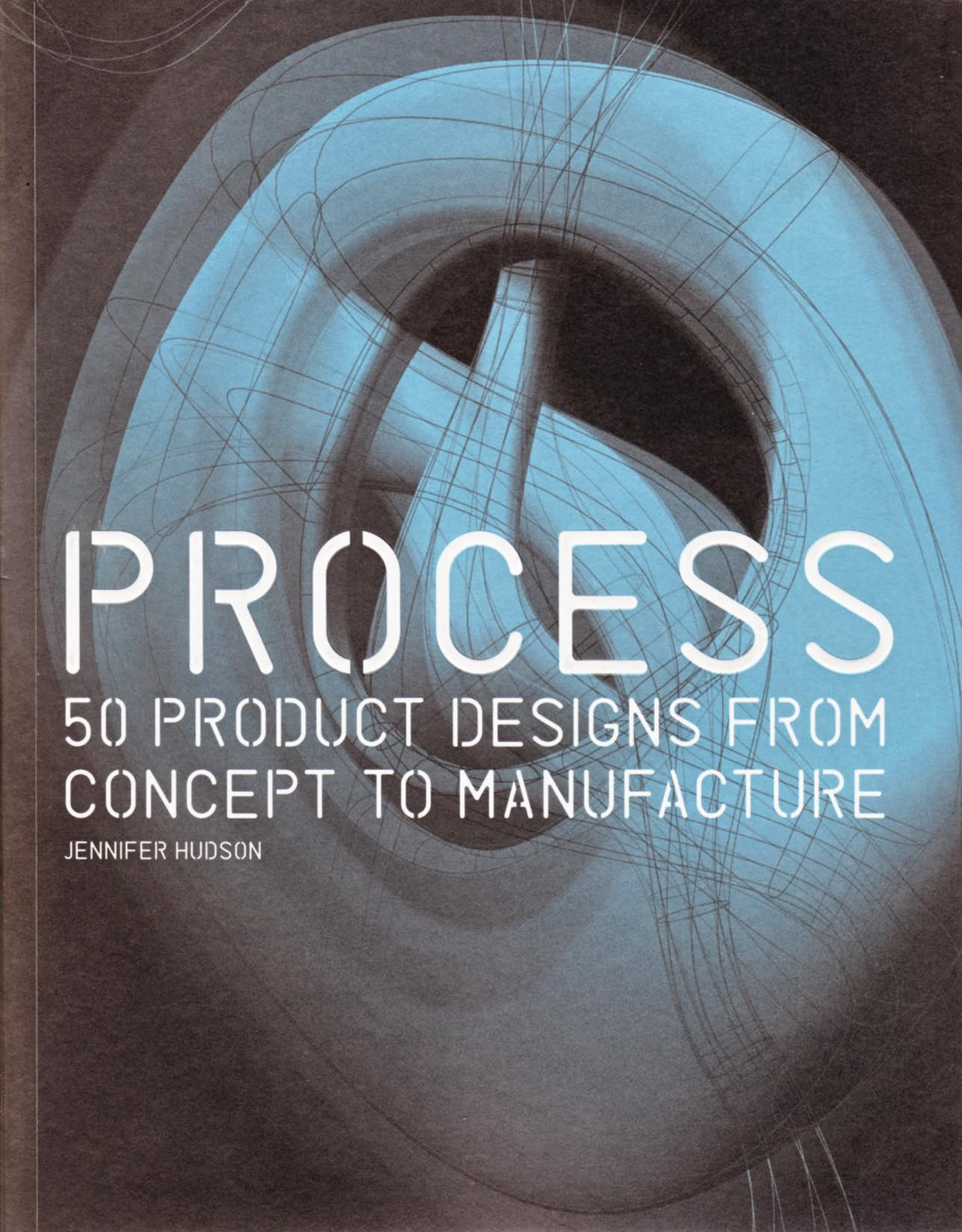




PROCESS

50 PRODUCT DESIGNS FROM
CONCEPT TO MANUFACTURE

JENNIFER HUDSON

Toshihiko Sakai is primarily an electronic designer but has also worked in the fields of furniture and interior design. His polymath approach has resulted in technologically advanced products that are accessible and share a sense of lightness and clarity in their aesthetic.

Sakai's inspiration always comes from words. Once he is given a commission he thinks up key expressions to describe the function and the form of a piece. He then considers all aspects of the product, from the identity of the client and market trends to styling, taking into account consumers' behaviour and aspirations in order to create an overall picture.

Sakai starts by sketching the general profile, and some of the details, as soon as he has conceptualized the product. The styling comes from considering the drawings and visualizing their 3D forms. Models in polystyrene foam are used to verify size and detailing. Data is fed into the computer to form the CAD drawings to machine the tools. Prototypes are produced to clarify and modify problematic areas, which are then trimmed and adjusted. Renderings are also created and employed to present Sakai's work to the client, along with colour and material samples. He works in Century 3D and Think Design software, making use of their refined fillet commands, which are capable of generating a radius that changes gradually on a curved line or at a complicated intersection of surfaces. Sakai remains involved in the design

process until limited batch production. Up until this point he can address problems, such as inner electronic parts not fitting, or practical deficiencies in the strength or functioning of materials.

BODiBEAT is unique as it is intended solely for use by a jogger. Unlike the iPod or any Nike MP3 player, it senses the pulse rate of a runner and plays music with a tempo best suited to the aerobic exercise being undertaken. This has a positive effect on the efficiency of a training session.

Sakai's key words in this case were 'euphoria' and 'one second's silence'. He developed a mental picture of the user operating the player attached to his or her upper arm in the early morning sunshine before starting to jog. He chose a transparent material, feeling it was necessary to create beautiful reflections to capture the essence of excitement. He then defined his market and the function of the unit: the product would be a completely new category in the field and not intended to compete with the market; the sensors required meant BODiBEAT could not be the same size as a normal portable player; the area of usage would be limited as it is necessary to read the pulse rate via the ear lobe and attach the player to the upper arm; and – as the player was intended for outdoor, athletic use – it had to be waterproof and impact- and UV-resistant. The concept was for a gadget that would become part of the ritual of exercise and an iconic fashion accessory, as well as a scientific instrument to measure

and record the body condition of the person using it.

The design was developed using Sakai's normal working methods (see captions). Styling elements were changed for cost reasons and also to fit better within the American market.

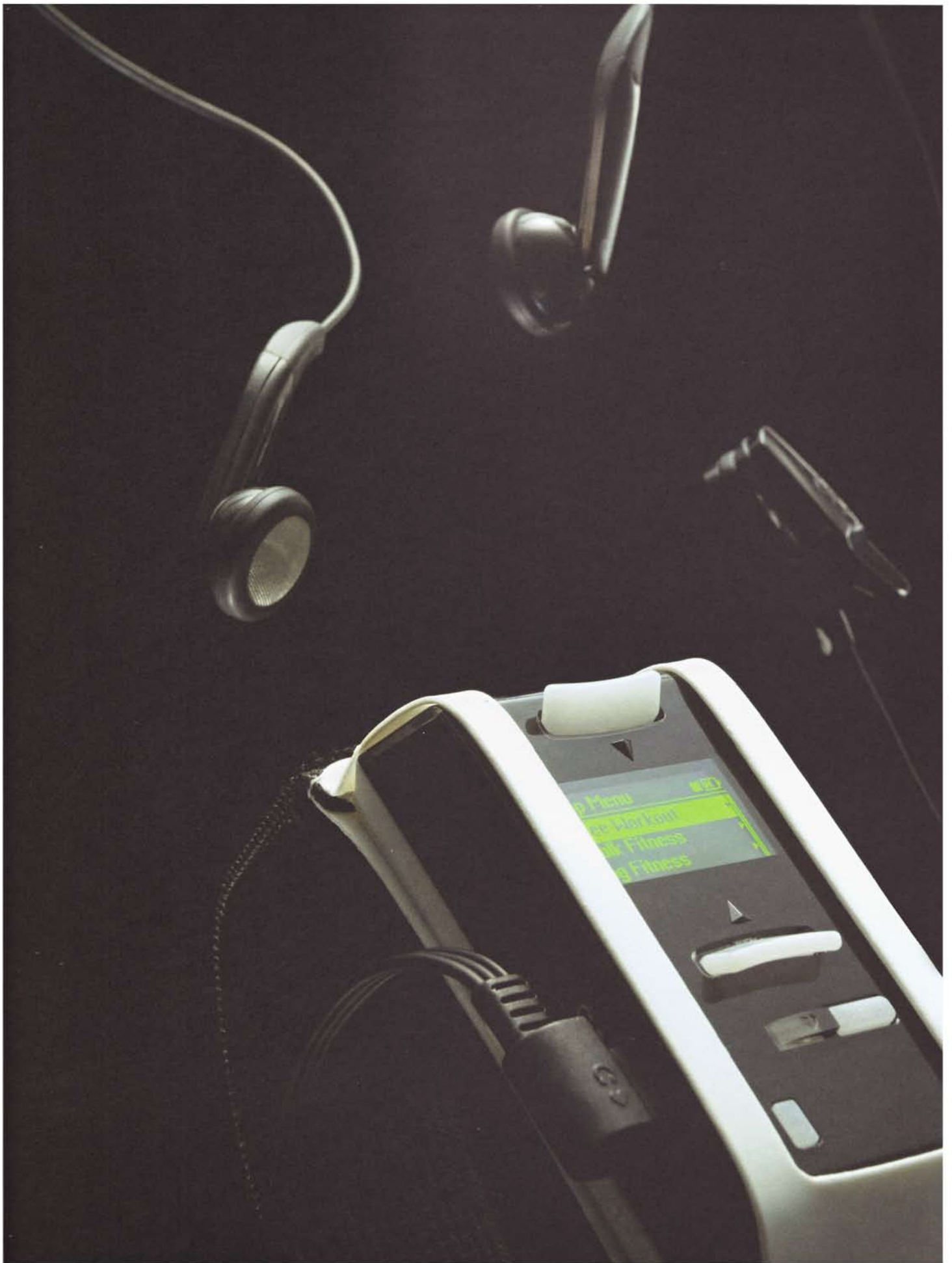
The main body is double-injection rather than insert-moulded. Reinforced transparent polycarbonate and black polycarbonate were moulded at the same time; this was a difficult process to perfect as the inner surface of the black material had a tendency to leak into the transparent outer layer. Also the restricted gate to inject the inner layer had to be specially cut and positioned in a limited space in order to achieve the best flow of the second resin. The moulding machine was developed to meet the specification by rotating the core side to fit the two different cavities. The earphone was injection-moulded. To create the complex shape a slide mould was used in three parts. The armband was planed by sandwiching polypropylene between a layer of Velcro and non-lead PVC, which were bonded together using ultraviolet light.

BODIBEAT MP3 PLAYER

TOSHIHIKO SAKAI

Manufacturer: Yamaha, Japan

Transparent polycarbonate with glass fibre, black polycarbonate, ABS earphones with PVC body
H: 2.5cm (1in) x W: 3.9cm (1½in) x L: 7.5cm (3in)
Design to manufacture: 17 months
Mass-manufactured
www.sakaidesign.com/www.yamaha.com



1

装着する高揚感

高揚感 一瞬の静寂

(Previous page). The BODIBEAT MP3 is intended for joggers. It senses the pulse rate and plays music appropriate to the level of aerobic exercise.

1. Sakai's inspiration comes from the words he chooses to express the essence of a design. For BODIBEAT he selected 'euphoria' and 'one second's silence'.

2. Sakai worked on ways of attaching the player to the body that would create a sense of tension and excitement and make the unit a part of the ritual of exercise.

3. The player is intended to be an iconic fashion accessory. It was Sakai's intention to

collaborate with fashion and graphic designers to update the design of the belt periodically, to maintain the product's appeal without excessive changes to the model.

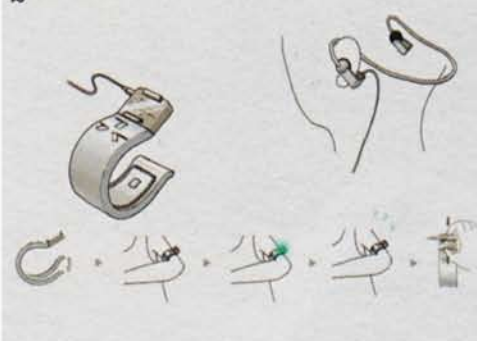
4. Sketches were developed to see whether the unit could be attached to other parts of the body. At this stage the acceleration sensor didn't activate well at the waist. However, technological development in the sensor now means that a waist-worn version is soon to appear on the market.

5-6. Polystyrene models were created to test the ergonomics of the design of the earpiece (5) and main body (6).

7. Nylon and ABS armband models were developed. ABS was too stiff, but the nylon version fitted much better.

8-10. A wing-type button that moves in and out of the upper part of the main body (8) and L-shaped earphones (9) were selected and the styling of the armband defined (10). CAD drawings were then created.

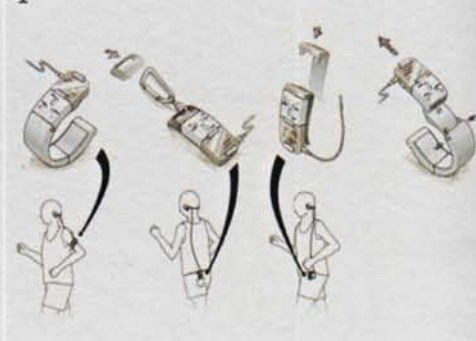
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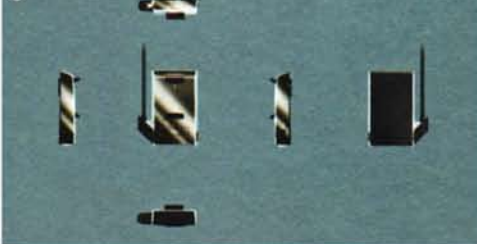
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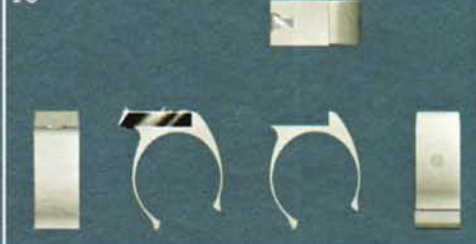
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10



11-12. CAD investigation into how the main body could be attached to the armband (11) and a proposal for the internal mechanisms in the body (12).

13-14. Design models of the body, armband (13) and earpiece (14) were produced from CADs.

15. After reviewing the model, changes were made: the earphone and heartbeat sensor, which had been in one piece, were separated to adapt to different ear shapes, and the headphones were then connected to reduce the possibility of them falling off.

16. The armband was changed to a Velcro belt to cut down on costs and because of the opinions of the American sales department, thus losing one of the main initial concepts for the design.

17. The final body was decided and finished in computer graphics.

18. At the very last moment, the earphone returned to a less expensive single piece to reduce costs. Adjustments were made so it fitted more snugly than the earlier one-piece version.

19. Image of the die used to create the upper parts of the earpiece.

20. All the various models of the main body, from early polystyrene to first product.

21-22. A limited batch of the product was made and put through various tests without being displayed in shops. The batch was used for promotional purposes and to iron out any problems with the production processes.



Spider 1 and 2 are the first hard-disk DVD recorders capable of automatically prerecording all eight terrestrial broadcasting channels in Tokyo for a week at a time. They were produced by a small IT company, PTP (Power to the People). Budget restrictions prohibited the use of expensive casting, and the units were manufactured in collaboration with an aluminium factory using cutting-edge finishing techniques.

The interior parts of both recorders make use of existing technology and match predetermined inner layouts with the exterior design. For Spider 1, a non-working prototype in aluminium, ABS and acrylic was made to verify the form. More height was needed so Sakai raised the upper acrylic display area, increasing the overall transparency of the unit.

The aluminium front body was laser-cut and bent in a pressing machine, and the texture applied by sand-blasting the surface with fine grains of metal; this is a difficult finish to achieve at this scale and in a light tone without discoloration. Colour was then added and the finish anodized. The steel body was punched and then bent before being finished. The acrylic parts were cut to shape and submitted to a 'secret' process to increase transparency. The light receiver for the remote control is injection-moulded.

Spider 2 was developed one year later, thanks to a technological advance that had seen the inner parts reduced considerably. Sakai was given the commission in

late July with instructions that the product had to be available for the Christmas market. This was a demanding schedule even though the internal layout had been predetermined: drawings had to be presented within ten days. As Spider 2 was a diffusion project, the budget was massively scaled down. The brief required a styling that would link the unit aesthetically with Spider 1. Sakai decided to concentrate on a high quality of finish to visually link the two recorders, and on making the front face as small as possible. Hand-drawn sketches of various possibilities were scanned into a computer, coloured with a Wacom® pen tablet and presented to the client, who decided to adopt a version that had a tilted front panel set back at an angle, thereby reducing the projected area visually and physically. Sakai presented a 3D computer diagram a week later. A prototype was developed in aluminium and the final exterior analysed. Small adjustments were made to the radius of the strengthening frame.

The manufacturing processes and finishing techniques had to be as economical as possible. The front panel was extruded in aluminium from a single die at lengths of 2m (6ft 6in) and then cut to size. Necessary apertures were CNC-cut. Tests to determine surface treatment were carried out. A hairline texture was chosen that was dyed using a dye/anodizing technique, and coated with transparent urethane resin to give a mirror-like finish. The bottom and top steel panels were cut and

bent, and holes opened using a pressing machine. The lower part was galvanized to prevent rusting and the upper case treated with a melamine resin finish, which is highly durable.

Both Spider 1 and 2 share the same remote control. The concept was to minimize the size and number of control buttons and to make the unit small enough to fit in one hand. Mock-ups in expanded polystyrene were made to gauge the tactility of the product. CAD drawings passed backwards and forwards between Sakai and the client's engineers to address the manufacturing processes and to refine the design. The controls invite the user to play with them. Sakai's design has what he refers to as an 'afterglow', with the resin buttons taking time to softly come back into position. A prototype was machined in ABS, aluminium and transparent silicon resin. This was used to correct the texture of the silicon controls and aluminium cover. The finished item was produced by precision-pressing using eight separate dies. The surface of the aluminium body was then given a hairline texture, dyed and anodized.

SPIDER 1 & 2 HARD-DISK DVD RECORDERS

TOSHIHIKO SAKAI

Manufacturer: PTP, Japan

Aluminium, steel, acrylic

Spider 1 – H: 34cm (13½in) x W: 59cm (23¼in)
x D: 15cm (6in)

Design to manufacture: 26 months

Mass-manufactured

Spider 2 – H: 11.5cm (4½in) x W: 40cm (15¾in)
x D: 36.9cm (14½in)

Design to manufacture: 6 months

Mass-manufactured

www.sakaidesign.com/www.ptp.co.jp



Spider 1 (above) and Spider 2 (below) share the same custom-made remote control (centre).

1 静寂 自律的な 緻密

1. Sakai starts any design project by thinking up inspirational words. For Spider 1 he selected 'tranquillity', 'independence' and 'elaboration'.

2-3. Various exterior designs were developed to fit the internal configurations of the electronic parts.

4. The L shape that Sakai originally envisioned changed to an oblong to fit the internal machinery, which had increased in size. The plugs were moved from the back to the surface to allow the unit to fit snugly to the wall.

5. The light movement in the recorder's controls had to be designed so as not to be too intrusive at night but still visible in the daylight. A number of trial models with different transmittance levels and paints were created, and were tested by placing them in front of the LEDs.

6. The investor changed and more money was available for the exterior design. Sakai created more height by raising the upper acrylic display area, thereby increasing the overall transparency of the unit.

7-8. A non-working prototype (7) was created from which changes were made in the DVD-loading cover and the acrylic base. Working prototypes (8) were developed and the inner contents settled.

9. Surface treatment of the front panel. The part was put in a tank with liquid chemicals and electrified. Many trials were carried out as a light finish was required. This depended on finely assessing the amount of electricity added and the length of time the panel was left in the chemicals.



10

守られる内包物 自律

10. The inspiration words for Spider 2 were 'protection', 'inclusion' and 'independence'.

11. Hand-drawn coloured sketches of various versions were produced using a Wacom® pen.

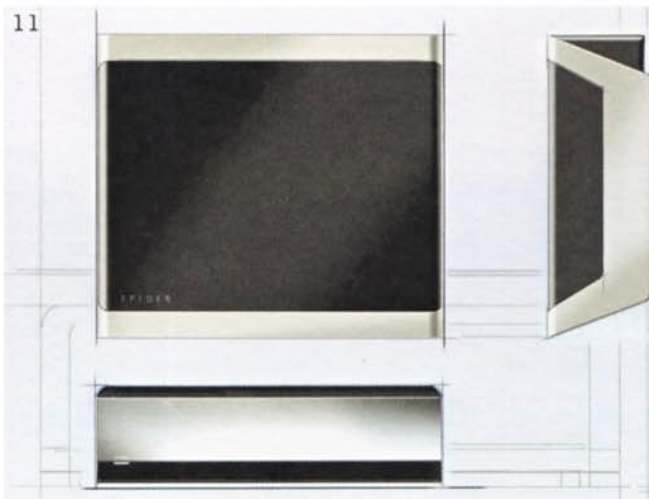
12. CAD drawings of Type 4 in white and black were

developed within a week. Black was chosen to match the mainstream colour of television frames.

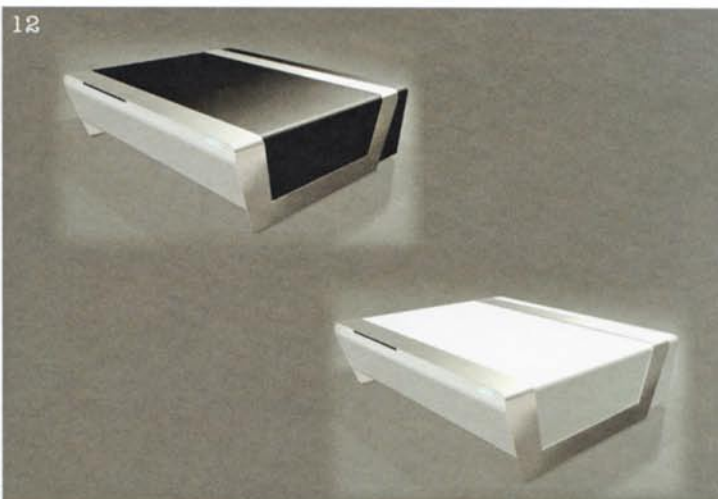
13. The front panel is in extruded aluminium. After it had been extruded from the die it was cut in 2m (6ft 6in) lengths and transferred to the processing plant.

14-15. The bottom part of the body is in bent steel and galvanized (14). The top was produced in the same way and coated with a melamine resin (15).

11



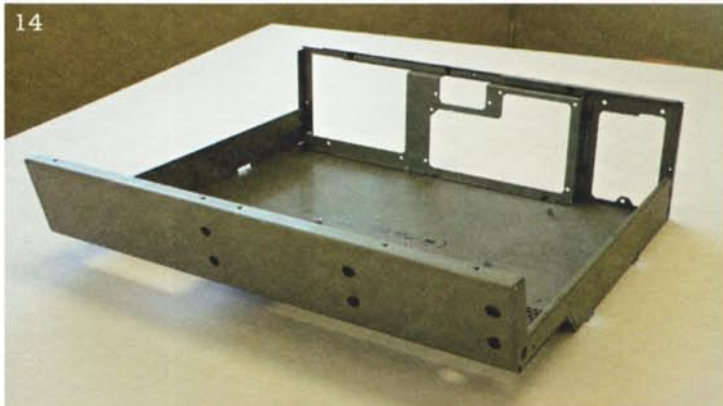
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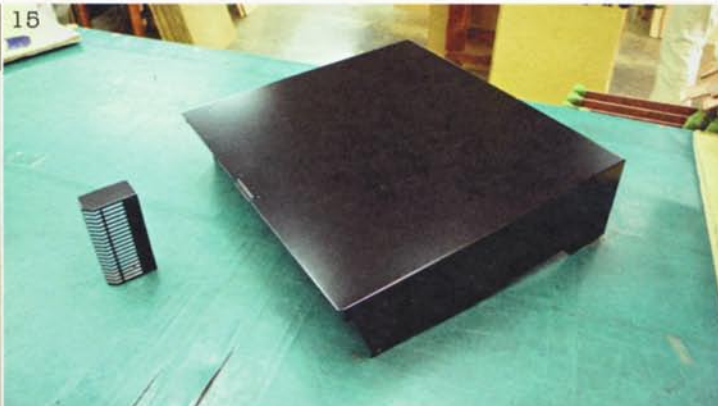
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14



15



16

16-17. A hairline finish (16) was given to the aluminium surface (17).

18. Necessary apertures in the front panel were punched.

19. Graphics were added to the unit using a silk-printing process.

17



18



19



俗 緻密

連続性

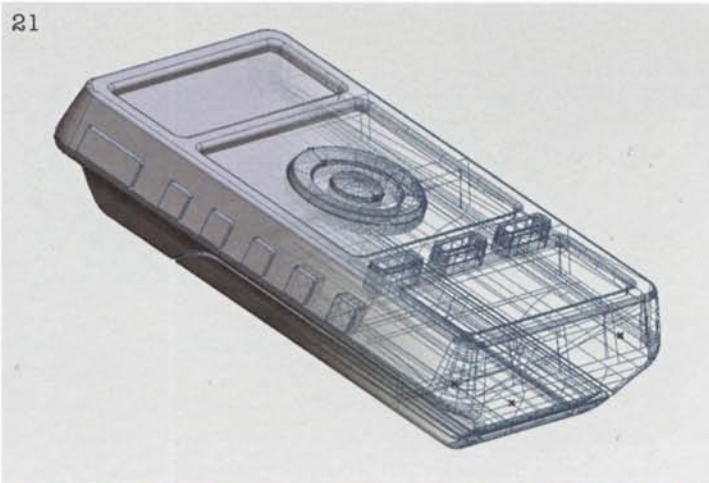
20. The inspiration words for the remote control were 'common', 'continuous' and 'precise'.

21-22. Once the design was agreed on, CAD files passed between Sakai and the manufacturer's engineers to refine the details (21) and a prototype was machined in aluminium (22).

23-24. To give the shape and the opening part as clean a finish as possible, the remote was die-cast using eight dies in total.

25-26. The top cover is pressed from an aluminium sheet (25) and finished using a die/anodizing technique. As with the recorders, the process had to be repeated again and again (26).

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