Introduction

1

> To design is much more than simply to assemble. to order. or even to edit; it is to add value and meaning, to Illuminate, to simplify, to clarify, m modify, to dignify, to dramatize, to persuade, and perhaps even to amuse.
>
> **Paul Rand,**
> **Design, Form, and** Chaos

This book is about visual design for graphical user interfaces. We have found the orienration, process, and training of the visual design disciplines to be especially well-suited to the problems of graphical user interface (GUI) design. When we speak of the *visual design* disciplines, we include communication-oriented graphic design (often described as visual communication design), industrial design, and architecture (including interior space design). These are the professions concerned most directly with the user's experience of a *form* in *the context of a specific task or problem,* as opposed to its functional or aesthetic qualities in isolation. Other *visual* disciplines – such as painting, sculpture, illustration, filmmaking, or photography – while they have much in common with the visual design disciplines, typically adopt a more specialized focus or a less applied orientation. Other *design* disciplines – including most branches of engineering – also have substantial overlap, particularly in process and methodology, but they tend to focus largely or even exclusively on functional issues, often at the expense of aesthetics. *Visual design* attempts to solve *communication* problems in a way that is at once functionally effective and aesthetically pleasing.

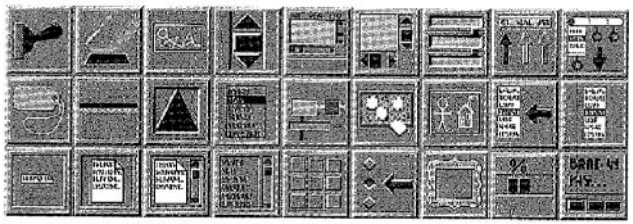
By communication, we mean the full process by which the behavior of one goal-seeking entity comes to be affected by that of another through the reciprocal exchange of messages or *signs* over some mediating physical channel. Research in communication theory (see Cherry, 1978) has investigated the statistical properties of cornmumcation channels, the structure of language

systems, the psychological and social characteristics of message senders and receivers, and the effectiveness of various coding techniques. All of these factors must be considered in communication-oriented design. Even more fundamental is the field of semiotics – the general theory and practice of signs (Peirce, 1931, Morris, 1938) – which we review briefly in Chapter Six. The goal of communication-oriented design is to develop a message that can be accurately transmitted and correctly interpreted, and which will produce the desired behavioral outcome after it has been understood by its recipient.

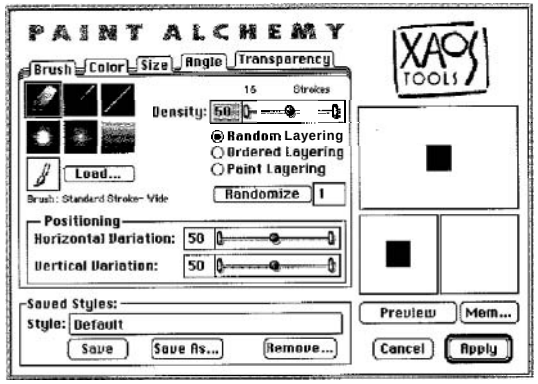
We refer frequently to visual *language*, by which we mean the visual characteristics (shape, size, position, orientation, color, texture, etc.) of a particular set of design elements (point, line, plane, volume, etc.) and the way they are related to one another (balance, rhythm, structure, proportion, etc.) in solving a particular communication problem. Any *language* system defines both a universe of possible signs and a set of rules for using them. Every visual language thus has a *formal vocabulary* containing the basic design elements from which higher-level representations are assembled, and a *visual* syntax describing how elements may be combined within that system. We will return to these topics shortly, but first we must review the state of the art.

Mess We're In

With a few notable exceptions, presentday GUI applications leave much to be desired from a communication standpoint. The arrival of GUI technology has opened up new degrees of freedom in the use of color, typography, and imagery. Most of the world's character-based applications are rapidly being ported to Microsoft® Windows™ (hereafter denoted simply as *Windows*), the Macintosh, or OSF/Motif (a GUI for UNIX workstations). The results are reminiscent of the early days of desktop publishing, when computers fist gave people without the appropriate background and skills the *mechanical*



1: Imagery that a stracts, confuses, or simply bewilders the un nitia:ed user s a roo conmon .n the current generation of graphica apo cations. (Palettes from Bu ger Xcesscy oy ICS.

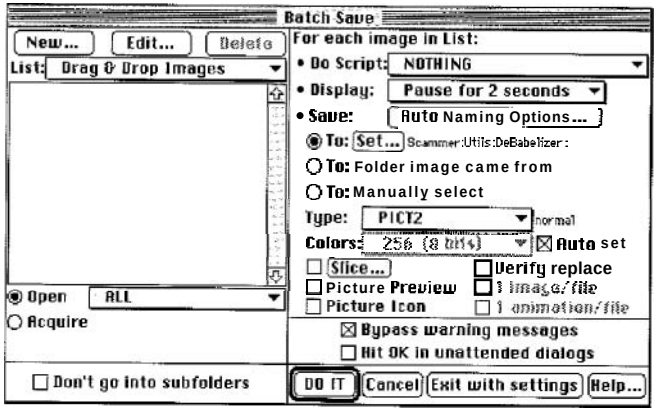


2: Nonstandardgrapt ca elements ntendea to differentiate an application from its competition underm ro tho opportunity for transfer of learning ottered by the GUI environment. Do you want users thinking about *their* work or *your* sliders?

capacity to produce "realistic" printed materials. While the technical level of production was indeed impressive, the aesthetic quality left much to be desired simply because powerful tools had been placed in the hands of people without the training needed to use them correctly. Today's GUI applications suffer from exactly the same problem, as shown in Figures 14.

> The public is more familiar with bad design than good design. It is, in effect. conditioned to prefer bad design, because that is whal it lives with. The new becomes threatening, the old reassuring.
>
> Paul Rand
> Design. Form, and Chaos

Ironically, given the graphical nature of the GUI revolution, imageryds one of the biggest problems. The Windows user, in particular, has been "blessed" with a hieroglyphic outpouring of tool *bars*, icon *bars*, *button bars*, *help bars*, *QuickAccess bars*, *SpeedBars*, and *SmartIcons*. The vast array of icons needed to satisfy this burgeoning demand (it is now customary to provide a configurable toolbar with an icon for each function in one's application) combined with the need to support low-resolution 16-color displays has led to an astonishing proliferation of low-quality images (1, see also 212–218, Note: *our convention is to cite figures parenthetically by number* only, *with multi-part examples labeled* from *left to right: (a), (b), (c), etc.)* that sacrifice



3: Reducing the number of dialog boxes may improve the organization of your application, but there will be little net benefit to the user if the dialogs are this crowded and disorganized as a result.

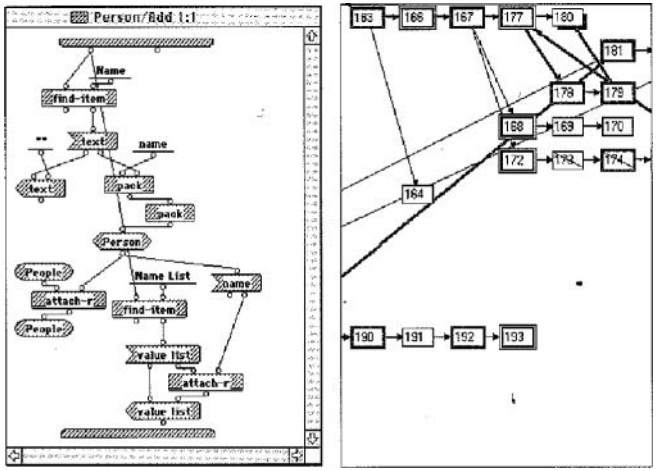
valuable communication bandwidth in a well-intentioned pursuit of graphical glitz and "fun." Unfortunately, many of these images are so poorly designed as to be practically unintelligible, even when (as is rarely the case) there is some degree of consistency across (or even within) applications.

Even in a well designed and faiily well standardized environment such as the Macintosh desktop, it has proven difficult to stem the tide of application-specific styles, arbitrary mappings, and idiosyncratic imagery **(2).** Flexible authoring environments such as Hypercard extend the "naive desktop publisher" phenomenon to the design of **wen** the GUI primitives themselves. The situation isn't much better in the Windows world, where at least four major "house styles" are now evident among mainstream applications (Berst, 1992 a-b). In fairness to application developers, existing user interface toolkits have provided very little support for communication-oriented visual design. In **fact,** most toolkits impose unnecessary design restrictions as a side effect of their own implementation or internal architecture.

Another problem that has been around as long as the GUI itself is evident in the haphazard, devil-may-care arrangements of controls in windows and dialog boxes **(3).** In fact, the typical application interface was probably structured more effectively in the days of character-oriented displays, since

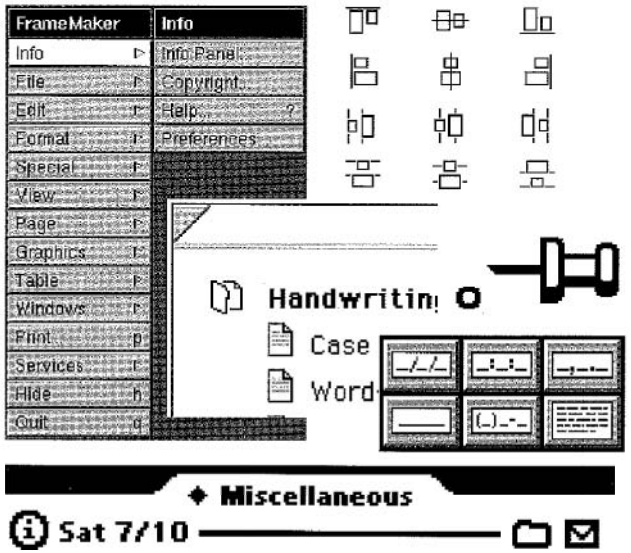
the limited number of positions in a character-mode screen had to be managed more carefully – and permitted less variation in the first place – than today's high-resolution raster displays. Basic principles of visual organization developed through centuries of experience with print media have rarely **been** applied to the on-screen media, and communication has suffered as a result.

Graphical interfaces have generated a prodigious body of research (Shu, **1988, Eades** and Tamassia, 1989, Myers, **1990) leading** to dozens of commercial products based on visual programming, program visualization, and graphical data display. A wide variety of scheduling tools, project management systems, and personal information managers, not to mention visual programming environments **(4)** employ visual representations to help users make sense of complex serial dependencies and interleaving or concurrent processes. Despite their commercial success, these applications are plagued by the generally low quality of their visual displays. There appears to be a tacit assumption in each of these areas **that** simply using a graphical display will automatically confer all the benefits of **effective** visual presentation on a



4: Existing "visual- applications are generally made surprisingly poor use of visual language and spatial organization in their graphical displays. Both this visual programming environment (a) and this graphical project manager (b) do a poor job of making the essential information obvious "at a glance."

complex problem domain. Unfortunately, a spatial representation must use visual (and non-visual) language effectively for the potential of graphical displays to be realized. The fact that it takes a very good picture to be worth a thousand words has rarely been appreciated within this domain (one notable exception can be seen in the elegant BALSA algorithm simulation environment [Brown and Sedgwick, 19841). The use of color has created similar problems. The limitations of a small color palette have long been compounded by the tendency to fill the color table with colors that are easy to



Excellent design can be found in modern GUI environments – albeit mostly at the system software level – as evidenced by this collage of effective graphical elements (each described in greater detail in the chapters to come) from various graphical applications and GUI standards.

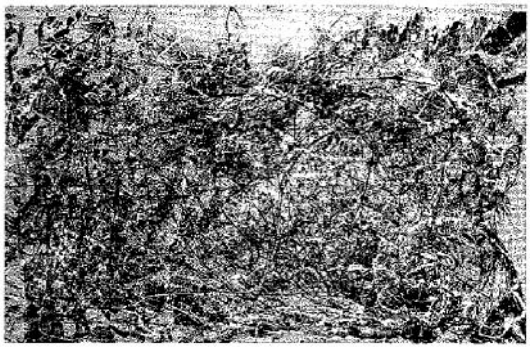
describe digitally. This practice inevitably produces the familiar range of intense, oversaturated colors that still predominates in many computer displays. Eventually, the problem should diminish as displays with higher color resolution become the norm, but better solutions will only arise if the problems with current displays are recognized. As with any dimension of visual language, color can enhance communication, but only if it is used correctly.

Of course we don't mean to imply that the industry has been completely without success in the area of visual design. On the contrary – a number of successful products have led the way with excellent visual solutions. Most of the familiar operating environments, for example, employ some visual elements, and occasionally a comprehensive visual language, that are effective for their target markets (5). These elements succeed from a visual design standpoint largely because their sponsors have made the commitment to involve professional designers. For large system software vendors, the investment is easily justified by the leverage gained in standard *user interface* toolkits that can be re-used by all developers.

Unfortunately, development organizations have rarely shown the same vision at higher levels of the software food chain, and much of the momentum provided by standardized toolkits has been squandered as a result. Today, simply using the low-level toolkit components does little to ensure a high quality (or even a style guide compliant) application because the way ***the pieces are put together is usually as important as the pieces themselves.*** The remainder of this book will describe ways in which these higher level issues can be addressed. We expect that real success will only be achieved through close collaboration between system-sensitized visual and conceptual designers and design-sensitized software engineers and managers. The rest of this introduction describes the field of visual design and the contribution that a competent visual designer can make to the development team.

What Visual Designers Do

Design is not something that can be applied after the fact, when the fundamental organization of the product has already been determined – though this is indeed a common misconception. To be effective, design must be an integral part of the product development lifecycle. The process employed by visual designers is comparable to the typical engineering methodology. An initial understanding of the problem based on thorough background. research is followed by an iterative cycle of generation and evaluation until the solution that best meets the requirements is selected for production. The designer serves typically as a planner, coordinator, and orchestrator of many specialist subcontractors. Areas of direct responsibility typically include background research and problem definition; high level design and concept/program development; planning, coordination, and design specification; production supervision and quality control. Some designers produce their own copywriting, illustration, photography, or pre-press production, but more commonly these tasks are contracted out to production specialists.



6: The painting, Number 1A, by Jackson Pollock. illustrates the concern of the fine arts for pure form – divorced completely from functional or representational criteria – as a direct expression of the personal aesthetic vision of the artist
© 1993 Pollock-Krasner Foundation/ARS, New York.

snd Design

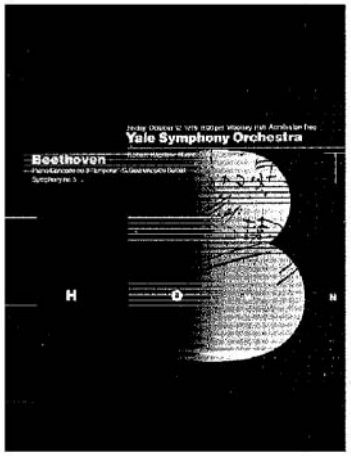
The designer is not an artist, at least not in the sense in which that term is commonly understood. This remains *a* point of confusion for many in the software industry. The artist, like the poet, is engaged in the manipulation of the formal.qualities of a particular medium to produce an aesthetic response. Aside from the technical ability of the artisan and the limitations of the medium, there are few if any constraints on the forms produced by the artist. That forms can be taken from their original context and experienced on their own terms is a central tenet of modern art. This concept underlies the work of modern artists from surrealist sculptor, painter, and conceptual artist Marcel Duchamp to abstract expressionist painter Jackson Pollock (6).

> The designer is a visually literate person, just as an editor is expected by training and inclination to be versed in language and literature, but to call the former an artist by occupation is as absurd as to refer to the latter as a poet.
>
> **Douglas Martin**
> Book Design

Art is valued for its originality and expressiveness. Its focus is on individual artifacts crafted through the manual and aesthetic virtuosity of the artist. Design, in contrast, is valued for its fitness to a particular user and task. Certainly, design is concerned with producing a life-enhancing aesthetic experience where possible, but the design aesthetic is always related to the intended function of the resulting product. Design is focused on the specification of products intended for mass production and widespread distribution. Whereas art strives to ***express*** fundamental ideas and perspectives on the human condition, design is concerned with finding the ***representation*** best suited to the communication of some specific information. The choice and arrangement of elements in the concert poster by Inge Druckrey (7), for example, are constrained by the need to effectively communicate the date, time, place, and event in question. The elegant manner in which this information is conveyed within the context of a formal aesthetic statement that reinforces and enhances the message is a hallmark of good design.

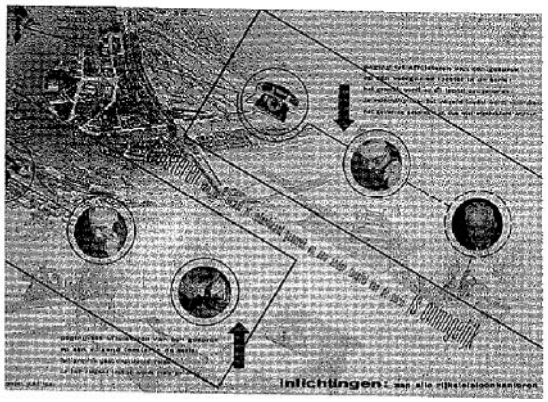
Functional vs. Aesthetic Concerns

Designers are constantly asked to resolve conflicting demands imposed by the problem, the budget, the schedule, and the desired quality level. As in any engineering discipline, trade-offs must be continuously identified, evaluated, and decided on the basis of the best information available. Among the most common sources of contention is the apparent opposition of functional and aesthetic criteria. Communication-oriented visual design views these forces not as irreconcilable opponents, but as symbiotic components of every high-quality solution.



7: Design elevates communication over expression, but without forsaking aesthetic values. Design by Inge Druckrey for the Yale Symphony Orchestra.

Some of the best examples of the **synergy** between form and function **can** be seen in the dynamic compositions and active constructivist typography of the so-called *Dutch Constructivists* – including Piet Zwart, Paul Schuitema, and Gerard Kiljan, among others – in the 1920's and 1930's. Faced with the need to produce visually interesting advertising material for some rather ordinary-looking industrial equipment, telephone cabling, and public utilities, these designers turned the problem on its head by celebrating rather **than** obscuring the formal character cs of the products being advertised. Unconventional orientations and viewing angles and dynamic graphical devices – including photomontage and superimposition – were used to underscore relationships among elements throughout the composition.

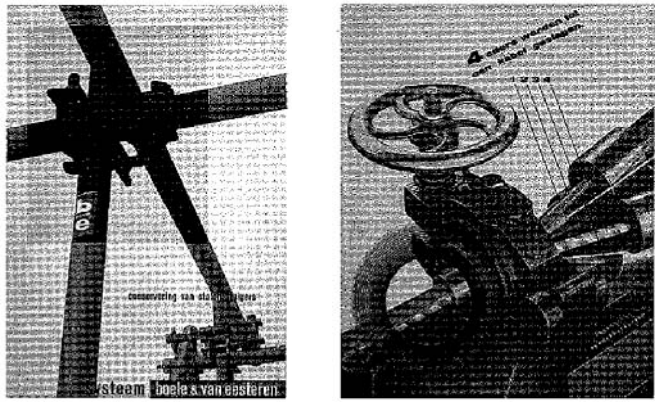


8: The striking formal juxtaposition of both long distance and close-up photography, act ve typography arc un fy ng graphical ele ents plays a clear funct onal role r this advert sement created by Gerard Kiljan for the Dutch Te efon Telagraf

Gerard Kiljan's poster for the Dutch PTT (8), **for** example, uses diagrammatic elements and dose-ups of callers superimposed in multiple layers upon a dramatic aerial view to show the telephone's ability to transcend physical distance. Note how closely the elements in each layer work together to convey the message of the poster while at the same time producing an aesthetically delightful statement. Similar effects can be seen in the advertising materials and catalog spreads produced by Piet Zwart and Paul Schuitema (9). Unusual framing, scale, and viewing perspectives are in each *case* **used**

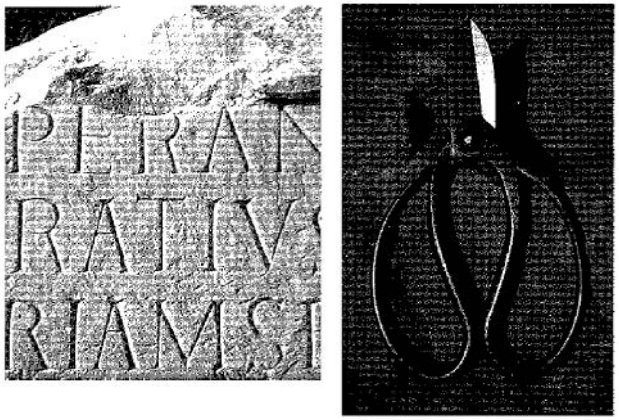
to produce images that are visually arresting and yet intimately related to the product itself. Superimposed graphical devices (the square on the left; the circle on the right) are again used to **draw** the viewer's attention to a particular area of the display and to relate dements to one another. By drawing attention first to the advertisement as a whole, and only secondarily to the image of the product, the formal aesthetics of the design complement the information content of the advertisement.

Good design defuses the tension between functional and aesthetic goals precisely **because** it works within the boundaries defined by the functional requirements of the communication problem. Unlike the fine arts, which



9: Unconventional viewing angles and dynamic composition – in which superimposed graphical elements play a critical role – play a functional role (by highlighting the product) in these industrial posters by Piet Zwart (a) – © Piet Zwart/VAGA, New York 1993 – and Paul Schuitema (b).

exists for their own sake, design must always solve a particular real-world problem. Functional criteria govern the range of possibilities that can be explored; aesthetic possibilities that are not compatible with this minimum standard of usability **must** be quickly discarded, if they are considered at all. Fortunately, there is almost always a wide latitude for aesthetic expression within these bounds, and experienced designers **realize** that solving a problem in a manner that is uniquely appropriate brings an aesthetic satisfaction all its own.

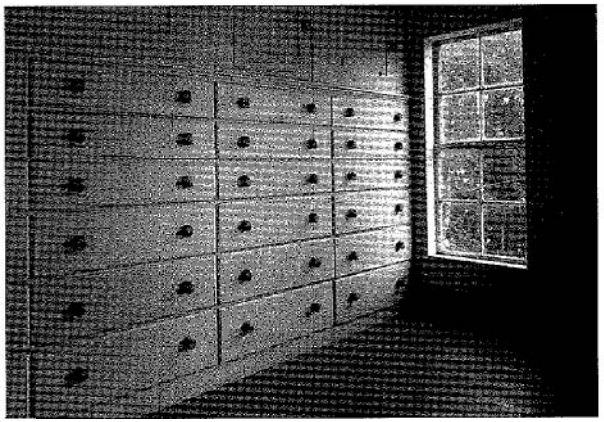


10: Good design is timeless and universal. Grace, economy, and fitness of purpose can be seen in both the monumental Roman inscription from Trajan's Column (a) and the modern Japanese gardener's *secateurs* (b).

m, Function, and Question of a versal Aesthetic

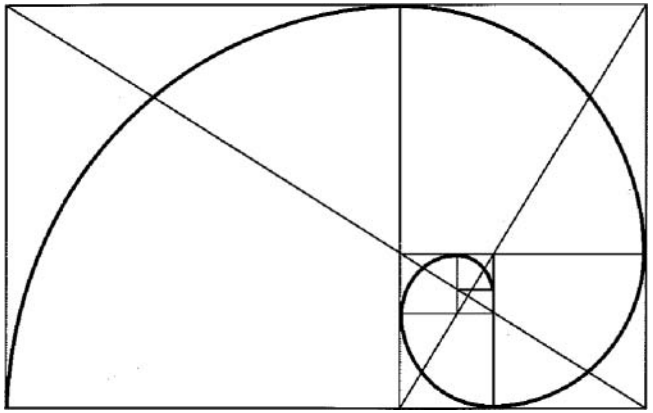
The timeless quality of a classic design is immediately apparent. From the majestic capital letterforms of the Roman inscription (10-a) to the towering grace of the cathedral's apse to the simple, natural forms of traditional Japanese craftsmanship and design (10-b), the human race has delighted in forms reflecting widespread agreement on basic qualities of scale, rhythm, proportion, balance, harmony, and craftsmanship. The same formal characteristics have been appreciated in advanced civilizations throughout human history and they are central to any coherent philosophy of design. An elegant solution is both an artistic and an intellectual achievement that – while it may come to be taken for granted – never becomes trite or irrelevant.

Modern design arose out of the Arts and Crafts movement of the late 19th Century, which in turn had its roots in the depredations of the early years of the industrial revolution. In the torrent of manufactured goods that followed the introduction of mass production, there was little concern for the quality of the design, the integrity of the materials, or the humanity of the production process. The resurgent concern for quality – in materials and construction as well as design – fueled a manufacturing explosion that has continued ever since. Phillip Meggs (1992) writes that, "*the* history of *design* is *the* history of technology *and craftsmanship.*" While design today remains grounded in mass production, the technology of manufacture is viewed as a means rather than an end. The ultimate focus is on the appropriateness of the design in relation to both the function the product is intended to fulfill and the materials from which it is constructed.



11: Shaker cabinetry shows the simple elegance of even a purely utilitarian application when natural materials are used with integrity. Does a woodgrain-printed vinyl dashboard really project the same image of quality? Photography by Michael Freeman

An appreciation for the inherent beauty of natural materials is unavoidable for anyone who has taken the time to reflect on the fine grain of properly finished hardwood, the texture of cleanly cut stone, or the fit of a well made artifact. Objects constructed from genuine materials are always valued more highly than those that use a cheaper substitute. The imposition of simulated woodgrain on aluminium siding or simulated leather on vinyl upholstery reflects not a preference for these surrogate materials, but rather, a deference toward the cost or availability of the genuine article. Compare the typical false wood dashboard of an American automobile to the delicate grain and careful seamless construction of Shaker cabinetry (11). The irony in this dishonest substitution is that the natural material qualities of the plastic or vinyl themselves – which often hold their own fascination (cf., Tecce and Vitale, 1990) – are prevented from revealing themselves.



12: The logarithmic spiral can be constructed geometrically. yet it provides the basis for countless beautiful forms produced by the growth of living organisms throughout the natural world.

ign and
onality

Is design fundamentally a rational or an intuitive endeavor? The great international design movements arising since the end of the 19th century have all advanced the belief that good design is a reflection of some higher truth, whether in form, method, or materials. From the beginnings of the Arts and Crafts movement, through the Vienna Secessionists and the Deutsch Werkbund, the De Stijl movement in the Netherlands and Constructivism in the emerging Soviet Union, through the Bauhaus and on to the rest of the world following the rise of National Socialism in Germany – modern design has been predicated on the rationalist belief that all design decisions should in principal be justifiable on objective grounds. While Modern design has occasionally been charged with mistaking post-hoc rationalization for functional determinism (cf., Banham, 1960, Margolin, 1989), there can be no serious question that the *intent* of these pioneering design movements was to promote appropriate design solutions that addressed the needs of the modem consumer as well as the requirements of mass production.

As to our initial question, of course both approaches to knowledge are essential. Modern design movements have emphasized the rational dimension, without rejecting completely the use of intuition as an important generative element. As with most classic dichotomies, there is value on both sides of the equation:

> Method help intuition when it is not transformed into dictatorship. Intuition augments method if it does not instill anarchy. In every moment of our semiotic existence, method and intuition complement one another
>
> **Mihai Nadin**
> Interface Design and Evaluation – Semiotic Implications

Without minimizing the value of intuition as a problem solving tool, we propose that systematic design programs are more valuable from *a communication standpoint* than are ad *hoc* solutions; that intention is preferable to accident; that principled rationale provides a more compelling basis for design ***decisions*** than personal creative impulse. When designing for human-computer interaction, communication is the overriding concern and creative expression is simply one means to this end. This is the orientation we consider most effective for designing visual interfaces and the perspective we adopt throughout this book.

The following pages describe some of the most important design rules and techniques learned by all students of the visual design disciplines that apply directly to GUI design. Most of the techniques we describe can be easily mastered and applied to your next product, We have tried to formulate the rules as crisply as possible, both to distinguish them from more general principles or guidelines that frequently conflict with one another, and to make them as useful as possible for addressing real-world problems. We do not mean to suggest, of course, that any of these rules should never be broken. As designers have realized for centuries, all rules are made to be broken – at least by the experienced practitioner.

> Some consider it nobie to have a method; others consider it noble not to have a method. Not to have a method is bad; to stop entirety at method is worse still. One should at first observe rules severely. then change them in an intelligent way. The aim of possessing method is to seem finally as if one had no method.
>
> **The Mustard Seed Garden Manual of Painting**

We maintain that a rational approach to design is not only possible, but that it is essential, if high-quality design skills are to be replicated and transmitted across the generations.

Elegance and Simplicity

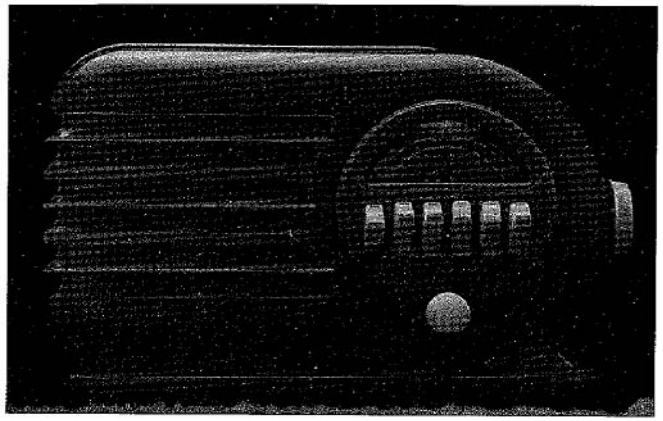
2

In anything at all. perfection is finally attained not when there is no longer anything to add, but when there is no longer anything to take away.

Antoine de Saint Exupery

The term, ***elegance*** derives from the Latin ***eligere,*** meaning to "choose out" or "select carefully." The same Latin root gives rise as well to terms such as ***elect*** and ***select*** – both of which carry a similar implication of reflection and careful decision. More recently the term has acquired the familiar connotations of refinement and grace, reflecting thoughtfulness and good taste. Achieving the latter, of course, depends upon the former. Visual design is intimately concerned with careful decision making and judicious selection of formal elements. Visual design decisions extend beyond the surface to the very heart of the product concept. The visual designer enhances communication by carefully selecting the elements to be emphasized – and this may involve selecting the elements to be ***included*** – and ensuring that they are presented so as to be perceptually salient.

Elegance in design is seen in the immediately obvious success of a ***novel*** approach that solves a problem ***completely yet*** in ***a highly economical way.*** The importance of simplicity can hardly be overstated. In fact, the sheer simplicity of an elegant solution is often its most startling and delightful aspect. Elegant solutions reveal an intimate understanding of the problem and an ability to ensure that its essence is grasped by the consumer as well. Economy of expression – the ability to cut directly to the heart of the matter – provides the basis for aesthetic evaluation in art and science alike. Simplicity abounds in the beauty of nature, from the laws of physics, to the symmetrical growth of crystals, to the structure of living organisms.



13: The Belmont Radio features clean lines and simple. approachable controls. The radio's basic forms are tightly integrated with the circular dial that serves as its focal point. From *Radios: The Golden Age* by Philip Collins ©1987, published by Chronicle Books

Simplicity plays a central role in all timeless designs. We appreciate solutions that – all other things being equal – solve problems in a clear, economical, fashion. The most powerful designs are always the result of a continuous process of simplification and refinement. We will return repeatedly to simplicity in the chapters to follow, as many of the other design goals depend critically on simplification as a means to their own particular end. Before you do anything else to improve the quality of a design, make sure you have reduced its formal and conceptual elements to the absolute minimum. The benefits of simplicity are functional as well as aesthetic in nature:

Approachability. Simple designs can be rapidly apprehended and understood well enough to support immediate use or invite further exploration. The Belmont Radio **(13)** includes only **three** sets of controls – the volume knob, tuning knob and dial, and station presets. The functional relationships of each control group are readily apparent in the absence of competing elements. Anyone can tell "at a glance" how to operate this simple design.

Recognizability. Simple designs can be recognized more easily than their more elaborate counterparts. Because they present less visual information to the viewer, they are more easily assimilated, understood, and remembered.

The function of the Belmont radio is a readily identified by its tuning dial and louvered speaker enclosure, both of which are emphasized by the absence of competing formal elements.

Immediacy. Simple designs have a greater impact than complex designs, precisely *because* they can be immediately recognized and understood wit a **minimum** of conscious effort. The radio's simple color scheme ensures that the eye is drawn immediately and involuntarily to the bright white controls. The most powerful symbols in human **culture** are always reduced to their absolute minimal form.

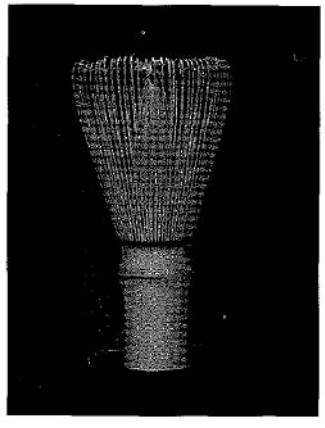
Usability. Improving the approachability and memorability of a product necessarily enhances usability as well. Simple designs that eliminate unnecessary variation or detail make the variation that remains more prominent and informative. In **fact,** it is nearly impossible to operate a simple design like the Belmont radio incorrectly.

Principles

Unity
Refinement
Fitness

Understatement **can** be a difficult quality to **grasp through** conscious effort. Apart from the obvious focus on economy, or ***minimization of component para and simplification of the relationships between parts,*** simplicity in design depends upon three closely related principles. The elements in the design must be ***unified*** to produce a coherent whole, the parts (as well as the whole) must be ***refined*** to focus the viewer's attention on their essential aspects, and the ***fitness*** of solution to the communication problem must be ensured at every level.

14: Traffic signs depend heavily on over-simplified, highly schematic imagery to alert the driver to potentially dangerous situations. Each sign refers to a general class of hazard with a corresponding set of plans and precautions, rather than the specifics of any particular roadway.



15: The elegant Japanese *chasen* whisk is created from a single piece of bamboo whose fibers have been split, formed. and rejoined.

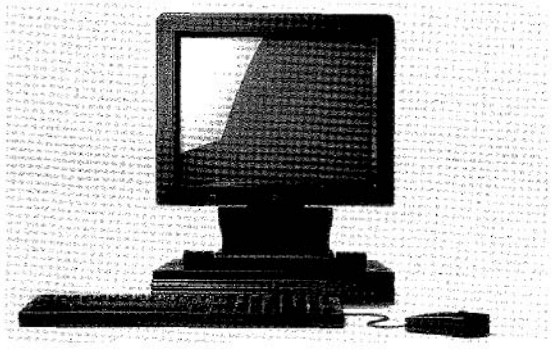
Elegant tools and utensils **such** as the Japanese *chasen* tea whisk (15) possess a unity that derives from the intimate relation of a minimal set of parts in pursuit of a common goal. Whenever a single **part** plays more than one role, the unity of the overall design is enhanced, Elegant solutions produce a **maximum** of satisfaction **from** an absolute **minimum** of components.

16: Circle and star are fused together in the classic identity symbol for Mercedes-Benz. Image courtesy of Daimler-Benz, Stuttgart

British poster designer Abram Games recognized the **key** to communication-oriented design in his philosophy of "*maximum meaning, minimum means*" (Livingston, 1992). Visual identity programs, like posters, must be very concise to cut **through** the torrent of competing messages encountered in everyday life. Identity symbols have evolved over the centuries from the highly pictographic trade-marks of the medieval shopkeeper to the more abstract, symbolic marks used in today's brand and corporate identity programs. The classic Mercedes Benz identity symbol (16) is a familiar example with a strong symbolic quality. Its unity derives from the powerful integration of the **three-pointed** star with the center of the **circumscribing** circle. The axes of the **star** focus the viewer's attention on the **origin** of the ring. This convergence **maximize** the integration of the basic forms and the unity of the **resulting** design.

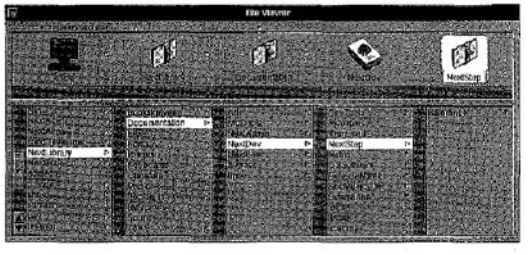
The EC2 phone from ECCO Design, Inc., (17) displays a similar unity of form in the common curvature of its handset and **cradle.** Instead of resting in a cavity **carved** into or molded onto the surface of the phone, as in most contemporary designs, the handset is held in place **by virtue** of its integration with the contours of the base itself. The relationship of the two elements was clearly **planned** from the beginning rather **than** a tacked-on as an afterthought. **Visual** unity in product design ensures **that all** of the individual components work together toward a common purpose. The role of the housing is to provide not merely an enclosure, but also a visual field within which control elements and visual displays can be properly related.

17: The unified form of the EC 2 Phone from ECCO Design Inc is most apparent in the shared contour of handse: anc orac e. The mechanism is des gned- n not tackea on as an afterthought. (See also color plate 1).

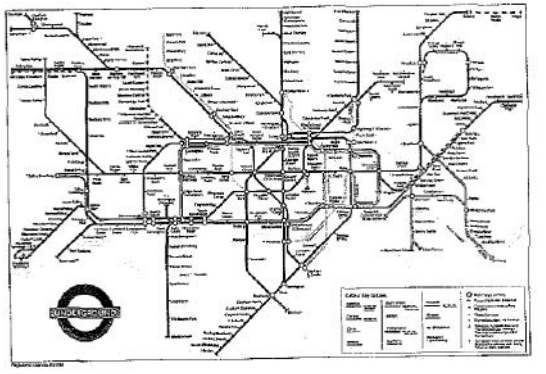


18: A common design language can be seen in the NeXT Station hardware and the NeXTStep GUI. Regardless of which came first, the coordination of on-screen image and physical product underscore the impression of a total solution

Visual unity in the human-computer interface may rake many forms. The foremost consideration is the integration of the visual language elements used throughout an application. Ideally, the same visual language should be apparent in the system software as well, and indeed, throughout the entire end-user environment. NeXT pursued this ideal to its logical conclusion by using a single design language to unify even the hardware with the system and application software (18, 19). This elegant design contrasts sharply with the colorful workstations from Silicon Graphics (e.g., Indigo, Crimson, Onyx), which awkwardly share the same egg-shell colored monitor. With the demise of the NeXT hardware business, this admirable unity will disappear for most NeXTStep users.



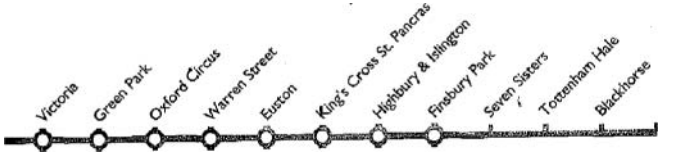
19: By matching the visual qualities of the hardware, NeXTStep transformed the original grayscale display from a marketing liability to a high-style asset



20: The network diagram for the London Underground reflects a problem-oriented refinement of the area's physical geography. By radically compressing the distances between outlying stations, this diagram became the first "fisheye" view. Designer, Henry C. Beck, 1935. (See also color plate 2)

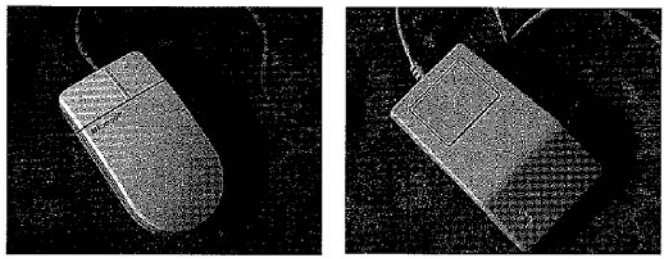
Refinement

Reduction through successive refinement is the only path to simplicity. To create an elegant solution, anything that is not essential to the communication task must be removed. Public transportation maps have for years applied this principle to present complex routing information in an understandable way. one of the earliest and most famous examples is the route diagram for the London Underground system (20), which has retained its basic form since 1935. Instead of maintaining the geographically correct position and orientation of each line, these diagrams maintain topological



21: The representation of a single line permits even further refinement of the diagram's form, since travellers who are already aboard the train need only concern themselves with the sequence of stops and the availability of connections.

accuracy while introducing simplifying generalizations that regularize the positions and orientations of lines, stations, and transfer points. In addition, the diagram provides a primitive *fisheye* view (Furnas, 1988) by compressing physical distance in outlying areas. By reducing and regularizing the spacing between stations, the diagram can accommodate more information in the same physical space. The same approach is used in the route diagram for the London Underground's Victoria Line (21). In this case, however, the generalization is even more extreme, since the orientation with respect to the surrounding geography or even the relative distance between stations is not important to riders who are already on the train. All that matters is the sequence of stops and availability of connections.



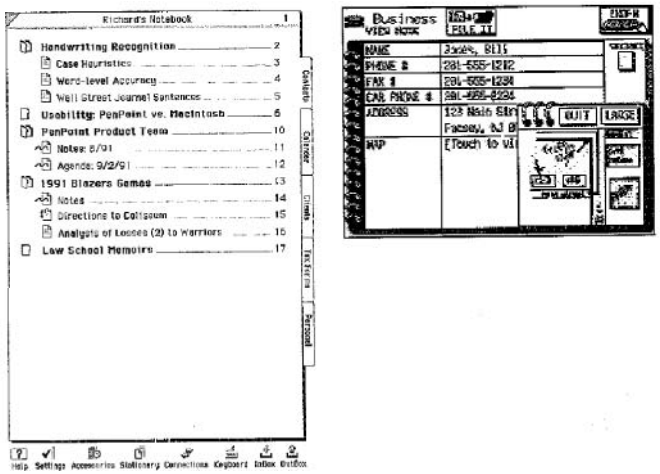
22: Simple, refined, forms convey the basic functionality of the these pointing devices from Microsoft (a) – (design by IDEO Product Associates) and Apple Computer (b). The aesthetics and ergonomics of each design are superior to their recent replacements.

Refinement of physical form can be seen in the original Microsoft Mouse and Apple ADB Mouse (22). The elegance of each design surpasses that of competing designs created before and since. Both designs feature button elements integrating tightly with the basic curves or planes of the mouse while still retaining a distinct identity. In the Microsoft Mouse, the left button (the primary control in the Windows environment) is half again as wide as the right button. This simple visual cue for button targeting is supplemented by a tactile cue in the form of a subtle ridge separating the two buttons.

The external appearance of GUI software has changed very little over the years. Researchers have experimented with minimalist interfaces that reduce the prominence of window borders, scrollbars, and other familiar GUI controls, but few tangible results have been obtained. One problem is that hiding "distracting" controls also removes the *visual affordances* (things that

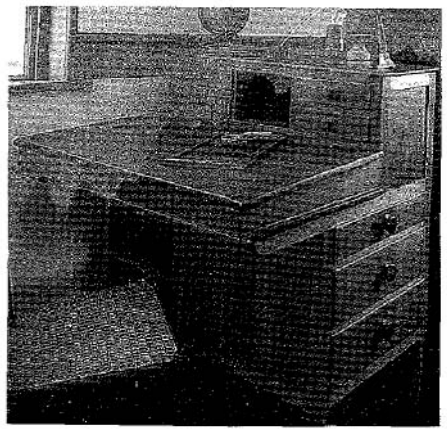
suggest interaction possibilities) those elements provide. The scrollbar itself, for example, reminds the user of its *availability* as well as its operation. Removing visual cues is disorienting, particularly for beginning users, but also for experienced users who can be disrupted by the abrupt transitions as controls materialize and disappear again.

An alternative approach can be seen in PenPoint, where some controls were replaced with simple gestures. PenPoint's elegant notebook metaphor (23-a) eliminates all extraneous details (note the absence of spiral bindings, perforations, rounded corners, ruled lines, etc.), depending largely on its vertical orientation and, of course, the tabs that have inspired a whole new genera-



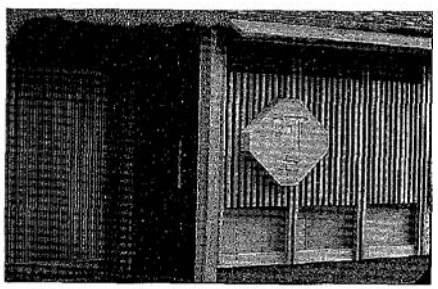
23: The elegant highly refined interpretation of a paper notebook in the PenPoint user interface (a) contrasts sharply with the intrusive, overly literal "notepad" cues provided by the Sharp Wizard (b). The former conveys a global impression of notebook-ness, while the later depends on crude "labels."

tion of notebook-builders. Compare the elegant PenPoint display to the busy Sharp Wizard screen (23-b) with its bulky spirals and axonometric rendering showing the dimensionality of the pad. Note how the spiral must sometimes be shortened due to space constraints. How interesting that this product, with its much smaller display, chose the more costly (in terms of screen real estate) route of a highly detailed literal representation.

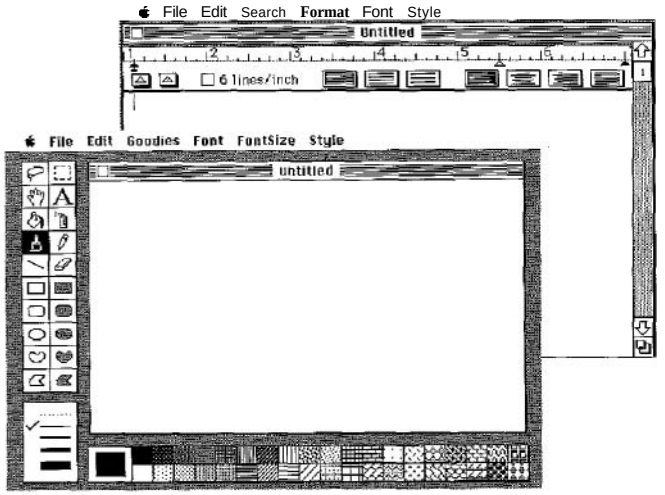


24: The frugal design of this Shaker sewing desk makes full use of the many small enclosed spaces while providing constant access to the work surface. Photo by Michael Freeman.

Designs are never **evaluated in absolute formal terms,** but rather, succeed or fail on the basis of how well rhey solve a particular problem. Solutions can be more or less appropriate in their method, their process, or their outcome. Elegant solutions solve problems with **maximum** effectiveness through **avenues** that are desirable in their **own** right. In addition to its h e construction, the Shaker sewing desk (24) reveals a design of remarkable compactness and



25: The Japanese *kanban* sign identifies the type of goods or services offered by the establishment while blending naturally with traditional building materials used in the facade



26: The modest design goals and focus on core functionality apparent in the original MacWrite and MacPaint applications reflect the commitment to an appropriate balance between *capability* and complexity seen in the first wave of software created for "the rest of us."

economy. The maximum use is made of the space consumed by the desk. The depth and accessibility of the drawers, as well as the leg-room under the desk, are all increased by allowing the drawers to open to the side, rather than the front. Tiny storage compartments throughout the desk reflect the need to accommodate materials and supplies. In short, every element reflects the practical concern of supporting the task of sewing.

The traditional kanban sign on many Japanese storefronts (25) reveals a similar sensitivity to the qualities of the material. In Japanese architecture, the concepts of subdued beauty (*shibui*) and elegant simplicity (wabi) are seen in the refinement and natural character of the buildings themselves. The *kanban* is an art form in its own right, but its fitness as a signage element is apparent in its visual compatibility with the surrounding material context.

In user interface design, the material choices are typically much narrower, but the digital medium can still be presented more or less appropriately. The original MacPaint and MacWrite applications (26) exemplified (and in some

sense, defined) the philosophy of the early Macintosh software environment. These simple, straightforward, and highly graphical applications were appropriate for the technical level of the target user as well as for the limited capabilities of the original machine. The presentation in each case is concrete and explicit, with visual affordances or reminders to help users recognize the tools available to them. Simple mechanisms such as the memorably vivid "Fat Bits" magnification mode in MacPaint helped users understand the novel technology while exposing them to some of its power and **flexibility. As** simple as they were, these two "bundled" applications met the needs of many early users all by themselves.

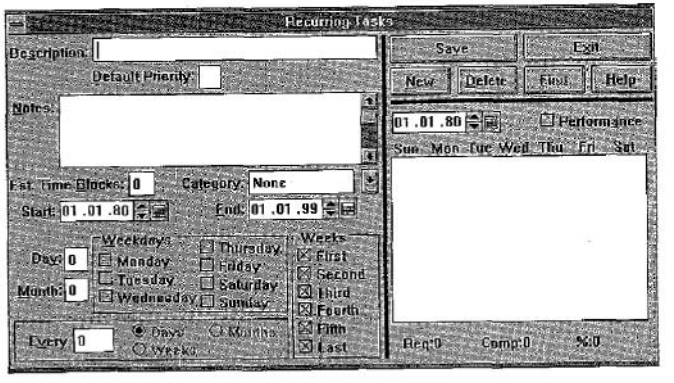
abcdefghijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ
$1234567890(.,'"-;:!)?&

27: The Chicago screen font was designed with the limitations and requirements of the low-resolution Macintosh display in mind. The thick vertical elements ensure that each character remains visible when dimmed with the standard 50-percent gray pattern.

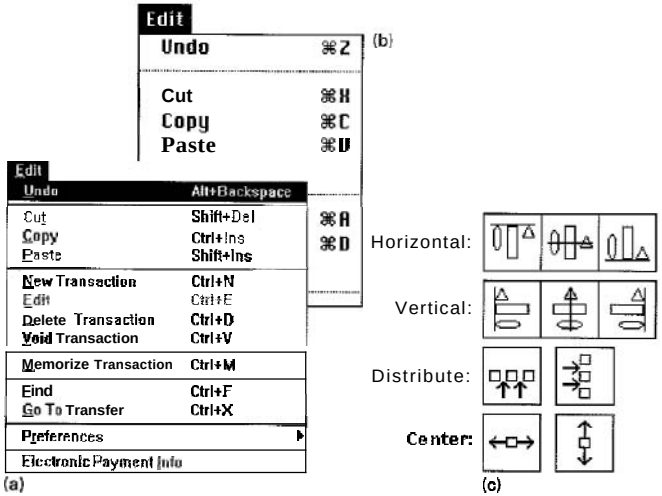
The Chicago screen font used for widget labels throughout the Macintosh system software **(27)** provides an even **better** example of matching a design to **the** material qualities of the **medium.** The font was designed to ensure adequate legibility and contrast on low resolution **(72** dots per inch) video displays. The thick vertical elements provide characters that remain legible even when some of their pixels are removed by the standard fifty percent gray pattern used to indicate **the** inactive state on the Macintosh. The **Chicago** font's unique typographic character and fitness to the display **task** helped make it a defining feature of the Macintosh interface from its earliest days on. The original design continues to thrive even as the technological limitations it was designed to accommodate have begun to disappear. Apple's recently introduced TrueType fonts include a scalable, outline-based version of Chicago even though the need for the pixel-level tuning seen in the original bitmap font is largely eliminated by the higher resolution output devices for which scalable **fonts** are intended.

Common Errors

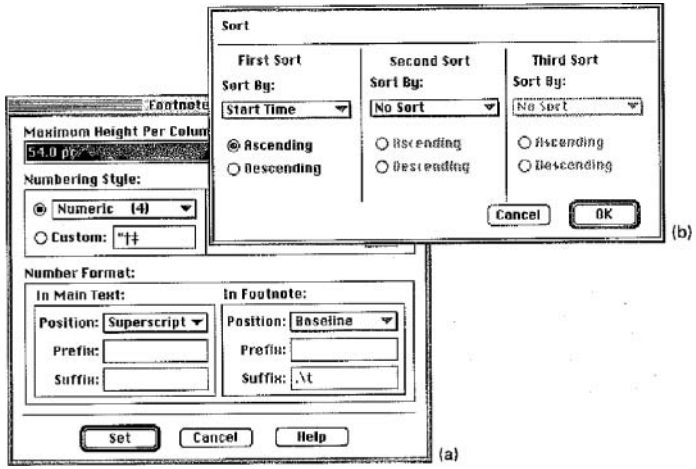
Common errors related to elegance and simplicity can usually be attributed to poor planning, poorly communicated structure, or attempts to go beyond the scope of a coherent, focused design. The inevitable result is visual or conceptual complexity and confusion. The **mistakes** described below are all too **typical** in today's GUI applications.



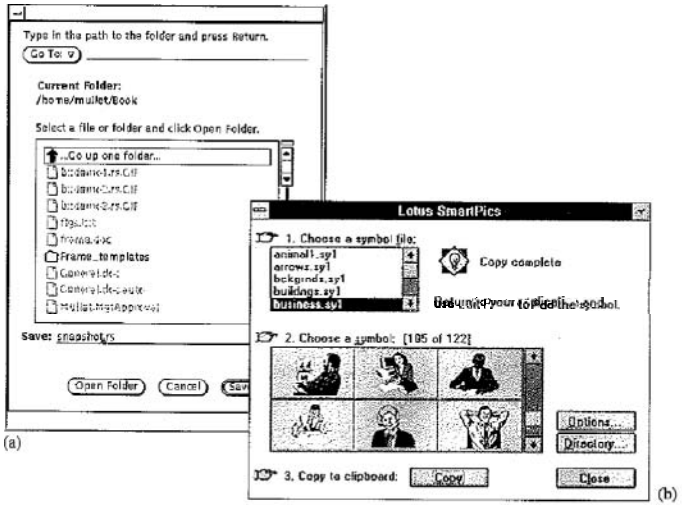
28: ***Clutter and visual* noise.** The advent of the GUI has meant more, not less visual clutter in most computing environments. Today software products are designed. marketed, evaluated (and all too often, purchased) on the basis of their aggregate feature set. even though many features are used rarely, if ever, by the vast majority of users. The only way to deal effectively with **this** unfortunate reality is to logically structure the presentation so that each display contains a manageable amount of information. Applications that try to pack as much information as possible into each screen create problems that rival the worst character-based displays. This window from a personal information manager is crowded. confusing, and almost impossible to scan. The window contains so much functionality that the usual I-pixel lines **were** not prominent enough to divide the layout into multiple regions. Instead, the design uses heavy 4-pixel horizontal and vertical dividers that do more to attract attention to themselves than to create meaningful higher-level units. In addition, the window's gray background turns a series of carelessly positioned text fields **(with** their bright white interiors) into a distracting pattern snaking randomly through the left-hand side of the display. While functional overload is clearly a problem with this design. effective use of visual language and display structure would bring a noticeable improvements.



29: Interference between competing elements. Menu accelerators (i.e., individual keyboard shortcuts that invoke menu commands directly) in Windows (a) use purely textual cues for both the *qualifier* (e.g., Ctrl, Alt, Shift – the keys you press to indicate that the next key should invoke a command) and accelerator keys. These alphabetic qualifiers – along with the "+" symbol used to separate qualifier and accelerator – interfere with the accelerator characters, and sometimes with the menu items themselves. Contrasting these accelerators with their Macintosh counterparts (b) demonstrates the effectiveness of the simpler approach, in which a single graphical symbol is used as the qualifier for all accelerators. Because the "propeller" symbol is not confusable with the alphabetic characters, and because there is less visual information in the surrounding area. the Macintosh acceieratorcharacters are far more readable than their Windows equivalents. They can be noticed in peripheral vision while choosing items with the mouse, which makes the logic of the accelerator scheme more apparem and incidental learning more likely. The same kind of visual interference is apparent in the Alignment icons from the OPEN LOOK Developer's Guide (c). The readability of these images suffers from an irrelevant variation in shape within each icon that serves to obscure the relevant variation in alignment.

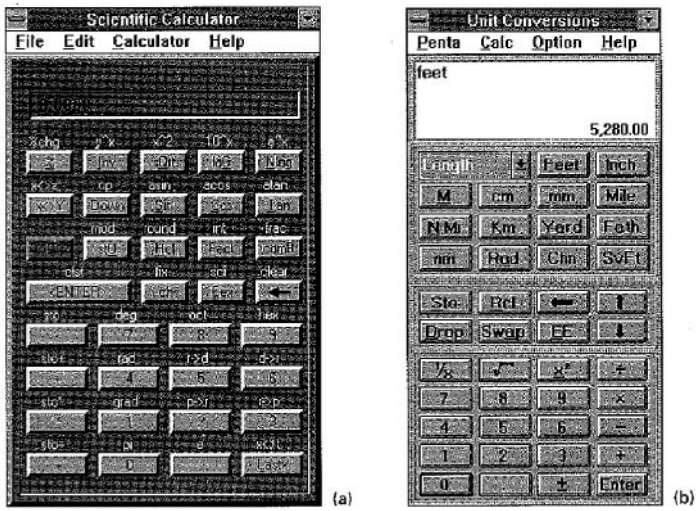


30: Using explicit structure as a crutch. The presence of nested bounding boxes is usually a symptom of a poorly organized layout. Packing information as densely as possible and surrounding the resulting groupings with explicit borders is never a good substitute for structuring the layout effectively in the first place. Bounding boxes interfere not only with the scanning of the items they contain, but with the surrounding items (including other bounding boxes) as well. Note, for example, how the gaps between bounding boxes, border lines, and textfield boundaries form a mesmerizing pattern at the bottom of the Footnote dialog above (a), where a single textfield is surrounded by four levels of boundary information. When proper spatial relationships end sufficient margins are maintained, explicit structure is rarely needed to ensure proper visual separation. Unfortunately many applications include structuring devices even when they are completely unnecessary. The Son dialog (b) would have reasonably effective spatial grouping based on vertical alignment alone if the vertical dividers were simply removed.



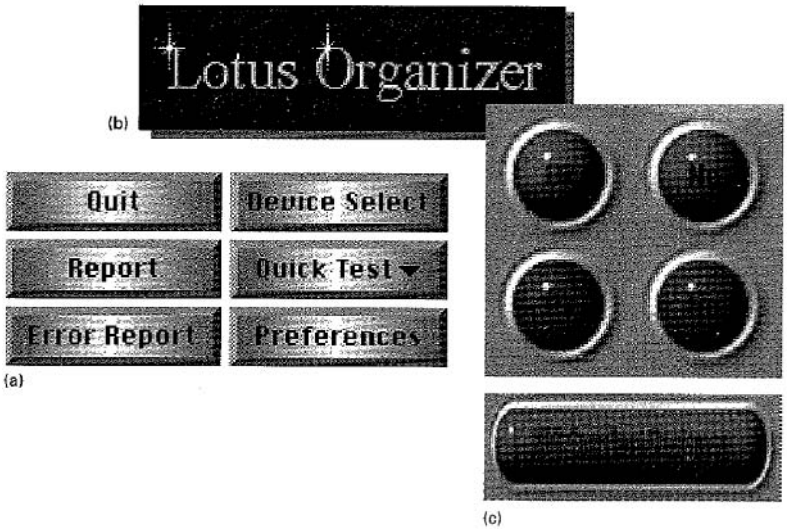
(a) (b)

31: *Belaboring the obvious.* Users of GUI applications remain totally unfamiliar with the application functionality only for a relatively short period. Unnecessary navigational aids that might be useful the first time a user sees a product quickly get in the way as soon as even a basic familiarity with the application has been established. Excessive "assistance" doesn't just slow semi-experienced users down – it can also prevent users from understanding the application in the first place, if it obscures the underlying structure of the window. The excessive verbal prompting in the file selection dialog above (a) consumes valuable space to tell users something that should have been obvious from the organization of the window and a basic understanding of the ubiquitous task of opening a file. Like the presence of taped-on instructions in the physical workplace, the presence of help text in the interface is itself a reliable indicator of flaws in the underlying design. As many as five additional items could have been included in the list (or the window made smaller) simply by removing (perhaps optionally) the redundant text. Similarly, the pointing hands in the SmartPics dialog box (b) merely lead the eye along a path it would have followed naturally in any case. Such self-consciously "helpful" feedback does little more than parrot the viewer's natural movement through the dialog. In TEST, it may well impede performance by interfering with otherwise obvious spatial relationships.

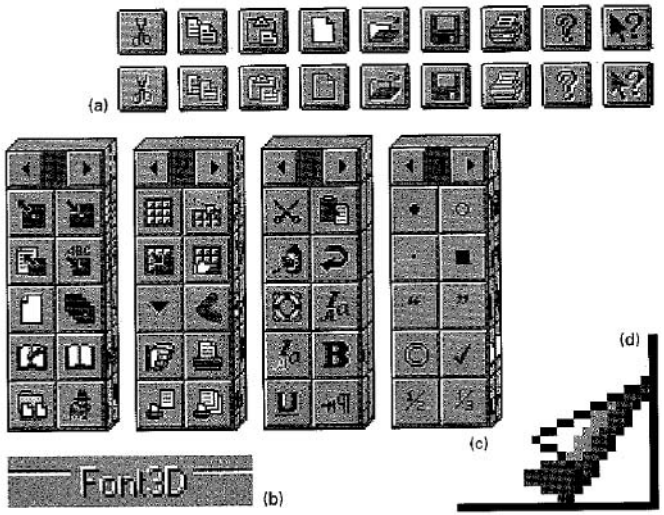


(a) (b)

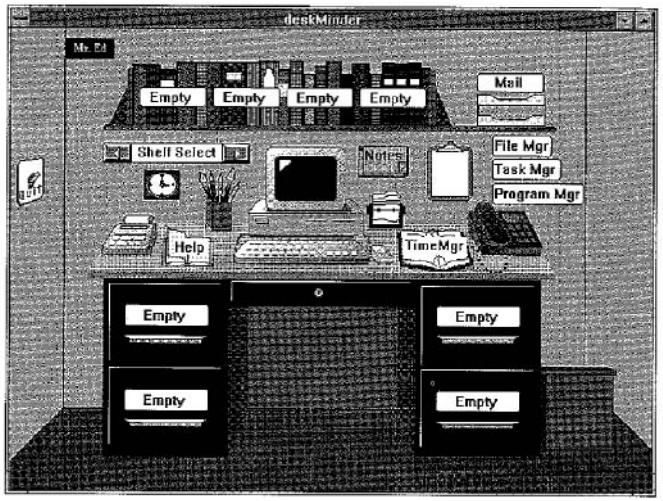
32: *Overly literal translation.* Even if the metaphor can be realized completely, presenting a software artifact as a direct analog to a physical object almost always imposes unnecessary visual and conceptual restrictions on the design. Most GUI calculators, for example, simply replicate the heavily moded, poorly labeled, and difficult to manipulate designs of existing physical designs. The model on the left (a) even goes so far as to replicate shifted functions (deg, oct, hex), even though dedicated software buttons could have been provided within the same space. While they may be familiar (to experienced users of the physical analog) these designs do little to leverage the power and flexibility of their computational host. The uncritical acceptance of the material constraints of a physical calculator prevents these calculator designs from focusing on the essence of the *problem of calculation* in any meaningful way. PentaCalc (b), in contrast, is only loosely patterned after a physical calculator (why shouldn't every GUI calculator provide the valuable tape feature, which is trivial to implement?). While perhaps less similar to "real-world" designs, it has been more carefully adapted to the capabilities and limitations of the GUI. It features flexible display modes, closely spaced buttons (which minimize mousing), and provides an excellent keyboard interface.



33: Excessive detail and embellishment The siren song of photographic realism is difficult to resist, particularly given the natural human receptiveness to visual stimulation. In the GUI, as in any new medium, more effort has been expended on faithfully replicating familiar themes than on uncovering the unique characteristics and qualities of the new electronic medium itself. Electronic media allow us to focus to an unprecedented extent on the essential elements of a design, but only if the available bandwidth is not squandered on graphical clichés and self-consciousornamentation. Graphicai embellishments that serve only to underscore the "realism" of the design such as the sheen of simulated brushed aluminum buttons (a), the sparkling splash screen (b) or the specular reflections on spherical plastic buttons (c) eventually grow tiresome despite the initial "oohs" and "aahs". These qualities rarely add to the long-term visual appeal of the product because they subvert rather than enhance communication. The extent to which this quest for graphical *pizzazz* has replaced concern for effective communication can be seen in the subtle highlighting of the spherical "OK" and "No" buttons (c). The buttons change color when pressed (woe to the user with color defiicient vision), but otherwise provide none of the essential visual feedback that provides the illusion of manipulating a tangible object.



34: ***Gratuitous*** dimensionality. Most people love the sense of tangibility imparted to a widget set by the popular pseudo-3D rendering technique in which highlighted and shadowed borders simulate a physically raised surface. It can even be argued that this visual treatment plays a valuable role in identifying "pushable" controls. The increasing use of 3D in situations that do not take advantage of the added dimensionality. however. is more difficult to defend. In the examples above, the chiseled "inactive" feedback in the toolbar icons (a) and the **3D** treatment of the textual label (b) both impede the legibility of the resulting signs. Legibility is also reduced by the unnatural foreshortening of the sides of the 3D palette (the Button Cube) (c). This 3D structure actually completes a complex (and *slow*) animated rotation whenever the user sw'tches to a different set of tools. While the obvious efficiency and scalability concerns (how do the design handle more than four palettes?) are serious enough, the design has problems even as a static display. The view of the "next" palette is too narrow and distorted to be very recognizable. so the complexity introduced by the third dimension provides little additional information over its 2D equivalent. Like the upturned page corner in the bottom of a "book" window (d), it is simply decoration attempting to woo the consumer with its seductive splendor.



35: ***All*** of the above. The most spectacular failing of simplicity is often seen in those products trying most earnestly to simplify the GUI for non-technical users. Applications – even whole environments such as MagicCap from General Magic – attempting to leverage users' knowledge about the physical world through a "3D Office" lor 3D world) metaphor are beginning to reach the marketplace. This approach has always been something of a rite of passage for GUI designers. While many wouid admit (when pressed) to having *their* version of the 3D desktop tucked neatly away in their files, its basic flaws are wideiy recognized. The extremely literal translation of the "real" world seen in all such attempts, for example, virtually ensures that users will find the resulting environments cumbersome and inefficient, and probably just as cluttered as their real-world office. interestingly enough, the 3D office nearly aiways suffers from both an unnatural point of *view* and an *awkward rendering style* that effectively eliminate the impression of being in a real physical space. Ironically, this phenomenon can be traced directly to the 3D representation itself. since accurate perspective conflicts with effective use of display space wherever two-dimensional editing tasks predominate. When the standard File Manager, Task Manager, and Program Manager appear in front of the virtual desk, as in the Windows desktop replacement shown here, any illusion of true three-dimensionality that might have arisen is quickly shattered.

What is simple should be treated simply, **what** is difficult should **be reduced** to the simplest terms.

Josef Müller-Brockmann
The Graphic Designer and His Design **Problems**

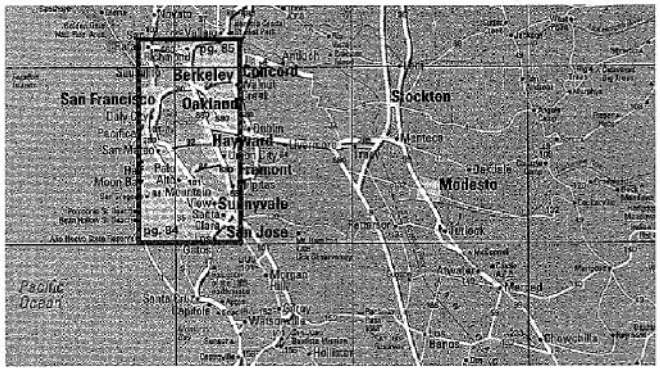
Techniques

Reduction
Regularization
Leverage

Elegance cannot be easily summarized in a few rules of thumb. It depends heavily on taste, and taste can only be developed through prolonged exposure to a series of high quality examples forming the benchmark against which subsequent solutions can be judged. Because complex designs rarely seem elegant, simplification is an important step in the development of any elegant solution. Three basic techniques can be used to simplify a design solution:

*Reducing a Design to its Essence
*Regularizing the Elements of the Design
• Combining Elements for Maximum Leverage

To the extent that the overall approach is appropriate to the task, the elegance of the resulting solution will be enhanced as these techniques are applied. With practice, these techniques become second nature. You will begin to apply them – almost unconsciously – to every emerging solution.



36: This map of the San Francisco Bay area from USAtlas shows use of reduction to produce a level of detail appropriate for the intended audience. The simplified design speeds orientation and facilitates reading at a glance. Design by The Understanding Business. (See also color plate 5).

ducing a Design
Its Essence

The most fundamental design technique is ***reduction.*** An elegant design must be reduced to its essential elements and each element reduced to its essential form. The travel maps produced by The Understanding Business (36) make extensive use of reduction as part of its distinctive visual language. This map of San Francisco and the surrounding area of Northern California eliminates any detail that is not likely to be needed by someone traveling through the area (the audience for the atlas in which these maps appear). The result is a truly elegant solution in which the simplified presentation solves the navigation problem for its target user in a way that makes the maps aesthetically effective on purely formal grounds as well.

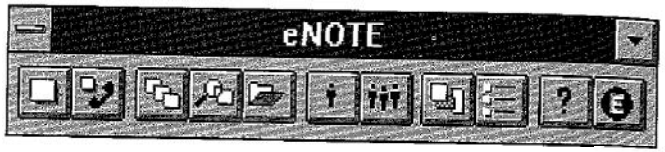
37: Reduction plays the critical role of emphasizing canonical features in these public information icons developed for the U.S. Department of Transportation (DOT) by the American Institute of Graphic Arts (AIGA). Design by Cook & Shanosky Associates.

Good design is simple, bold, and direct. It ensures that significant design elements will be noticed by removing insignificant elements wherever possible. The familiar public information signage (37) developed for the U.S. Department of Transportation (DOT) was commissioned by the American Institute of Graphic Arts following an extensive study comparing the legibility and aesthetic qualities of 28 existing signage programs (AIGA, 1981). The pictographic signs focus on elements typical of an entire class of objects rather than on the details of any one instance. All visual details except those needed to identify the object's category are removed. This ***reduction*** of *iconicity* makes the images more portable across cultural and linguistic boundaries.

Even "essential" elements can often be removed to good effect. Images are often more visually appealing – and just as identifiable – when portions of the image are suggested rather than explicitly depicted. This technique is especially common in visual identities and signage systems where impact and recognizability are critical. The partial contour of the "A" in the identity for London's Victoria and Albert Museum (38-a), for example, is easily completed by the viewer, thanks to graphical cues provided by the serif of the ampersand and the top of the partial letterform. Similarly, the upper portion of the wheel of the wheelchair in the DOT pictogram set (38-b) is only suggested, with no loss in clarity. Viewers are not only able to fill in "missing" contours. They delight in doing so. The active involvement of the viewer can make recognition easier and communication more effective.

To apply this technique to interface design, the designer must simplify the presentation as much as possible and question the functionality being presented when the resulting display is still too complex. Every aspect of the

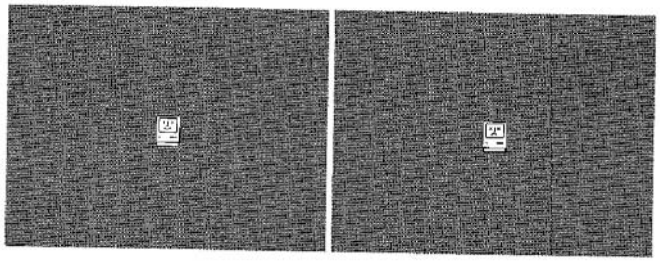
38: Even basic contour information can sometimes be removed without impeding communication. When the overall form is clear, the eye is quite willing to supply missing data, as in this identity for the Victoria and Albert Museum, London (a) – design by Pentagram – and the DOT's access icon (b).



39: Simplified iconic imagery is a necessity at the small scale required by the eNote workgroup pop-up messaging system, from Visual Cybernetics. Reducing the images to their essence and eliminating unnecessary variation helps the imns communicate clearly even at this small scale.

eNote pop-up messaging system (39)is devoted to conserving display space so that the window to remain open on the screen most of the time. The simple, elegant, imagery used for the button labels communicates effectively without a need for verbal labels and the additional space they would require (the process of reducing an image to its essence will be discussed at length in Chapter 6). But the designers did not stop there. Most of the product functionality has been off-loaded into separate, task-specific dialog boxes. This design keeps the main window small and simplifies its window management tasks: since the window need not be resizable, even the window header and borders can be reduced to a simple outline.

An even more ambitious reduction can be seen in the Macintosh start up screen. Instead of a stream of cryptic and often confusing textual status messages, the Macintosh operating system displays a simple image (the "happy Mac" icon in 40-a) that conveys the system status while introducing personality and occasionally even a little humor into a potentially stressful situation. A textual error message (and the "sad Mac" icon in 40-b) is displayed only if a problem is encountered during the start up sequence.



40: The minimal feedback provided during the Macintosh boot sequence simply identifies the system status as normal (a) or abnormal (b).

> Simplicity does not mean want or poverty. It does not mean the absence of any decor, or absolute nudity. It only means that the decor should belong intimately to the design proper, and that anything foreign to it should be taken away.
>
> **Paul Jacques Grillo**
> Form, Function, and Design

Summary: Reduction

In all of these examples, the message is reinforced, not weakened, by removing non-essential elements from the design (or by resisting the temptation to add them in the first place). Even experienced designers depend heavily on trial and error to determine which elements are truly essential. The use of reduction as a design technique should be approached as a three-step process:

1. Determine the essential qualities (typically a short list of adjectives) that should be conveyed by the design, along with any fixed formal elements, such as a name or label, an essential control, or a color, texture, pattern, or image.
2. Critically examine each element in the design and ask yourself why it is needed, how it relates to the essence of the design (identified above), and how the design would suffer without it. If you can't answer any of these questions, remove the element.
3. Try to remove the element from the design anyway. What happens? If the design collapses, either functionally or aesthetically, the element must be replaced. Otherwise, consider omitting it from the final solution.

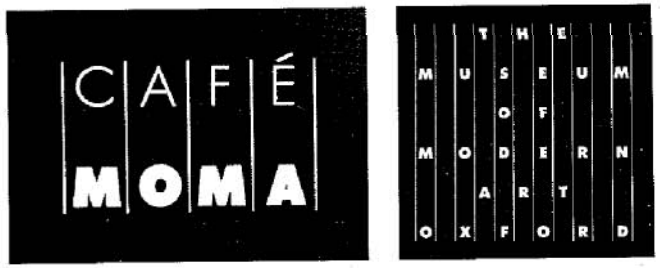
Don't be afraid to remove peripheral features or redundant information. These can always be replaced if users subsequently demand them. Effective design often involves oversimplifying to help make a point. An ounce of inaccuracy can be worth a pound of explanation – if it helps the viewer gain a basic understanding of the message you are trying to convey.

41: In this elegant route diagram for the commuter rail system north of Milan the orientations of the station labels are regularized along the same diagonal used to govern the placement of the lines themselves.

Regularizing the Elements of a Design

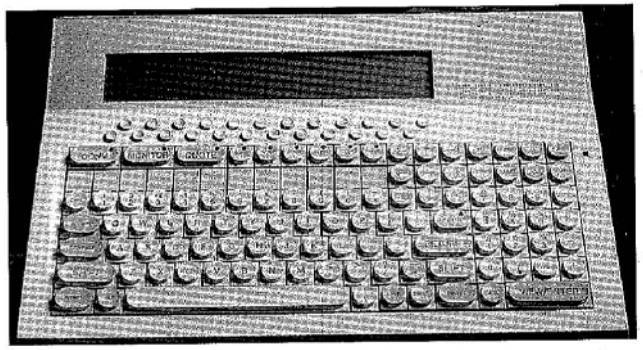
When further reduction is not feasible, the remaining elements can be regularized to further simplify the design. Regularity reduces information by repeating elements according to a discernible rule, principle, or rhythm. Human perception and memory operate more efficiently on regularized stimuli, since the visual complexity of the display is reduced while its structure is enhanced. The predictability of a regular pattern allows the viewer to "scan ahead" more easily to the area of interest when making a comparison or answering a question. Regularity also introduces significant aesthetic benefits, as evidenced by the near-universal human fascination with the decorative effect of repetitive patterns.

Regularity can be achieved by aligning or reflecting elements along common axes, by standardizing or repeating sizes and spacing of components, or by reducing components to basic geometric forms wherever possible. In the diagram in Figure 41, the placement of the station labels on the same 45-degree diagonal used to govern the lines themselves underscores the schematization of the line orientations. Regularizing the weight of the lines throughout the diagram enhances communication by making the one discontinuity – the double width porrion in the lower right – immediately apparent.

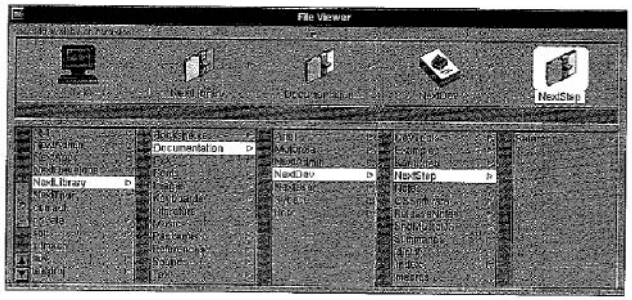


42: The signage program designed by Pentagram for the Oxford (England) Museum of Modern Art utilizes the regular spacing of its vertical rules to modulate the sharp contrast between thick and thin elements in order to create a sense of stability in the dynamic visual identity

Effective design balances contrast with regularity. The signage program for the Oxford Museum of Modern Art (42) uses regularization to balance the playful contrast between thick and thin forms seen throughout the system. Note how the regularity introduced by the absolutely consistent spacing between characters, lines, and vertical rules creates the impression of rigid vertical alignment at the global level (even though characters on two lines fall on different axes entirely), while exhibiting playful variation locally (where the three-letter words can be seen to break the alignment). This interplay between global and local readings produces a dynamic visual identity that is stable, yet active and visually interesting.

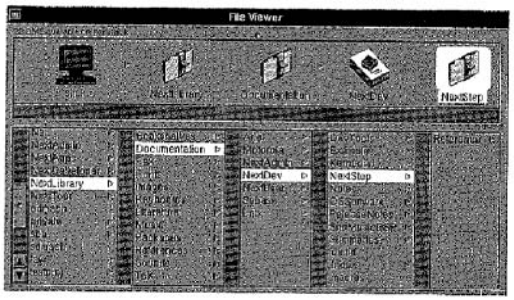


43: Regularization is both necessary and apparent in any keyboard layout. This information terminal designed by Pentagram for the Reuters news agency employs subtle color coding to establish functional groupings that emerge from the rhythmic modular background pattern



44: The elegant NeXTStep browser displaysuniform spacing from column to column. As the window is resized, it "snaps" to the modular dimension to maintain constant spacing.

Effective design establishesa predictablerhythm. The importance of predictability in a keyboard layout **(43)** is obvious, but simpler tools benefit as **well.** The simple elegance of the NeXTStep browser, like that of a well-designed page, owes much to *the* regularity of its column widths (44).Columns **can** be added or removed by resizing the window, but the width remains constant throughout. Note how the rhythm is disrupted when the widths of the columns are reduced to the minimum required to display the labels at each level of the hierarchy (45). The irrelevant variation in column widths merely introduces visual noise and distracting apparent motion as the hierarchy is traversed, so the minor reduction in screen space is hardly justified.



45: Reducing column widths to the minimum needed to display the widest item may seem like a good idea, but the irregular pattern that results is visually disorienting. The impact on the readability of the resulting display more than offsets the minor savings in terms of screen real estate that results.

Continuity is not only the uninterrupted steps from one point to another. but it is also the cohesive force that holds a diverse composition together.

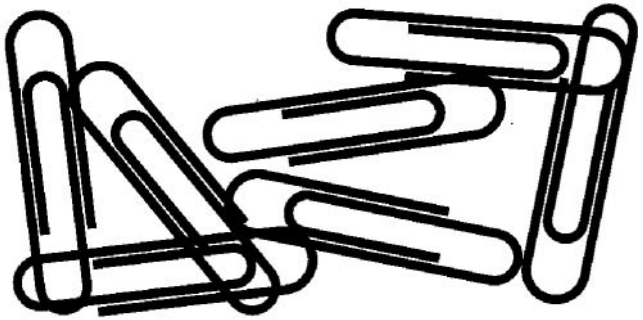
Donis A. Dondis
A Primer of Visual Literacy

Summary: Regularization

Establishing a pattern simplifies the design by moving the viewer's experience to a higher level of abstraction. Thus, a series of black and white rectangles becomes a "checkerboard" when suitably arranged. Design elements must be regularized on many levels simultaneously to produce this effect. Some generally useful strategies include:

1. Use regular geometric forms, simplified contours, and muted colors wherever possible.
2. If multiple similar forms are required, make them identical, if possible, in size, shape, color, texture, lineweight, orientation, alignment, or spacing.
3. Limit variation in typography to a few sizes from one or two families.
4. To reap the benefits of regularity, make sure critical elements intended to stand out in the display are not regularized.

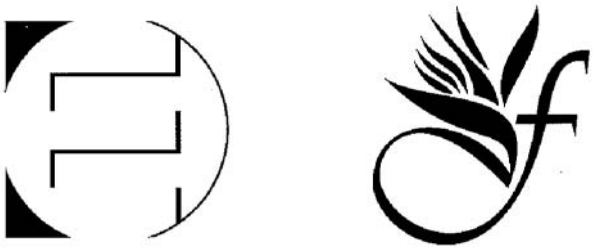
Any irregularity will be interpreted as significant by the user, who will cheerfully ascribe to it a meaning even where none was intended. By regularizing noncritical design elements throughout the work, you will be able to attract the user's attention reliably by introducing an obvious irregularity whenever you do wish to make a distinction.



46: The ubiquitous paper clip achieves its marvel of simplicity by combining the tensioning and grasping functions needed by any clipping device within a single wire element. The Norwegian inventor Johann Valer is credited with the original design in 1899

Combining Elements for Maximum Leverage

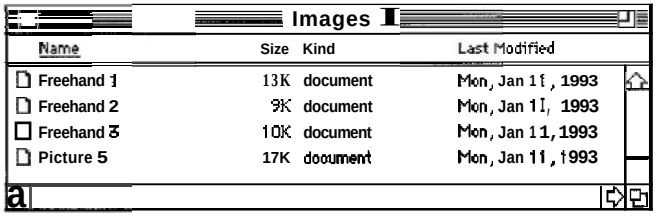
The most challenging means of simplification involves finding points of leverage at which design elements play multiple roles. When one part does the work of two, the elegance of the solution is always enhanced. The humble paper clip (46) shows that elegant design is not limited to expensive luxury items. The effectiveness of this familiar commodity is not compromised by its incredible simplicity. The clip combines the tensioning and grasping functions needed by any clipping device in a single strand of carefully stressed wire. Though we rarely pause to appreciate this elegant solution (an unfortunate consequence of effective design is that it tends to "disappear" as use of the product becomes transparent), its grace is hardly diminished by its ubiquitous presence and utilitarian role.



47: Individual design elements play multiple roles in these identity marks for the Ohio Depanment of Education - Office of Sex Equity (a), and the Floral Images florist service.

Effective design is *visually efficient*. Both of the identity marks in Figure 47 incorporate multi-functioning visual elements. The rectangular element in the symbol for the Office of Sex Equity (47-a), for example, forms part of the "E" in *equity* while forming the square that serves as counterpoint to the circular element in the underlying "different but equal" theme. In the second example (47-b), the vertical stroke of the "F" (for Floral Images) curves organically through a transitional flourish to double as the stem of the mark's bird-of-paradise flower.

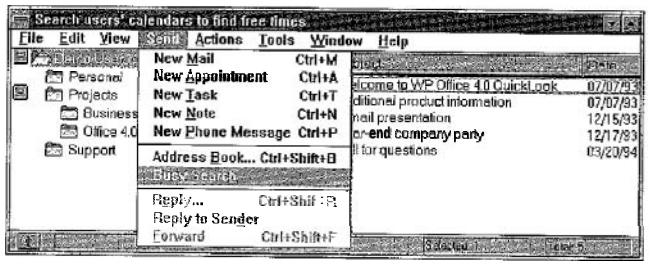
Leverage is particularly important in user interface design, where screen real estate (the amount of display space available to the application) is a precious commodity that's always in short supply. Successful designs use Leverage extensively to simplify standard elements that recur throughout the environment. One of the best examples is a GUI window's title bar (48), which provides not only a place for labeling the window, hut also an area for locating



48: Leverage abounds in a window header, which is at once a label. a drag area, and a space within which to present window manaaement controls. The lines used to highlight the active window provide further leverage by affording draggability even as they increase the window's prominence.

window management controls, indicating when the window is active, and allowing the user to drag the window to a new location. Similarly, a scroll bar provides not only a handle with which to scroll the window content, but also an indication of the current location in the document and (in some GUI's) the portion of the document that is currently visible (44, 48).

Leverage is difficult to achieve because it requires *insight* into the user's task domain. When it becomes apparent that two controls or displays are almost perfectly coordinated (or perfectly complimentary) the designer can use the same mechanism to support rhem both. A clever example of this technique is seen in WordPerfect Office (49). Instead of adding an extra message line to .



49: Leverage in a GUI presentation is often made possible when two aspects of the user's task are mutually exclusive. In this window from WordPerfect Office. the window title is replaced with a string describing the current function as the user browses through a menu.

each window, the design re-uses the window's title bar to display help information while browsing items in the menu. Because users necessarily choose the correct window before they begin looking for the menu command, they are unlikely to need the contextual information provided by the title while navigating the menu system (which is the only time the help display is used).

Effective design utilizes every component to its fullest. While every GUI control requires some form of label, each control doesn'r necessarily require a label all its own. Indeed, identification can often be provided by context. When controls have different logical priorities, labeling items uniformly across levels (SO-a), obscures the relationship. Combining labeling functions allows the logical relation of the subordinate parameters to be conveyed by their position and "indentation" while making it clear that the higher level labels to apply to the subordinates as well (50-b). The consolidation of irrelwant detail makes the important information immediately apparent.

50: Leverage can often be achieved by exploiting contextual information provided by the display itself. Visual interference between adjacent labels (a) can be reduced by allowing each bald label in the left-hand column to set the context for several subordinate controls on the right (b).

Elegance is achieved when a variety of roles is accepted by each part, permitting the whole to operate at several levels of awareness. with interweaving functions inflecting one to another in a state of equilibrium and flux.

Krome Barrett
Logic and Design

Summary: Leverage

Achieving maximum leverage for each element in your design requires a thorough understanding of both the communication problem at hand and the design elements at your disposal. As a design nears completion, it should be systematically examined to determine if any unneeded redundancy remains:

1. Review the functional role played by each element in the design. (This information should be a natural product of the reduction phase.)
2. Look for situations where multiple elements are filling (or partially filling) the same role.
3. Question whether an element's role could be filled as well by an adjacent component, possibly after minor modifications.
4. Combine redundant elements into a single, simpler unit or replace the lot with a common higher-level idiom from the target environment designed to address the situation.

Maximum leverage is not desirable in every design. Particularly in user interface applications, too much leverage can cause problems if it introduces complex mappings that must be remembered by the user. The classic example is the digital watch whose multiple functions and modes of operation are accessed through a pair of tiny buttons. The difficulty of remembering which buttons to press (arid how many times!) quickly outweighs the aesthetic advantages of the economical design. When leverage can be used to reduce the complexity of the interface, however, it enhances both the usability and the aesthetics of the product.