The art of
materials selection

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Products achieve success through a combination of sound technical design and imaginative industrial design. The amalgam creates *product character* – the way material and processes are used to provide functionality, usability, and satisfaction in ownership. This last – satisfaction – is greatly influenced by the aesthetics, associations, and perceptions that the product carries, a combination that we shall refer to as *product personality*. The overall character of the product is a synthesis of its functionality, usability, and its personality. In this article we explore product personality and character, illustrating the ideas by analyzing a number of products, noting particularly how the choice of material and process has contributed.

Good design works. Excellent design also gives pleasure. Pleasure derives from form, color, texture, feel, and the associations and perceptions that these invoke. Pleasing design says something about itself; generally speaking, honest statements are more satisfying than deception, though eccentric or humorous designs can be appealing too. Those who concern themselves with these dimensions of engineering are known, rather confusingly, as 'industrial designers'. This article introduces some of the ideas of industrial design, emphasizing the role of materials and the processes used to shape, join, and finish them.

But first a word of caution. Engineering design – design for technical function – follows well established and widely accepted procedures; it is *systematic*. Industrial design is not, in this sense, systematic; success, here, involves sensitivity to custom and educational background, and is influenced (manipulated, even) by fashion and advertising. Although there are many books on the subject of industrial design, you will find – it may surprise you – that they hardly mention the issues of functionality and efficiency, which are the central theme of texts on engineering design. They focus instead on qualities that cannot be measured: form, texture, proportion, and style; and on subtler things: creative vision, historic perspective, honesty to the qualities of materials. The views of this article are partly those of writers who seem to us to say sensible things, and partly our own[1]. You may not agree with them, but if they make you think about designing to give pleasure, then this article has done its job.

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Aesthetics, associations, perceptions

The pen with which I am writing this page cost $5 (Fig. 1, upper image). If you go to the right shop you can find a pen that costs well over $1000 (lower image). Does it write 200 times better than mine? Unlikely; mine writes perfectly well. Yet there is a market for such pens. Why?

A product has a cost, *C*, the outlay in manufacture and marketing. It has a price, *P*, the sum at which it is offered to the consumer. And it has a value, *V*, a measure of what the consumer thinks it is worth. For a product to succeed in the market place it is necessary that,

$$C < P < V$$

because if $C > P$ the manufacturer will lose money, or if $P > V$ no one will buy it. The greater the value, the larger the price that can be charged without infringing the inequalities in the equation; and the larger the difference between price and cost, the larger the profit. Cost is determined by the technical design of the product and the choice of materials and processes used to make it. But what determines value?

Functionality, provided by sound *technical design*, clearly plays a role. But a greater role is that of *industrial design*: the concern for the aesthetics of the product, the associations and perceptions it carries. We will elaborate on these in a minute; first a closer look at the requirements for a products' success. The requirements pyramid of Fig. 2 has, as its base, *functionality*: the product must work properly, be safe, and

Fig. 1 Pens, inexpensive and expensive. The chosen material – acrylic in the upper picture, gold, silver, and enamel in the lower one – create the aesthetics and associations of the pens. They are perceived differently, one pair as utilitarian, the other as something rare and crafted. (Lower image courtesy of Vintagepens.com.)

economical. Functionality alone is not enough: the product must be easy to understand and operate, which are questions of *usability* – the second tier of the figure. The third tier, completing the pyramid, is the requirement that the product gives satisfaction: that it enhances the life of its owner.

Think for a moment about buying a car. Within a given price range there are many models, all of which, today, offer about the same performance, and are almost equally safe and economical. Functionality alone does not sell a car. Think now of usability. You or I can rent a car we have never seen
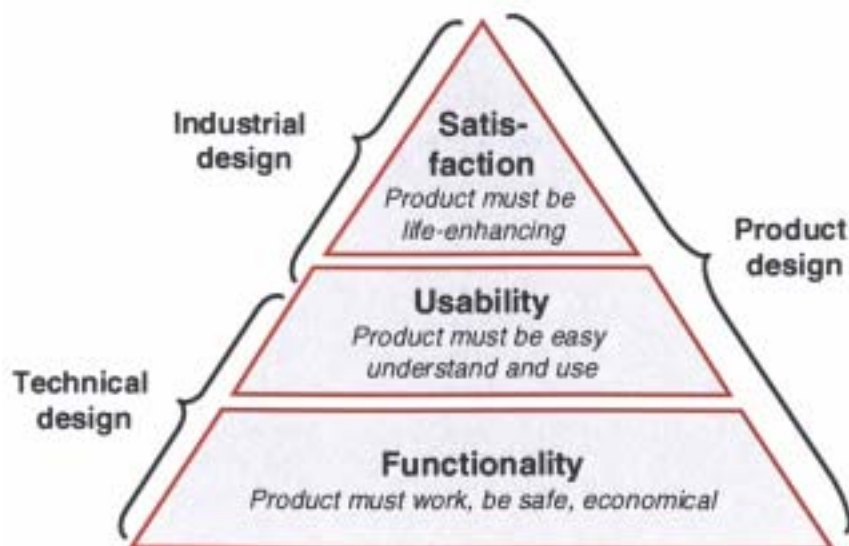

Fig. 2 The requirements pyramid. The lower part of the pyramid tends to be labeled 'Technical design', the upper part 'Industrial design'; better, perhaps, is to think of think of all three tiers as part of a single process that we shall call 'Product design'.

before and drive it out into dense traffic in an unfamiliar city, and do so in a reasonably safe, competent way. This suggests that the user-interface is pretty standard, that one car does not differ greatly from another in this regard. With so little to distinguish them in these ways, the things that perhaps most differentiate one model from another – that create its individual character – are its aesthetics, the associations it carries, and the perception it creates.

There is a view – one held by engineers as different as Brunel and Barnes Wallis – that a design which is functional is automatically beautiful. Its proponents cite the undeniable appeal of a beautiful bridge or of a modern aircraft. The craftsman Eric Gill (noted for his elegant typefaces and sculptures) expresses it on a higher plane, saying: "Look after goodness and truth in design and beauty will take care of herself." But there also exists a different and widely-held view that design is an art, or if not that, then a craft with its basis in art, not in engineering. Its supporters – and they have included many distinguished designers – argue that the practice of fine arts and drawing must form the basis of the training of designers. Only this can give an appreciation of form, color, line, and quality, and the sensitivity to the possibilities of their right relationship.

Both views are extreme. The first argument is the one most likely to appeal to the engineer: that a functionally efficient machine is, of itself, pleasing to the eye and mind; it is the basis of what is called a 'machine aesthetic'. But something is obviously missing. It is part of the purpose of the machine to be *operated*, and the design is incomplete if the satisfaction of the operator is ignored. It is as if eating had been reduced to the intake of measured quantities of carbohydrate and protein, depriving it of all gastronomic pleasure. The missing elements include the ergonomics – the man-machine interface – and include the idea of visual enjoyment and aesthetic pleasure for its own sake.

Empty decoration, on the other hand, is equally unsatisfying. Styling can give pleasure, but the pleasure is diminished if the appearance of the product bears no relationship to its function. The pleasure is transitory; you quickly grow tired of it; it is like living on a diet of chocolate and puff-pastry. Successful industrial design tells you what the product is, how to use it, *and* gives pleasure.

So what is excellent design? It is the imaginative attempt to solve the problem in all its aspects: the use to which the product will be put; its proper working; the suitability of the materials of which it is made; its method of production; the quality of the workmanship; how it will be sold, packaged, and serviced; and, but by no means least important, the satisfaction it will afford the user. It seldom costs more to use a good shape than a bad one, or good texture instead of bad.

Why tolerate ugliness? Take the bar code, for example. Few things are more functional, more information-intensive, than the bar code (Fig. 3). And few are uglier. Their ugliness causes designers of book jackets, wine labels, food packages – of almost everything – to make them small and hide them at

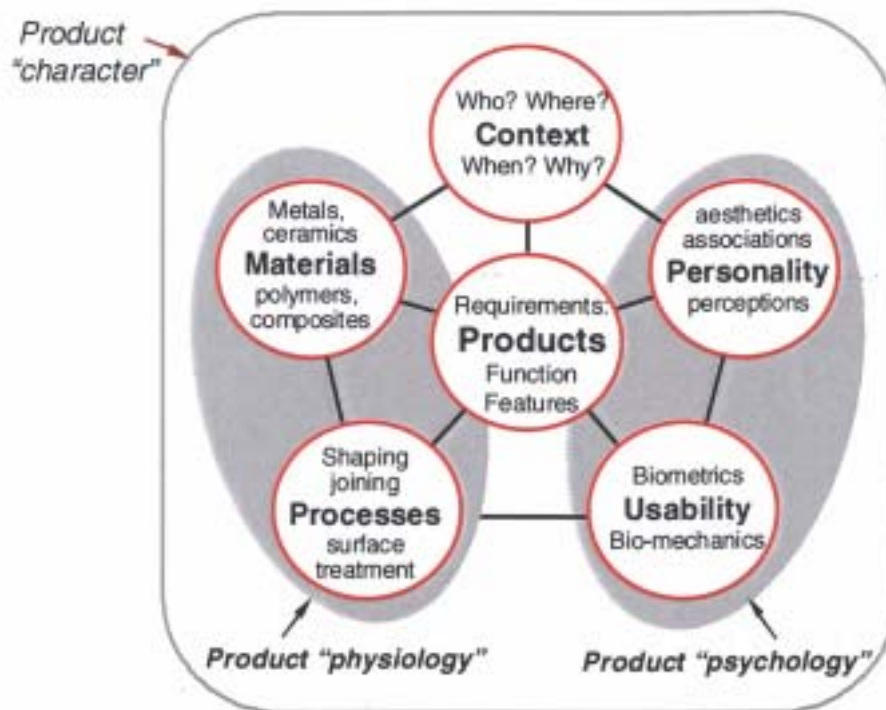*Fig. 3. Bar codes before and after modification.*

Fig. 4 The dissection of product character. Context defines the intentions or 'mood'; materials and processes to shape, join, and finish them create the flesh and bones; ergonomics determines usability; and the aesthetics, associations, and perceptions of the product create its personality.

the bottom, round the back. And even there they are ugly. Is that necessary? Could they not, in some small degree, give pleasure? Bar codes are read by a horizontal sweep; no information is contained vertically. Those in Fig. 3 come from a pharmaceutical product and from the end of a bobbin of thread. Why not, at least, acknowledge this?

One response is shown in the lower part of Fig. 3. These are designs from the Ecole Supèrieure des Arts Graphiques in Paris, commissioned by the US firm Intermec, which markets the most widely used coding system. They succeed at two levels. They are novel – other bar codes are not like this – and because they are novel, they entertain, they turn dullness into interest, they please. And because they are 'to be seen', not 'to be hidden', the designer can make them bigger and display them prominently where they can be scanned more easily.

And making this change has cost nothing at all[2]. It is no more expensive to print a bar code that appeals as an abstract design, or as a caricature, or has humor, or conveys visual information (the examples of Fig. 3 do all these things) than it is to print an ugly one. So why not? Designing for pleasure as well as functionality is a worthy goal. But there is

more to it than that. To get further we need to dissect product character, psychoanalyze it, so to speak.

Product character

Fig. 4 shows a way of dissecting product character. Think of it as a way of organizing information about the design of a product and the way this strikes an observer. In the center is information about the product itself: the basic design requirements, its function, and features. The way these are thought through and developed is conditioned by the *context*, shown in the circle above it. Fig. 5 elaborates: the context is set by the answers to the questions: *Who? Where? When? Why?* Consider the first of these: *Who?* A designer seeking to create a product attractive to women will make choices that differ from those for a product intended for children, or the elderly, or sportsmen. *Where?* A product for use in the home requires a different choice of material and form than one to be used, say, in a school or hospital. *When?* One intended for occasional use is designed in a different way than one that is used all the time; one for formal occasions differs from one for informal occasions.

Aesthetics
Colour, transparency
Form
Feel, texture
Taste, smell
Sound

Associations
Wealth   (Rolls Royce)
Military hardware (Land Rover)
Aerospace   (many US cars)
Plants/animals   (VW Beetle)
Children's toys   (Renault Twingo)

Perceptions
Youthful -- Mature
Expensive -- Cheap
Playful -- Serious
Feminine -- Masculine...
...
And - if you owned it ...
Proud -- Disappointed
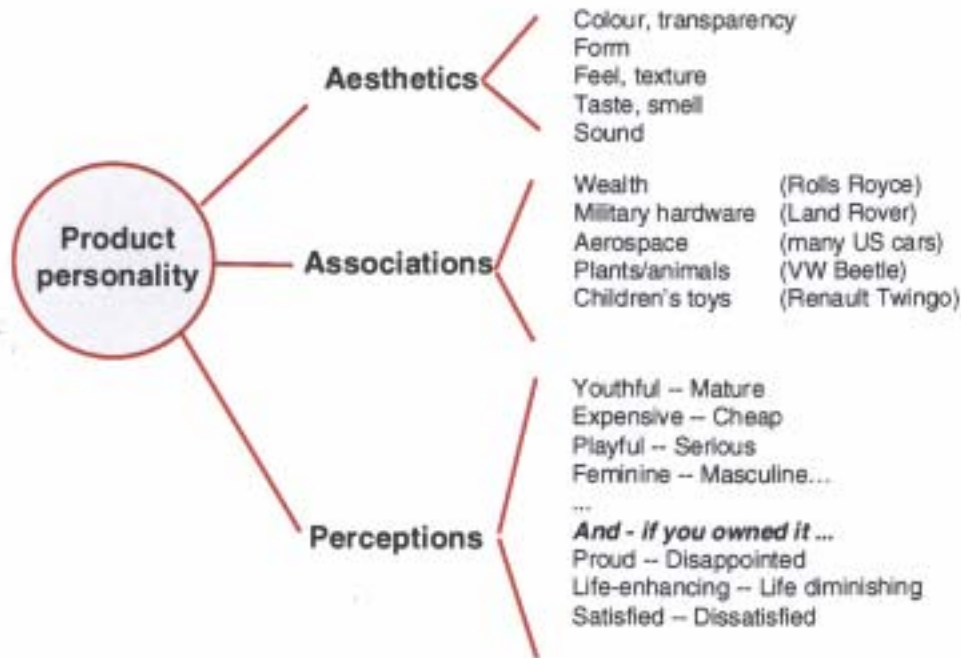Life-enhancing -- Life diminishing
Satisfied -- Dissatisfied

Fig. 5 Personality is created by product aesthetics (color, form, feel, etc.), its associations (the things it suggests), and the way it is perceived (the emotions it generates in an observer).

Why? A product that is primarily utilitarian involves different design decisions than one that is largely a lifestyle statement. The context influences and conditions all the decisions that the designer takes in finding a solution. It sets the *mood*[3].

Now back to the dissection of Fig. 4. On the left lies information about the *materials* and *processes* used to shape, join, and finish the product. Each represents the library, so to speak, from which the choices can be made, and the attributes that each choice offers. The primary step in selecting both material and process is that they can meet the constraints imposed by the primary design requirements – the essential functions and features of the central circle. Material and process give the product its tangible form, its flesh and bones so to speak; they create the *product physiology*.

On the right of Fig. 4 are two further packages of information. The lower one – *usability* – characterizes the ways in which the product communicates with the user: the interaction with their sensory, cognitive, and motor functions. Product success requires a mode of operation that, as far as possible, is intuitive, does not require taxing effort, and an interface that communicates the state of the product and its response to user action by visible, acoustic, or tactile response. It is remarkable how many products fail in this and, in doing so, exclude many of their potential users.

One circle on Fig. 4 remains: the one labeled *personality*. Product personality is the central topic of this article; it derives from *aesthetics*, *associations*, and *perceptions*. They require explanation. Anaesthetics dull the senses. Aesthetics do the opposite: they appeal to the five senses of sight, hearing, touch, taste, and smell. The first row of Fig. 5 elaborates: we are concerned here with color, form, texture, feel, smell, and sound – think of the smell of a new car and the sound of its door closing. Products also have associations, the things they remind you of, the things they suggest. The Land Rover and other SUVs have forms and (often) colors that mimic those of military vehicles. The streamlining of American cars of the 1960s and 1970s carried associations of aerospace. It may be an accident that the VW Beetle has a form that suggests the insect, but the others are no accident; they were deliberately chosen by the designer to appeal to the consumer group (the *Who?*) at which the product was aimed.

Fig. 6 Lamps. Both have the same technical rating, but differ completely in their personalities. Materials, processes, form, weight, and color all contribute to the personality.

Finally, the most abstract quality of all, *perception*. Perceptions are the reactions the product induces in an observer, the way it makes you feel. Here there is room for disagreement, certainly; the perceptions of a product change with time and depend on the culture and background of the observer. Yet, in the final analysis, it is the perception that causes the consumer, when choosing between a multitude of roughly similar models, to prefer one above the others; it creates that 'must have' feeling. Table 1 lists some perceptions with their opposites (a way of sharpening the meaning). They derive from product reviews and magazines specializing in product design; they are a part of a vocabulary, one that is used to communicate views about product character[4].

Analyzing product character

The ways in which material, processes, usability, and personality combine to create a product character tuned to the context or 'mood' is best illustrated by examples. Fig. 6 shows the first. The image on the left is an office desk lamp. Here is an attempt to analyze its character.

Character analysis: the office desk lamp.	
Context	An office worker who spends most of the time at the desk.
Materials and processes	Folded steel sheet, cast iron base, powder-coated.
Usability	Straightforward: a simple on/off switch.
Personality	Aesthetics. Form: angular, metallic. Color: cream. Feel: smooth, heavy (very). Associations. Color and form echo those of computer consoles, keyboards, executive phones (hence advanced technology, the modern office). Perceptions. Well-made, durable, fit for the task, modern, efficient, subdued, but also dull, impersonal, suggesting the workplace (not for the bedside).

The lamp on the right of Fig. 6 has the same technical rating as that on the left; the same functionality and usability. But there the resemblance ends. Its character is shown overleaf.

Fig. 7 shows a second example. On the left is a product from a company that needs no introduction; the effective

Table 1 *Some perceived attributes of products, with opposites.*			
Aggressive	Passive	Extravagant	Restrained
Cheap	Expensive	Feminine	Masculine
Classic	Trendy	Formal	Informal
Clinical	Friendly	Hand-made	Mass-produced
Clever	Silly	Honest	Deceptive
Common	Exclusive	Humorous	Serious
Decorated	Plain	Informal	Formal
Delicate	Rugged	Irritating	Lovable
Disposable	Lasting	Mature	Youthful
Dull	Sexy	Nostalgic	Futuristic
Elegant	Clumsy		

Character analysis: bedside lamp.	
Context	Designed for children and adults who still enjoy being children; the playroom or bedroom.
Materials and processes	Injection-molded acrylic, self-colored.
Usability	Straightforward: a simple on/off switch.
Personality	Aesthetics. Form: rounded, contoured. Color: contrasting, translucent hues. Feel: smooth, light in weight. Associations. Form derived from nature; cartoons, comic strips (hence lighthearted). Perceptions. Playful, funny, cheerful, clever; but also: eccentric, not durable, and easily damaged.

way in which the industrial design is used makes it instantly recognizable. Its character has the following components.

Character analysis: hi-fi	
Context	One might guess: upwardly mobile or successful professionals with considerable disposable income desiring discreetly noticeable, state-of-the-art products in their home environment.
Materials and processes	Brushed aluminum, black enamel, and fabric.
Usability	Complex: infrared remote control with multiple functions.
Personality	Aesthetics. Form: linearity, use of primitives (circles, squares, cylinders, cones). Color: restrained matt silver and black. Associations. Organ pipes (hence music); precision instruments (hence performance, reliability). Perceptions. Advanced technology; cutting-edge design; quality; a symbol of taste; 'only the best is good enough'.

The products on the right of Fig. 7 have a very different character. This is a company that has retained market share, even increased it, by *not* changing, at least as far as appearance is concerned (I had one 40 years ago that looked exactly like one of these).

Character analysis: radio	
Context	One might guess: individuals with traditional tastes who feel uncomfortable with modern technology or feel that it clashes with the home environment.
Materials and processes	Polished wood, dyed leather, suede.
Usability	Exceptionally simple and easily understood: four buttons, two knobs, each with a single function.
Personality	Aesthetics. Form: simple, soft form. Color: muted, pastel. Feel: soft. Associations. Handcrafted furniture, leather purses and handbags (hence luxury, comfort, style), the past (hence stability). Perceptions. Solid craftsmanship, reliability, traditional, appealingly retro but durable design.

What we have here is a framework for analyzing existing products, what you might call 'reverse industrial engineering'. But if we wish to examine the choices a designer might make in creating the personality of a new product, we need to go further and examine how materials and processes contribute to creating personality and character.

Creating product personality

Do materials have a personality? There is a school of thinking, which holds as a central tenant, that materials must be used 'honestly'. By this they mean that deception and disguise are unacceptable – each material must be used in ways that expose its intrinsic qualities and natural appearance. It has its roots in the tradition of craftsmanship – potters' use of clays and glazes, carpenters' use of woods, the skills of silversmiths and glass makers in crafting beautiful objects that exploit the unique qualities of the materials with which they work – an integrity to craft and material.

This is a view to be respected. But it is not the only one. Design integrity is a quality that consumers value, but they also value other qualities: humor, sympathy, surprise, provocation, even shock. You don't have to look far to find a product that has any one of these, and often it is achieved by using materials in ways that deceive. Polymers, as we have said, are frequently used in this way – their adaptability invites it. And, of course, it is partly a question of definition – if you say that a characterizing attribute of polymers is their ability to mimic other materials, then using them in this way *is* honest.

But can a *material* be said to have a personality? At first sight, no – it only acquires one when used in a product. Like an actor, it can assume many different personalities, depending on the role it is asked to play. Wood in fine furniture suggests craftsmanship, but in a packing case, cheap utility. Glass in the lens of a camera has associations of precision engineering, but in a beer bottle, that of disposable packaging. Even gold, so often associated with wealth and power, has different associations when used in microcircuits: that of technical functionality.

But wait. The product in Fig. 8 has its own somber association. If you had to choose one, you would probably not have any particular feelings about this one – it is a more or less typical example. But suppose I told you it was made of *plastic* – would you feel the same? Suddenly it becomes like a bin, a waste basket, inappropriate for its dignified purpose.

Fig. 7 Consumer electronics. The products on the left are aimed at a different consumer group than those on the right. The personalities of each (the combination of aesthetics, associations, and perceptions) have been constructed to appeal to the target group. Materials play a central role here in creating personality. (Left image courtesy of Bang & Olufsen; right image courtesy of Roberts Radios, Ltd.)

Materials, it seems, *do* have personality.

Expression through material. Think of wood. It is a natural material with a grain that has a surface texture, pattern, color, and feel that other materials do not have. It is tactile – it is perceived as warmer than many other materials, and seemingly softer. It is associated with characteristic sounds and smells. It has a tradition; it carries associations of craftsmanship. And it ages well, acquiring additional character with time; objects made of wood are valued more highly when they are old than when they are new. There is more to this than just aesthetics; there are the makings of a personality, to be brought out by the designer, certainly, but there none the less.

And metals... Metals seem cold, clean, precise. They ring when struck. They reflect – particularly when polished. They are accepted and trusted: machined metal looks strong, its very nature suggests it has been *engineered*. The strength of metals allows slender structures – the cathedral-like space of railway stations or the span of bridges. It can be worked into flowing forms like intricate lace or cast into solid shapes with

Fig. 8 A coffin. Wood is perceived to be appropriate for its sombre, ceremonial function, plastic inappropriate.

Fig. 9 Design styles and the materials they exploit to create product personality. (Image of Bauhaus chair courtesy of Steelform; Dyson vacuum cleaner courtesy of Dyson.co.uk.)

elaborate, complex detail. And – like wood – metals can age well, acquiring a patina that makes them more attractive than when newly polished – think of the bronze of sculptures, the pewter of mugs, the lead of roofs.

And ceramics and glass? They have an exceptionally long tradition – think of Greek pottery and Roman glass. They accept almost any color; this and their total resistance to scratching, abrasion, discoloration, and corrosion gives them a certain immortality, threatened only by their brittleness. They are – or were – the materials of great craft-based industries: the glass of Venice, the porcelain of Meissen, the pottery of Wedgwood, valued at certain times more highly than silver. And ceramics today have additional associations – those of advanced technology: kitchen stove-tops, high-pressure/high-temperature valves, space shuttle tiles... materials for extreme conditions.

And finally polymers. 'A cheap, plastic imitation', it used to be said – and that is a hard reputation to live down. It derives from the early use of plastics to simulate the color and gloss of Japanese handmade pottery, much valued in Europe. Commodity polymers *are* cheap. They are easily colored and molded (that is why they are called 'plastic'), making

imitation easy. Unlike ceramics, their gloss is easily scratched, and their colors fade – they do not age gracefully. You can see where the reputation came from. But is it justified? No other class of material can take on as many characters as polymers: colored, they look like ceramics; printed, they can look like wood or textile; metallized, they look exactly like metal. They can be as transparent as glass or as opaque as lead, as flexible as rubber or as stiff – when reinforced – as aluminum. But despite this chameleon-like behavior they *do* have a certain personality: they feel warm – much warmer than metal or glass. They are adaptable – that is part of their special character; and they lend themselves, particularly, to brightly colored, lighthearted, even humorous, design.

So there is a character hidden in a material even before it has been made into an recognizable form – a sort of embedded personality, a shy one, not always obvious, easily concealed or disguised, but one that, when appropriately manipulated, imparts its qualities to the design. It is for this reason that certain materials are so closely linked to certain design styles (Fig. 9). A *style* is a shorthand for a manner of design with a shared set of aesthetics, associations, and perceptions. The Early Industrial style (1800-1890)[5]

embraced the technologies of the industrial revolution, using cast iron, and steel, often elaborately decorated to give it a historical façade. The Arts and Crafts movement (1860-1910) rejected this, choosing instead natural materials and fabrics to create products with the character of traditional handcrafted quality. Art Nouveau (1890-1918), by contrast, exploited the fluid shapes and durability made possible by wrought iron and cast bronze, the warmth and textures of hardwood, and the transparency of glass to create products of flowing, organic character. The Art Deco movement (1918-1935) extended the range of materials to include, for the first time, plastics (Bakelite and Catalin) allowing production both of luxury products for the rich and also mass-produced products for a wider market. The simplicity and explicit character of Bauhaus designs (1919-1933) is most clearly expressed by the use of chromed steel tubing, glass, and molded plywood. Plastics first reached maturity in product design in the cheeky iconoclastic character of the Pop Art style (1940-1960). Since then, the range of materials has continued to increase, but their role in helping to mold product character remains.

Expression through process. Creating form is one of the earliest forms of human expression: carved stone and molded pottery figures, beaten ornaments, and cast jewelry predate any documented ability to write or draw, exemplifying shaping as a channel for self-expression. The processes used in product design today are evolutionary descendants of these prehistorical antecedents. Figs. 6 and 7 show ways in which form and materials can be chosen and shaped to create products personalities, each with a particular user-group in mind.

Joining, too, can be used expressively. It reaches an art form in bookbinding, in the dovetailing of woods, and in the decorative seaming of garments. In product design, too, joints can be used as a mode of expression. The fuel cap of a contemporary performance car shown in Fig. 10 (left), machined from stainless steel and attached by eight Allen screws, is an expression of precision technology that implies the same about the rest of the car. The watch on the right, intended for sports-diving, uses the same motif to suggest the robust quality. The prominent welds on the frame of a mountain bike of Fig. 11 (left) suggest a stronger, tougher product than does the brazed sleeve joints of the town bike on the right. Deliberately highlighted joints are used as decorative motives, sometimes to emphasize the function of the product, sometimes as a way of creating associations, as in the lamp on the right of Fig. 6.

Surface finish, too, carries messages. The late 20th and early 21st century is addicted to flawless perfection[6]. Makers of earth-moving equipment have long known that, if their products are to sell, they must deliver them with a class A finish, the same as that required for a passenger car. And this, despite the fact that the first thing a purchaser does is to lower the thing into a hole full of mud to start digging. It is

Fig. 10 Joining as a means of expression. The precision-machined stainless steel fuel cap on the left, attached by eight Allen screws (it carries no significant loads) projects a sense of the precise engineering of the entire vehicle. The watch on the right uses the same motif to suggest that it is built to resist the harshest treatment.
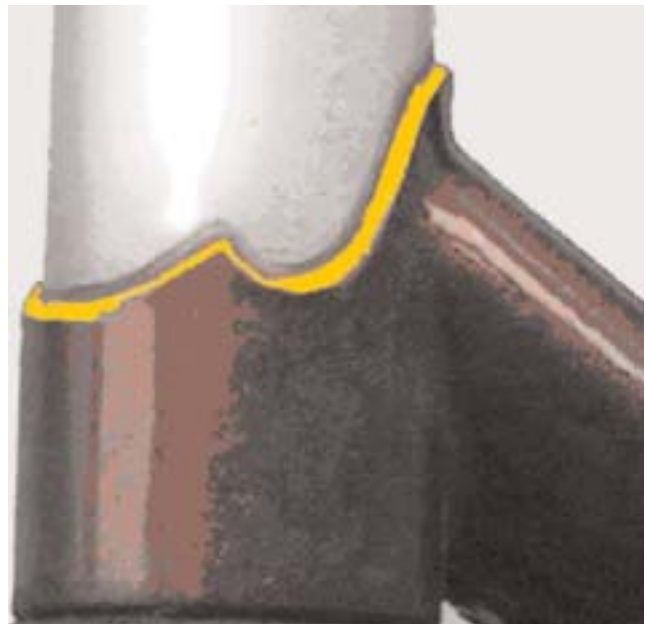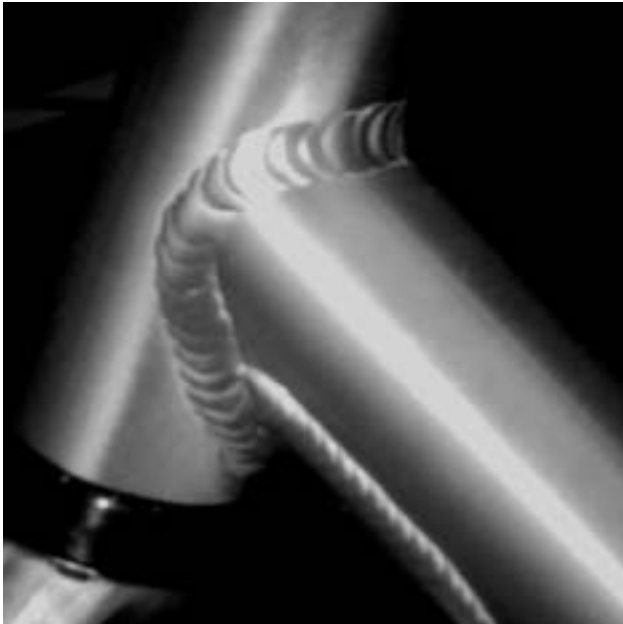
Fig. 11 The bold, prominent weld of the mountain bike on the left carries an aura of robustness, implying the same about the bike itself. That of the town bike, on the right, suggests decorated delicacy.

Fig. 12 Fuji Nexia Q1s: the same performer presented in four different costumes: cool, blush, beach, and tech. (Courtesy of Fuji Film.)

because the perfection of the finish expresses the perfection of the equipment as a whole; a poor finish implies, however mistakenly, poor quality throughout. Look again at the brushed aluminum and dyed leather of the products of Fig. 7 and the way they create associations, the one of technical perfection, the other of luxury handbags and luggage.

So surface processes can serve to attract, as with the digger. It can suggest, sometimes with the aim of deceiving; metallized plastic is an example. It can surprise, adding novelty – a jug kettle with a thermochromic surface coating that changes color as the water heats up. It can entertain: holographic surface films can suggest something lurking inside the article to which it is applied. It can add function: nonslip coatings add an ergonomic function, contrasting colors identify different function elements. And it can simply dress up the same product in different clothes, each to fit a different context (Fig. 12).

Summary and conclusions

What do we learn? The element of satisfaction is central to contemporary product design. It is achieved through an integration of good technical design to provide functionality, proper consideration of the needs of the user in the design of the interface, and imaginative industrial design to create a product that will appeal to the consumers at whom it is aimed.

Materials play a central role in this. Functionality is dependant on the choice of proper material and process to meet the technical requirements of the design safely and economically. Usability depends on the visual and tactile properties of materials to convey information and respond to user actions. Above all, the aesthetics, associations, and perceptions of the product are strongly influenced by the choice of the material and its processing, imbuing the product with a personality that, to a greater or lesser extent, reflects that of the material itself.

Consumers look for more than functionality in the products they purchase. In the sophisticated market places of developed nations, the 'consumer durable' is a thing of the past. The challenge for the designer no longer lies in meeting the functional requirements alone, but in doing so in a way that also satisfies the aesthetic and emotional needs. The product must carry the image and convey the meaning that the consumer seeks: timeless elegance, perhaps; or racy newness. One Japanese manufacturer goes so far as to say: "*Desire* replaces *need* as the engine of design".

Not everyone, perhaps, would wish to accept that. So we end with simpler words – the same ones with which we started. Good design works. Excellent design also gives pleasure. MT

Acknowledgments

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2. A disingenuous statement. It costs design time.

3. Many designers working on a product assemble a 'mood board' with images of the sort of people for whom the product is intended, the surroundings in which they suppose it will be used, and the other products that the intended user group might own, seeking to capture the flavor of their lifestyle.

4. Aesthetics, associations, and perceptions are discussed more fully in the book by Ashby and Johnson (see above).

5. The dates are, of course, approximate. Design styles do not switch on and off on specific dates, they emerge as a development of, or reaction to, earlier styles with which they often coexist, and they merge into the styles that follow.

6. A mistake. Surface perfection is violated by the slightest defect – it has no hope of aging gracefully. Better to make visual imperfection a part of the personality of the product – something that gives it individuality. It is this, in part, that makes natural materials – wood, leather, and stone – attractive.

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