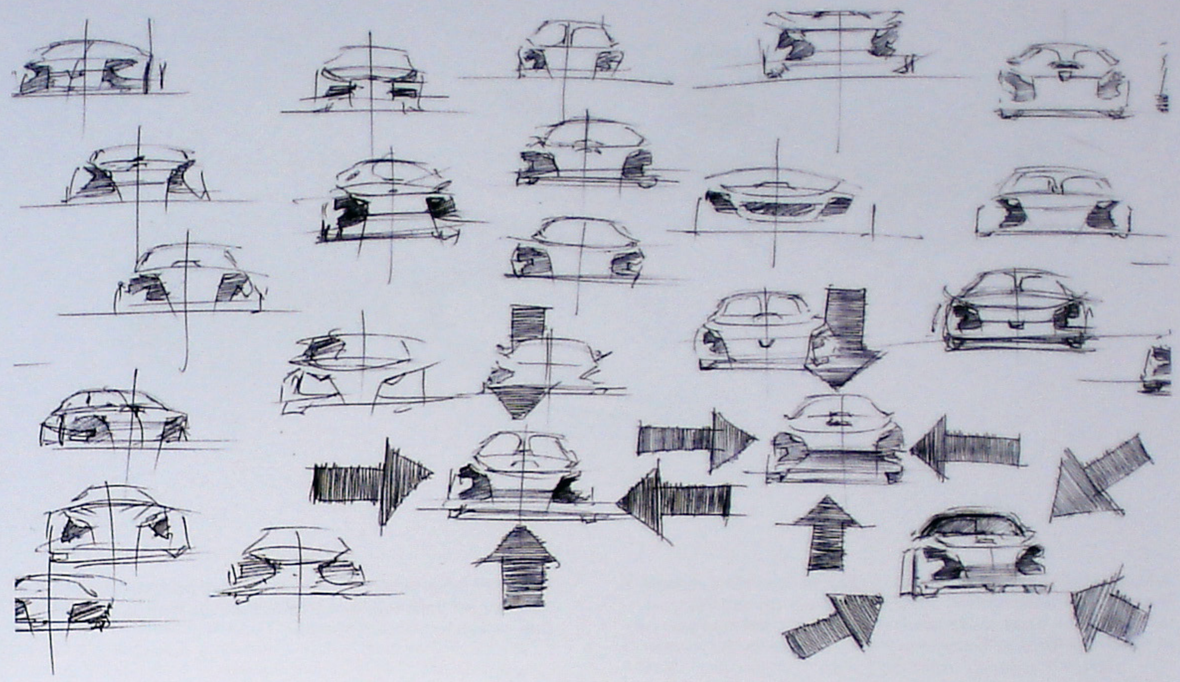




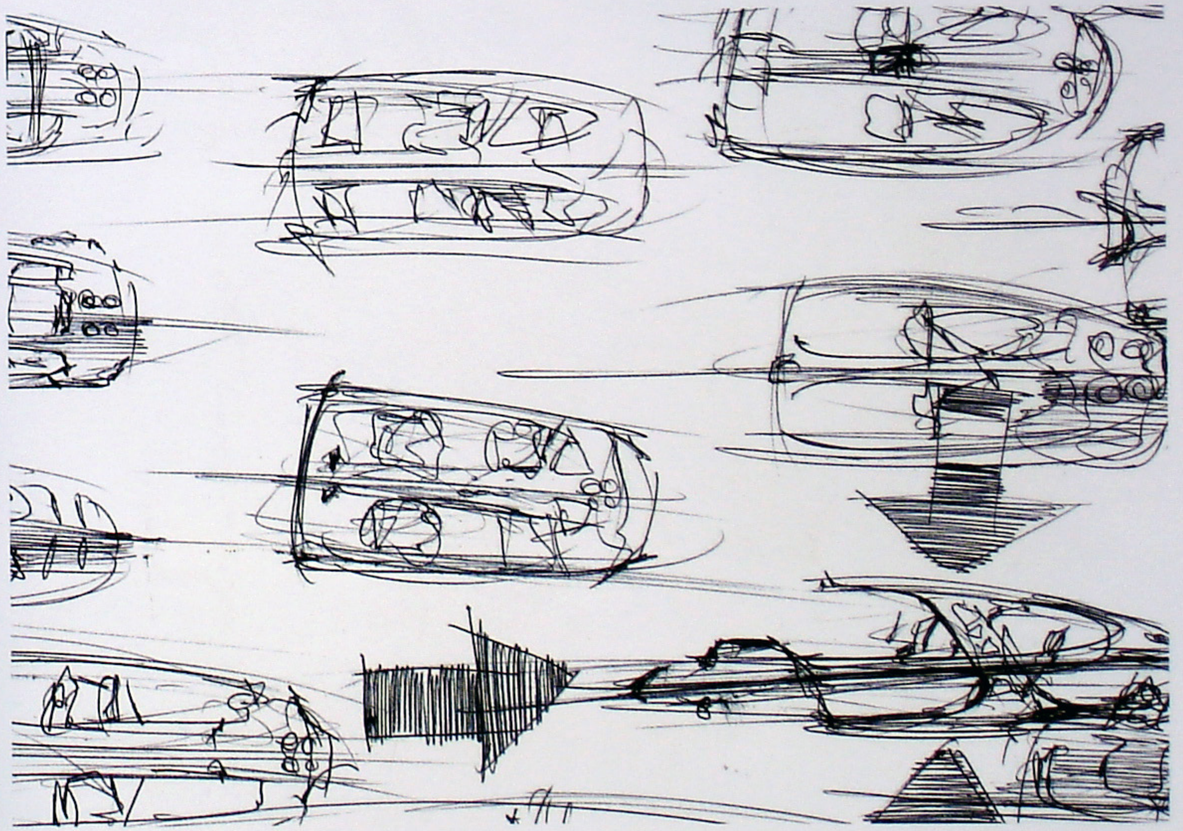
▲ **Rescue Project** This is a typical example of an investigative sketch page. The creation date noted in the top left corner makes it easier for the designer to keep a record of the chronological steps taken to complete a project. (Ballpoint pen, marker)

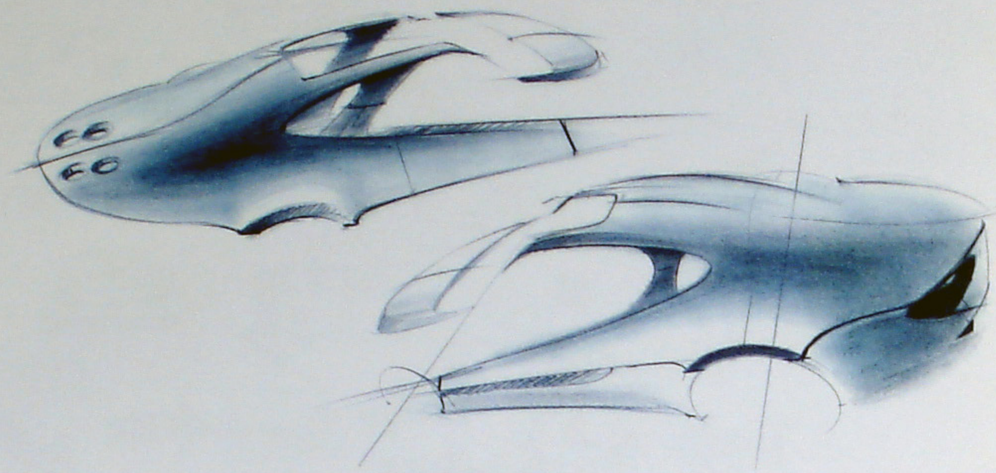
▼ With the basic design already set, marker and pencil were used directly on a printed photo of a three-dimensional foam model to effectively explore more detailed ideas and form-solutions. (Black hard pencil, marker)



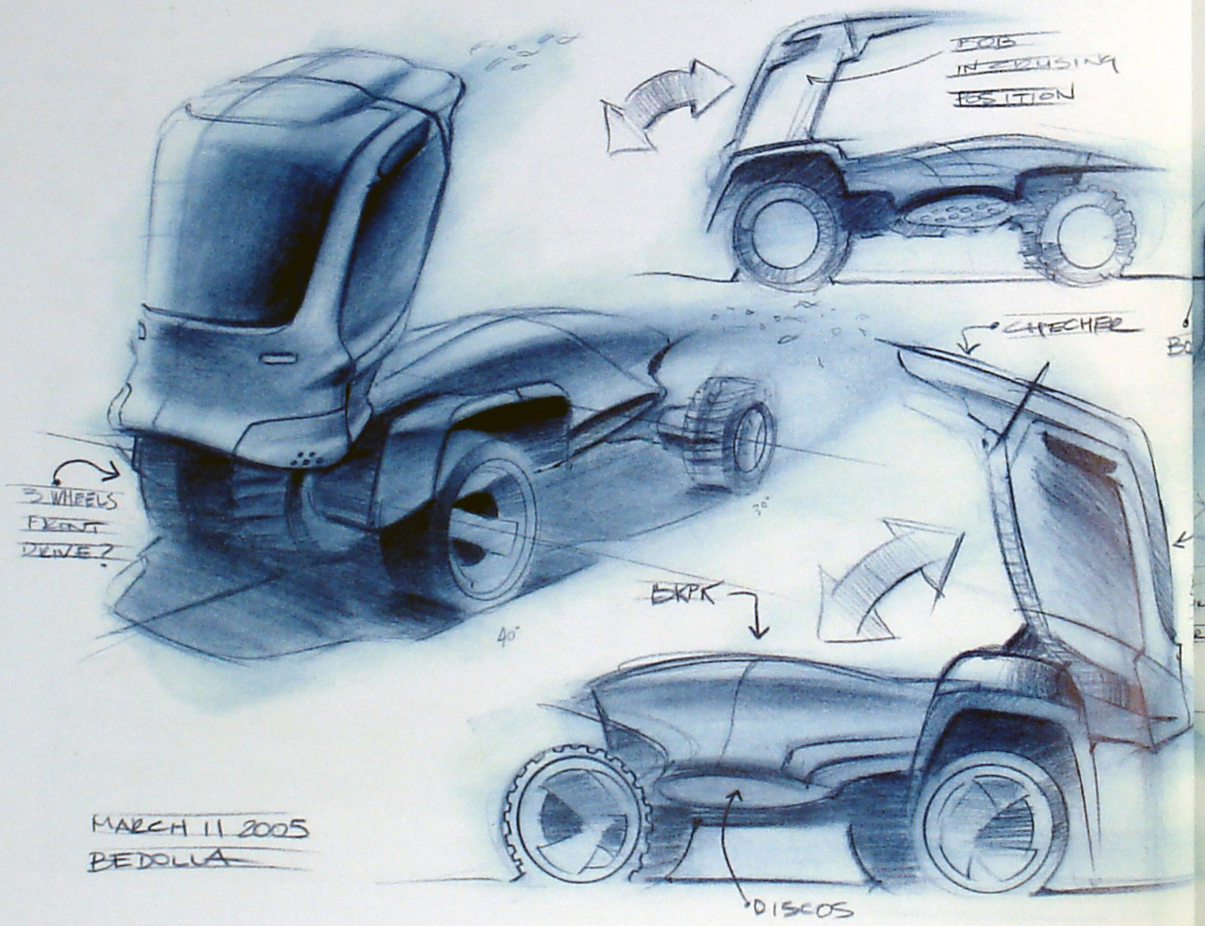


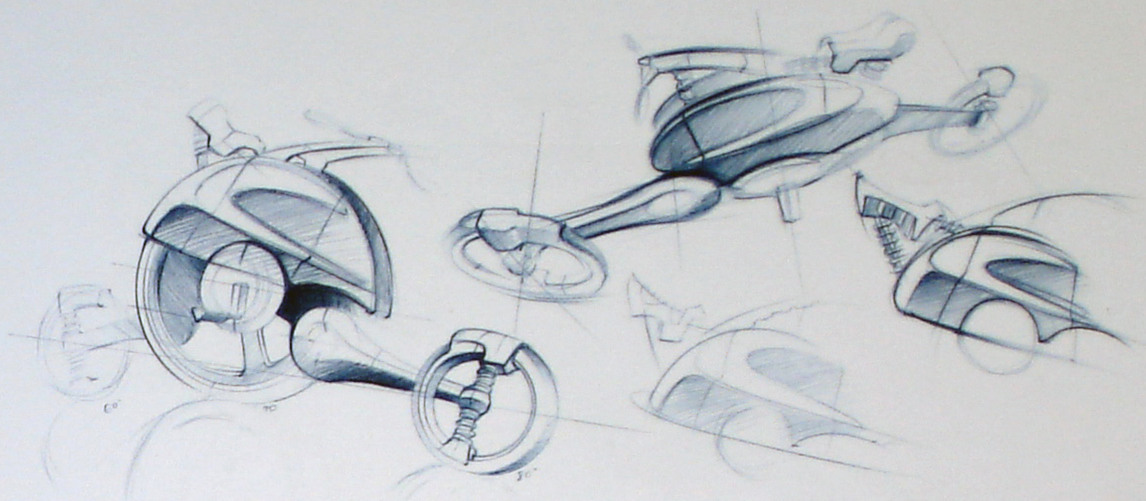
Fuel Cell Car During the initial sketch phase of a project, small 'thumbnail' sketches can be used to quickly explore ideas. This quick sketching technique was used in these examples to fill sheets of low-quality paper. Arrows were added to mark out sketches deserving further exploration, and centre lines were drawn to note planes of symmetry. The 'thumbnail' sketches below are shown in actual size. (Ballpoint pen)





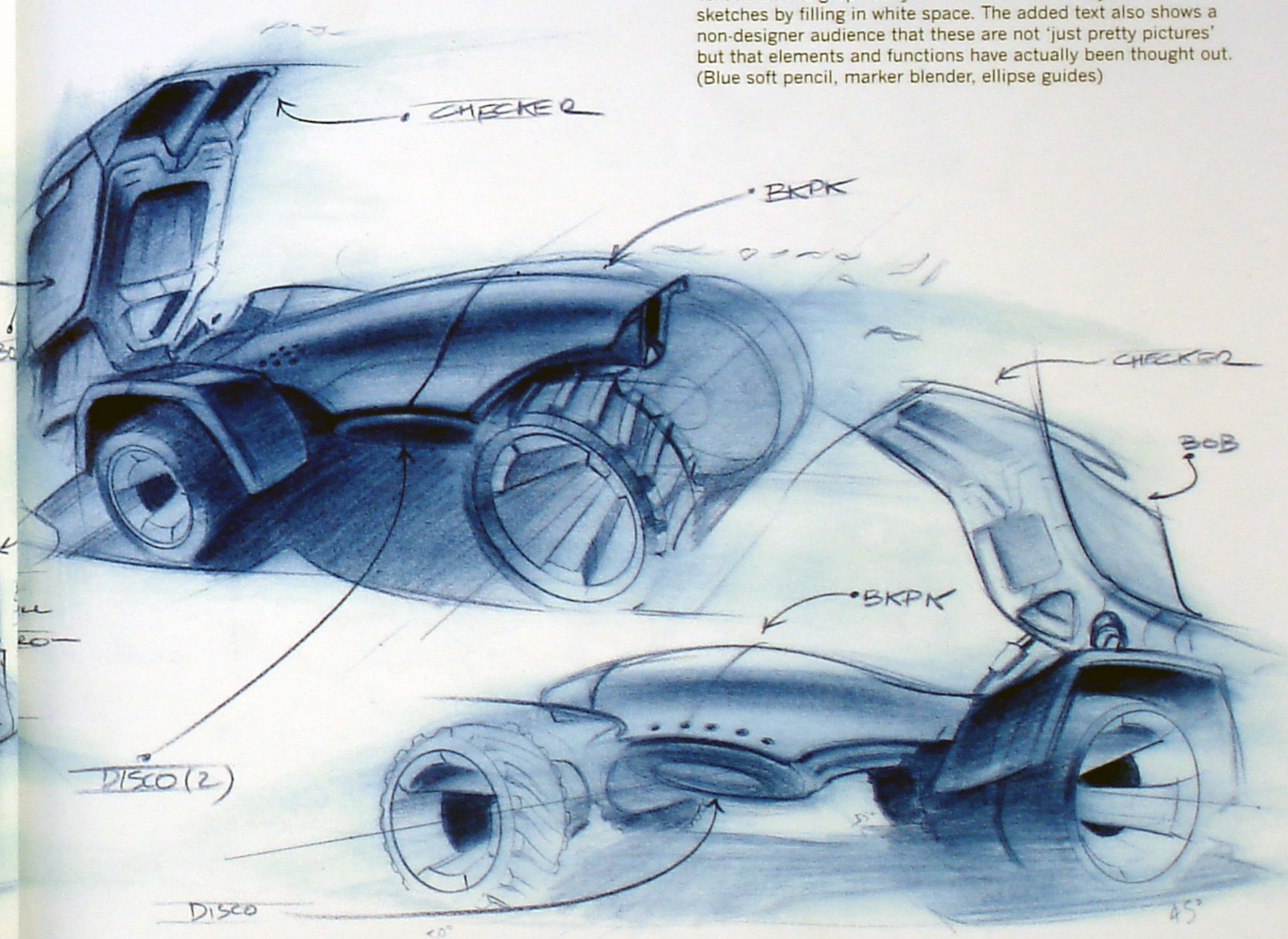
▲ **Fuel Cell Car** These sketches are a further form development based on the sketches from the previous page. Notice that only some selected parts of the exterior are shaded and that sources of light are placed in such a way that core shadows are created, further defining the car's shape. This technique takes form development from flat sketching to the next level of definition. (Blue soft pencil, ellipse guides)

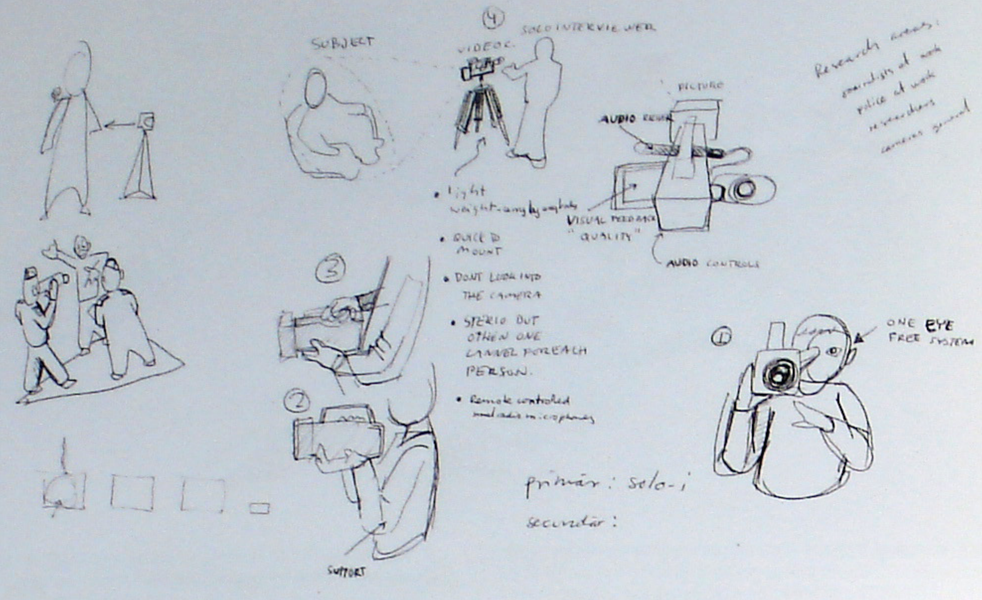




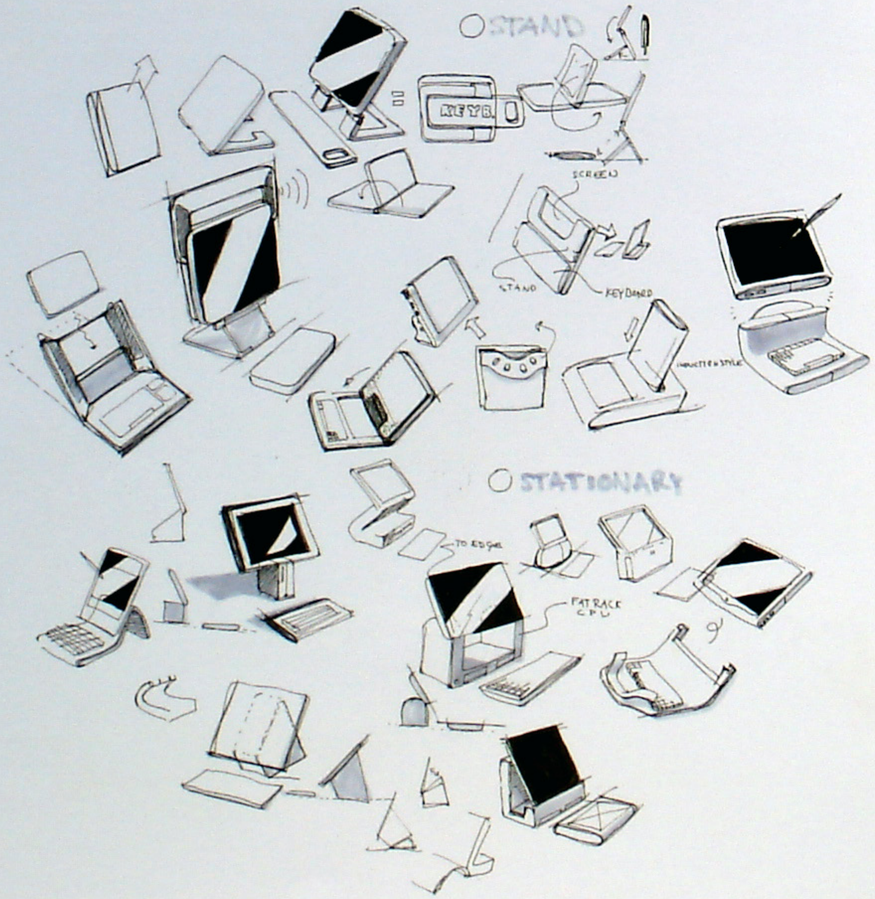
▲ **Bicycle, Branding Project** This designer commented that when creative energy is being focused on the exploration of form, it is sometimes difficult to consider the sketch's overall layout at the same time. If there is a chance that the sketch will be used in a future presentation, however, it may be wise to give the layout some consideration.
As shown above, it is helpful to note the values of ellipses used in order to save time if the same perspective is used again. (Blue soft pencil, ellipse guides)

▼ **Toolbox Truck** At this stage in the design process, parts of the truck that have been roughly designed are assembled. The overall ideas are examined from different points of view.
To allow for mistakes, a special technique is used where marker blender is applied with pads to more or less erase the pencil lines. This offers the opportunity to detail a form, but also to create attractive blending or shading. Since marker blender is expensive, other solvents can be explored to achieve the same effect.
Text notations graphically enhance the overall layout of the sketches by filling in white space. The added text also shows a non-designer audience that these are not 'just pretty pictures' but that elements and functions have actually been thought out. (Blue soft pencil, marker blender, ellipse guides)

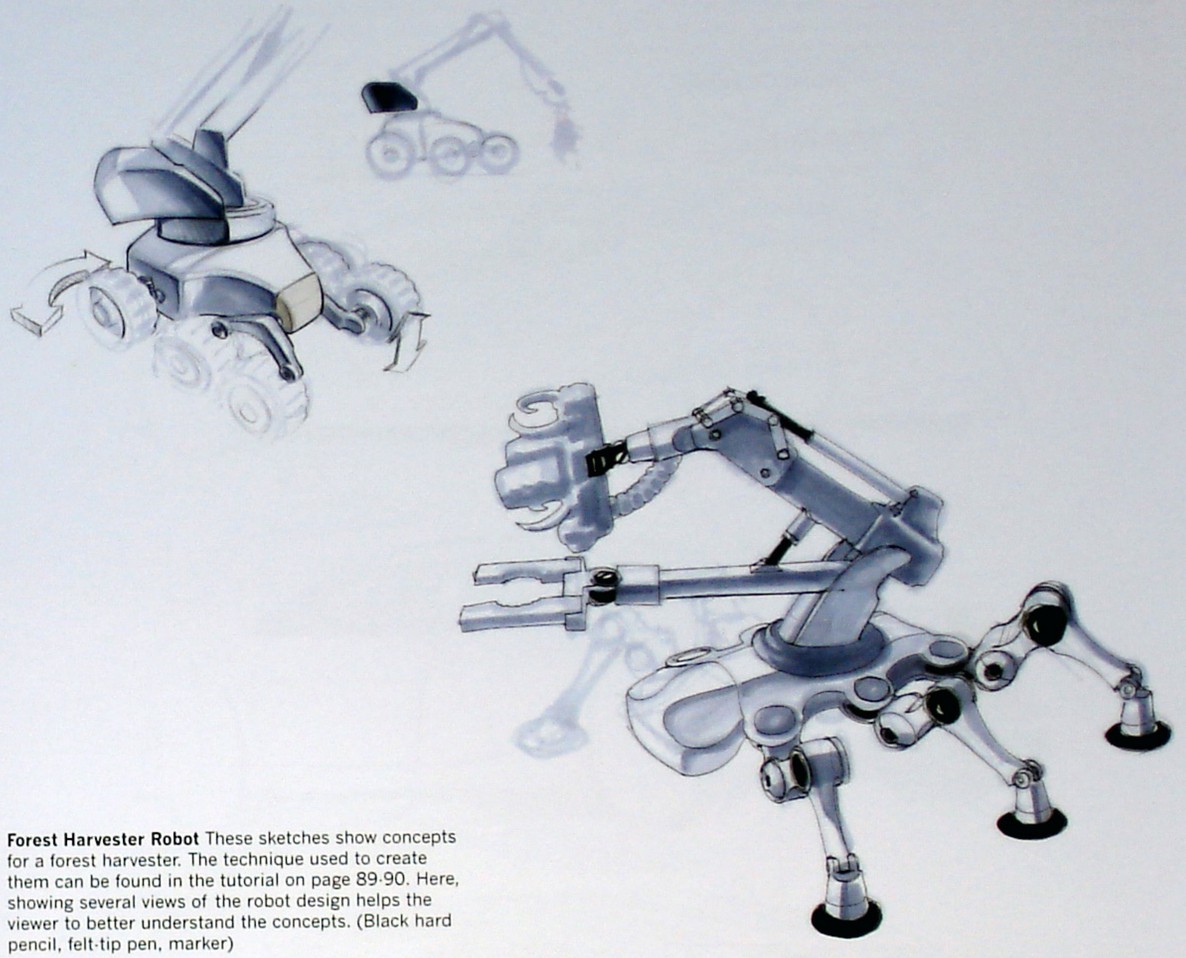




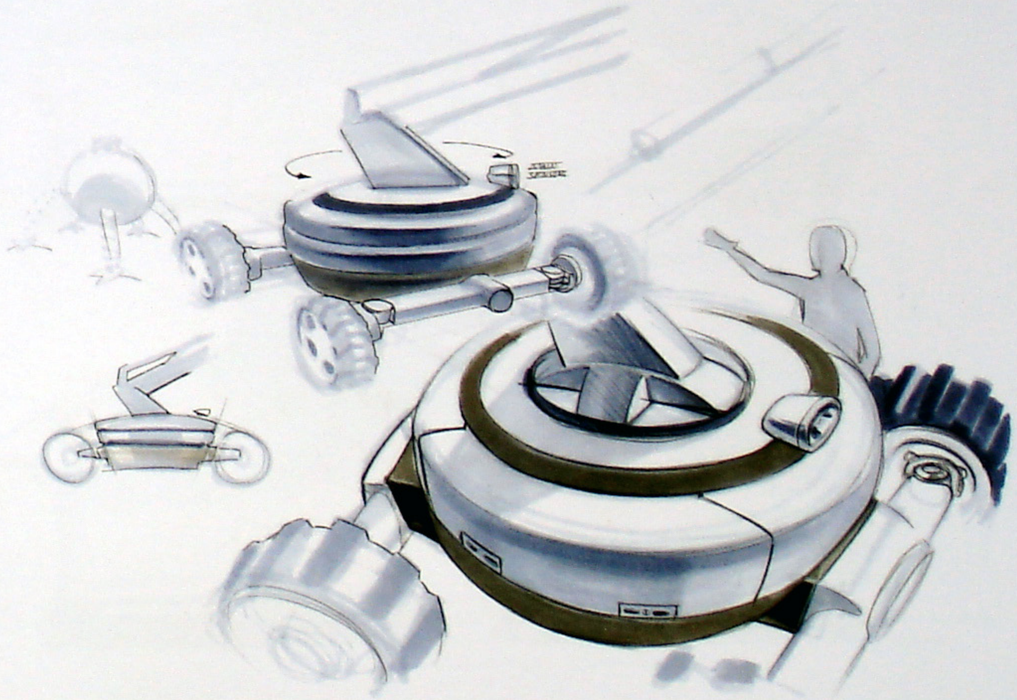
▲ **Journalist's Tool** The simple illustrated notes above were not meant to be shown or presented. Visualizing thoughts may improve a designer's focus and prove helpful when deciding how to proceed in a project. (Ballpoint pen)



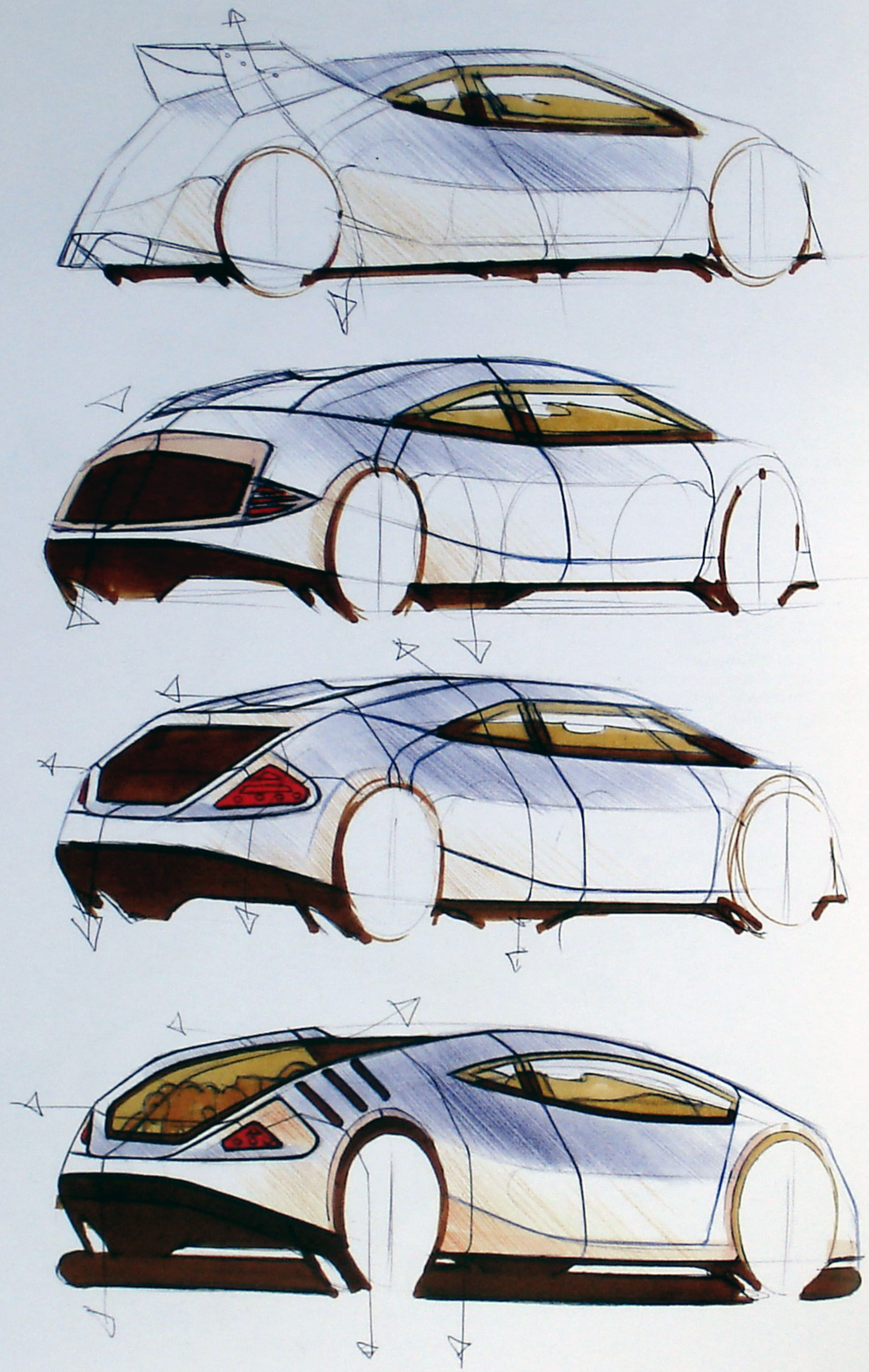
▼ **Monitor/Display** Small thumbnail sketches are sufficient to explain simple ideas. They are quick to produce and easy to understand. The cluster of sketches below was assembled using Photoshop. (Felt-tip pen, marker, Photoshop)

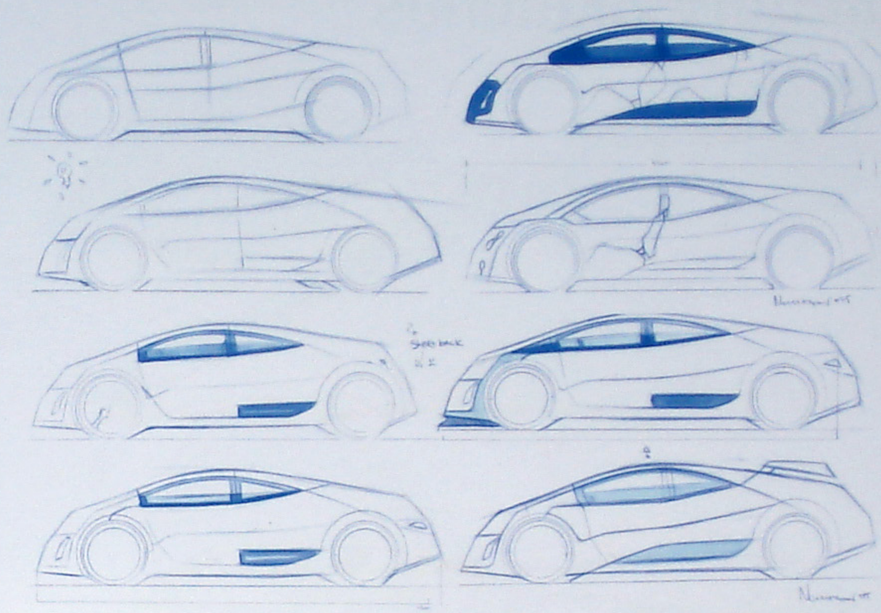


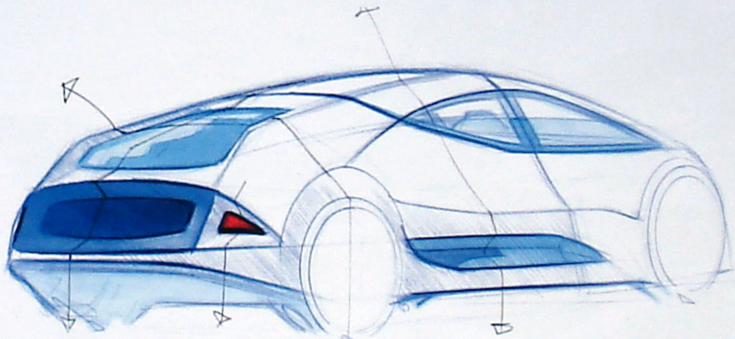
Forest Harvester Robot These sketches show concepts for a forest harvester. The technique used to create them can be found in the tutorial on page 89-90. Here, showing several views of the robot design helps the viewer to better understand the concepts. (Black hard pencil, felt-tip pen, marker)

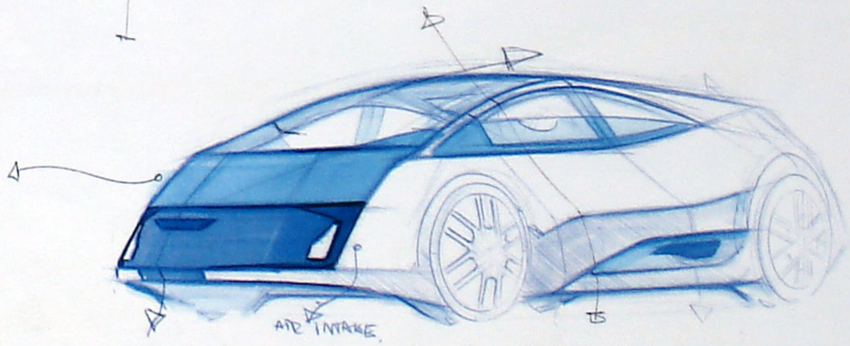


Sports Car Here, an almost flat perspective was chosen for its relatively uncomplicated nature, which allowed for quick sketching. Ellipses on the side of the car have been drawn to measure and control the wheel base. (Blue and brown hard pencil, ballpoint pen, marker, ellipse guides)







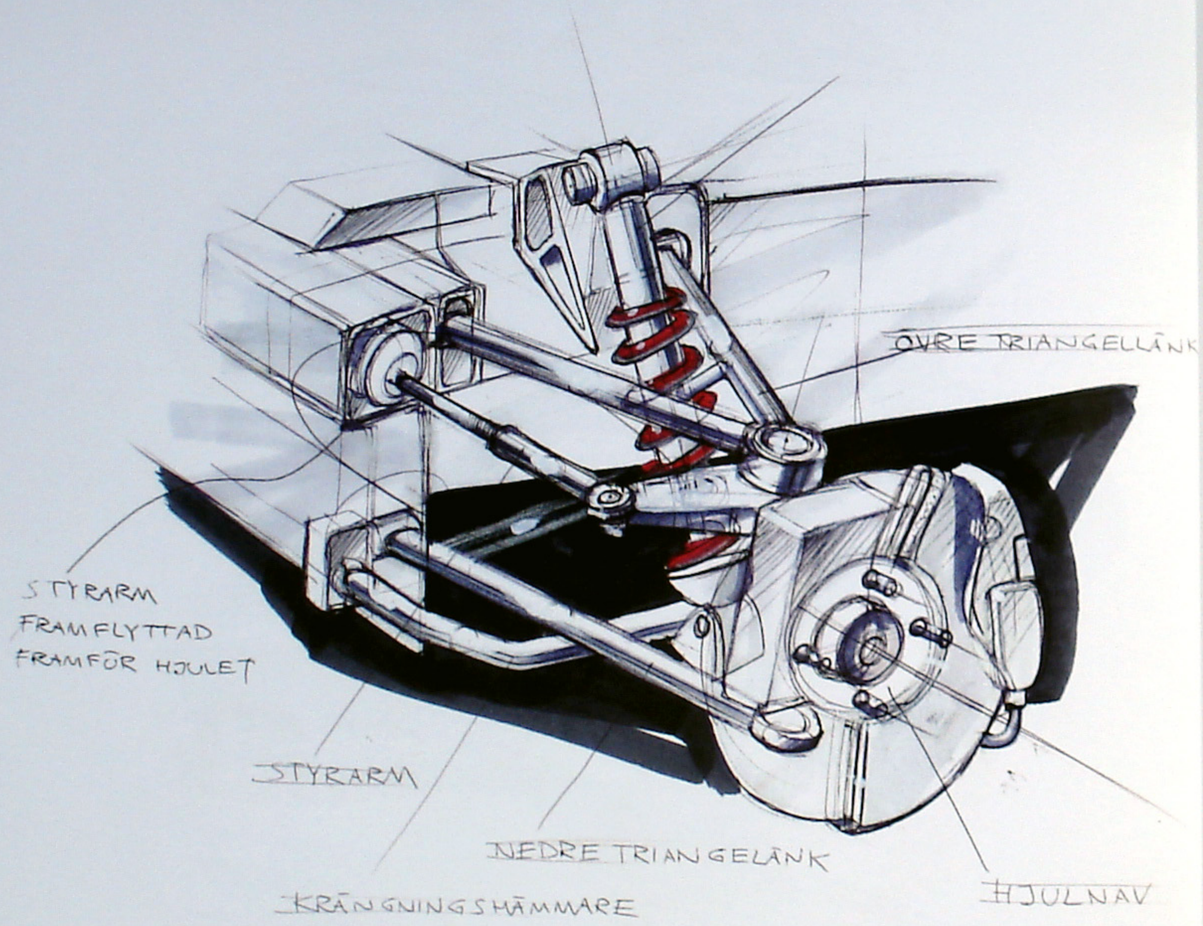


▲ The side-view sketches at the top of the page were created to define the car's silhouette before starting on a clay model. The profiles also serve to explore and analyse the graphic effects of different part lines and chamfers. (Blue hard pencil, marker, ellipse guides)

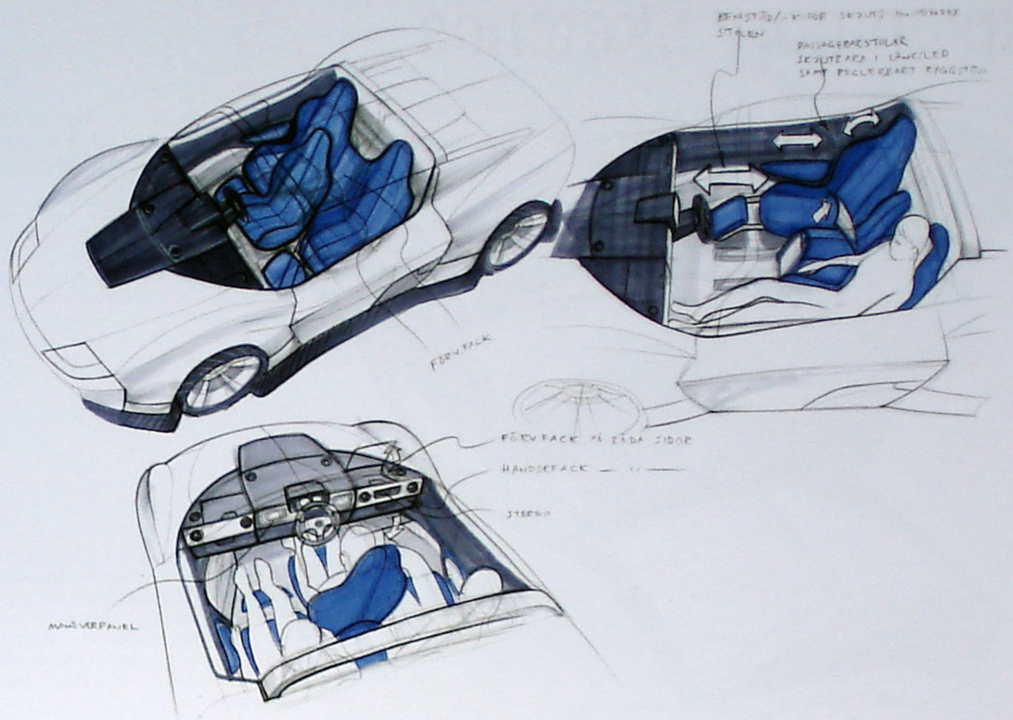
▲ The above three-quarter view sketches show the back and front of a selected side view. The thin cross-section curves were given arrows to help differentiate them from part lines. Marker was used to develop undefined sections, while areas that were already defined were left uncoloured to save time. (Blue hard pencil, ballpoint pen, marker, ellipse guides)

Explanatory Sketches

Explanatory sketches are created to explain function, structure and form. They most often communicate a design in a clear and neutral manner, focusing on explaining it rather than trying to sell it. Explanatory sketches are commonly used to impartially present a number of concepts for users and clients to evaluate. Additionally, relatively unfinished designs are often illustrated in a more explanatory way in order to facilitate discussion of concepts with others.

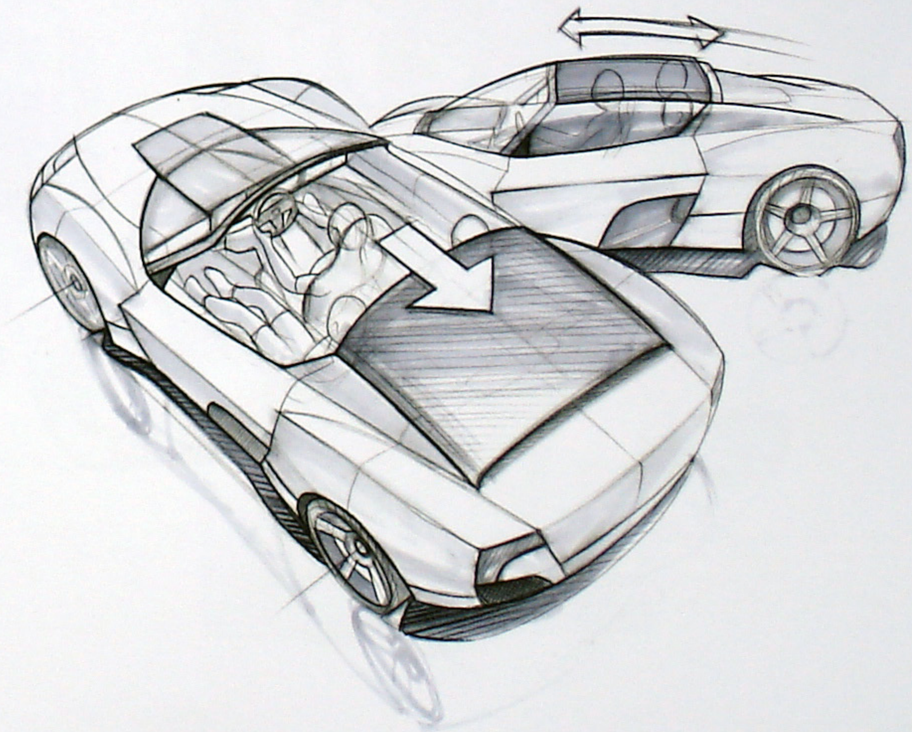


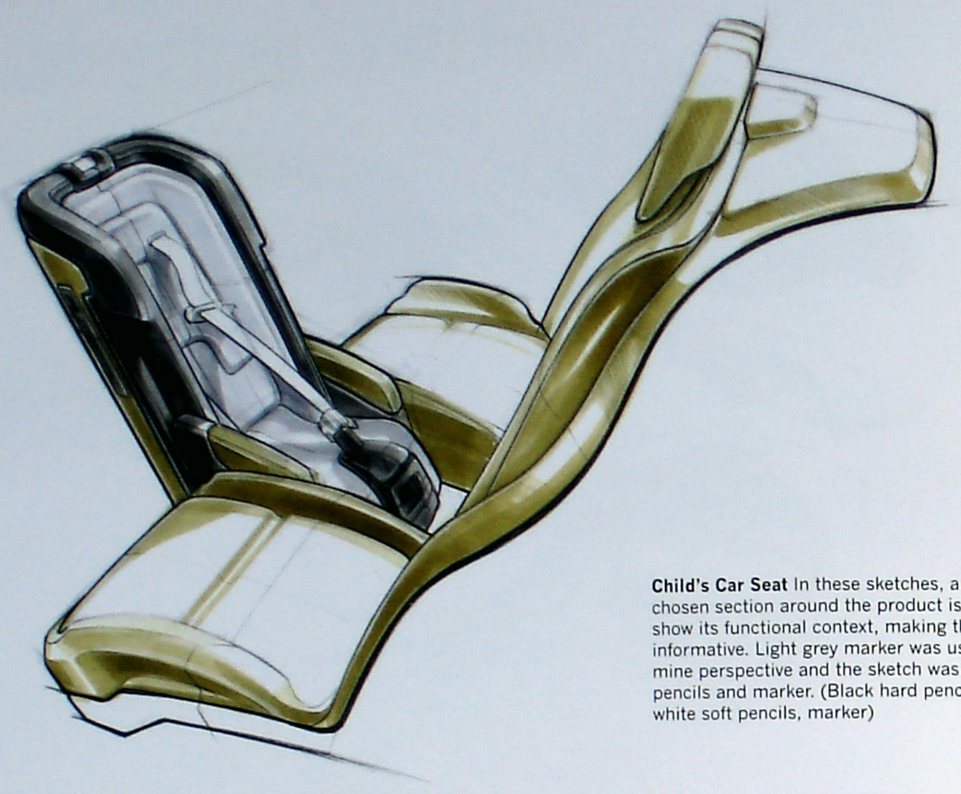
Sports Car, Construction This sketch was specifically created for use in discussions with an engineer. Black marker was added to further detail and isolate parts, making the sketch more understandable. (Graphite pencil, ballpoint pen, marker, gouache)



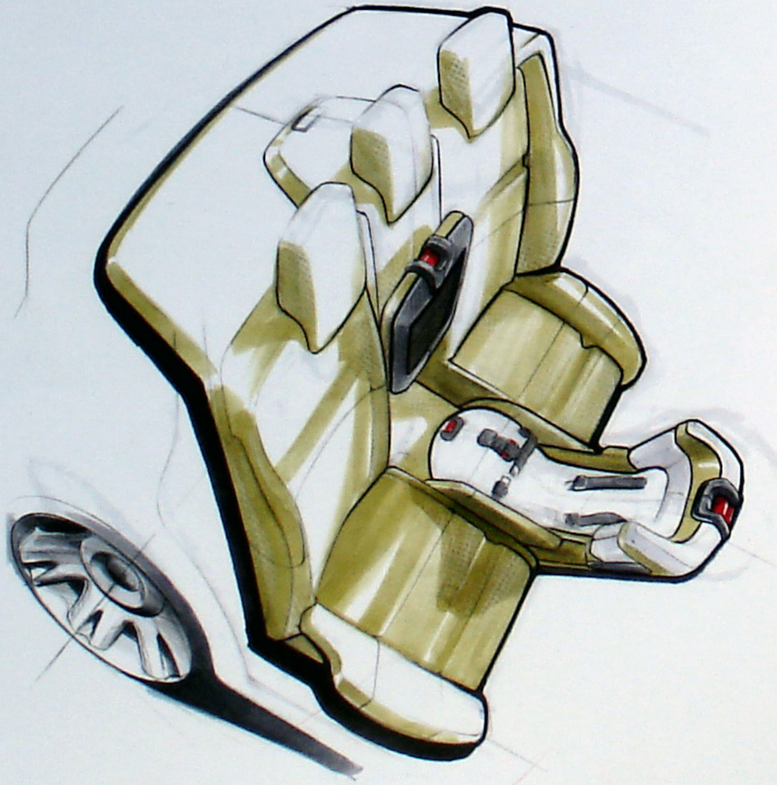
▲ These sketches feature the interior of the vehicle but also show enough of the car's exterior to show context. The body of the car was drawn quickly using a printout from a 3D CAD program as an underlay. The faint treatment of the exterior section serves to emphasize the interior's design. (Black hard pencil, marker)

▼ When an object features a moving part, in this case the sunroof, the whole object can be drawn two or more times to clearly describe that part's function and different positions. Reflections drawn beneath the car imply that it is situated on a surface. (Black hard pencil, marker)

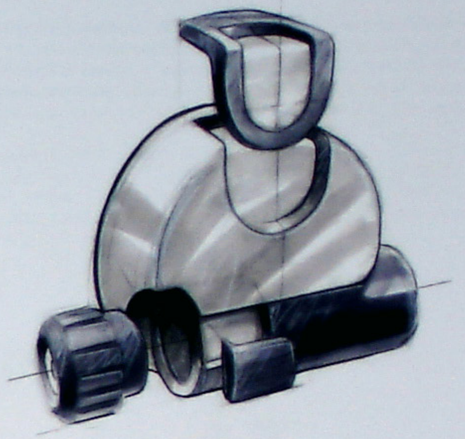


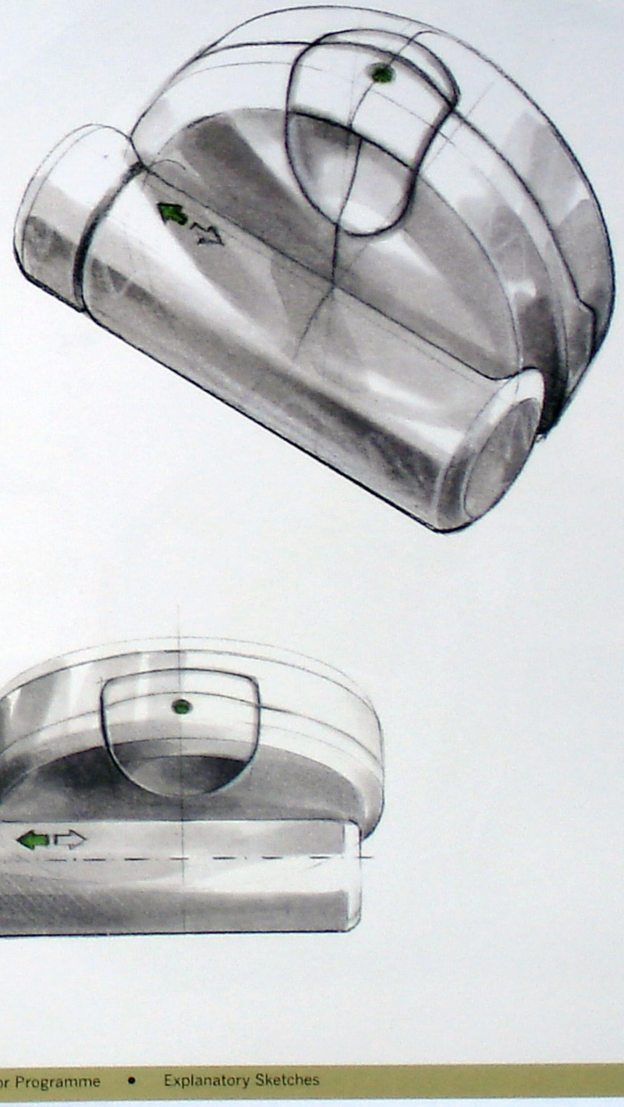


Child's Car Seat In these sketches, a carefully chosen section around the product is included to show its functional context, making the sketch more informative. Light grey marker was used to determine perspective and the sketch was finished using pencils and marker. (Black hard pencil, black and white soft pencils, marker)

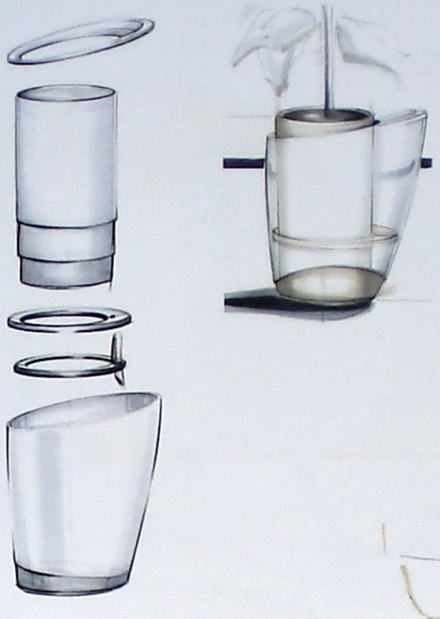


Alarm Clock Here, the designer has used slightly crossing lines of marker to add life to the lightning in the sketch. The purpose was not to make a perfect illustration or photorealistic sketch, but rather to show the product in a clear yet artistic manner. Notice the placement of the marker lines; in most of the cylindrical shapes, the marker lines follow their longitudinal axes to help describe the direction of the surfaces. The lines often end at an edge, visually separating surfaces and making gradients easier to create. Surface angles on each side of the chamfers are represented by the changing direction of marker lines. (Black hard pencil, black and white soft pencils, marker, ellipse guides)



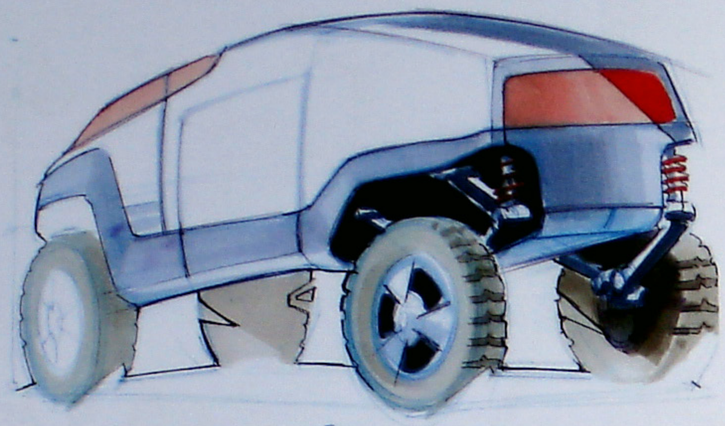


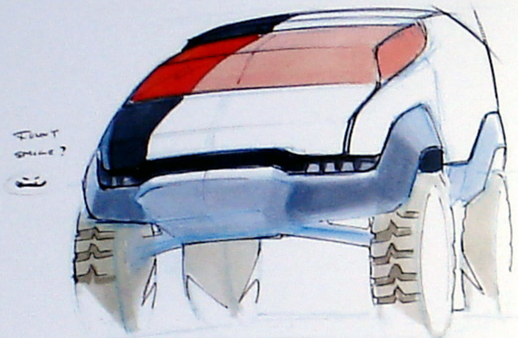
Lawn Mower In these two sketches marker is applied in different manners to describe specific types of surfaces; convex surfaces and radii have little or no marker applied, to describe light reflections. (Black hard pencil, black and white soft pencils, marker)



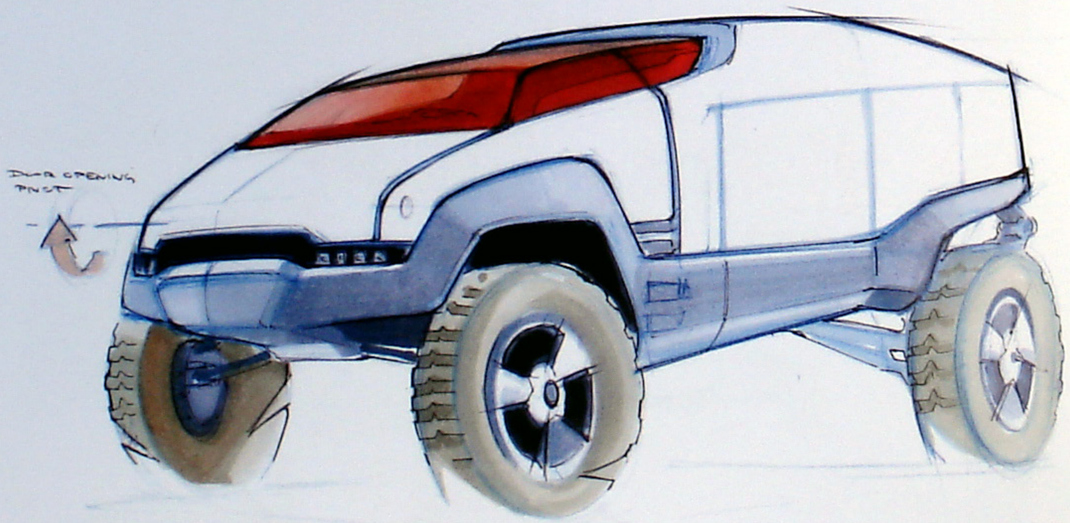
◀ **Self-watering Flower Pot** Using exploded views makes it possible to show all the parts of a product, as well as their relative positions and assembly. Bending an apparently horizontal line to depict the effect of refraction indicates that the pot is made of a transparent material. (Black and white soft pencils, marker)

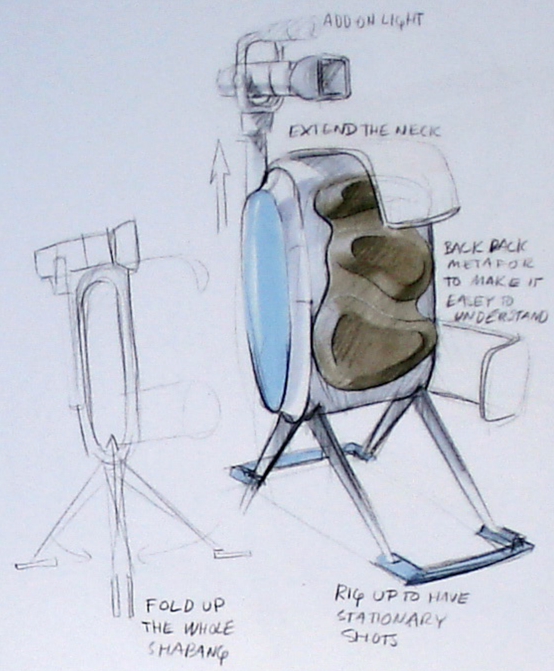
▼ In order to ensure that the pot is the main focus of this sketch, the plant and background have been drawn using low-contrast colours. Again, the linear edge between the wall and the floor appears refracted through the glass. (Black and white soft pencils, marker)

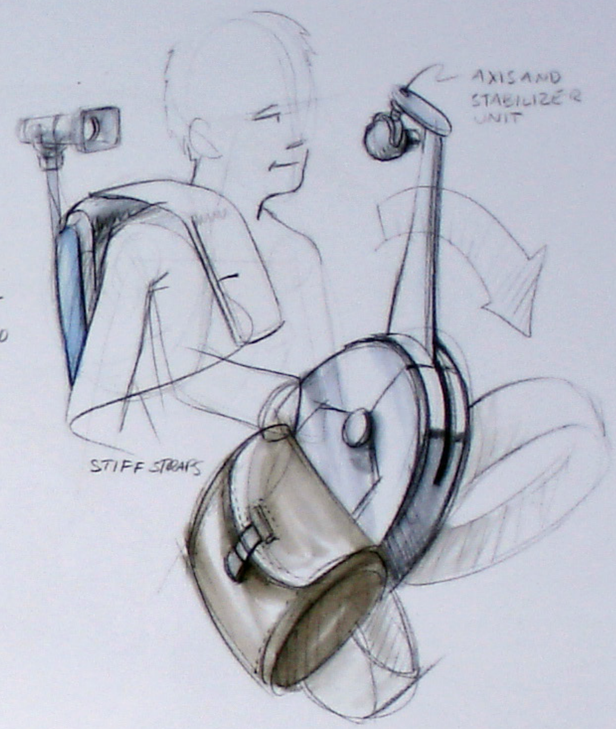




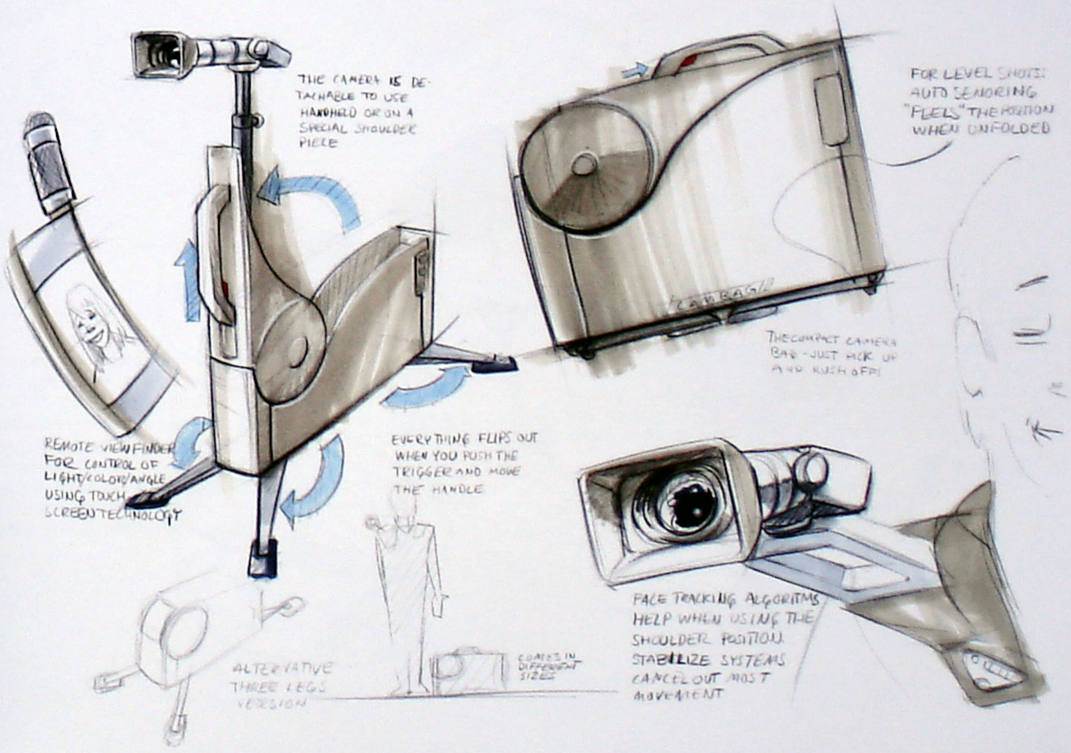
Rally Truck These sketches show how high-contrast surfaces and pronounced outlines emphasize the graphic impact of a product, highlighting the relative positioning of its parts. The contrasts are exaggerated to bring out certain areas and make them easy to distinguish; the most notable example is the red glass.
Exaggerating the size of the wheels and reducing window size is a commonly used design trick that strengthens the character of a vehicle.
Here, the edges of clear reflections on shiny surfaces serve the same form-describing purpose as cross-sections. (Blue soft pencil, ballpoint pen, marker)

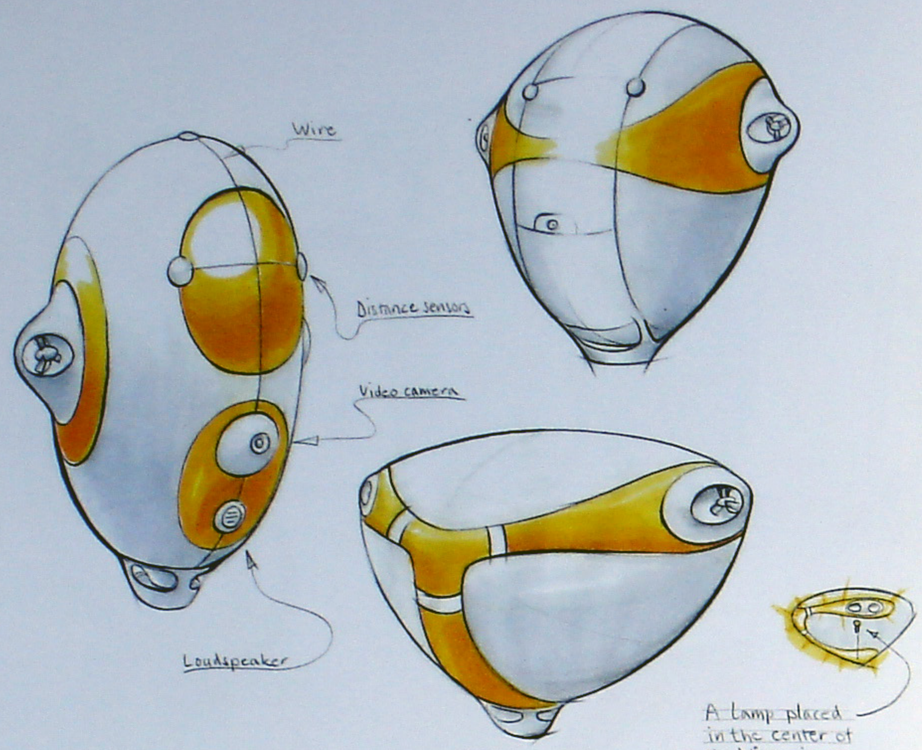


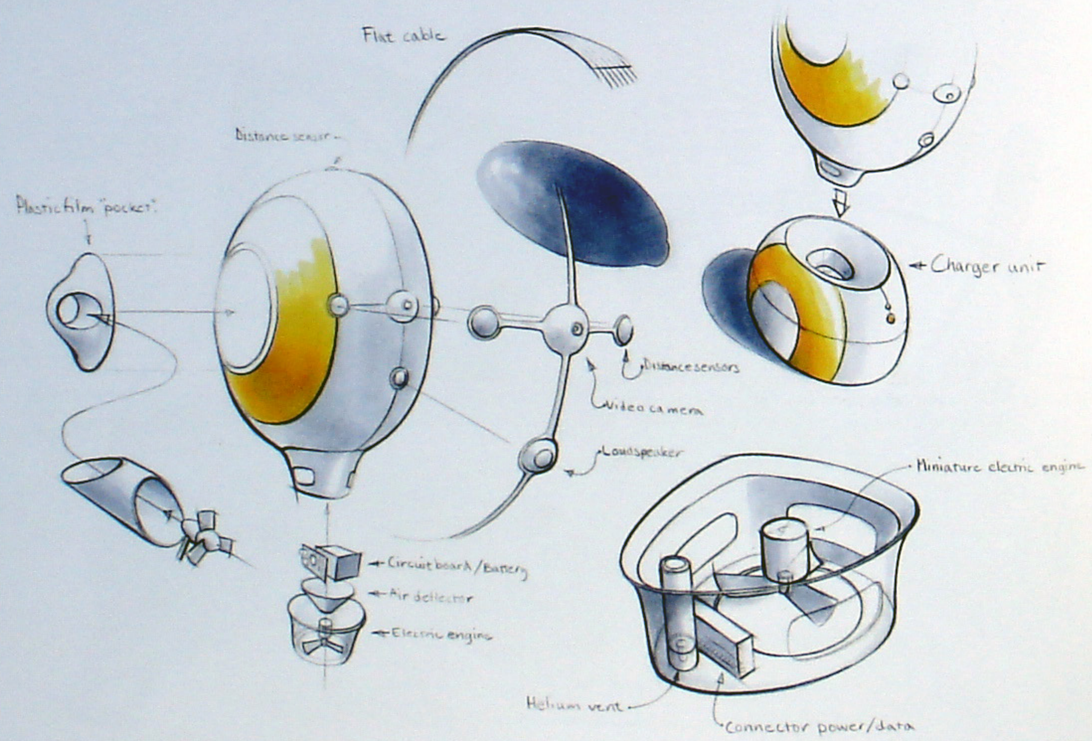


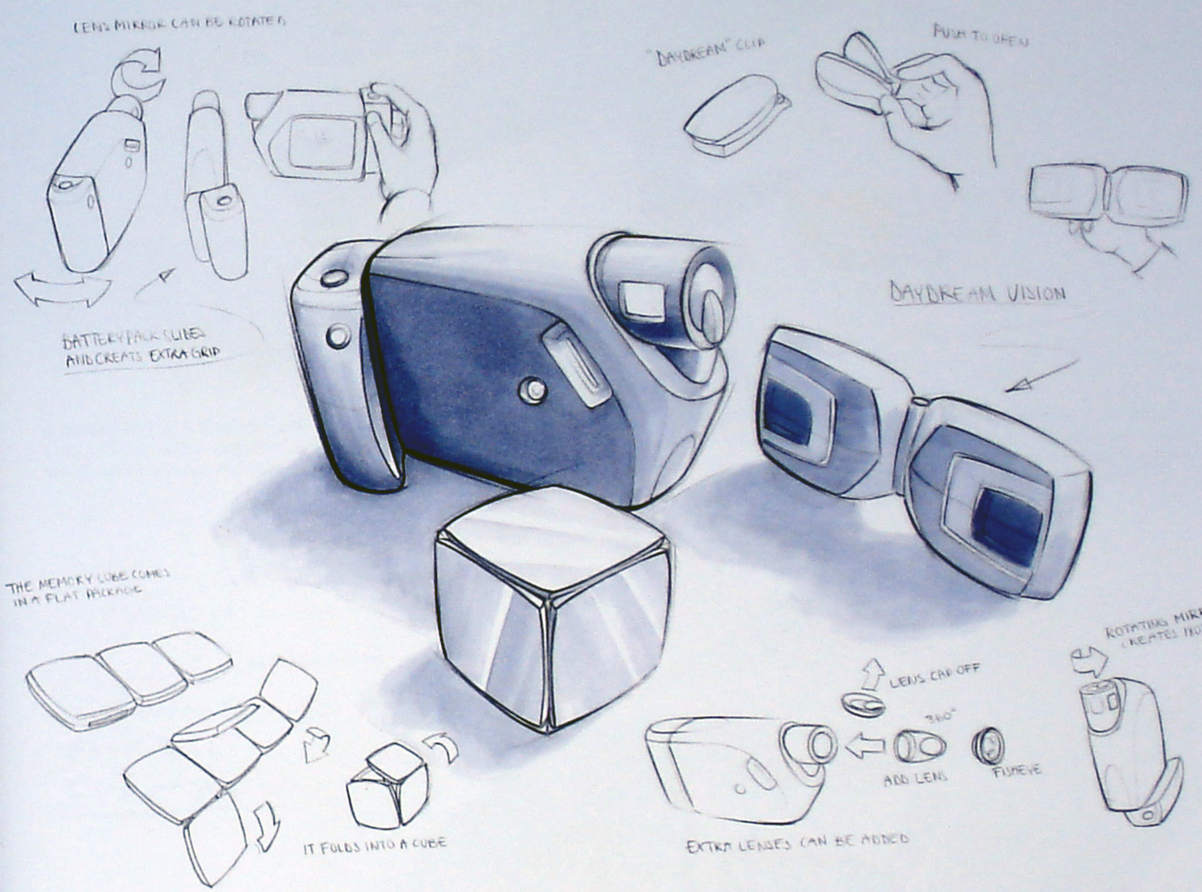


Journalist's Tool In these sketches, the eye is drawn to the areas treated with the highest contrast while parts drawn only in pen take on a secondary or supporting role. Both warm and cool greys have been used to isolate objects from one another and to make the overall composition more interesting. These sketches were developed by first creating a line drawing, then adding marker, and finally applying soft black and white pencils along part lines. (Black hard pencil, black and white soft pencils, marker)



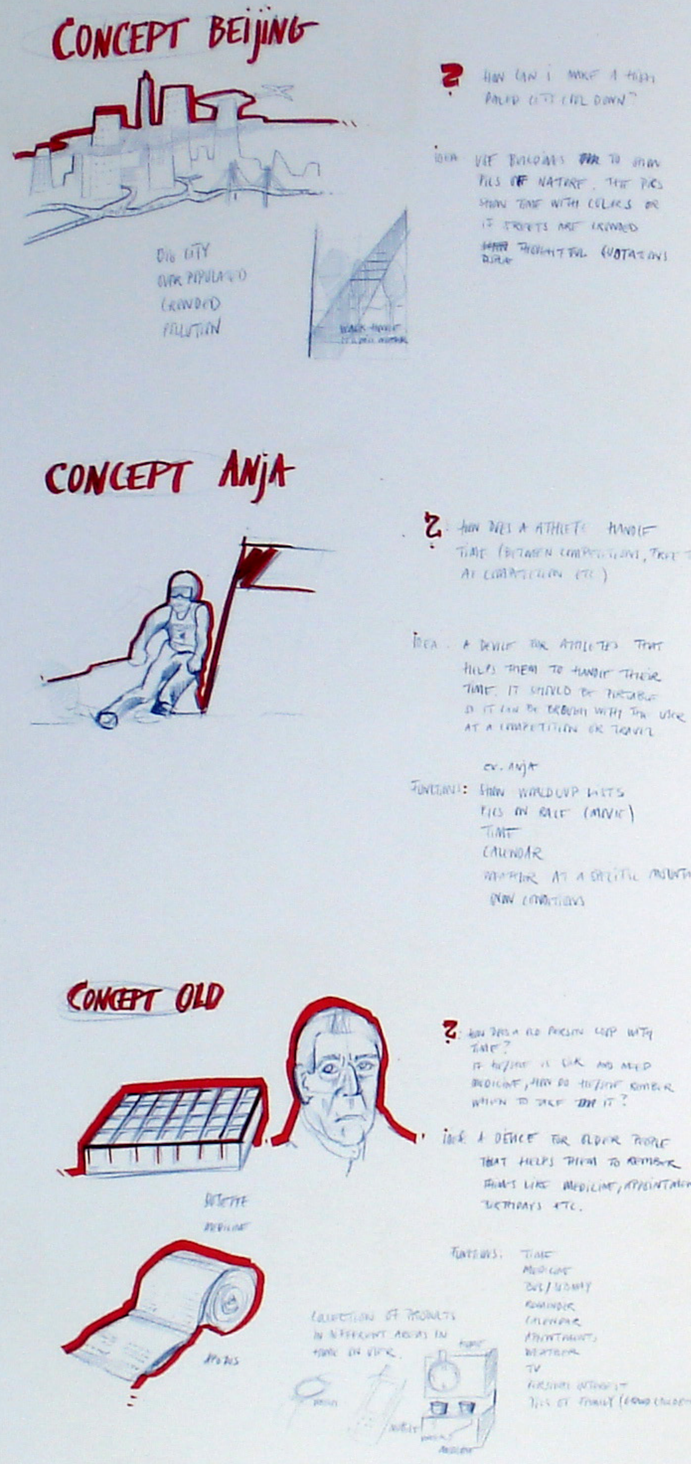




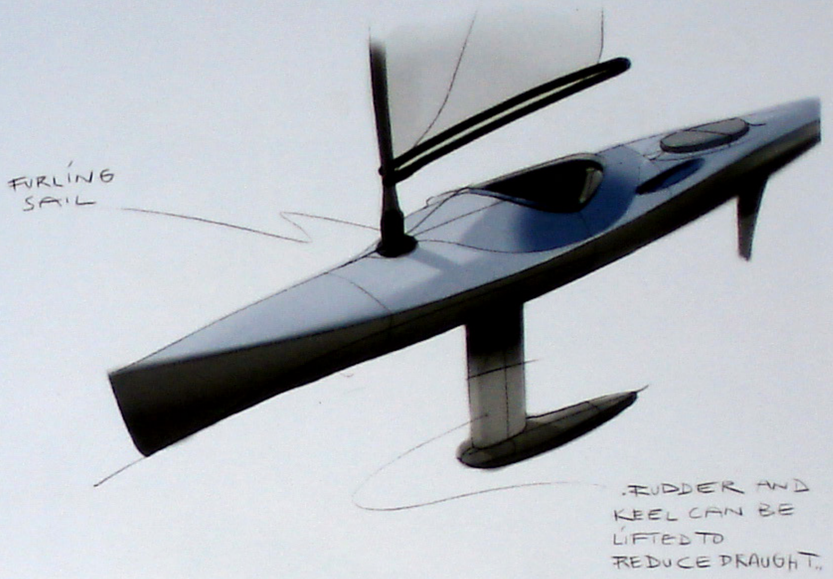


◀ **Autonomous Balloon Robot** To give the appearance of soft and inflated forms, two yellow and four grey toned markers were used. First, thin outlines were drawn to define the forms, then a mid-toned marker was used to shade. While the marker was still wet, the other values were added to develop the soft shapes. An appealing marker gradient is easier to create when there are no pen lines in the way to smudge. For this reason, part lines across large surfaces were added as a final step in these sketches. (Black hard pencil, marker)

▲ **Digital Camera** This sketch was created in order to explain a concept to a non-designer audience, with focus on describing moving parts, functionality and other details. The placement of the smaller sketches fills in space and creates a balanced layout. (Hard and soft black pencils, marker)

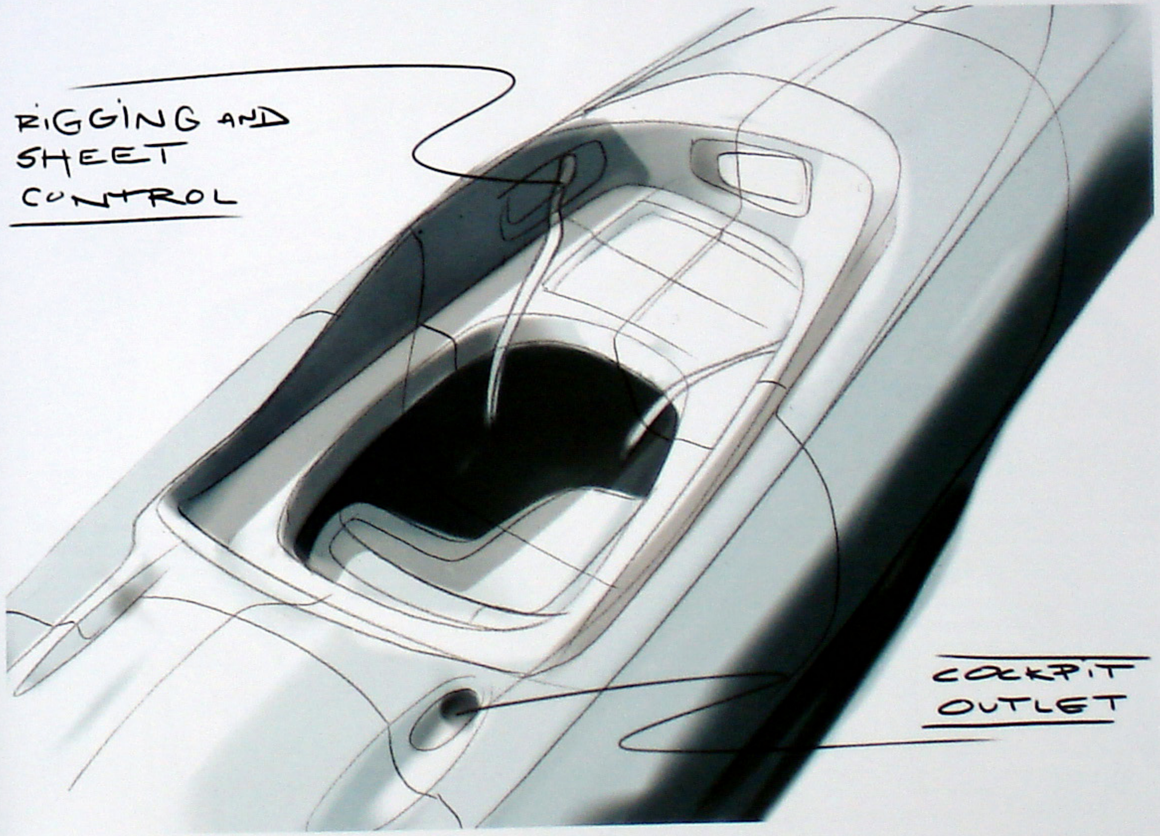


Project "Time: Organize, Share and Remember" Despite their humble appearance, this simple type of sketch accompanying a descriptive text is a commonly used method for detailing ideas. The sketches above give the viewer a quick description of three concepts. The images associated with each of the ideas clarify the concepts and make them easier to remember. Red marker is used to accentuate the pencil lines and make the sketches stand out from the page. (Blue soft pencil, marker)

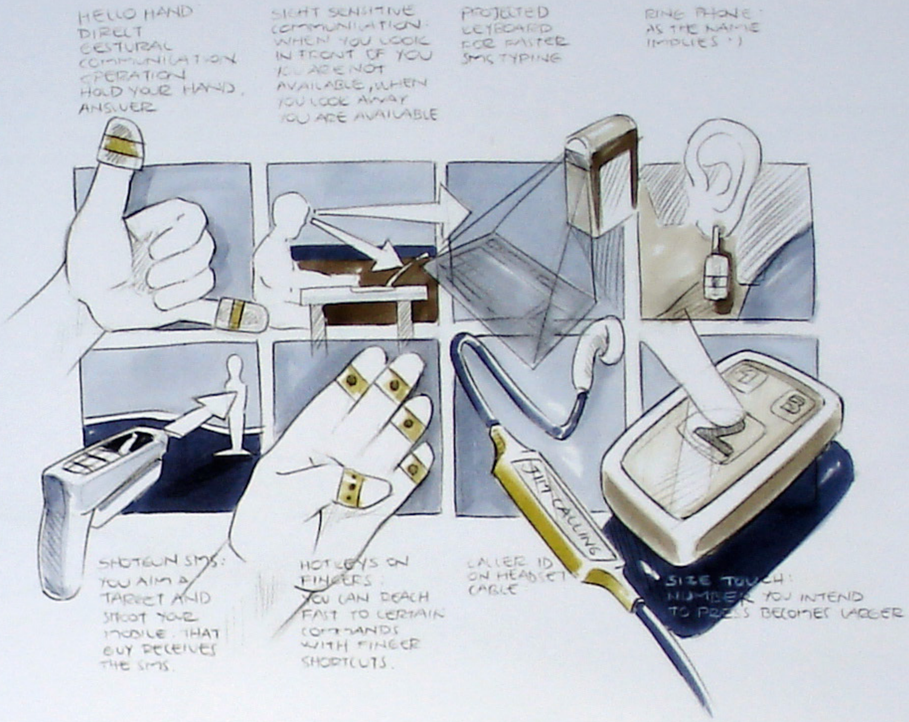


▲ **Sailing Kayak** Notice the cast shadow from the mast in the sketch above; this is a type of small detail that makes a sketch seem more realistic and polished. (Black hard pencil, Painter)

▼ In the sketch below, elastic and free cross-section lines help to describe the kayak's form. The shading is quickly laid down using only a few nuances, applied as defined fields rather than by grading the tones into each other. (Black hard pencil, Painter)

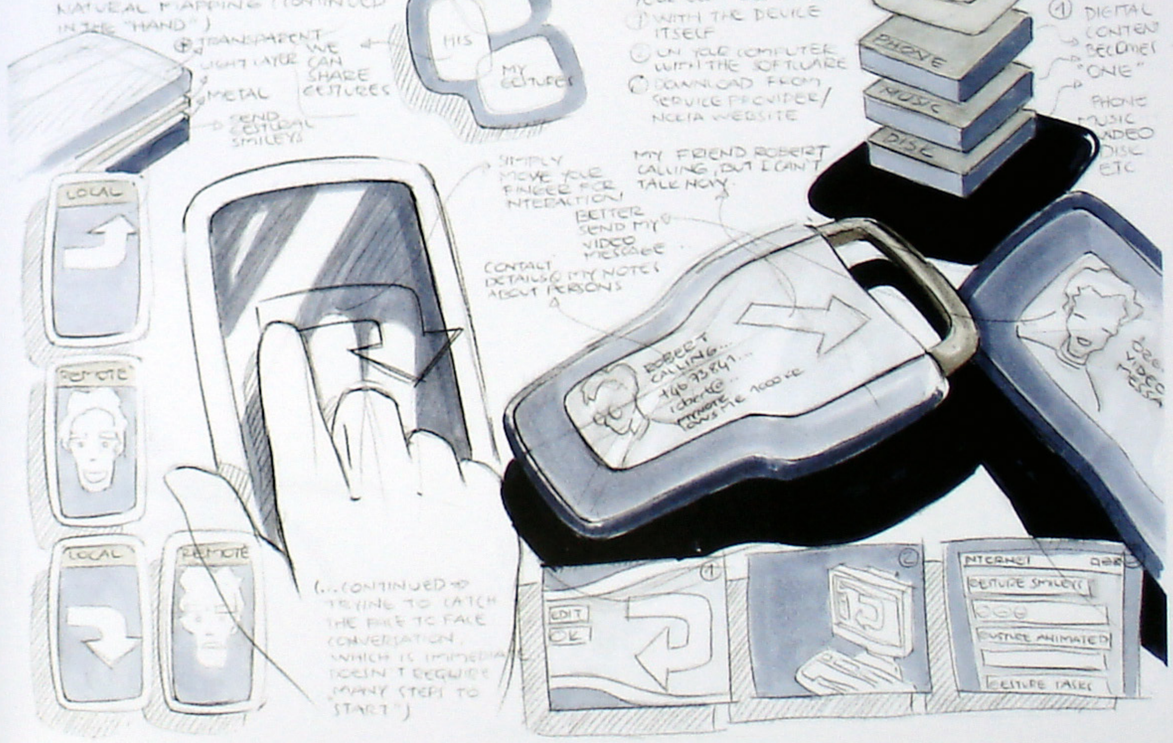


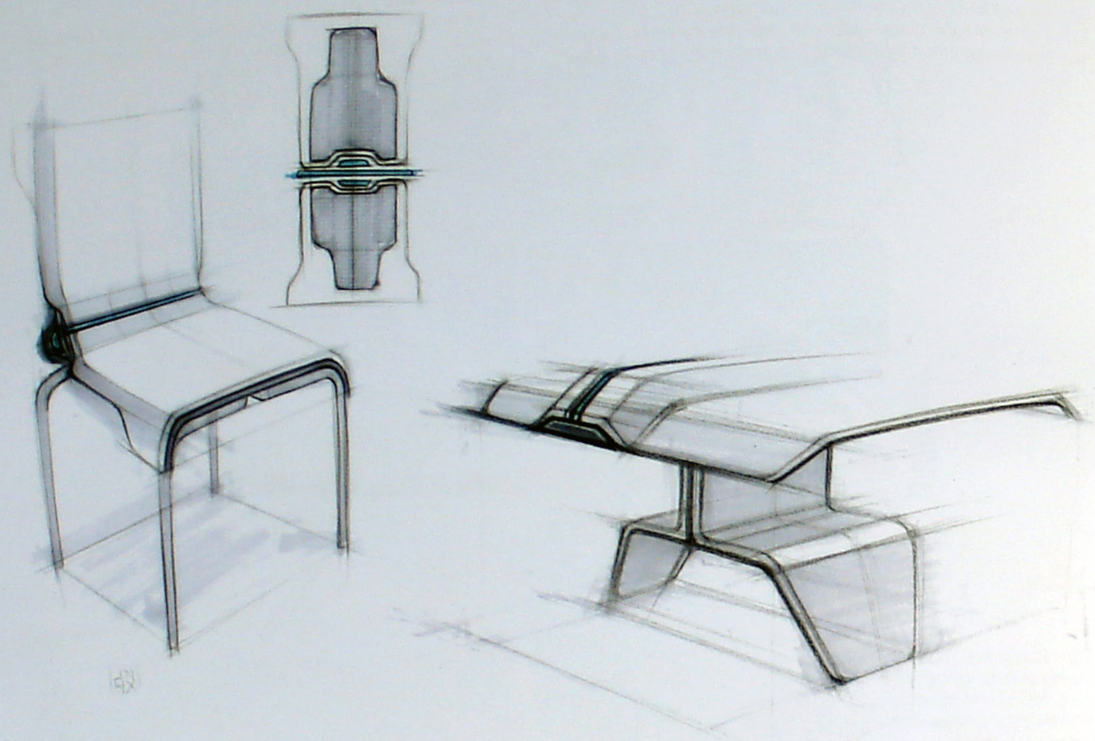
Articulated Dump Truck This sketch shows an alternate way of using marker to explain form. Marker ink has been added liberally using a pad and without worrying about staying within the lines of the sketched frame. The lines were then reinforced to make the sketch more explicit. Matte surface finishes are represented by sections completely covered in marker, while high-gloss surfaces are more varied with marker-free areas illustrating light reflections. The interior of the truck is only faintly indicated without detail, in order to keep attention on the design of the outer shell. (Black hard pencil, white soft pencil, marker refill, marker, ellipse guides)



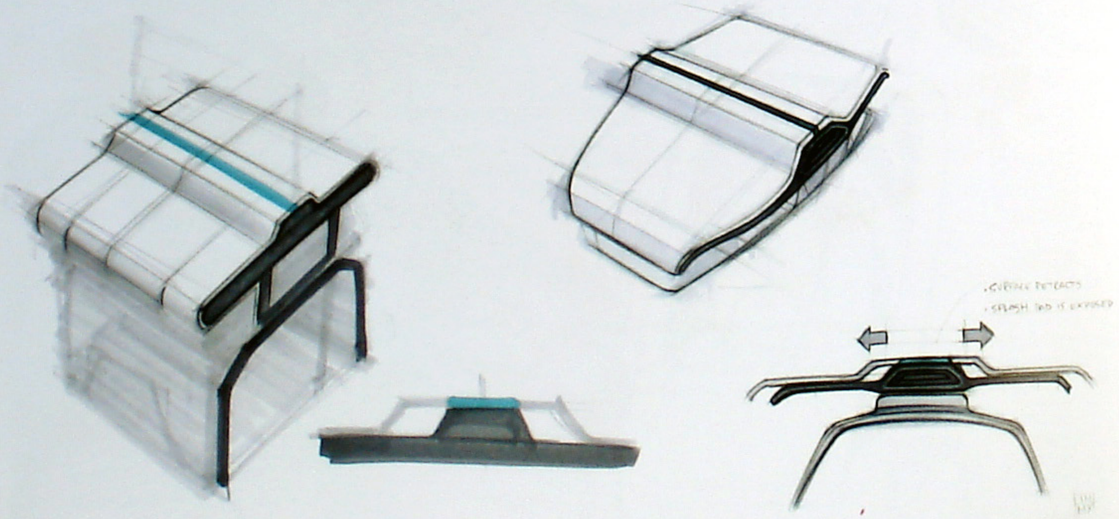
▲ **Communicator** The sketched presentation above was created in order to help explain these concepts to others. Using shaded boxes behind instead of around sketch segments creates a more dynamic yet still organized delivery. (Black and white soft pencils, marker)

▼ This page is filled with as many aspects of the design as could be shown on a single page, including diagrams, text, pictures and scenarios. (Black and white soft pencil, marker)

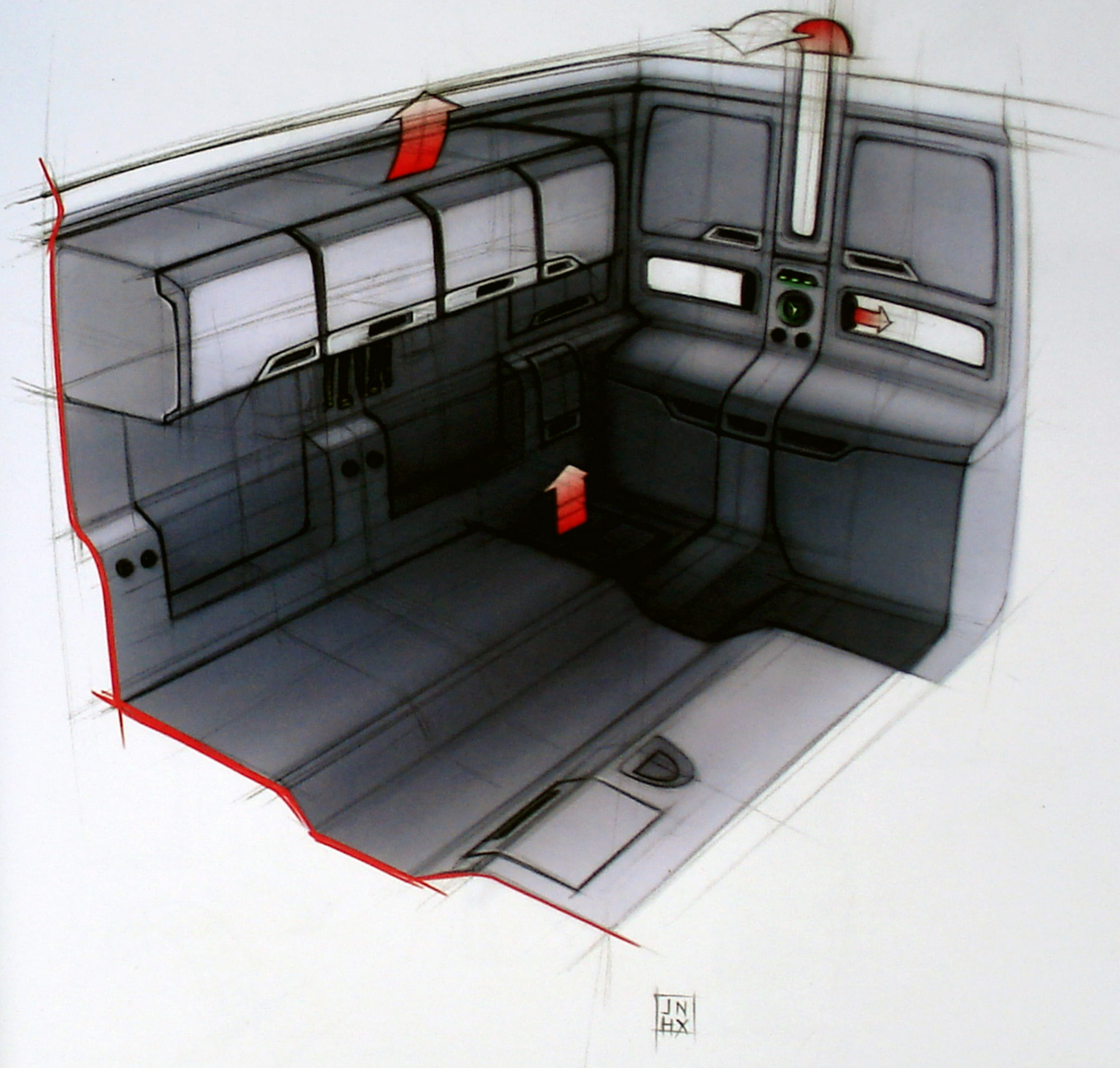


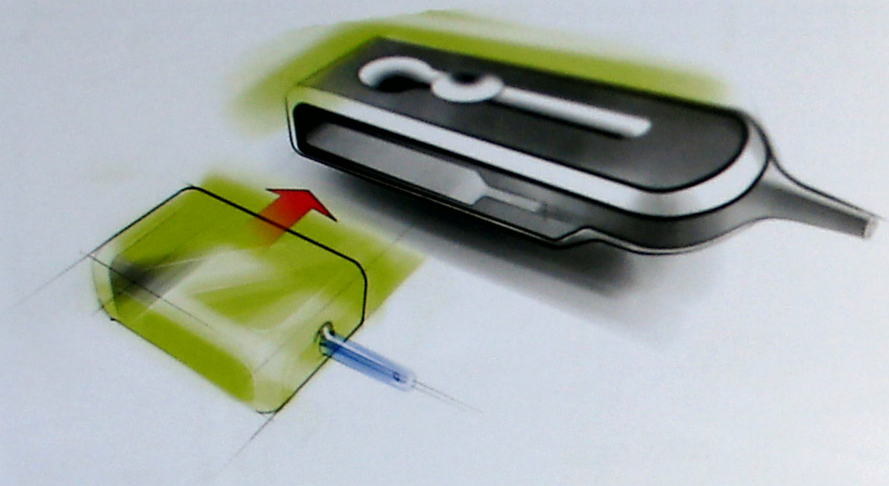


Furniture, Branding Project The addition of planar views gives extra explanation, making the concepts more readable.
The sketchy emotional look was achieved by first using cool grey marker to find the right perspectives and forms. Darker grey (8 or 9) marker areas suggest sections with a different material than that of the lighter ones. A black hard pencil was then used to further define the design and finally, a white soft pencil helped to create highlights. The electric blue details add impact to the sketch. (Black hard pencil, white soft pencil, marker)



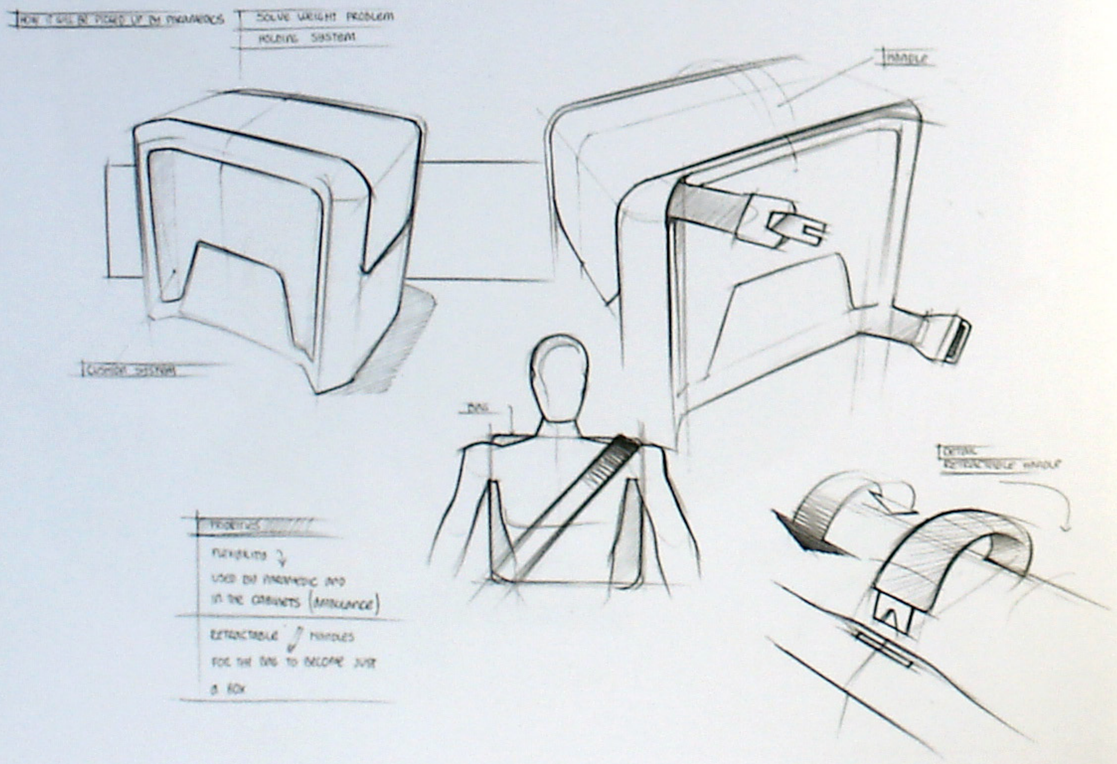
Ambulance Interior Using a bold red line in this manner is an effective way to depict a sectional cut-through.
To make the interior shapes easier to read, the dark part lines have been exaggerated by drawing fine white highlights on either side of them.
Translucent green areas have been applied around parts that light up, illustrating light being reflected on the surrounding surfaces. (Black hard pencil, Painter)

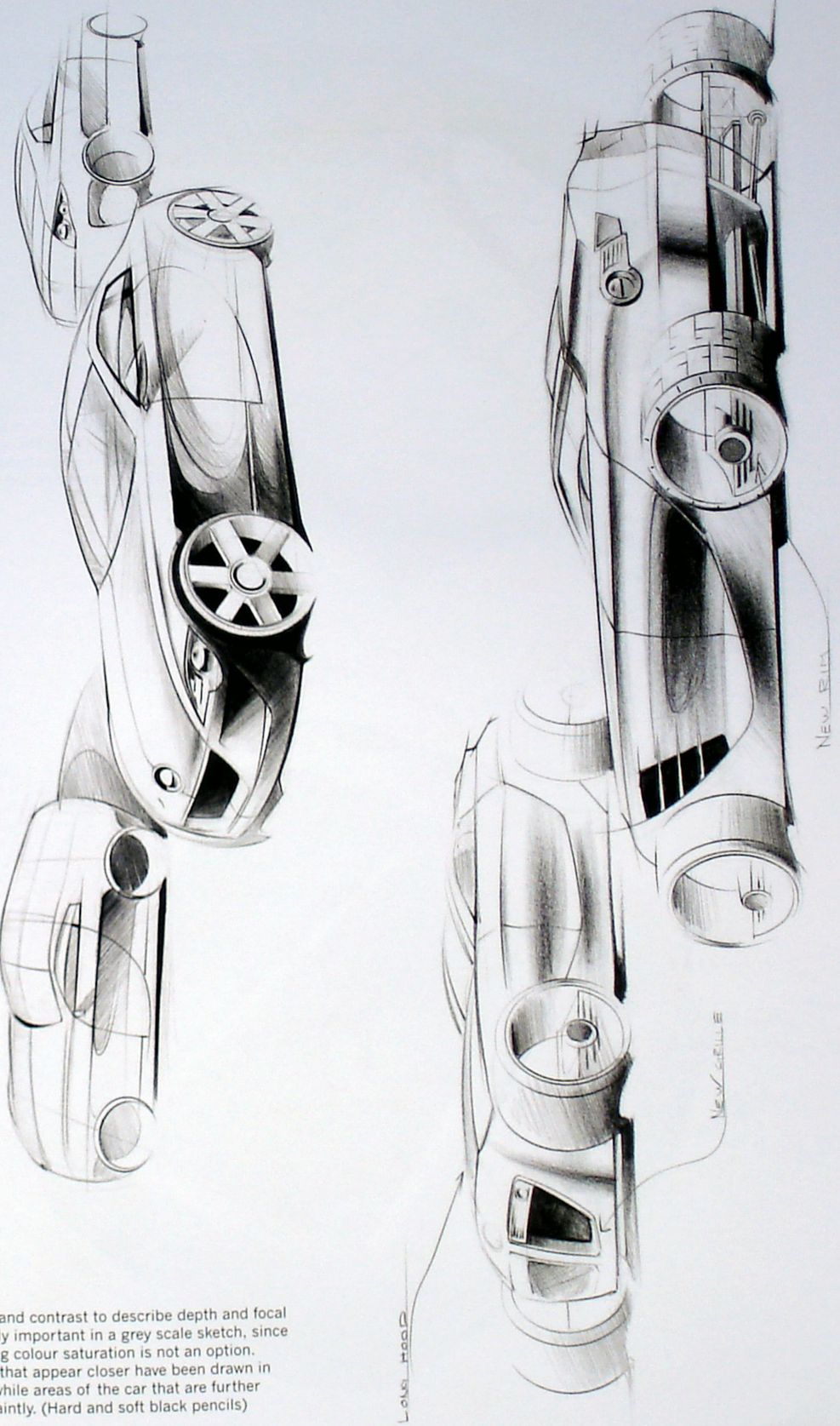




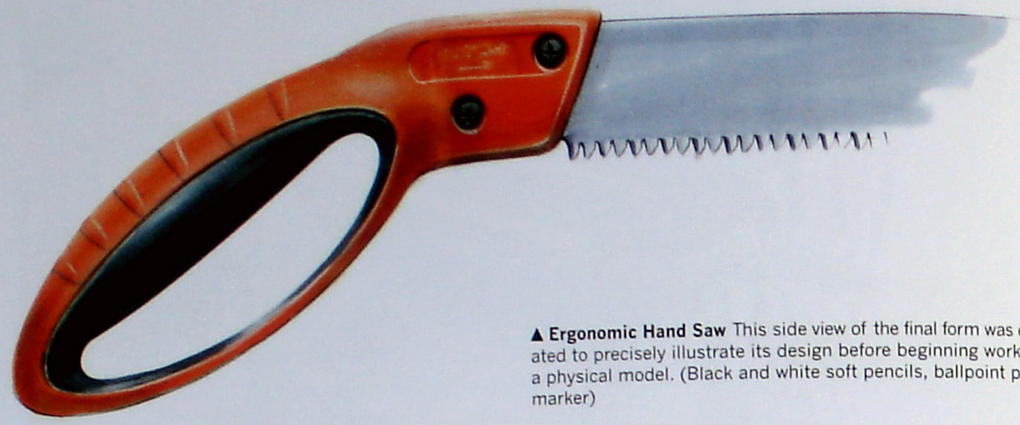
▲ **Injector, Ambulance Project** This concept sketch was drawn at an early stage in the design project. Knowing the sketch would be used later in a presentation, the details were made relatively clear. (Photoshop)

▼ **Storage System, Ambulance Project** This quick sketch below describes the use of a backpack. Complementary information is simply noted in a short written list. (Black hard pencil)



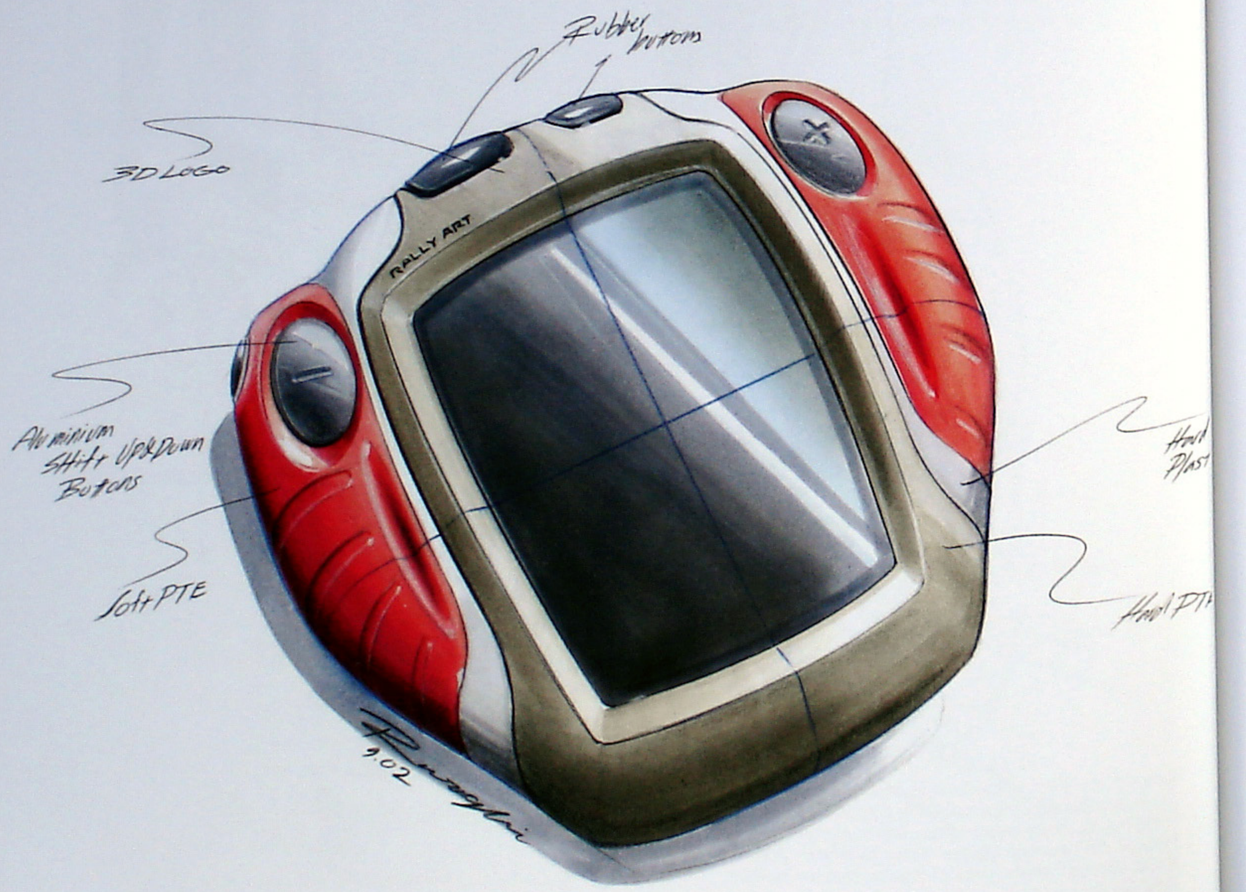


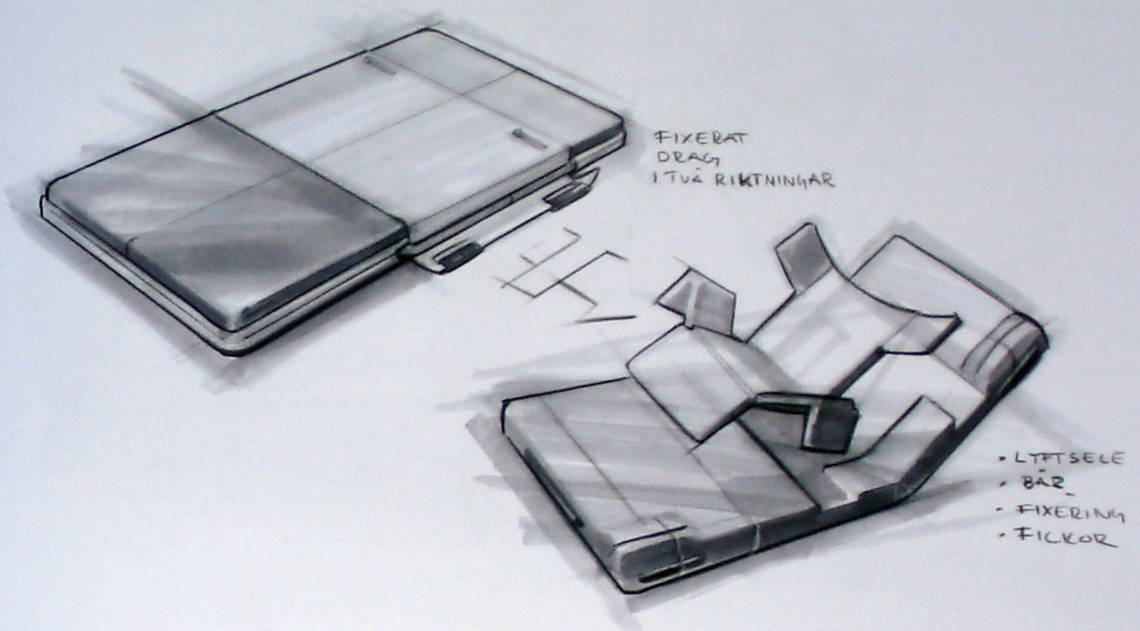
Cars Using value and contrast to describe depth and focal points is especially important in a grey scale sketch, since doing this by using colour saturation is not an option. Parts of the cars that appear closer have been drawn in higher contrast, while areas of the car that are further away are drawn faintly. (Hard and soft black pencils)



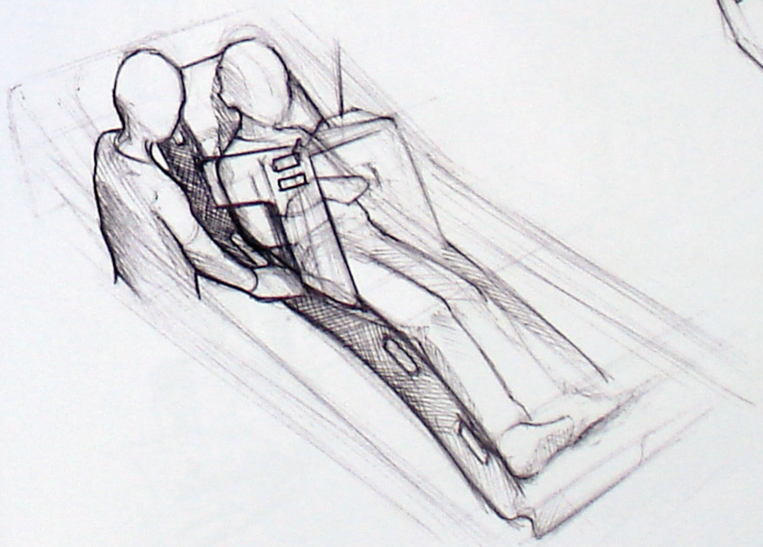
▲ **Ergonomic Hand Saw** This side view of the final form was created to precisely illustrate its design before beginning work on a physical model. (Black and white soft pencils, ballpoint pen, marker)

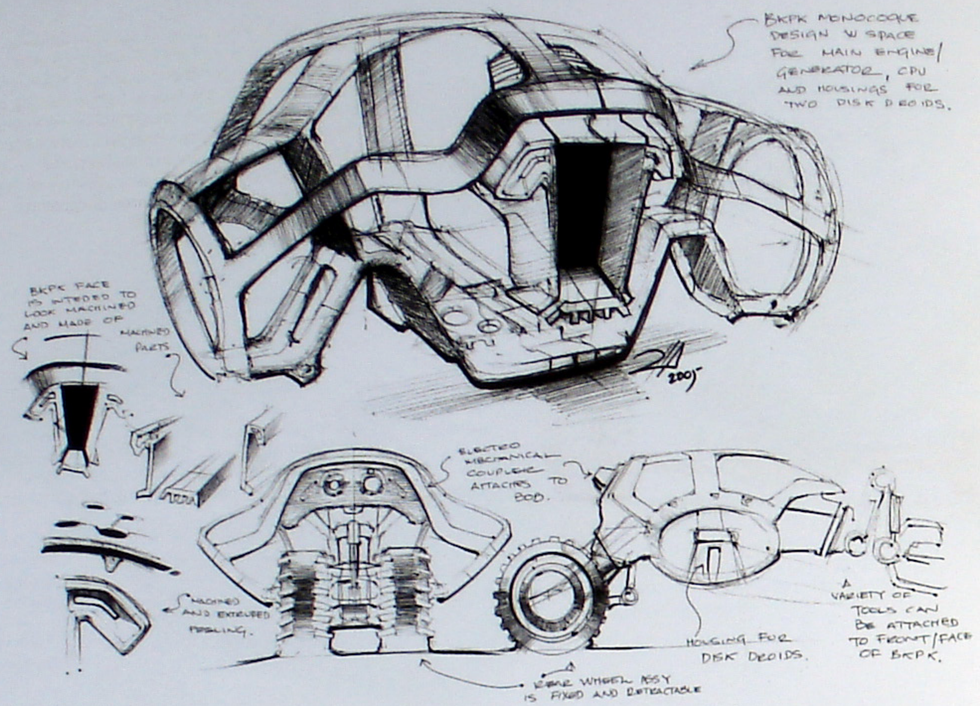
▼ **Map Reader for Rally Co-drivers** The concept below was drawn expressly for a non-designer and therefore is as detailed and full of explanation as possible. Even though the sketch is realistically rendered, cross-section lines were added to further explain the form. (Black hard pencil, black and white soft pencils, ballpoint pen, marker, pastel, gouache)



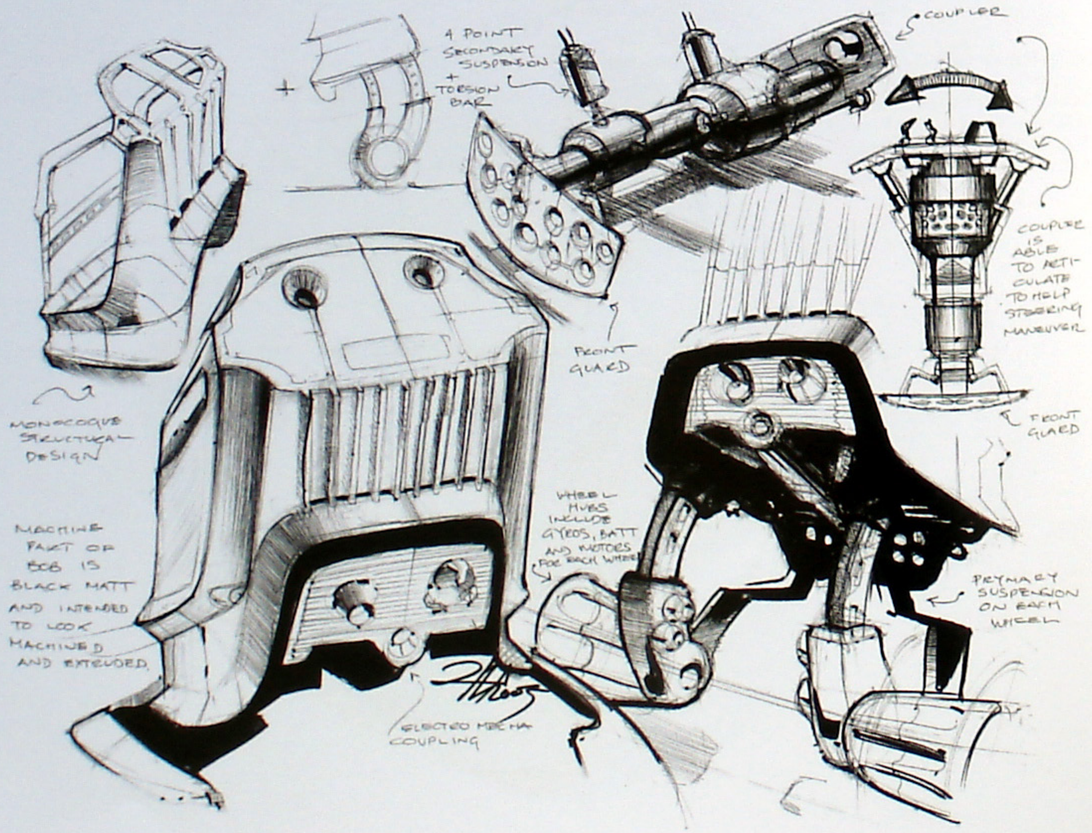


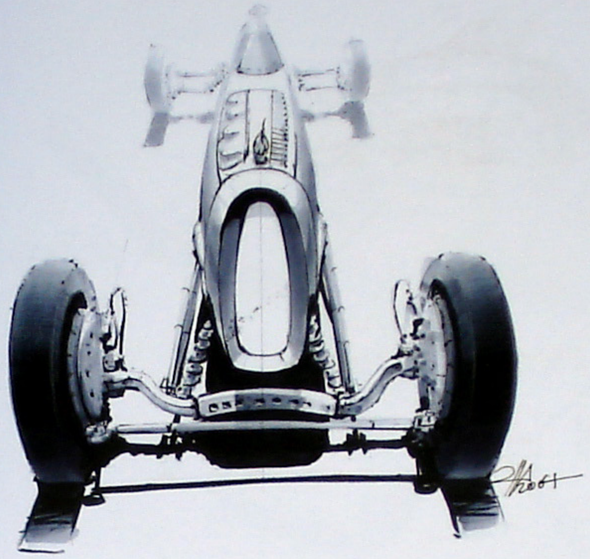
Bed for Elderly Care Full human figures, hands, heads or other body parts are often included in product sketching to demonstrate an object's scale or use. This designer advises that practising figure drawing with live models is a great way to improve your ability to draw the human form. (Hard black pencil, ballpoint pen, marker)





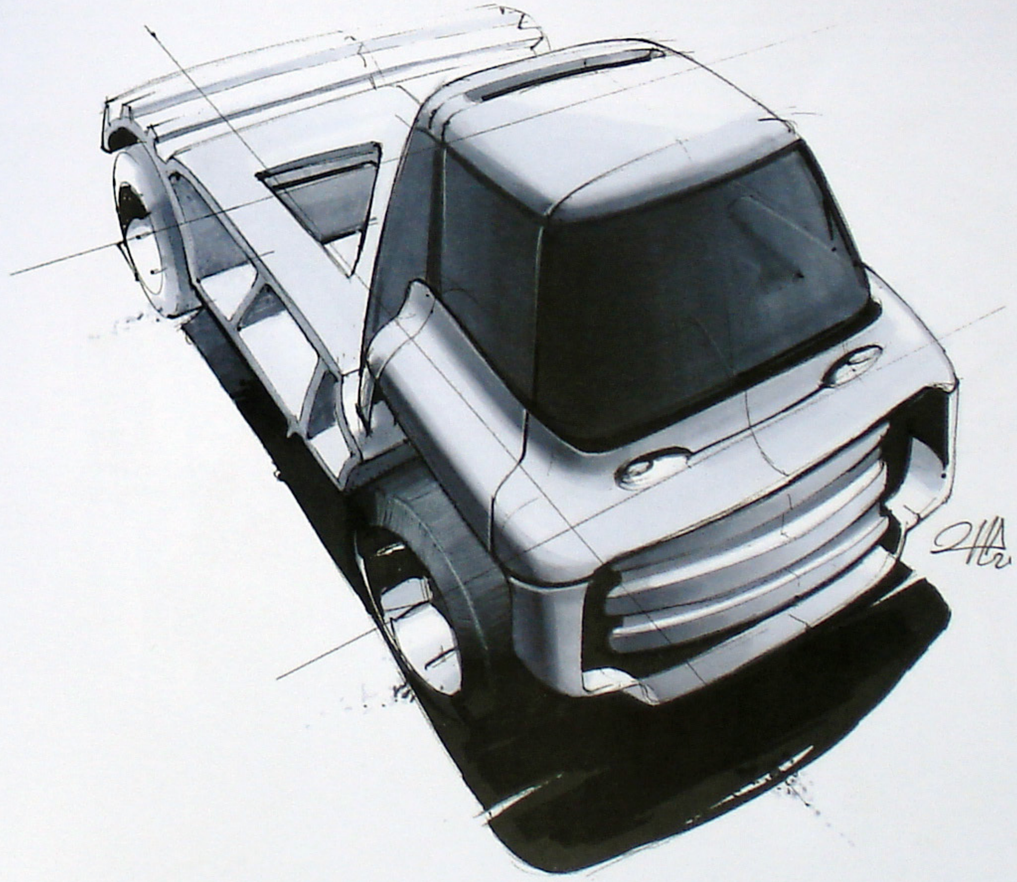
Toolbox Truck, Construction These sketches were created to be used in discussion with engineers. They primarily serve to define volumes that influence the basic shape of the design. The black marker was added to hide irrelevant aspects of the design, as well as to represent reflections or radii on surfaces. (Ballpoint pen, felt-tip pen, marker)

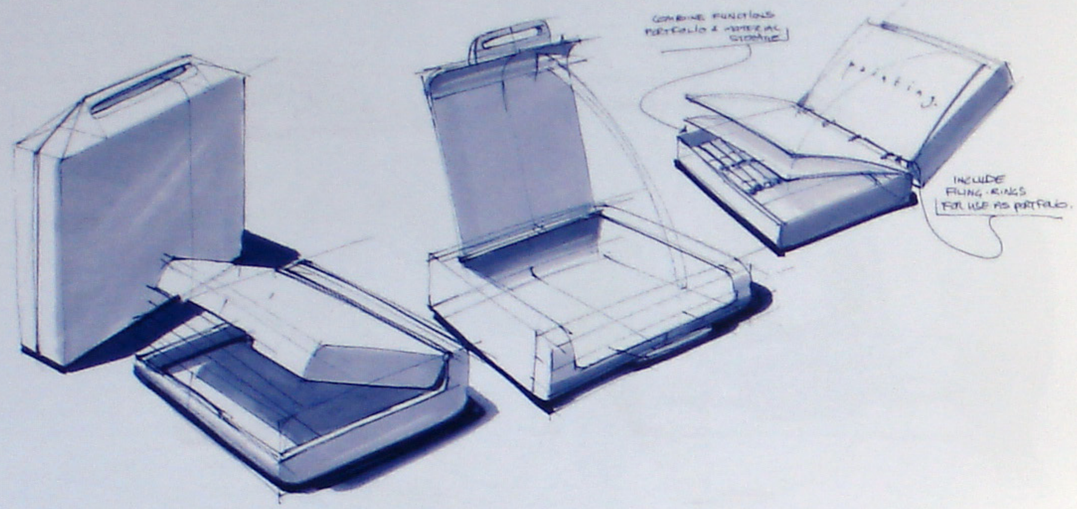




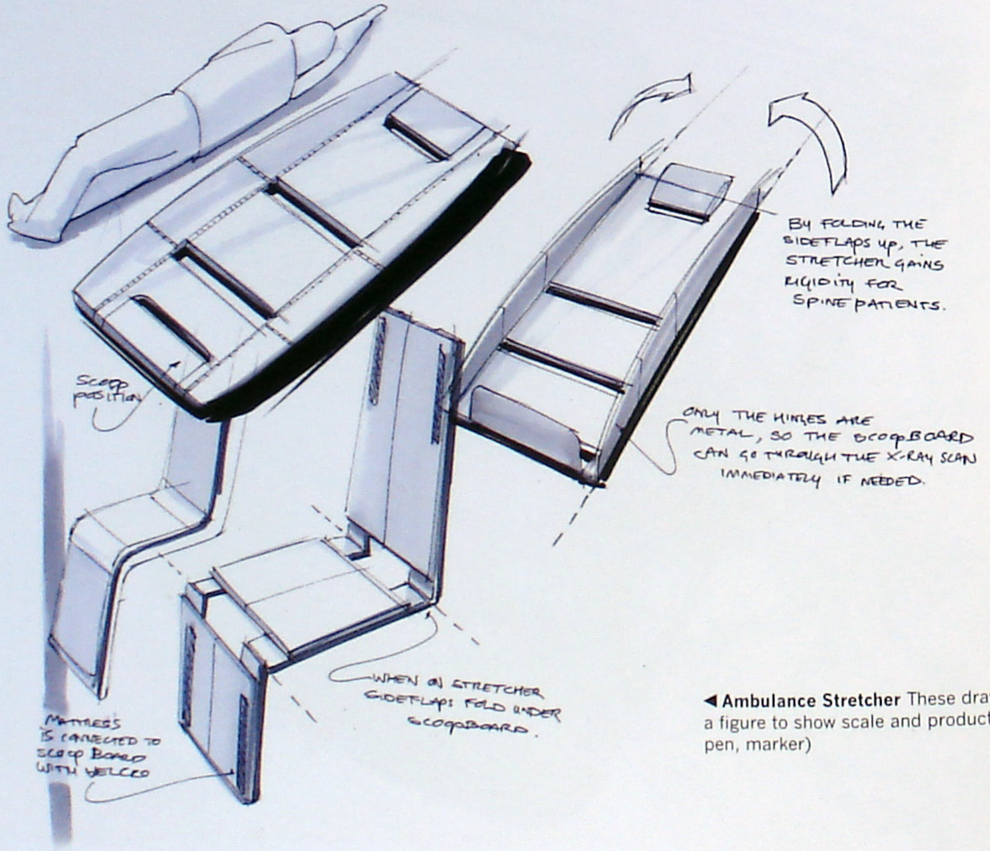
◀ **Car** For this one-point perspective drawing, a sketch of one side of the car was used as an underlay and then mirrored along its centre line to create symmetry. Notice the look of light reflecting onto the underside of the tyres. Including reflecting or 'bouncing' light is often forgotten, but its use often results in a much more expressive sketch.
These kinds of details are very effective at making tightly curved shapes feel three-dimensional, adding extra depth to a sketch. (Ballpoint pen, white soft pencil, felt-tip pen, marker)

▼ **Truck Inspired by Extrusion** The initial ballpoint pen line art of this sketch was scanned into Photoshop and printed out, to provide an underlay whose line art wouldn't smudge when subjected to application of marker. The lines were made fainter in Photoshop by adjusting the image opacity. Doing this gave the designer an opportunity to draw over the faint sketch lines to adjust the shape for further exploration. Because the initial sketch is saved digitally, it can be reprinted as often as needed to be used as an underlay for lighting and shape exploration.
The pleasing gradients were accomplished by keeping the paper wet, using first light then increasingly darker markers. The full grey scale was used, from white to black, to amplify the depth and appearance of the sketch. (Ballpoint pen, felt-tip pen, white soft pencil, marker, Photoshop)

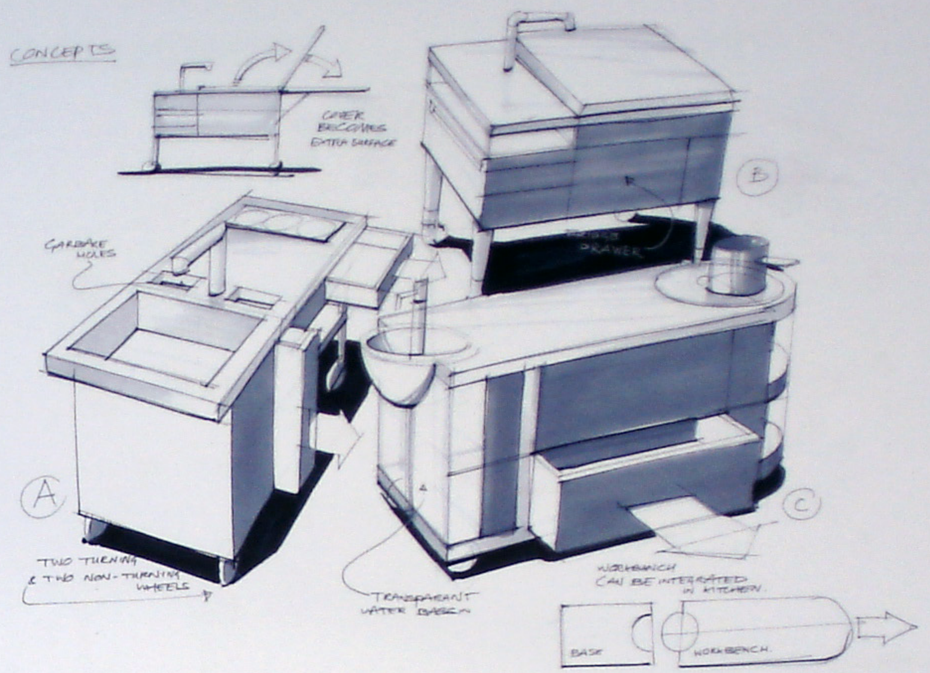




▲ Portfolio Suitcase This sketch shows a suitcase from several different angles in order to describe its functions and features. The designer would like to point out that overly complicated shadows (and reflections) are time-consuming to complete, and seldom improve the quality of a sketch more than simple shadows do. (Felt-tip pen, marker, Photoshop)

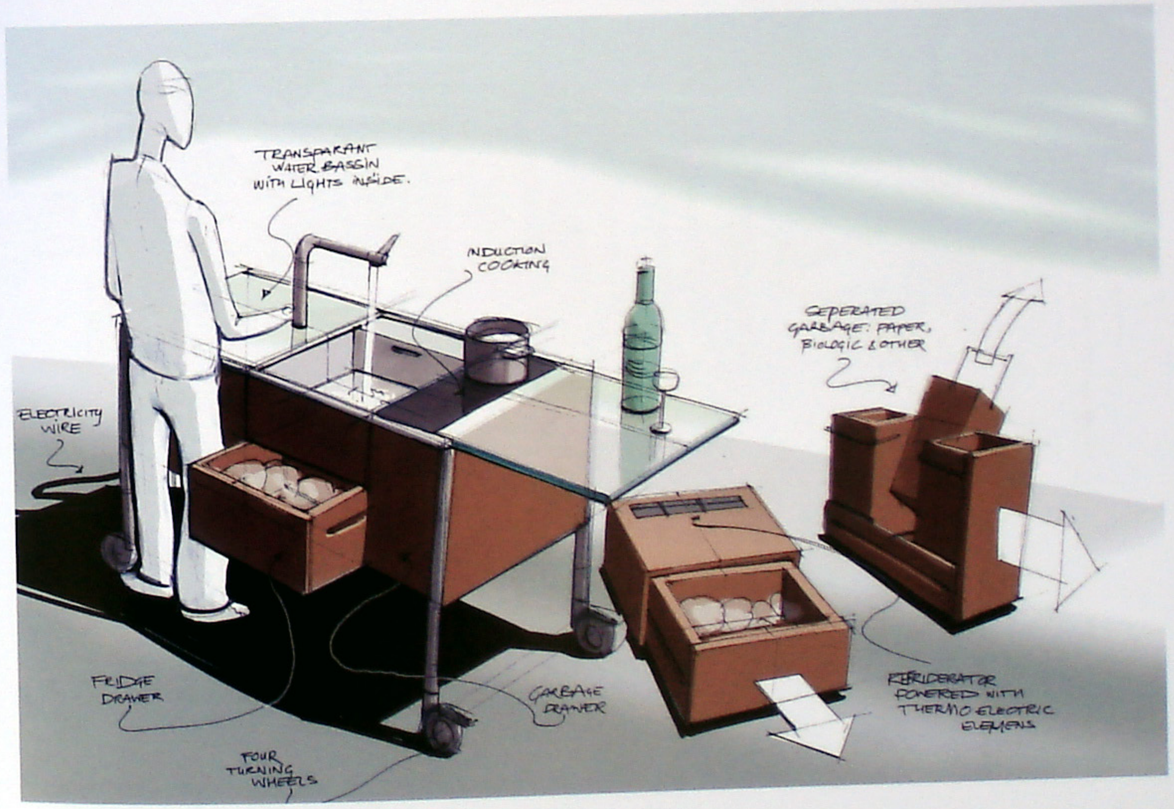


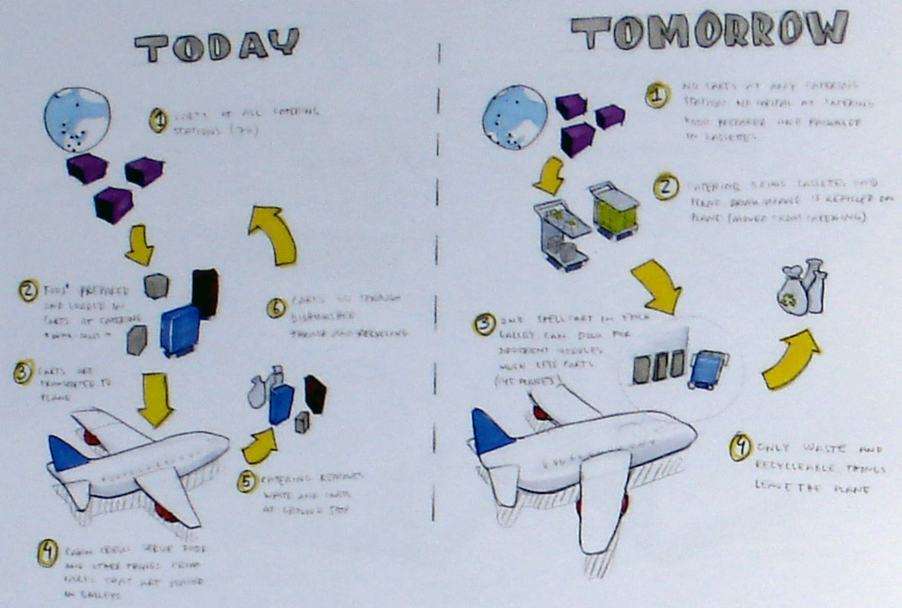
◀ Ambulance Stretcher These drawings include a figure to show scale and product use. (Felt-tip pen, marker)



▲ Kitchen Workbench Adding two-dimensional views can sometimes explain overall dimensions and proportions more effectively than perspective sketches alone. In the sketches above, arrows are used to indicate the functions of moving parts. (Felt-tip pen, marker, white soft pencil, Photoshop)

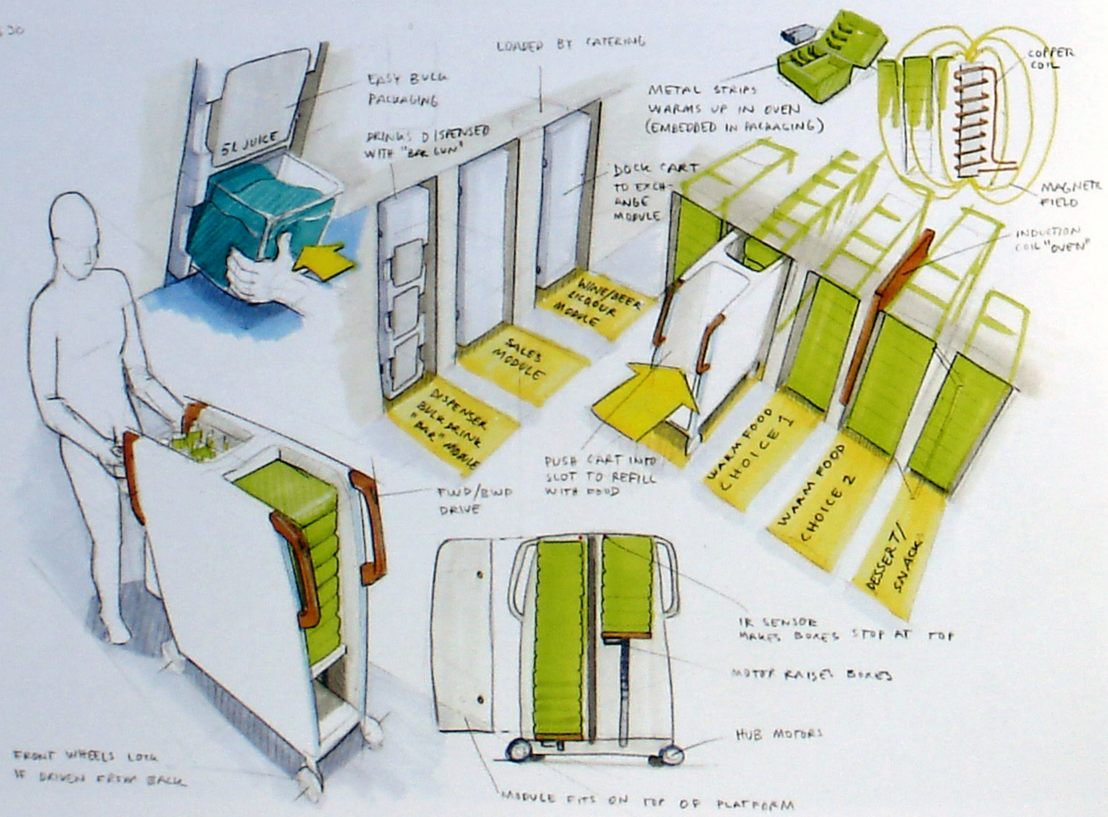
▼ A scanned monochrome sketch was coloured in (using Photoshop) to create this composition. Reflections and other lighting effects are easily added to dark backgrounds using digital media (see the reflections in the glass). In this case, an airbrush would have been needed to create a similar effect using analogue tools. This designer focused on creating an attractive balance in values, choosing low-contrast colours to avoid dividing the composition. (Felt-tip pen, marker, Photoshop)

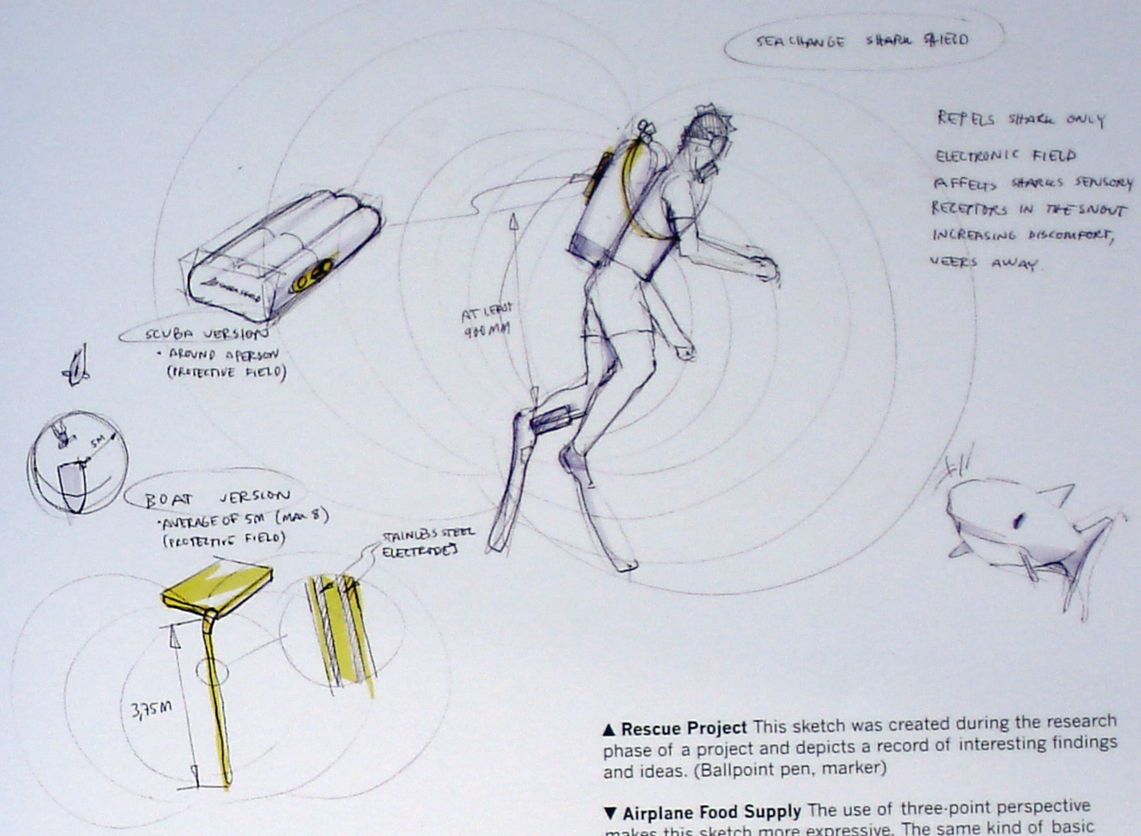




▲ **Airplane Food Supply System** The sketches above explain a concept by comparing a present-day scenario to the proposed idea. Using text together with key illustrations can be an informative method to use when explaining an idea, since it makes the presentation more interesting, understandable and memorable. (Black soft pencil, marker)

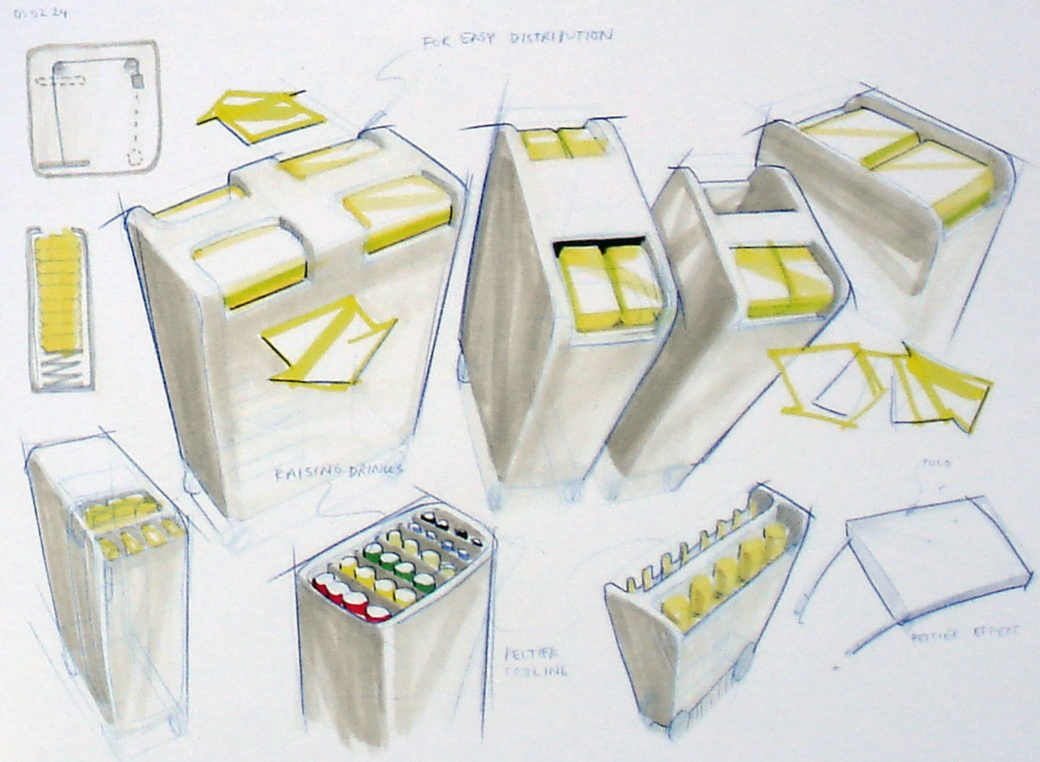
▼ **Airplane Food Supply** This sketch explains several technical details of a concept. Ruled lines were used to set the perspective. (Hard and soft black pencils, marker)





▲ **Rescue Project** This sketch was created during the research phase of a project and depicts a record of interesting findings and ideas. (Ballpoint pen, marker)

▼ **Airplane Food Supply** The use of three-point perspective makes this sketch more expressive. The same kind of basic lightning as described on page 15 was used to give the objects a three-dimensional feel. (Hard and soft blue pencils, marker)

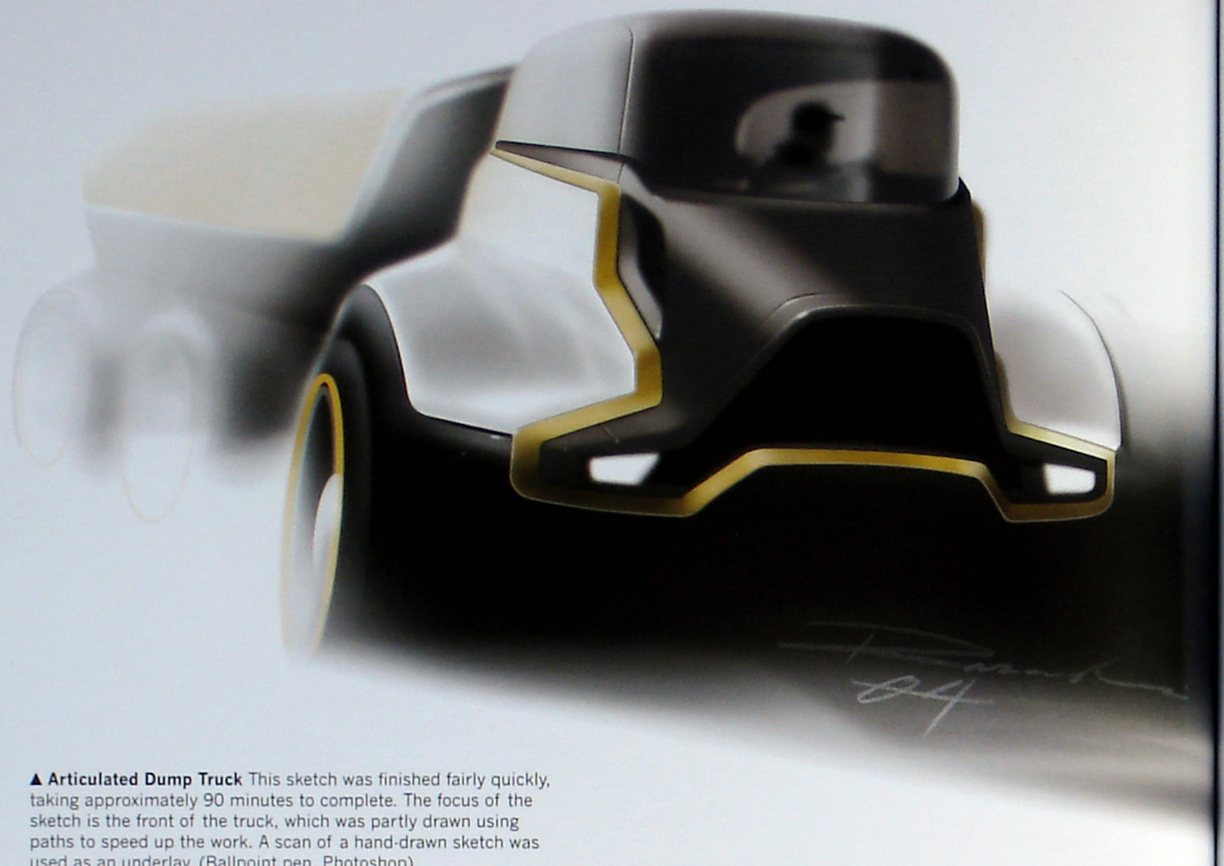


Persuasive Sketches

Persuasive sketches go further than explanatory ones – they not only explain the product, but are also drawn to influence the audience and to sell a design concept. In some cases, persuasive sketches are more intent on conveying a character or feeling than illustrating the physical product in detail. Many designers do not sketch the most time-consuming types of well-rendered illustrations, preferring to use 3D CAD programs for this purpose.
However, sketches are considered by many to have certain invaluable and exclusive characteristics, such as expression, picturesque qualities and artistic flair, which can be difficult to achieve in 3D renderings.

Solar Cell Back Pack Photoshop shading was used over pencil line art to create this moody rendering, which was developed to sell a concept to an audience of non-designers. Using the paths tool in Photoshop allows for the creation of exact lines, which are first defined with a vector line and can then be used for masking, drawing a line using brush strokes, etc. Some lines in this sketch were sharpened using stroked paths. (Black soft pencil, Photoshop)

Goggles The transparency of the coloured glass is emphasized by drawing the goggle straps vaguely, to show them lying behind the glass. The appearance of a floral texture on the leather was created using a Photoshop texture brush. The designer chose to use a print of roses as brush texture to enhance the illusion of leather and to add a 'rock'n'roll' quality to the goggles.
The technique used to create these sketches can be found in the tutorial on page 96-97. (Black hard pencil, Painter)



▲ Articulated Dump Truck This sketch was finished fairly quickly, taking approximately 90 minutes to complete. The focus of the sketch is the front of the truck, which was partly drawn using paths to speed up the work. A scan of a hand-drawn sketch was used as an underlay. (Ballpoint pen, Photoshop)

▼ This quick method of rendering, using a monochromatic colour scheme, effectively conveys a mood to the viewer. The rendering was created by first laying out a large mid-tone colour surface to work on, using marker refill and a pad. To this coloured area, lighter and darker tones were applied to create the impressions of light and shadow.

To create sharp highlights at this point (for bright windows etc.), the designer suggests that you cut the desired highlighted areas out and place the rendering over a fresh white sheet of paper. (Blue, black and white soft pencils, marker, marker refill, ellipse guides)

Vehicle, Form Project The purpose of this final rendering was to display the design with maximum clarity. Pastels were used to quickly render a smooth sky reflection (see the white part of the vehicle). Templates were used to generate the sharpest lines possible.
Notice where the wheels meet the ground and how they appear to 'melt' together. This trick of the trade is frequently seen in transportation drawings. (Black and white soft pencils, marker, pastels, gouache, ellipse guides)

Electric Hand Saw These two design proposals were quickly rendered for presentation. Line art was first scanned and imported to Photoshop where large brush strokes were added to create wide fields of value and colour. Each sketch took about two hours to complete. (Black hard pencil, Photoshop)

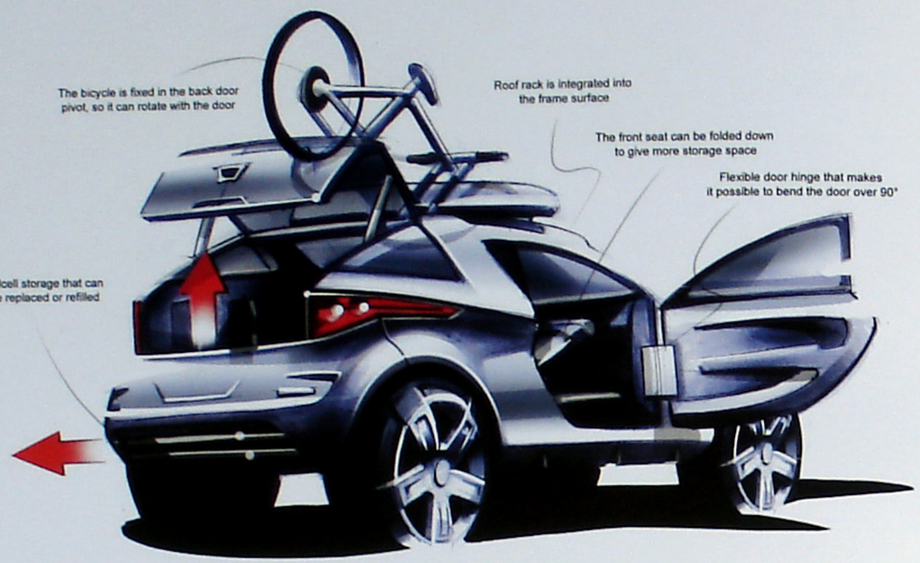
▶ **Toolbox Truck** This complex rendering was created in several steps using many underlay. First, a rough sketch was drawn and used as an underlay to create a more refined sketch. That refined sketch was in turn used as an underlay for an even further detailed and defined sketch and so on. When the design was finally established, a final pencil sketch was drawn, scanned and imported into Photoshop. Sections were further defined using paths and filling them with one colour. Shading and highlights were created using the *airbrush* and *dodge* tools, at low opacity. This process gradually built up the sketch with layers of warm and cool shades. (Black hard pencil, Photoshop)

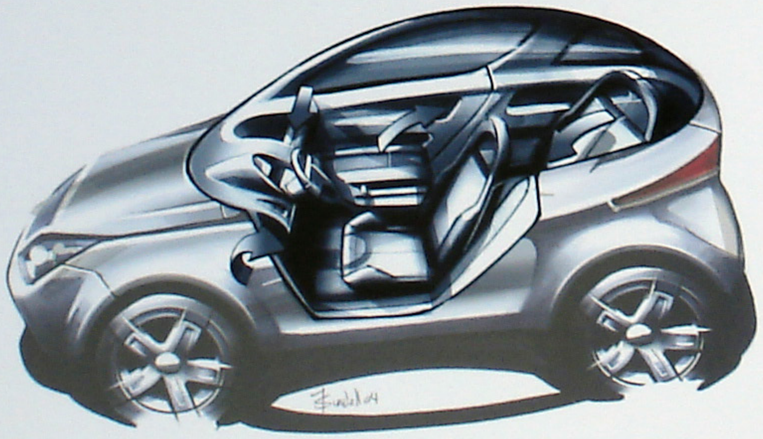
▼ This experimental sketch shows an independent part of the truck in a more expressive way than in the sketch above, by conveying a sense of drama and speed. A few paths were used (see the wheels) and a rough-edged Photoshop brush was employed to create a sketchier and less rigid look.
A tip from the designer: this rough-edged brush can also be used on more defined renderings like the one above, to make them look looser and more 'sketchy'. (Black hard pencil, Photoshop)

▲ **Fuel Cell Car** This rendering took about one full working day to complete (a working day exceeding 8 hours...). The sketch was first rendered roughly using Painter, creating an effect similar to that of the lowest placed rendering on the previous page, followed by gradually development and refinement. (Photoshop, Painter)

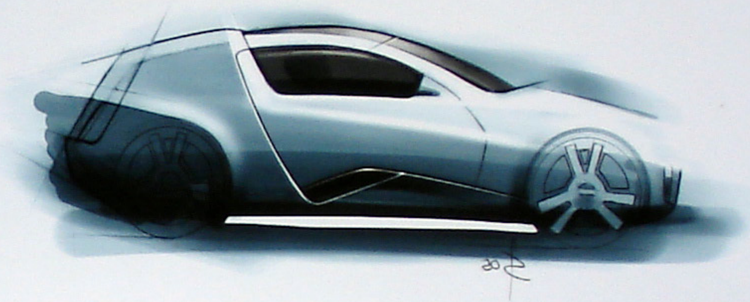
▼ Shown here is a rendering where an image of a 3D model was used as an underlay. The designer commented that in order to create a rendering like this one, it is necessary to understand the art of depicting reflections. Rendering skills can be improved by paying attention to and trying to reproduce the effects of light on the different materials and surfaces that surround you. Another tip is to copy photos or imitate other designers' styles to improve your own skills. (Photoshop, Painter)

This is another example of a sketch created by mirroring half of an accurately drawn car around its central plane (see page 67). With the complete symmetric body of the car in place, shadows and reflections were added. Realistic cast shadows were created by copying and offsetting the contour of the vehicle onto a background derived from a photograph. The form was inspired by a lion's skull, shown here in a playful manner near the front of the car.
This designer's preferred style of rendering is loose and 'sketchy'. Even on renderings from 3D models, Photoshop is used to achieve a human touch and some looseness.
A comment from the designer is that ideation and concept development are the most important aspects of a design project. Therefore, this type of rendering should only be started when you are satisfied with a complete and final design. (Photoshop, Painter)





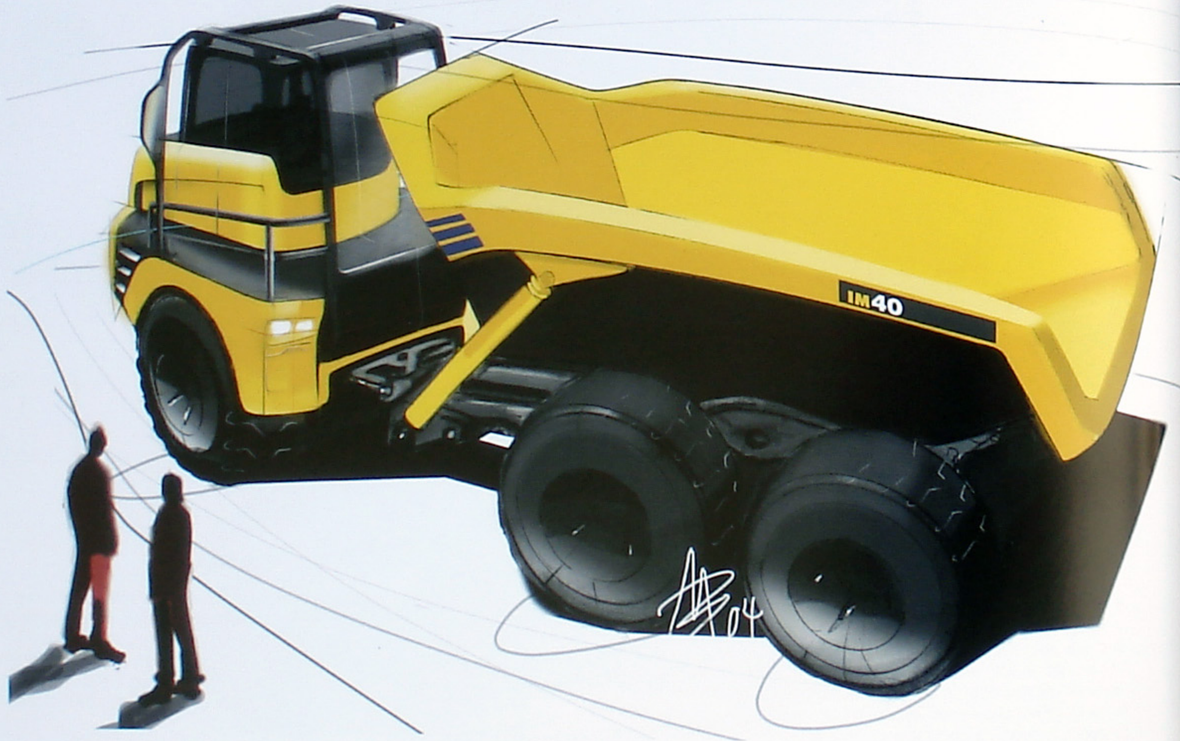
◀ **Mini SUV** These are three of many renderings drawn from different perspectives in order to explain all aspects of the Mini SUV design. The sketch that shows the vehicle fully open is drawn from a perspective that allows as much information as possible to be displayed in one image. Basic sketches in ballpoint pen and grey marker were imported to Photoshop for colouring. Photoshop tools were used instead of pastels to create gradients and to render highlights and fine details. (Ballpoint pen, marker, Photoshop)



▲ **Sports Coupe** These concepts were presented mid-way through a design project. They describe the form without excessive detail and are appropriate to show at this stage in development, where the design is still not set. It is important to keep sketches at a level where the details are not too highly defined, or the audience or client may be prematurely led to believe that the finished product will look a certain way. This could restrict the designer's freedom to explore form when proceeding with the design process.

A large Photoshop brush was used to create the coloured fields, while a white brush was used to erase some of the image, adding contrast and highlights – a trick that cannot be done using markers. The greatest difference in contrast was given to the elements considered most important to show here; the rear lights.
About one 'working day' was spent completing three sketches on this level. (Ballpoint pen, Photoshop)

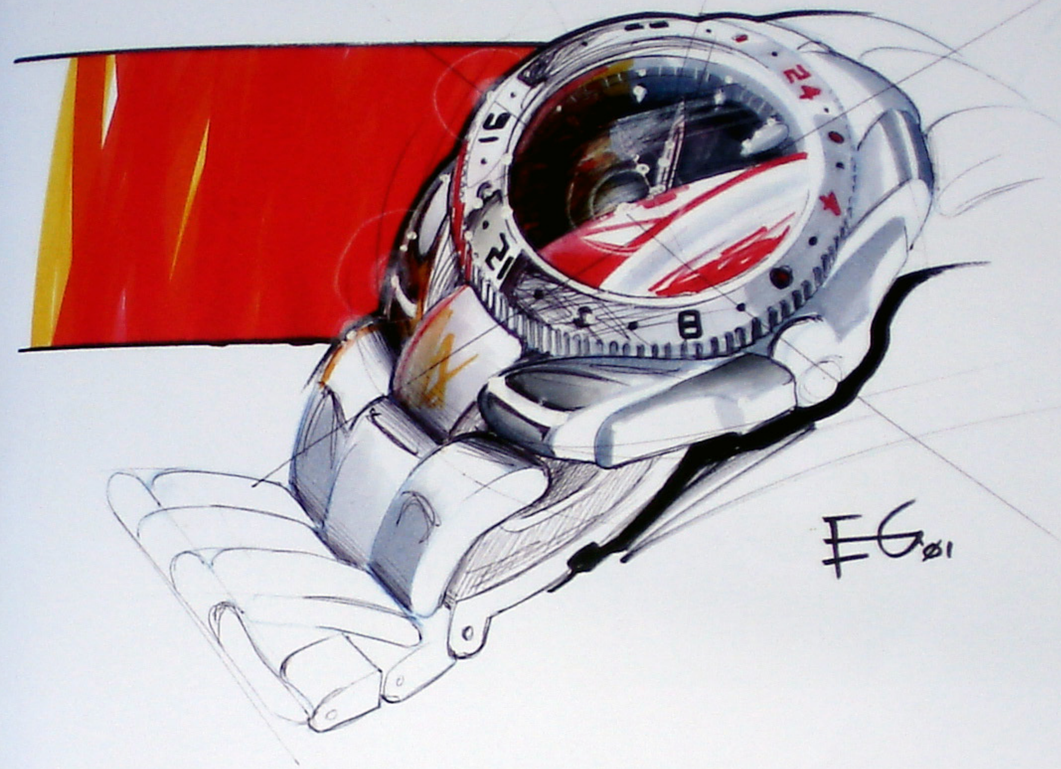
Articulated Dump Truck Quick, simple lines provide a hint of environment but are kept faint enough to not divert attention from the vehicle. Some of the sketched lines pass slightly beyond the contours of the vehicle, making the sketch more lively. (Black hard pencil, marker, ellipse guides, Photoshop)



Rally Truck, Teasers The main purpose of these teasers was to show different possible outcomes of a project to a sponsor. The sketches were initially intended to focus on the trucks' mood and expression, with very vague forms and explorations of a few isolated parts. However, due to inspiration, the designer brought the teaser sketches to a much higher level of definition. Highlights and lowlights were used at an early stage to sculpt shapes and find a desirable expression. The dramatic look was achieved by placing the light sources at either end of and slightly behind the object, creating a dark core shadow on the edge closest to the observer. (Ballpoint pen, Photoshop)

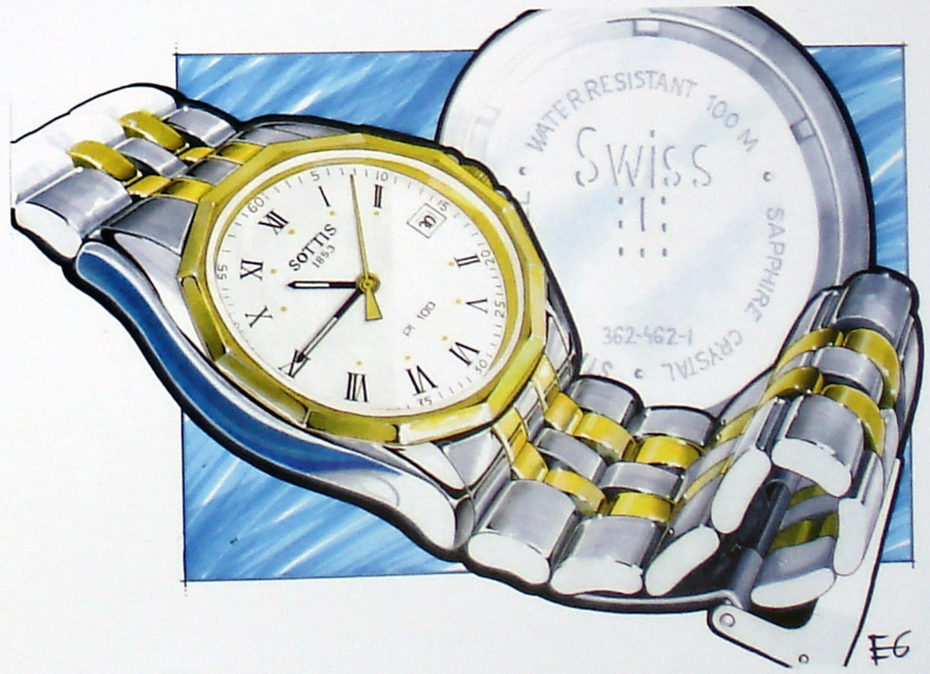
▲ **Post Delivery Vehicle** The vaguely indicated shapes of buildings in the background of this sketch are enough to imply that the vehicle is in an urban setting. (Black hard pencil, Photoshop)

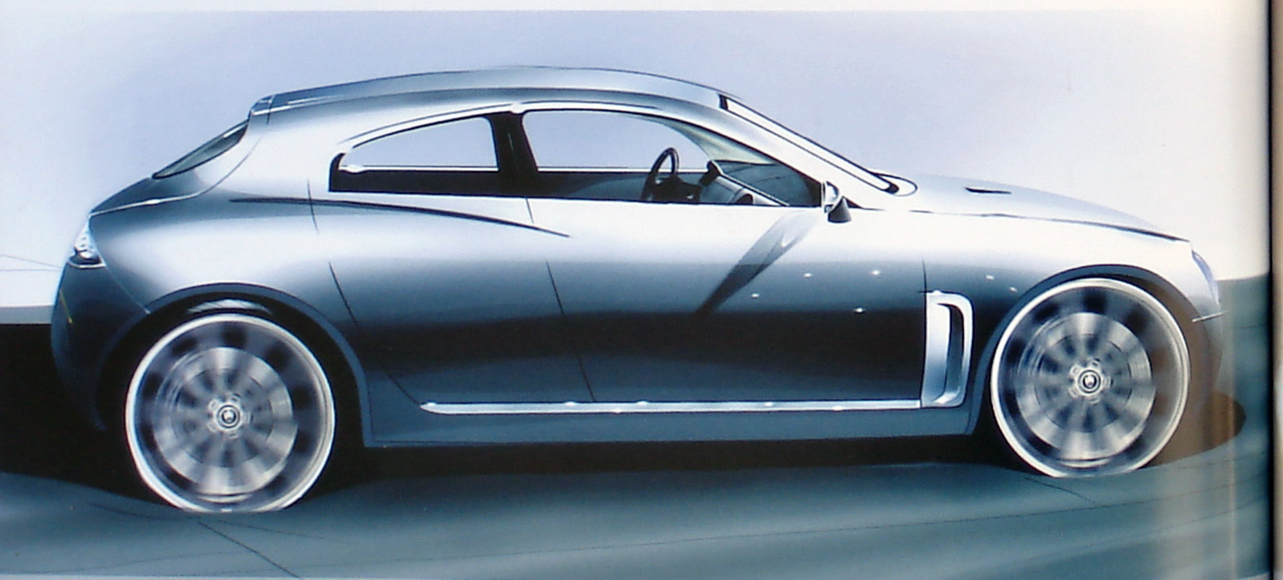
▲ Here, a loose and exaggerated fish-eye perspective is used to imply movement while still persuasively conveying the vehicle's form. The designer's advice here is that since vehicles are made for motion, they should be given a more dynamic sketch treatment than static products. (Black hard pencil, Photoshop)



▲ **Wrist Watch, Rendering** The perspective lines were added as a final touch to make this free-hand sketch look more relaxed. The line weight is varied, with the heaviest lines used to contour the shape and make the watch stand out from the page. (Blue hard pencil, white soft pencil, ballpoint pen, marker, gouache, ellipse guides)

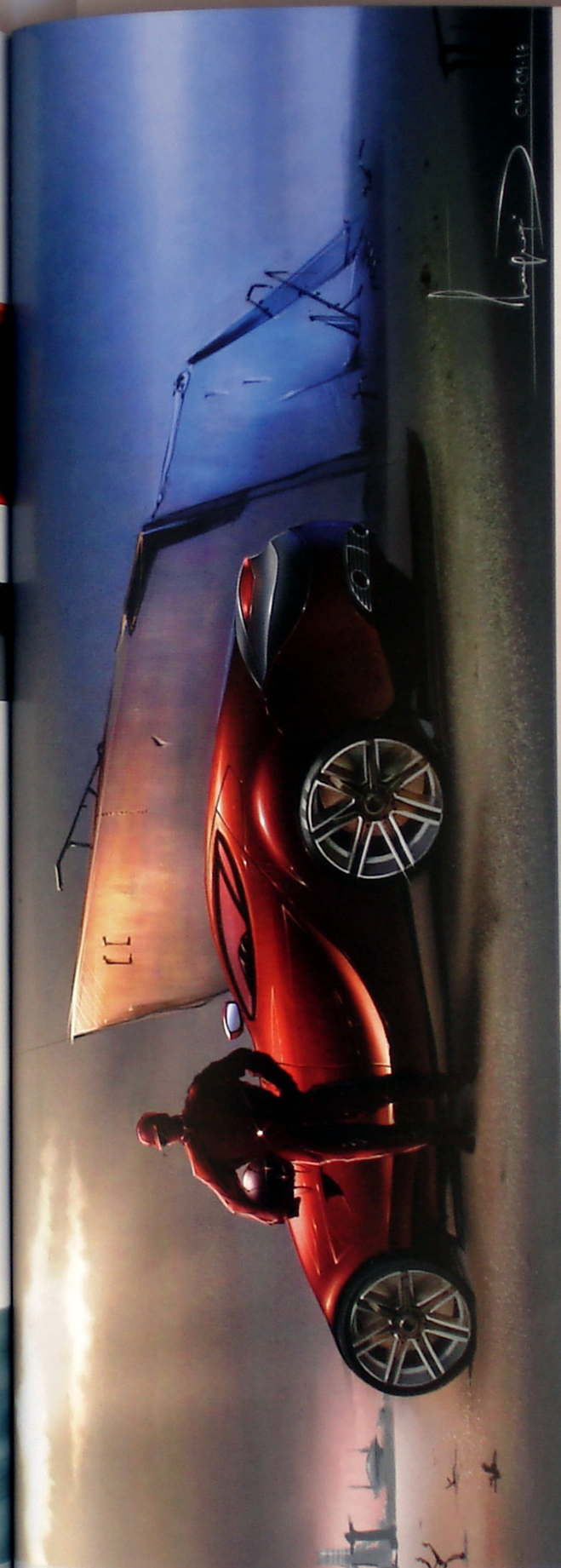
▼ The sides of the links in the watch band below were given a metallic feel by adding marker to the back of the paper and by using plenty of gouache to illustrate shine and reflection. A sketched underlay was used to give the rendering a clean appearance, with no visible perspective/guide lines. (Black soft pencil, felt-tip pen, marker, gouache, ellipse guides)





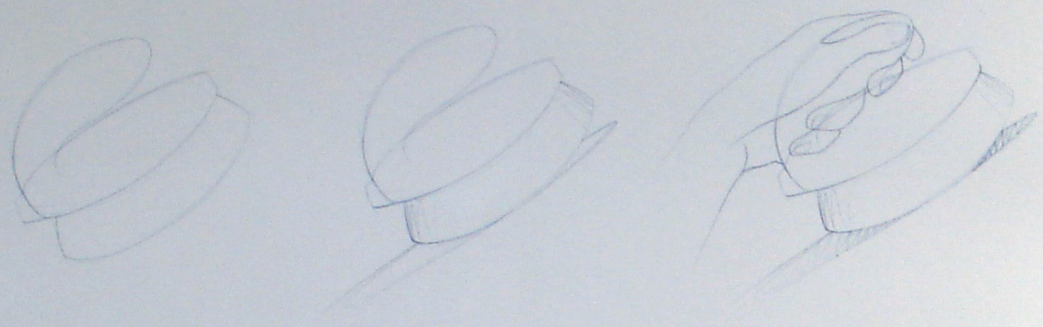
Cars, Rendering Study All four cars on these pages were created expressly to capture a mood and to show texture and lighting. One tip from the designer is to first paint the scene as matte, with only ambient light. Afterwards, light sources can be gradually 'turned on' by building layers of painted reflections of light. By beginning with a matte appearance, shadows will not have to be applied as they will occur naturally in areas not painted as lit.

A second suggestion is to use reference pictures from catalogues, magazines etc. for inspiration, in order to establish a colour scheme and render components accurately. This will help to more precisely express texture, thereby conveying the true feeling of a design. Thirdly, decide on the purpose and mood of a sketch as early as possible, so that you have a goal to work towards. (Photoshop, Painter)



Step-by-step Tutorials

This chapter shows the working sequence of the creation of six design sketches. The sketches shown vary in levels of complexity, and highlight some of the most commonly used media and techniques.
The main purposes of this section are to illustrate how each sketch is created, and to break down a seemingly intimidating and complex sketch into steps that are more easily understood. There are often several ways to achieve the same effects, so consider the steps shown in these tutorials merely as options or examples.



Eric Gunnarsson, Dish Brush

(Hard and soft blue pencils, marker)

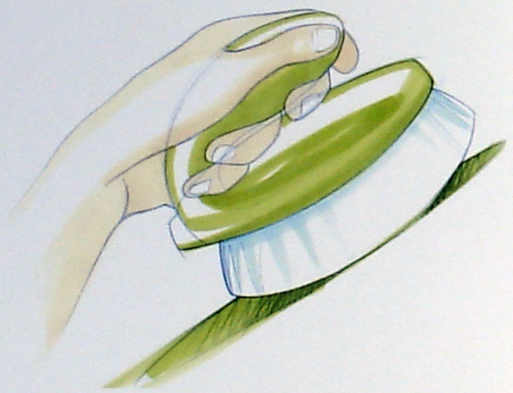
1 The sketch was started off using a hard indigo blue pencil.

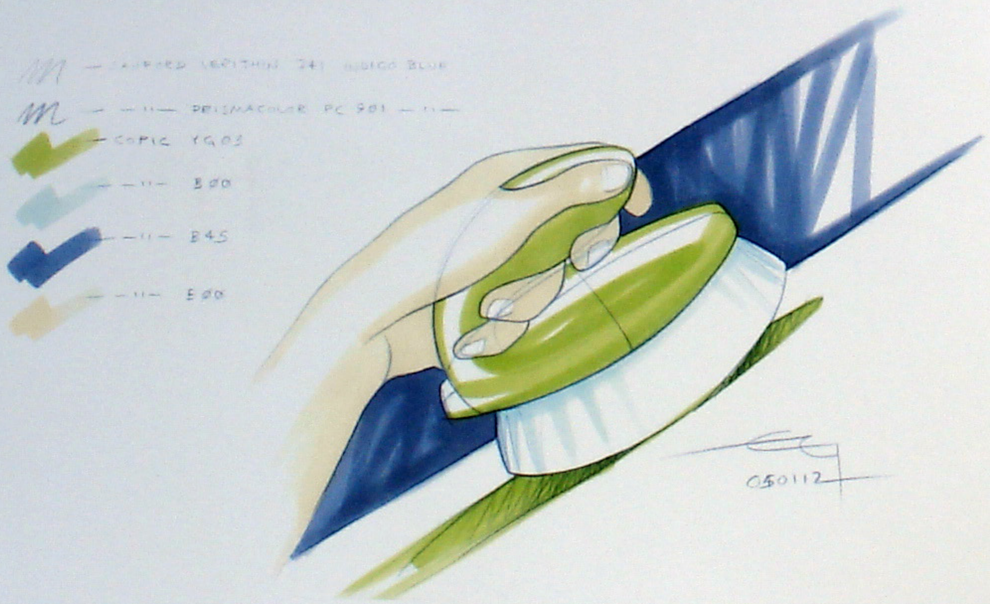
2 More pencil lines began to define the bristles of the brush. The contour of a cast shadow was drawn, thereby revealing the direction of the light source.

3 The addition of a hand showed how the product is supposed to be held, and also assured that the form and proportions of the handle were accurately drawn.

4 Different coloured markers defined different materials and expressd form through shading. Note that the surfaces are not saturated with colour but have sections left white to indicate areas of light reflection.

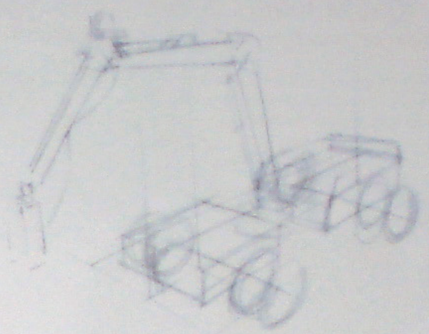
5 A simple contrasting background block lifts the drawing off the page. A signature and date completed the sketch.





Pontus Unger, Forest Harvester Robot

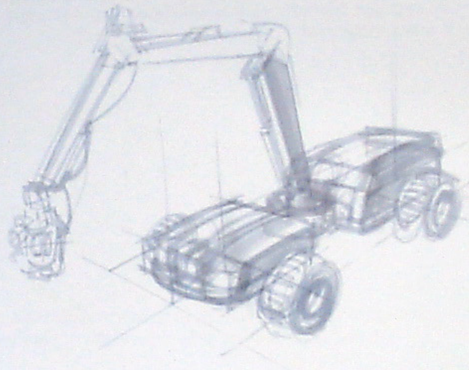
(Marker, black and white soft pencils, felt tip pen)

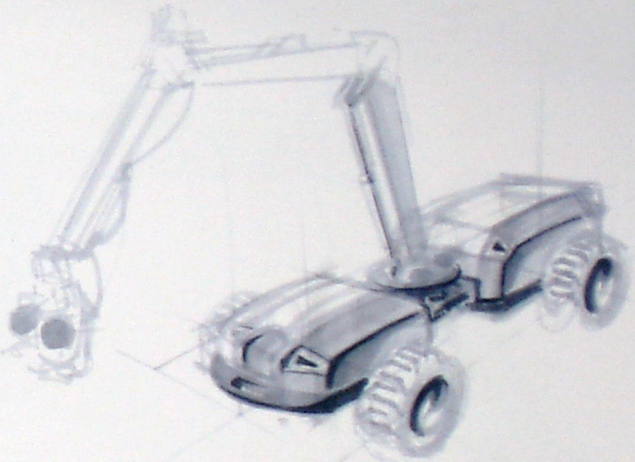


1 The sketch was begun by drawing basic perspective lines with a light grey marker.

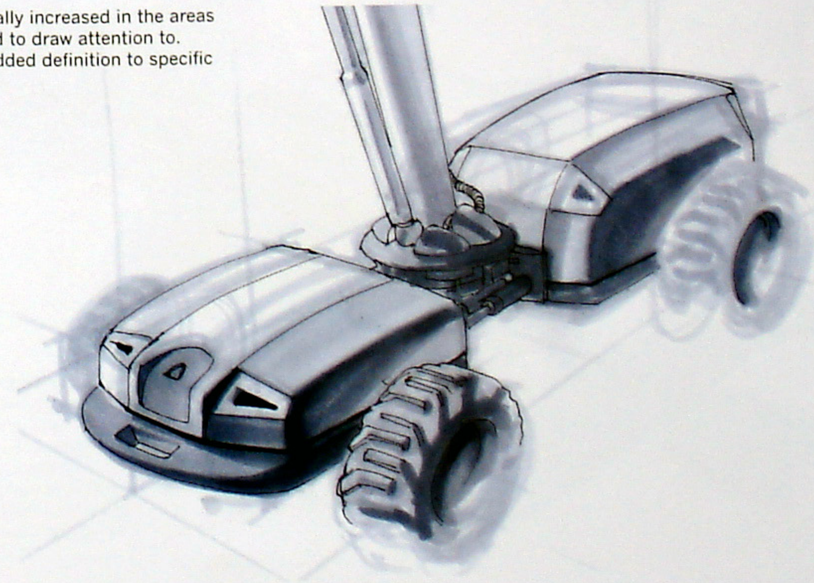
2 Cuboids with centre lines defined the volumes that would eventually make up the object.

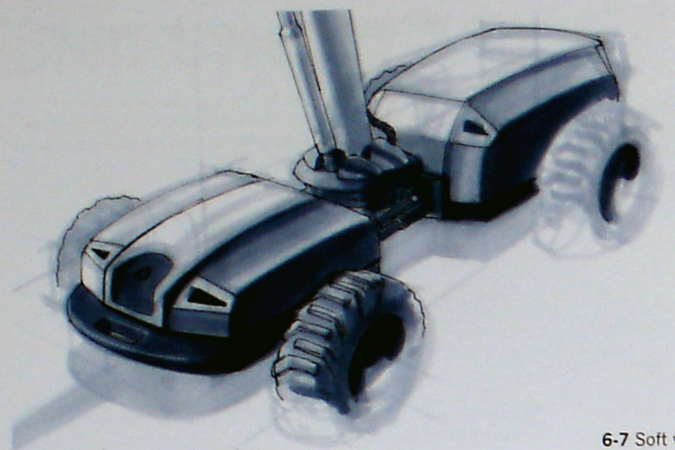
3 A number 2 cool grey marker was used to experimentally work towards the desired form. Alternately drawing on the left and right sides of the centre line helped to keep proper proportions.



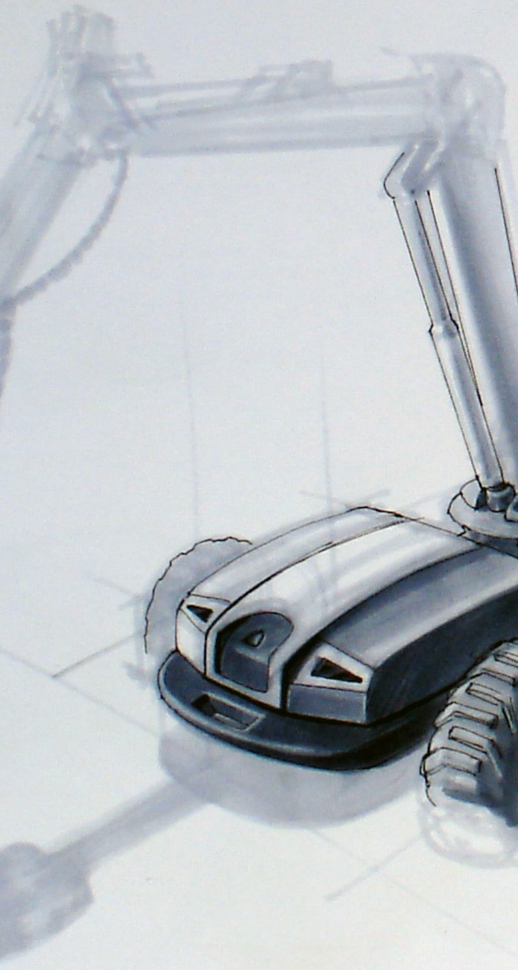


4-5 Contrast was gradually increased in the areas that the designer wished to draw attention to. Dark felt-tip pen lines added definition to specific regions of the sketch.





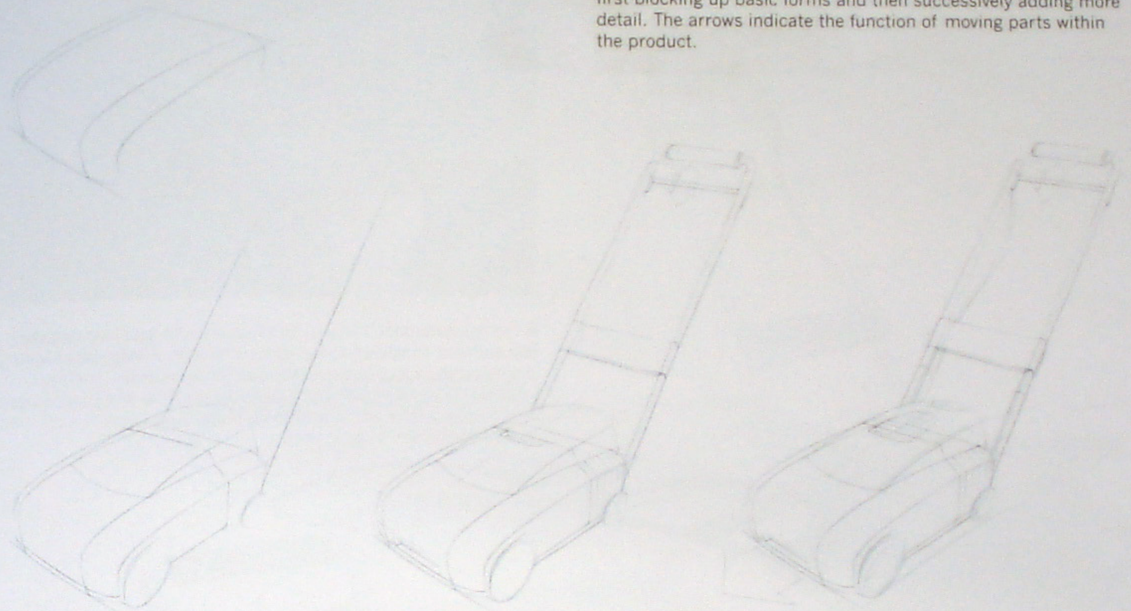
6-7 Soft white pencil was used to create highlights. A simple cast shadow was constructed by drawing imaginary vertical lines from points on the robot down to the horizontal plane.
The designer notes that this type of sketch is interesting because it is not fully detailed. Sometimes it is appropriate and effective to leave some areas undefined.



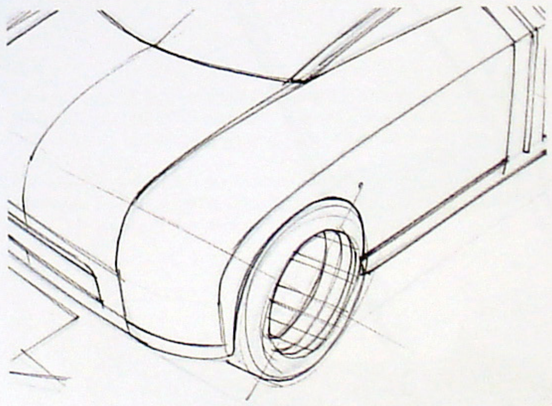
Floris Wiegerinck, Lawn Mover

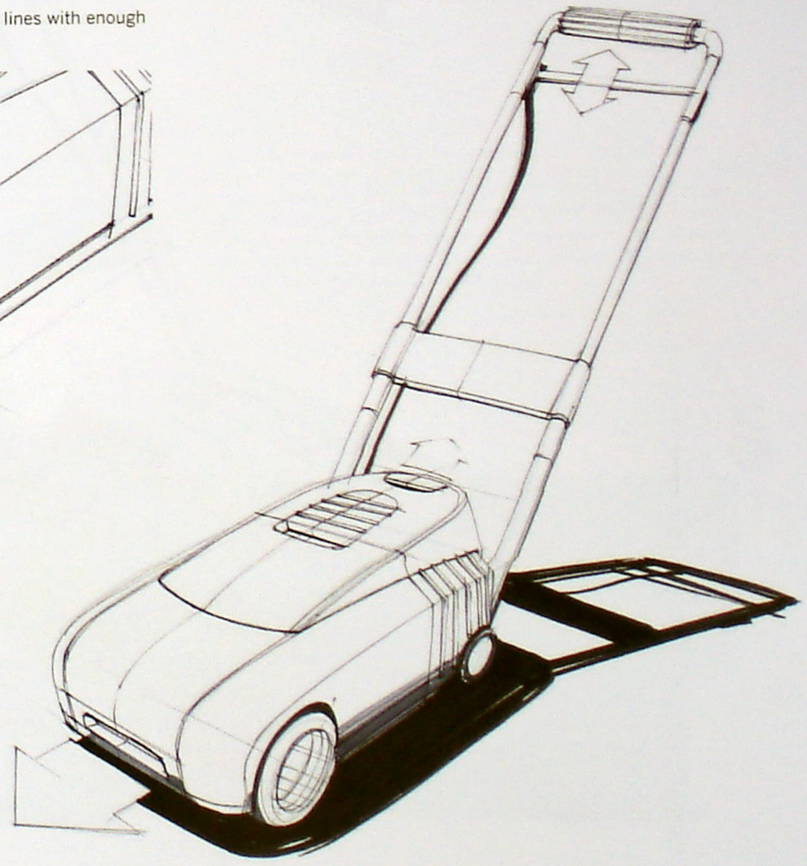
(Blue hard pencil, white soft pencil, felt tip pen, marker, pastel)

1-4 A hard blue pencil was used to find the desired shape by first blocking up basic forms and then successively adding more detail. The arrows indicate the function of moving parts within the product.



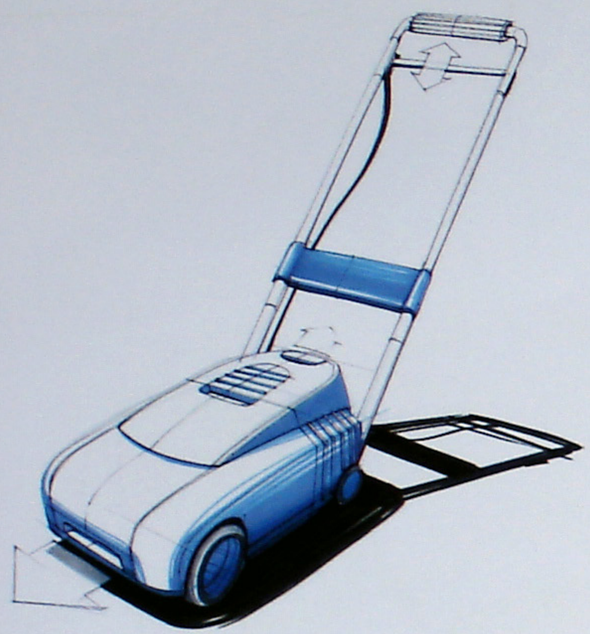
5 A felt tip pen was used to to create dark clean lines with enough contrast to stay visible after marker application.

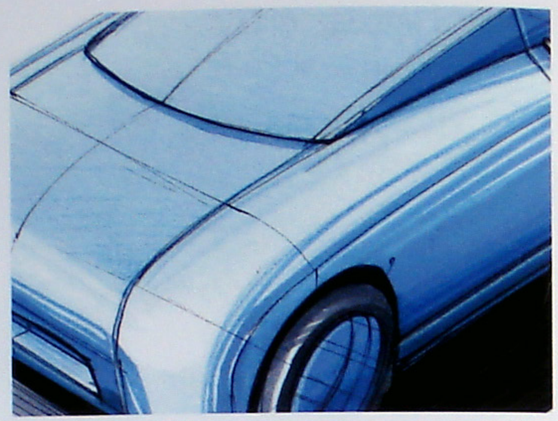




6 A drop shadow was added by using black marker, and the darkest areas of the lawn mover were shaded with dark cold grey markers. The designer suggests that this is a good time to stop drawing if you are not pleased with the design; a sketch completed to this point will still show your train of thought and intent.

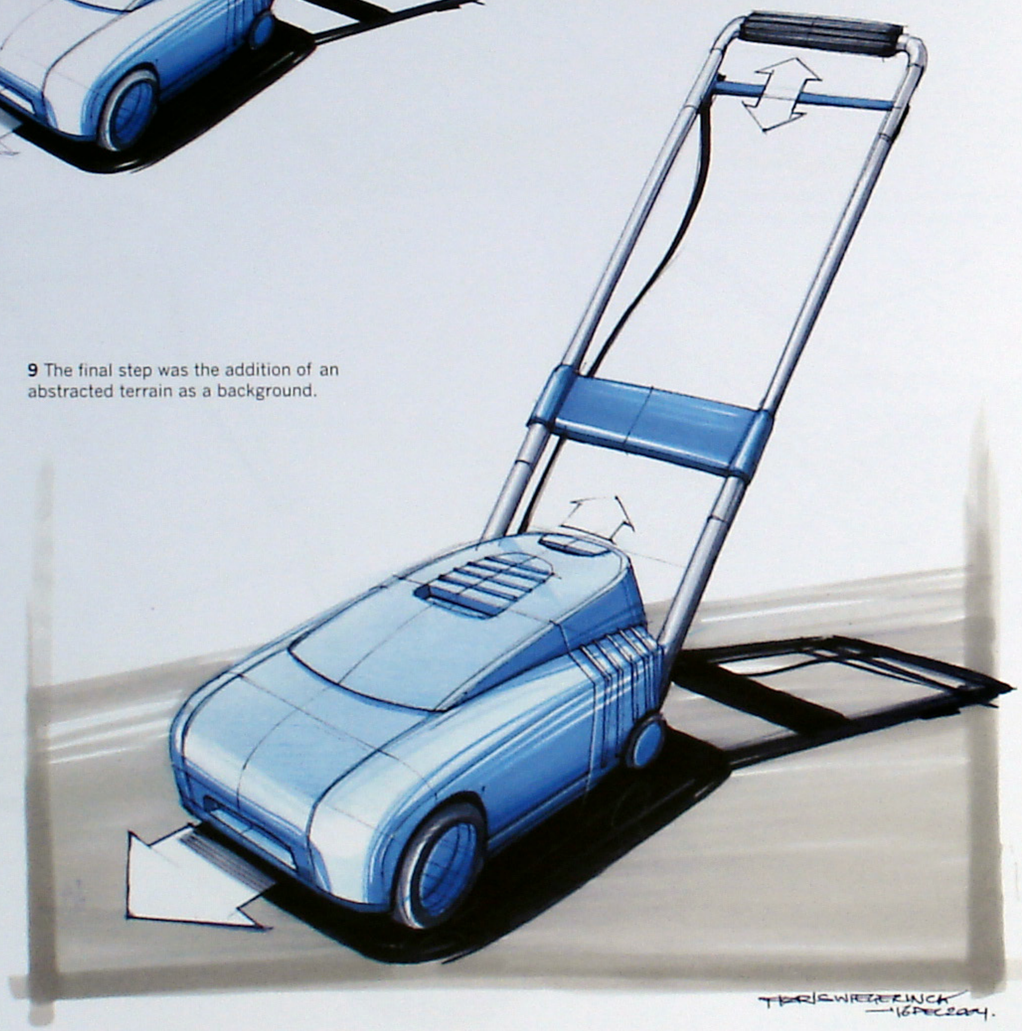
7 Sections of white were left on top surfaces to indicate the reflection of light, while marker was liberally added to the front and right sides of the lawn mower.





8 Pastels were then used to create a smooth gradient over the top surfaces to depict a high-gloss material. A suggestion from the designer is to use paper tissues (or even better, make-up removal pads) to apply the pastels, since using one's fingers gets very messy. White and black pencil were drawn next to each other to add dimension to part lines.

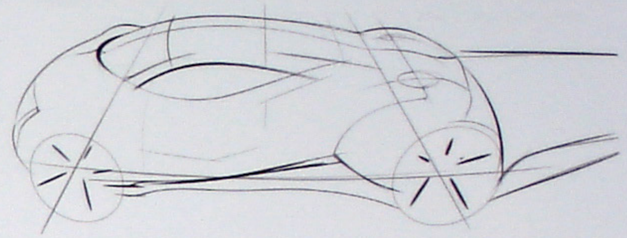
9 The final step was the addition of an abstracted terrain as a background.

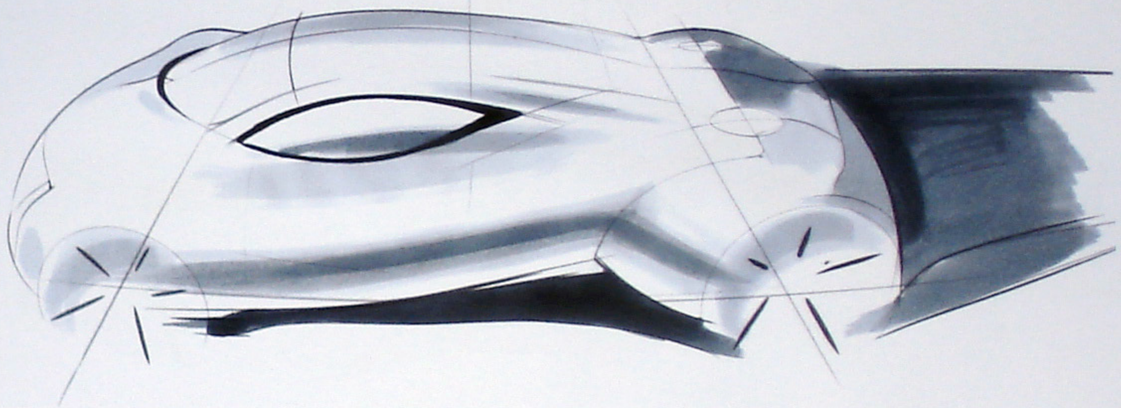


Mikael Lugnegård, Car

(Black hard pencil, marker, marker air brush, Photoshop)

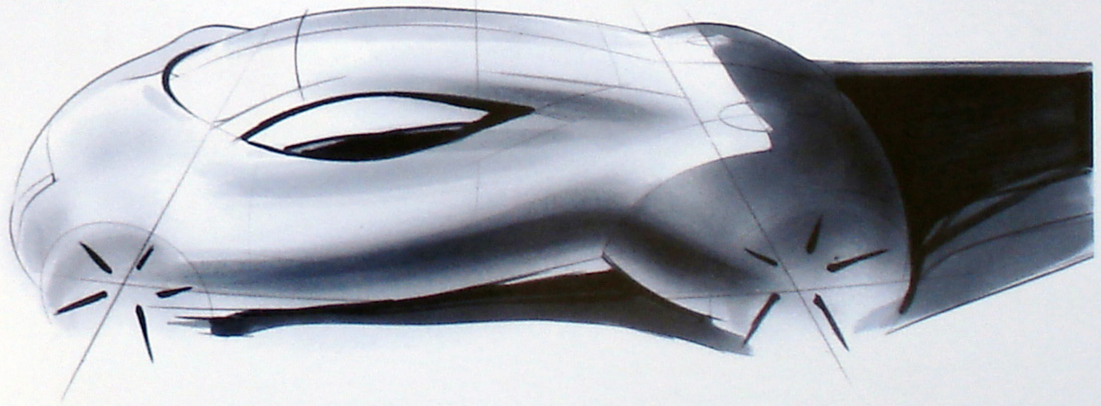
1 The perspective lines were drawn as guide lines marking the proportions of overhangs, cab placement, waistline, etc. The graphic layout of light clusters, windows and trim patterns were defined and guidelines for the placement of basic reflections and shadows are also included in this line art.
The designer notes that the chosen view of the sketched object should of course be the view that best describes the aspects of the design you are presenting.

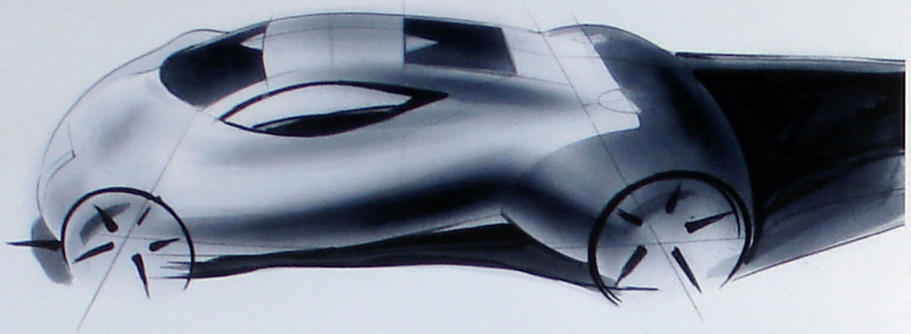




2 A first layer of light marker (numbers 2-4, cool grey) was applied without letting the marker ink dry between applications. Cast shadows, core shadows and reflections were all hinted at during this stage.
The designer notes that for this step, one should work fast and roughly without fear of destroying the sketch with misplaced lines. This will keep the exploration free and flowing.

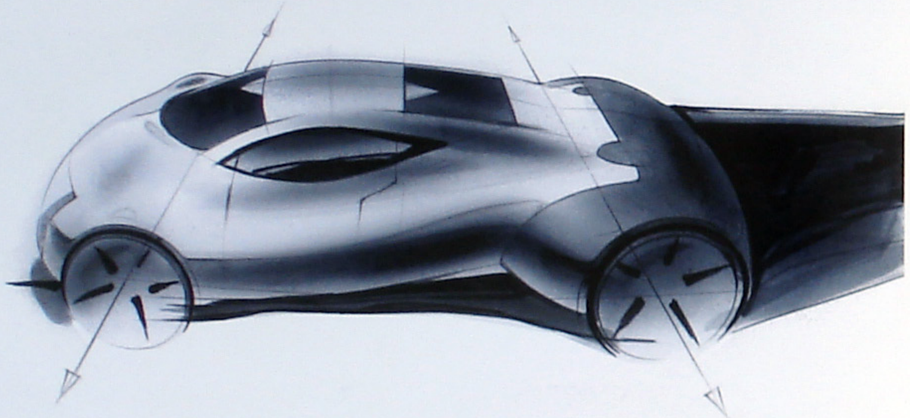
3 The shapes in the car's body were further sculpted using marker airbrush (numbers 2 and 3, cool grey), always with the light source direction in mind to ensure the correct placement of shadows. Shadows, matte surfaces and reflections were all enhanced by combining marker and marker airbrush. Keep in mind that marker applied with an airbrush generally gives darker results than marker applied with a pen.

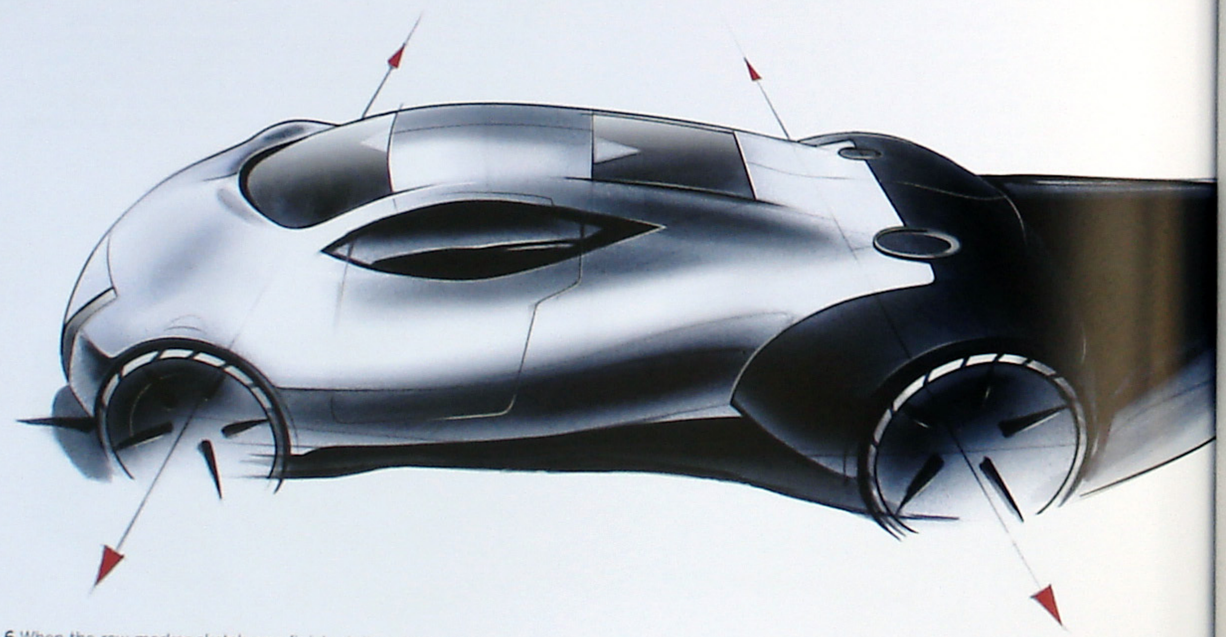




4 The body of the car is sculpted even further using darker tones of marker (cool grey, numbers 5 and 7). The drop shadow is streaked with black, giving it more weight and visual power. Shapes behind the glass were depicted using a cool grey number 5 tone.

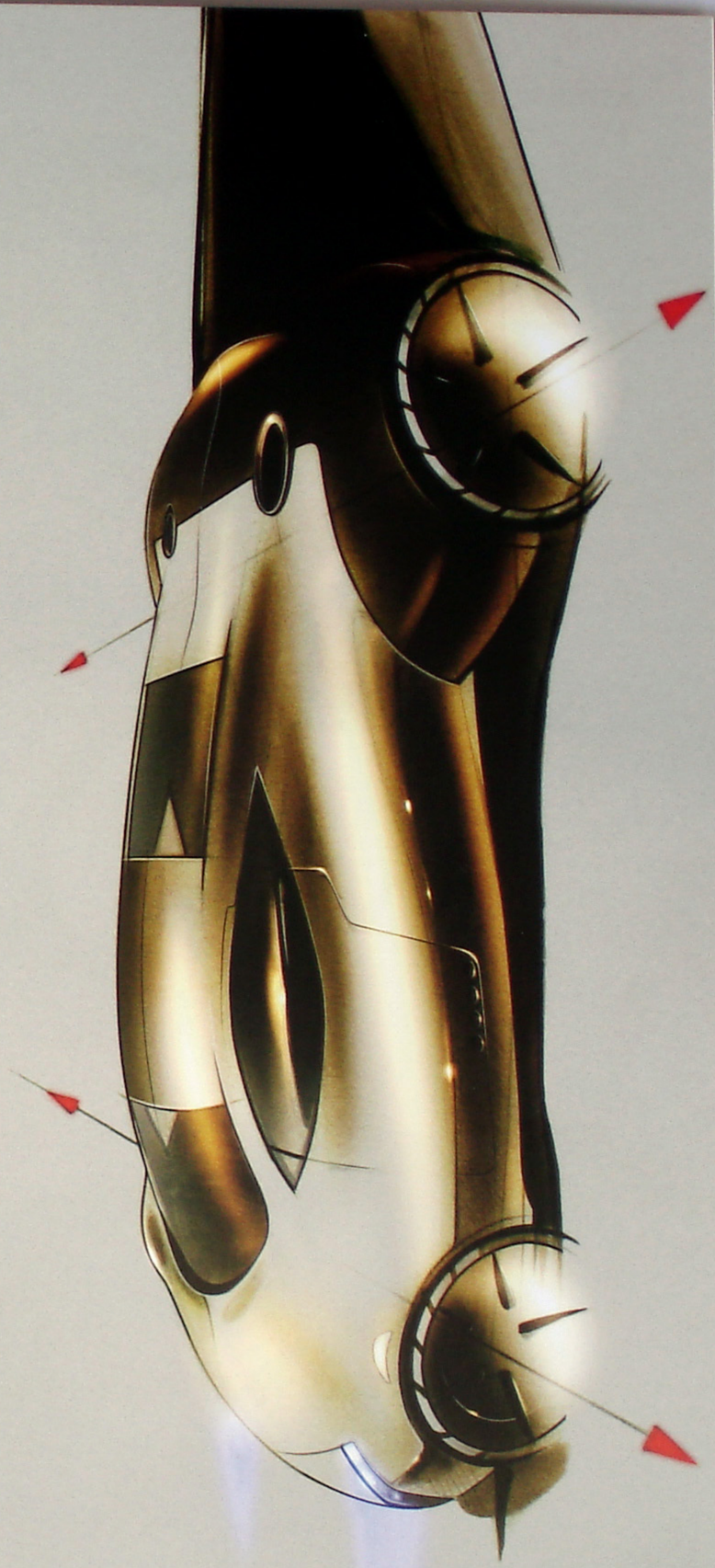
5 This was the last hand-rendered step. The designer's aim was to create the highest contrasts possible with areas of white appearing close to dark greys, in order to give the sketch maximum visual impact and clarity.





6 When the raw marker sketch was finished, it was imported to Photoshop for final digital adjustments. Masks were used to precisely manipulate sections such as wheels, windows and matte materials. Several layers were used to tweak contrast, hue and saturation of different areas. Paths were used and stroked to create sharply defined part lines.
The designer comments that at this stage, any and all types of digital manipulation can and should be used in order to further express the concept to the client.

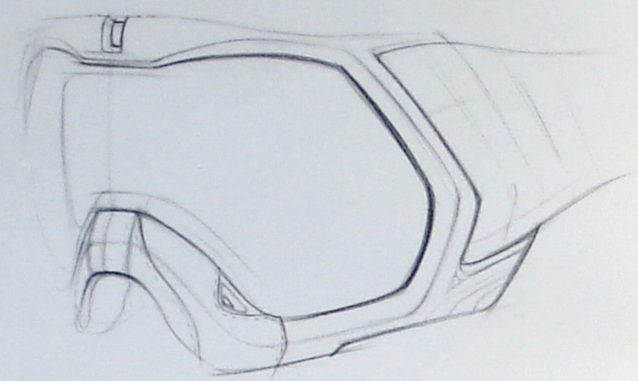
7 The process described here is more of a total "make-over" of an already completed sketch rather than a step. The sketch from step 6 was flattened, and several copies were made of the resulting image. This made it possible to compose several proposals of the final sketch, increasing the freedom to play around, adjusting *curves*, *brightness/contrast*, *hue/saturation* etc. *Hue/saturation* (with the "*colour*" box checked), was used to see how the colours change when adjusting the hue (a tinted warm sepia-greyish tone was chosen for the version shown here). In order to make the background look more like a sheet of grey-toned coloured paper, the brightness was lowered.
With the base palette of the entire sketch set, the next step was to add some highlight streaks along the metallic surface of the car. The image was taken into Painter, where the *FX/glow* brush with the default settings (except for a small tweak on the space setting) was used. Selected areas were carefully lit whilst keeping the focal points in mind to make sure that light was placed to emphasize points of interest to the viewer.
The sketch was taken back into Photoshop, and placed in a layer above the one containing the sketch prior to the application of highlights. Masks were created and some of the top layer was erased to show the layer underneath, thus sharpening edges and making the light streaks more controlled.
The lifeless and artifically perfect look devoid of defects was improved by first adding a mid grey layer, and then manipulating it a number of times. A 400% *Noise* filter, a *brush strokes* or *spatter* filter, and finally a *blur* filter were applied. The blend mode of the layer was set to *overlay*, and the opacity was reduced to 3-5%. This removed the flawless appearence, and added a non-digital finish to the image.
The designer commented that following step-by-step tutorials may very well help you acquire many skills and give helpful tips, but the only way to excel in sketching is to practise diligently and develop your own unique style!



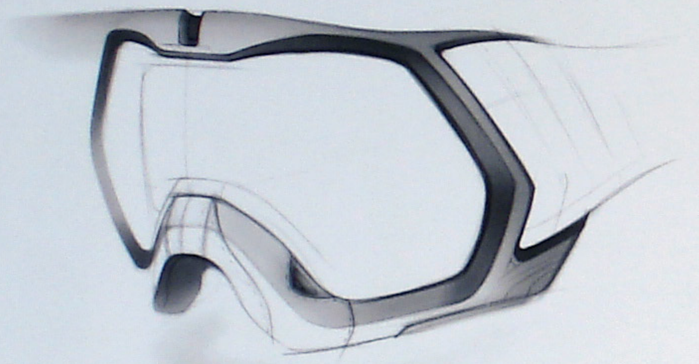
Jonathan Hicks, Goggles

(Black hard pencil, Painter)

1 A line art sketch was created using a hard black pencil. The design is still loose and not fully resolved, leaving the designer room to explore design directions in Painter.



2 The previous sketch was imported to Painter, where basic greyscale shading was applied. To create the clean-edged shadows, brush strokes were first applied 'over-spraying' the lines of the object. An eraser tool was then used to remove all unnecessary areas of shading.
The designer mentions that no specific light source was used. Instead, the object's shape would be communicated just as effective using this intuitive nuanced shading. In reality, so much reflecting light would hit this object that rendering it true-to-life would be too complex.



3 A leather texture was applied around the nose. The main shape of the straps was created using a large brush and the wavy texture was formed with a smaller brush. Notice that the texture fades toward the edges of the sketch, adding dynamics.

In this tutorial, no paths were used to delineate areas – instead, the whole sketch was finished using layers of colour where edge sharpness has been achieved with an eraser.

4 A tactile and rubberized surface was created using a 'honeycomb' texture. The bright red 'microinjected' adornment is an important detail that was added to make the product seem more defined and realistic.
This designer doesn't use 100% opacity, in order to achieve a more painted look. For this reason, the rubberized red area was left white in the previous step; had grey parts been present, they would appear through the translucent red, making it appear 'dirty'.

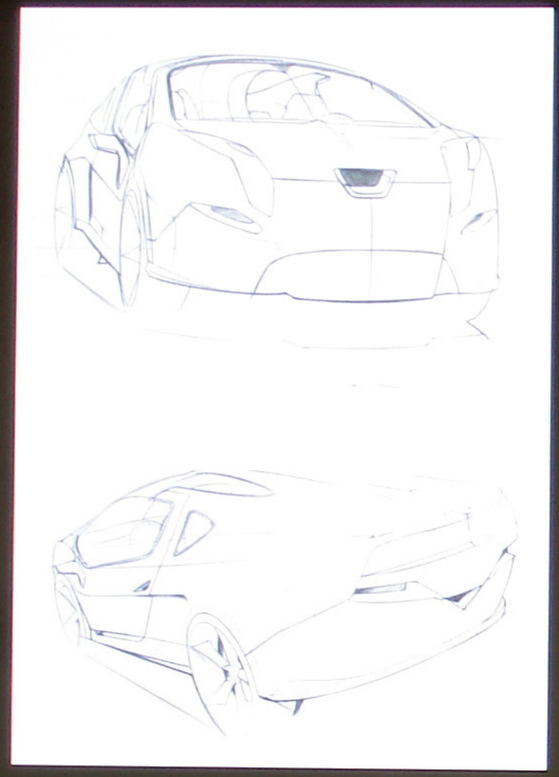
5 The look of the glass was achieved by first filling the space with translucent yellow, followed by a layer on top in a graded translucent orange.

6 Highlights are added to the glass and along the part lines; The designer would like to stress that adding highlights along part lines is very significant to the overall effect, since they reinforce the illusion that the object is constructed of different parts.

Mauricio Bedolla Gasca, Fuel Cell Car

(Blue hard pencil, Photoshop, Painter)

A comment from the designer is that it is important to ensure that the initial line art is of high quality so that it provides a good foundation for the rendering. Otherwise, the steps that follow will be made in vain.



1 This initial line drawing (originally drawn with blue pencil) was imported to Photoshop, where the lines were desaturated and cleaned up to tighten the sketch. The image was then blurred slightly to reduce the appearance of paper grain visible in the initial scan. To save time and make it easier to repeat the mood, colours, and textures for the front and back views, the two sketches were imported as a single image. The file was saved as a Photoshop Document (.psd format), enabling easy transfer of the file from Photoshop to Painter. (This is done frequently, and is not mentioned in the text that follows.)

2 A medium grey canvas was chosen, enabling the designer to work with both darker and lighter tones. A 'smeary' *pallette knife* tool was used to block the initial background and vehicle. A small file size ensures that the large brushes run smoothly.
At this stage, the designer's goal was to develop the mood and expression for the sketch. In this case, a vague impression of a night-time street environment was created.

3 When the basic values of the background were established, colour was added – still with the general mood of the sketch in mind. The *broad water brush* (a digital watercolour tool used in Painter) was used to create bright glazes of translucent colour. The brushwork was kept loose in order to experiment. The canvas was 'dried' often to avoid unintended results that would have to be painted over. Colour was applied in a more controlled manner using Painter's *soft vine charcoal* tool.

4 Several rounds of colouring and blending brought out the three-dimensional shape of the car. At this point, the vehicle was treated as a matte object, since reflections and highlights were to be added in later steps. Using an underlying duplicate layer, the designer was able to check progress by switching off the working layer and comparing the latest changes with the original image. Painter offers many methods for blending colours. The following three examples involve different brush tools, set to very low opacity:

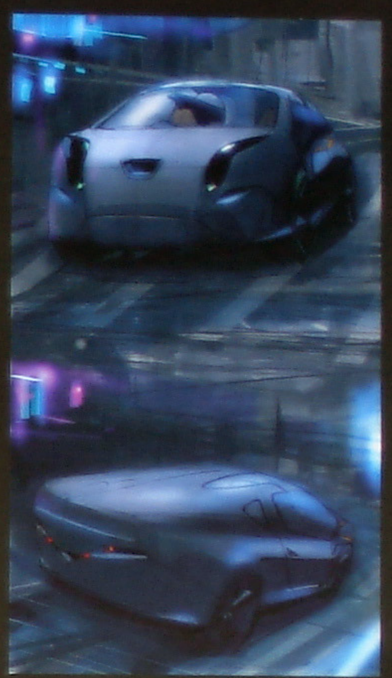
I. Use colours derived directly from the working canvas using the *eyedropper tool*, then use the airbrush to quickly blend colours back and forth.

II. Use the *soft vine charcoal tool*, after picking the local colours with the eyedropper tool.

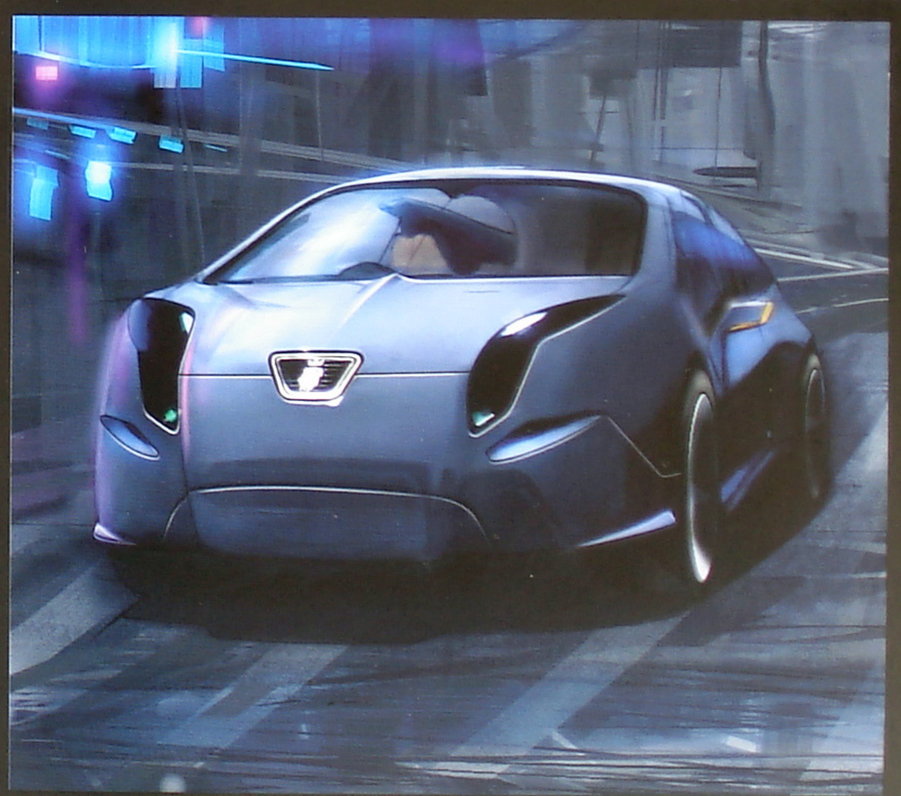
III. Use the *grainy water* blending tool.

5 When the general shapes were defined to a satisfactory level, more lighting was added using low opacity *dodge* (Photoshop) *or glow* (Painter) tools, and then blended.

6 At this stage, when the basic shape is set, detailing can begin.

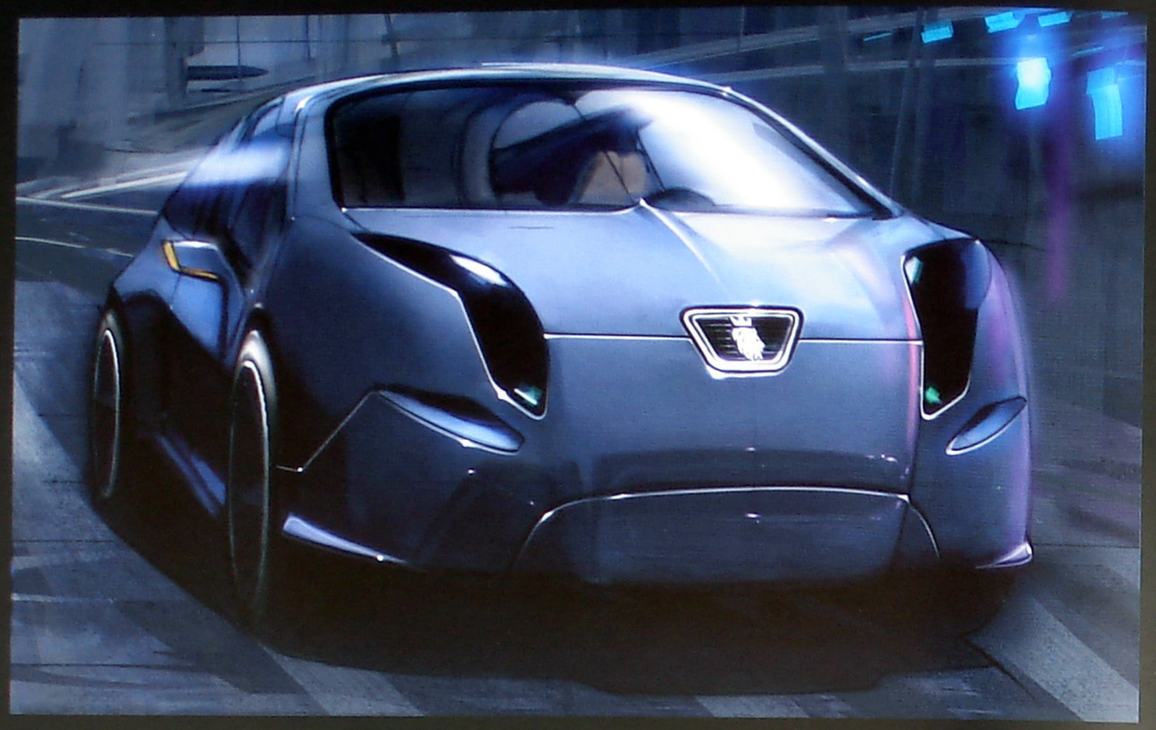


7 The mood, feeling and colours are now the same for both the front and back views of the car. The image will now be split in two and separately taken to a more detailed level.

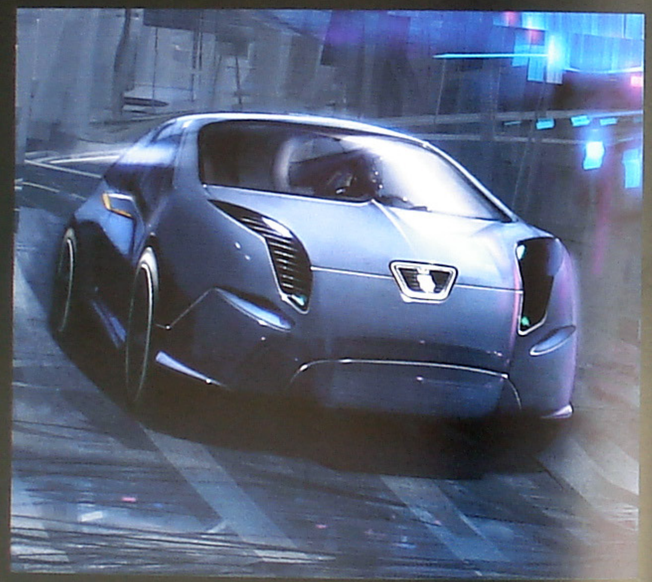


8 The picture was 'up-sampled', creating a high resolution image for further detail work. As a result, the relative size of the brushes becomes smaller, and therefore they do not diminish the performance of the computer even though the file size is larger.

A focal point was established by adding details in Photoshop and keeping the rest of the background loose for contrast. Paths were used for areas where especially high detail and sharpness were required, such as windows, wheels and part lines.

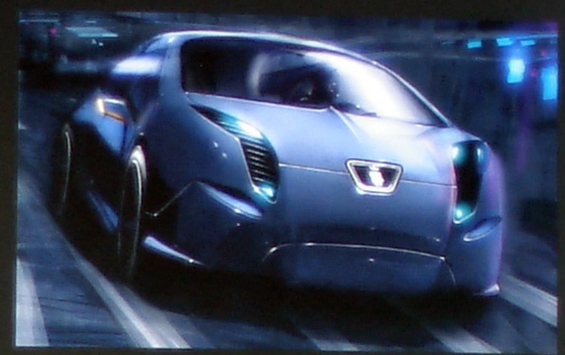


9 Paths were used to further define edges, important part lines and ellipses. More highlights were added and the image was flipped horizontally in order to check symmetry (this was also done in step 7). Often, after working on the same sketch for a long period of time, it becomes difficult to objectively assess symmetry. Mirroring the image creates the opportunity to perceive the sketch as a new picture, making it easier to pick out mistakes in symmetry and perspective.
The designer comments that this should be done frequently, and also suggests keeping a mirror at your desk to check the symmetry and perspective of hand-drawn sketches.



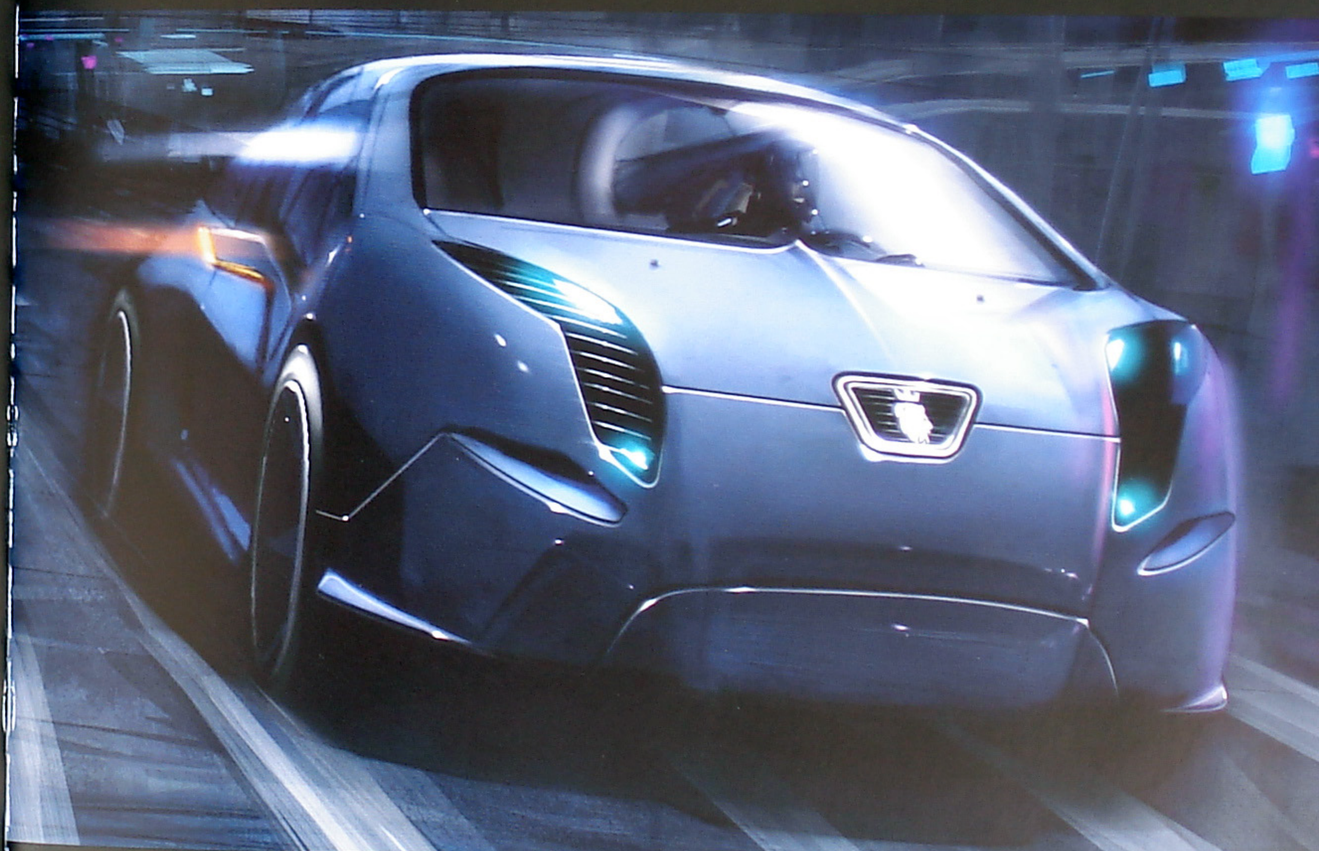
10 ▼▶ The addition of a driver's silhouette gives more detail to the sketch and provides a sense of scale. The image was tilted slightly to add drama to the composition. To give the appearance of transparent glass, the interior of the vehicle was removed, allowing the background to show through.

11 Adjustments to the brightness, contrast and hue was made. The designer took note of the adjustment, to be able to replicate the effect on the rear view of the vehicle. Cropping the image reduced it to this final size. The headlights of the vehicle were 'turned on' using the *dodge* tool. (With Painter, the *glow* tool can be used to create a similar effect.)



12 More changes of the hue were made (a tone close to the one used in the steps prior to step 11 was brought back), as well as changes to the saturation. The *dodge* and *burn* tools were used to emphasize bulk.

13 The tool *motion blur* was added to some of the lights in Painter. Final experimentation with the *brightness/contrast* controls ensured the best presentation of the sketch (the most extreme variations are not shown here).



14 (Next page) Final details and speed highlights were added. The speed highlights were created by first filling a path with colour using the *paint bucket* tool. This colour field was then put through a *motion blur* filter, using a high pixel rate. The angle of the blurred field was adjusted, to better relate to the vehicle. For final effect, the transparency of the highlights was adjusted through experimentation.
The designer suggests keeping the number of layers used to a minimum. This sketch was done using four layers, one each for line art, paint work, split lines and highlight work. All layers were set to *normal*, except for the line art layer which was set to *multiply*.

As a final comment, the designer would like to point out that this tutorial is meant to act as a guide, and should not be considered law. Feel free to experiment with blending modes, filters, layer styles and other tools offered by Photoshop and Painter to find your own style and expression.

Thanks to

First of all, we want to thank the students contributing to this project. Many of them have devoted several years to develop their skills, but unfortunately the layout and structure of this book cannot fully do their designs justice. Because this is a book solely concerned with sketching technique, it offers no more than a glimpse of their incredible work, intelligent solutions, pioneering ideas, or all of the thoughts behind the sketches.
You not only trusted us to show your work, but also supported us throughout the whole project. We owe you all many thanks, and wish you the best of luck for the future!

We also want to thank all the students and personnel at the Umeå Institute of Design, our families and friends, Umeå University and Uminova Innovation for the guidance and encouragement you have given us. You have been an invaluable help and inspiration!

Erik and Klara

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