THE EXPRESSIVENESS OF FORM

by
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Preface

Industrial design requires a broad range of skills and competencies, and the Pratt MID program does an admirable job addressing many of them. But for me, the parts of the program that have been the source of the greatest revelations have involved developing my own 'eye'. By means of my hands, I have been attempting to master form-generation. I have begun to learn the language of form, developing verbal and visual vocabularies necessary to clearly articulate the nuances of three-dimensional form. While Pratt's design training emphasizes a number of facets of the design process (such as idea-generation, problem-solving, research and presentation), the primary value of my time at Pratt has been in beginning to understand (or perhaps more accurately, intuit) what makes form beautiful, and learning to create beautiful objects. Perhaps because of its subjective nature and its elusiveness, the word beauty is rarely used in the program; instead, we talk about making an object 'interesting-looking,' a composition 'balanced' or a space 'active.' But in all of these cases, the goal is to cause pleasure via the senses. I have come across many compelling theories about what beauty is, where it comes from and what properties make something beautiful, but because my objective is not to understand the nature of beauty in the philosophical sense, when I use the

word, I am referring only to the vague, pedestrian definition; namely, beauty is what is pleasing to the senses.*

Before beginning my thesis, it never occurred me to ask why beautiful was better, given the constant, if unspoken, aesthetic emphasis in almost every course at Pratt. My assumption was that beauty was its own reward, or when feeling more cynical, I thought its purpose was to sell more units.

In his 2004 book, *Emotional Design*, cognitive psychologist and design critic Donald Norman offers another argument in favor of beauty. He describes how, in addition to being preferred for aesthetic reasons, users report that beautiful products seem to work better, even in the absence of any objective functional superiority [ED 17].†

Increased sales, perception of improved function and aesthetic pleasure for its own sake are all good reasons for beauty to be at the heart of Pratt's graduate industrial design program, and I now feel well-equipped to create aesthetically pleasing forms. But sometimes I have a hard time even choosing a general shape to make beautiful. In my own experience and from speaking to other designers, I found that I am not alone in feeling that, perhaps paradoxically, the more constraints or criteria a project has, the easier it is to invent form. Finding a design solution that meets all of the functional criteria often limits the configuration of elements, and that gives the designer a head-

* I intend the broadest possible definition of what constitutes one of the senses. Aristotle first proposed five basic senses (sight, hearing, vision, touch, taste), but more recent researchers have come to some agreement on nine: equilibrioception (balance), proprioception (awareness of body position), nociception (pain), touch (pressure), gustatory (taste), olfactory (smell), thermoceptive (temperature), vision and hearing. As many as twenty-one different senses have been proposed, but I suspect you get the idea [Wikipedia: Sense].

† Here and throughout, references are indicated by an abbreviation (specified in list of works cited) followed by the page number within the cited work.

start on determining the form. For example, a screwdriver handle must fit comfortably into a user's hand and its tip must be shaped to interact with the standardized receptacle on the screw head; on the other hand, a bowl is still a bowl (and can fulfill its purpose of containing) whether it is monstrous or miniature, tall or short, wide or narrow, round or square. There are, of course, many other possible design criteria, such as engineering, ergonomic, marketing and manufacturing considerations (just to name a few), but in the absence of such criteria, I occasionally find myself at a loss as to what criteria should determine the overall shape or proportion of, for example, a bowl? Of course, in practice there is not likely to ever be a time when *no criteria* are specified, so perhaps this situation is somewhat artificial and unique to a school environment. But the floundering I did, the paralysis I felt in generating form without narrow criteria was instructive. So, in some sense, this thesis is my attempt to find a system for inventing criteria to help guide form-generation when they are lacking.

Beauty implies the observer has a visceral reaction to form. Considering the nature of beauty led me to wonder about the other possible character traits a form could express. And while beauty is a worthy goal for students of design, I found that aesthetic pleasure is not the only visceral reaction an object can elicit. The form of any object may communicate traits such as flexibility, sturdiness or gracefulness, or, at a higher level of complexity, a product expresses what we might call 'personality traits' such as friendliness or aggressiveness. I am interested in investigating the full range of expressive qualities that can be expressed. My hope is that understanding how such

traits come about will help me be more sensitive to form as a designer.

Of course, expression is central to the work of designers, yet for me it remained at the level of subtext until I began this thesis. Design training may focus on the elements of design* in the absence of what those lines, planes and volumes communicate. Designers can be taught to make objects with harmony of shape and good proportion, and along the way, most seem to develop an intuitive sense of what form is appropriate for a given product, and learn to trust that intuition to guide form-generation in their work as designers. Successful designers have always made use of the expressive qualities of form to strengthen, clarify and beautify their work, but many do so intuitively, not consciously. Unfortunately, I was not so lucky as to be satisfied with this kind of intuition about form; I wanted some conscious, coherent, rational way of understanding the expressive qualities of form.

And so it is that I came to believe that expression might be one answer to my bowl-design conundrum. This project is about giving myself criteria for determining form. Asking what a product should express—what message it should convey—seems like a good way to get to a form when its engineering or ergonomic considerations do not offer many clues about what a form should look like.

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* Yes, this is a reference to Gail Greet Hannah's 2002 book *Elements of Design: Rowena Reed Kostellow and the Structure of Visual Relationships* which is often recommended to students entering the program by the department. While I believe that my work is very much in line with Rowena Reed Kostellow's teachings, I have found no direct reference to her discussing expression in the same sense that I use the term. According to the author, Kostellow instead referred to abstracting the essence of a phenomenon or idea and expressing it in visual form.

Introduction

Imagine the following scenario, which took place several years ago at two in the morning in a reportedly dangerous part of Los Angeles: A cop has pulled over a suspicious vehicle and as the officer steps out of his car and draws his weapon, a man steps out from the passenger side of the suspect's vehicle and points a gun at the officer. For a moment, they stand, guns trained on each other—whoever pulls the trigger first is likely to walk away uninjured. Everything in the officer's training tells him he should shoot, but he does not. A moment later, the gunman lowers his pistol and submits to arrest.

Why didn't officer John Yarbrough shoot? "Something just didn't feel right. It was just a gut reaction not to shoot—a hunch that at that exact moment he was not an imminent threat to me." Years later, the officer met with psychologists who were training cops to detect lying by identifying subtle and often fleeting facial expressions. They gave Yarbrough a series of tests designed to test his acuity at detecting the subtle visual cues which might indicate a deception. His scores were off the charts; one in a thousand. While no one can know for sure, the officer's extraordinary ability at reading faces suggests that maybe he didn't fire because he saw something in the gunman's face

or manner which indicated he would not shoot, and officer Yarbrough had the rare and remarkable ability to spot it even if he was not sure precisely what led to his hunch.

This story is recounted in a 2002 *New Yorker* article about University of California Medical School psychologist Paul Ekman's system for identifying the facial movements associated with particular emotions, known as the Facial Action Coding System or FACS [NF 38]. Along with his colleague Wallace Friesen, Ekman identified forty-three distinct movements the muscles every normal human face can make, plus a few more for non-facial movements such as nodding and eye-rolling. Using the FACS, nearly anyone can learn to read faces, maybe even with the level or sophistication of the officer in Los Angeles. At first, the process of identifying expressions is laborious, but with enough practice, those who master the system say that the process becomes automatic, intuitive. What they could not see at all before becomes obvious.

While most people take it for granted that they can read faces, (i.e., that they can correctly infer how another person if feeling based on their facial expressions and body language), most will also admit that some people are much better at it than others. Perhaps a lesser ability contributes to social awkwardness and those we consider socially adept are endowed with above-average face-reading skills. And then there are those who, like the officer who didn't shoot, just seem to pick up on things that the rest of us simply do not see. From the outside, it can seem like these people have ESP, and even they themselves do not necessarily know which specific cues they are responding to. As Yarbrough said, he just had a hunch, a gut reaction.

I cite this example for several reasons. First, to point out that we all read meaning from form every time we notice how another person is feeling. Second, we often do it effortlessly and without even being consciously aware of the actual visual cues that lead to our conclusions. Third, if nearly anyone can learn to recognize and interpret the minute subtleties of facial expression using the FACS, it suggests the ability to infer meaning from form is a perceptual skill that must be honed to precision, practiced, like any other mental or physical skill. Fourth, Ekman's research suggests that very few people have honed their skills for interpreting three-dimensional form and that raises the question of why such a seemingly valuable skill might be so frequently neglected in our culture. Possible answers to that last question are discussed in the following chapter.

The first three points require further parsing. When Ekman and Friesen set out to identify the movements of the facial muscles (rather, the visible form that results from such movements) and correlate them with the meanings conveyed (emotional expressions), they made a number of fundamental assumptions which were well supported by their own prior research. They assumed that all people express emotion in approximately the same way and also universally interpret facial signals to mean the same things around the world. For example, no culture's members frown when happy or slouch when excited. In chapters two and three, I will make a parallel argument: that the underlying perceptual capacity to infer meaning form is an evolved capacity and is therefore universal. The evidence to back up my claims comes from the study of the evolution of human aesthetic preferences and research in the field of visual perception.

What I am setting out to do in this thesis is analogous to what Ekman and Friesen did, but I am trying to understand how form, more generally, communicates expression. Obviously, there are more than forty-three different variables that constitute expressive form, so my results are unlikely to include anything so specific as a 'coding system' such as that of Ekman and Friesen. The infinity of possible shapes is too diverse place into a tidy taxonomy, but I can refer to the work of a number of theorists (including those who developed the concepts and terminology taught in the Pratt MID program) who have identified the constituent elements of form. What I am trying to do is, at its core, the same thing: to understand what specific forms are associated with particular expressive qualities. Instead of the forty-three facial action units, I will attempt to describe the constituent elements of form more generally as they relate to perceived expressive qualities.

What I hope to offer is an explanation of and method for generating and analyzing form with regard to its expressive qualities. My emphasis is on the three-dimensional form of functional products, though the related properties of surface, color, texture and pattern will also be addressed somewhat less extensively. For the sake of simplicity, and to limit the number of variables which might play a role in perception of expression, my focus is on the expressive qualities inherent in the form of static objects. We certainly perceive expression in the way objects and people move,* the sounds they make and even the smells they give off, but this investigation is limited to static form.

* For an investigation into motion in products, see Ben Hopson's Pratt master's thesis *Designing Movement: An Aesthetic Investigation of Motion in Product Design*. Ben graduated in February 2006.

I will apply findings from a number of diverse fields, but throughout, my attention will be focused on how all of these factors relate to industrial design, that is, the design of mass-produced, functional or decorative objects with which humans interact.

The seed of this idea came from an assignment Professor Lucia DeRespinis uses in all her classes in which students are asked to create symmetrical paper cutouts of specific dimensions which represent adjectives such as cold, lazy or aggressive. What does 'flamboyant' look like? Of course, I recognize it when I see it, but when I faced blank sheets of paper, I was at a loss. So I just started cutting and evaluating afterward; it was a process of trial-and-error and it was frustrating and time-consuming. At the time, I am sure I could not have articulated the frustration, but I was also sure there must be a better way. I had a hunch that being able to communicate these kinds of themes visually—being able to figure out (or at least intuit) what formal characteristics cause a product to express coldness, laziness, aggression, or any other trait—was a pretty crucial skill for an industrial designer.

When presented with an expressive form, I am able to read expression from visual cues—I was able to recognize 'flamboyant' when presented with an example—but like John Yarbrough, I was unable to isolate the visual cues necessary to create a flamboyant shape from scratch. Mine was a hunch, a gut feeling.

With no special instruction, we are capable of reading the body language of our fellow humans, our pets and even creatures that do not exist, as in science fiction and fantasy films. The ability is not even limited to living (or at least animate) things; sports

cars look fast, jeeps look rugged. But there is a crucial step that operates mostly below the level of consciousness; while we are able to discern meaning from form, we cannot necessarily identify the formal characteristics [MWO 33, 40]. With an extremely high degree of accuracy, we can all tell if a person is angry or sad, but when asked to describe the configuration of body parts that led us to that conclusion, most of us fall back on stereotypes [EE 384]. For example, we might say that a frown involves turning the corners of the lips down, when in reality, a more reliable indicator of genuine sadness is conveyed by the eyes and eyebrows [EE 366]. When it comes to expression, we get the gist, the underlying meaning, without necessarily being aware of the forms that actually communicate that meaning.

My objective for this thesis is to better understand the relationship between specific formal characteristics and the expressive qualities they convey. I will argue that the ability to infer meaning from form is universal; that close attention to the expressive qualities of form can be a valuable guide during the process of form-generation. I will discuss findings in several fields of study: the evolution of human aesthetic preferences, the psychology and neuroscience of visual perception, aesthetic theory, and hands-on experimentation with form generation.

Perceptual Atrophy

While there is no consensus within the field as to the industrial designer's essential role, the ability to create forms which embody the appropriate expressive qualities is arguably one of the designer's most important skills. Yet, as discussed, the ability to do so (at least with regard to facial expression) appears to be fairly rare among the general population. Perhaps designers as a group are more attuned to the expressive qualities of form, but the general lack of perceptual acuity raises several questions. First, if everyone has the capacity to develop a highly nuanced sensitivity to form, why do so few actually develop the skills? Secondly, why is the study of the expressive qualities of form addressed only obliquely in many design curricula? In the process of researching this thesis, I found that many designers and thinkers have raised these questions and offered a number of possible explanations.

With regard to the study of facial expression discussed in the introduction, the *New Yorker* article cited offers the explanation that most of us miss so many of the social visual cues "because it does not challenge the ordinary boundaries of human relationships." The author continues, describing and quoting from one of Ekman's essays:

> …part of what it means to be civilized is not to 'steal' information that is not freely given to us. When someone picks his nose or cleans his ears, out of unthinking habit, we look away. Ekman writes that for [sociologist Erving] Goffman the spoken word is "the

> acknowledged information, the information for which the person who states it is willing to take responsibility," and he goes on: "When the secretary who is miserable about a fight with her husband the previous night answers, 'Just fine,' when her boss asks, 'How are you this morning?'—that false message may be the one relevant to the boss's interactions with her. It tells him that she is going to do her job. The true message—that she is miserable—he may not care to know about at all as long as she does not intend to let it impair her job performance." What would the boss gain by reading the subtle and contradictory microexpressions on his secretary's face? It would be an invasion of her privacy and an act of disrespect. More than that, it would entail an obligation. He would be obliged to do something, or say something, or feel something that might otherwise be avoided entirely. To see what is intended to be hidden, or, at least, what is usually missed, opens up a world of uncomfortable possibilities [NF 49].

This argument that we willfully ignore the subtleties of expression (or at least have a social reason not to develop our perceptual abilities) for the sake of keeping the peace is the only argument I have found that might be interpreted as favoring maintenance of the status quo, that is, that the majority of people in our culture miss the finer points of facial expression and body language. This position is specific to emotional expression in humans and may not be relevant to the larger question of the expressive qualities of form, however, I found it notable for being the exception to the more numerous commentators lamenting the public's inability or perhaps lack of interest in appreciating aesthetic nuance.

Rudolph Arnheim, a German-born author, art theorist and psychologist of the Gestalt school whose life's work centers on expressive qualities in the arts (and whose work is a major influence on my own thinking), attributes the neglect of expression to the scientific, analytical mode of schooling dominant in western cultures. While there have been many notable exceptions to this overall trend, the pursuit of logic, reason, and scientific method have gradually displaced the pursuit of the sublime as mankind's greatest earthly aspiration. The value of beauty was further discounted by

the puritanical religious belief that pleasures of the flesh (aesthetic pleasure has often been considered among them) are morally suspect. As a result, twenty-first-century American culture tilts toward the quantifiable and scientifically verifiable, at the expense of the more ethereal and interpretive. Arnheim describes the resulting failure to develop a sensitivity to the aesthetics (or perhaps visual intuition) as "spoiling" [AVP 456] that results from too great a focus on rationalist principles:

> We are the victims of an inveterate tradition according to which thinking takes place remote from perceptual events. They are limited to collecting the raw material of experience. It takes "higher" powers of the mind to process the sensory data. In order to learn from experience the mind must extract generalities from the particulars, and in the realm of the generalities no further commerce with direct perception is supposed to be possible. Berkeley, in his *Treatise Concerning the Principles of Human Knowledge*, made this view plausible to generations of readers. For example, the abstract idea of the body of animals refers to "*body* without any particular shape or figure, there being no one shape or figure common to all animals, without covering, either of hair or feathers, or scales, etc., nor yet naked: hair, feathers, scales and nakedness being the distinguishing properties of particular animals, and for that reason left out of the *abstract idea*."
>
> If the operations of thought were assumed not to rely on perception, what vehicle could they use? The unavoidable answer was that man thinks in words alone, and that without words no thinking can take place. What is more, an efficient thinker, whenever possible, employs the most clearly defined sets of words, namely, numbers and other mathematical signs.
>
> Consequently, Western education has been concerned foremost with words and numbers. In our schools, reading, writing and arithmetic are practiced as skills that detach the child from sensory experience, and this estrangement intensifies during the high school and college years as the demands of words and numbers grow and childish things must be put aside. Only in kindergarten and first grade is education based on the cooperation of all the essential powers of the human mind; thereafter this natural and sensible procedure is dismissed as an obstacle to training in the proper kind of abstraction [EV 2].

Eva Zeisel, ceramicist, industrial designer and former Pratt instructor, argues that even within training programs for students of the fine and applied arts there has long been an artificial concentration on shapes and colors [AVP 456] with no reference to the sensations a particular specimen might evoke. She writes that this situation did not come about by accident. Zeisel attributes the omission of training in the expressive

qualities of form to the Modernists' reaction against Victorian decorative excess, which they saw as oppressively sentimental. Zeisel quotes a 1925 passage from French architect and city planner Le Corbusier:

> Our parents wanted that a radiant atmosphere should glorify our gloomy life; but we want the objects to be our mute slaves rather than soulful friends. We want instruments. We exact from them punctuality, accuracy and unobtrusive presence [OD 18].*

Zeisel suggests that influential taste-makers of the early-twentieth century actively tried to suppress the expressive qualities of form, for they believed that emotion must be tempered by reason, but only ended up creating a style which many people now consider cold and uninviting. Zeisel laments the loss of sensitivity to expression or what she calls "the magic language of things" among designers as well as the general public. Another example of the critique of words-and-numbers-based schooling is the Visual Literacy movement. Founded in the late nineteen-sixties, it argues that the ability to interpret images (especially in our media-saturated culture) can be learned in much the same way as reading and writing [IVLA].

However, it is important to note that in all of these examples, there is an underlying assumption that all people are capable of sophisticated visual sensitivity to expression, but that the ability has been suppressed (or at least neglected) as a result of cultural or political influences. In the next two chapters, I will present an argument

* Zeisel quotes Le Corbusier without attribution. Le Corbusier published three tracts in 1925: *La peinture moderne*, *L'art décoratif d'aujourd'hui* and *Almanach d'architecture moderne*. A cursory search could not confirm Zeisel's quotation, which seems to be a paraphrase of several passages from *L'art décoratif d'aujourd'hui (The Decorative Art of Today*, Translations by James I. Dunnett, The Architectural Press, London) such as, "[proponents of the predominant fashion] have decided: an object of use should be decorated; as our companion in fortune and adversity it should have a soul. Together, the souls of objects that have been decorated create an atmosphere of warmth which brightens our unhappy lot. The great emptiness of the machine age should be countered by the ineffable diffusion of a soothing and gently intoxicating decoration. ...The objects of utility in our lives have freed the slaves of a former age. They are in fact themselves slaves, menials, servants. Do you want them as your soul-mates? We sit on them work on them, use them up. When used up, we replace them. ...We demand from such servants precision and care, decency, and an unassertive presence" [7-9].

that this assumption is correct; everyone is capable of developing the kind of perceptual acuity that is now considered exceptional.

The Evolution of Human Aesthetic Preferences

The question of how beautiful something is or what makes it beautiful is at the core of the branch of philosophy concerned with aesthetics, but beauty is only one of many possible character traits an object might embody. Yet, beauty has been a consistent thread running through the work of many researchers and thinkers and many of their conclusions bear upon the work of industrial designers seeking to more fully understand the expressive properties of form.

At its root, to experience beauty is to experience pleasure. Psychologists use the more generic term 'affect' to describe any sort of emotion or sensation. *Positive* affect includes pleasure, excitement, happiness, fondness, affection, interest, attraction, pride, wonder, etc. *Negative* affect includes pain, fear, anger, disgust, boredom, sadness, confusion, etc. There are certainly varying degrees of positive and negative affect and we usually feel multiple and sometimes conflicting emotions simultaneously, but at the level of neurophysiology, we are never indifferent to any experience. Colorado State University animal scientist Temple Grandin writes that "researchers have found that even nonsense syllables spark positive and negative emotions; to your brain, there's no such thing as neutral" [AIT 45]. It follows that we are also never aesthetically

indifferent; just perceiving a product or a work of art causes a positive or negative reaction even before we know why, or form or articulate a more rational opinion.

Neuroscientists theorize that this 'quick and dirty' positive or negative judgement system evolved because it allowed our ancestors to react to danger more quickly. The difference might only be a matter of a few milliseconds, but for an animal trying to escape from a predator, it may have meant the difference between life and death.

In the brain, signals from the sensory organs are processed by at least two parallel (though not unconnected) pathways. New York University neuroscientist Joseph LeDoux dubbed them the 'high road' which leads to the conscious, declarative object recognition ("That thing is a bear, and it is coming to maul me") and the other, the 'low road' leads to the nearly instantaneous emotional or 'gut' reactions ("Ack! Run!") [EB 166].

LeDoux's theory is derived largely from the study of fear reactions (fear being a form of negative affect). The larger manifestation of fear consists of familiar physiological changes such as increased heart rate, blood pressure and respiration, sweaty palms and so on. These kinds of reactions are controlled by the autonomic nervous system (ANS) and are known as more generally as ANS responses* [EB 144].

I mention the phenomenon of ANS response to sensory input because it illustrates a form of judgement made by the brain based on sensory information from the outside world. If the low road determines something is a threat, it activates the body's defense

* ANS responses are just one example of the bodily systems that are involved in fear and other emotional responses, but for the sake of brevity, I will refer only to ANS responses. "In the presence of danger or stimuli that warn of danger, behavioral, autonomic and endocrine responses are expressed and reflexes are modulated" [EB 160].

mechanisms and the physiological changes begin before we become consciously aware of the threat. The same thing happens with all types of sensations; our brains are constantly making judgements and activating physiological systems even before we become aware of why. We like to think we understand our motivations, emotions and bodies and that our responses are reasonable and well-considered, but in reality, our nervous systems spring into action long before we even consciously recognize what we are looking at.

This raises the question of what part of the stimuli the pre-conscious brain is reacting to. With sound, it is plausible that loudness or suddenness—regardless of pitch or timbre—could be fear triggers, but with visual input, the criteria seem much more complex. Many of us have had the experience of walking in the woods (it has even happened to me on a city sidewalk) when, out of the corner of an eye, we catch sight of a snake. Before we can even turn our attention to the snake, we freeze stock-still and our heart-rate jumps. But once we do look, we see that there is no snake, but only a stick (or for me in the city, it was a piece of ticker-tape-style confetti). The whole scenario takes less than a single second. That raises the question of what our visual system sees that justifies activating the fear response. Is it the curviness, the slenderness, the color, the pattern of shadows cast, its position relative to our eyes, that causes our hearts to skip a beat?

In the case of fear, LeDoux suggests that the low road is activating the physiological fear response based on a simplified set of sensory input data. Another

possibility is that it has a lower threshold, implying not a simplification of incoming data, but less sophisticated criteria for activation of the ANS, meaning the low road sees all the sensory data but only reacts to certain aspects. In either case, abstraction from the stimulus input is implied, that is, the complexity of either the stimuli or the ANS activation criteria is reduced. Generally, abstraction is based on ignoring or excluding information or detail which is irrelevant to the task at hand, but it is unclear how, or based upon which criteria the brain determines what aspects of the stimulus are relevant. According to LeDoux, the nature of the abstraction with regard to visual stimuli used by the low road has not yet been determined [personal interview, 6 FEB. 2006]. Other researchers in the field of visual perception have posited that the brain parses visual information into its component parts (for example, scale, motion, shape, color) and that each of these has its own threshold for activating bodily responses, possibly working in combination. For example, a small, fast moving object will draw most any animal's attention (this is known as an orienting reflex), and in predators, may initiate prey chase behaviors [AIT 135].

Luckily, the low road does not get the last word in what is dangerous and what is not. Consider the following example: in a dimly lit room, the low road sees a dark, vertically-oriented shape, sets your heart racing (ANS response) and perhaps sends a message up the high road saying "Danger!" That data may be incorporated into the high road processing causing a momentary identification of the dark shape as a malicious intruder. But an instant later, the high road sees that the object is just the bathrobe you

draped over the door, and your heart-rate returns to normal.

Furthermore, it seems that watching a story about intruders on the local news before bed, for example, can predispose a person to see intruders. That is, the low road's judgements are subject to the influence of experience. The same may be said of intuition, and in fact, LeDoux suggests that the low road is the basis of, or at least one element of intuition. Just as intuition is developed and improved over time; new experiences refine the criteria by which the low road activates bodily responses to external stimuli [EB 293]. The same principle is in play when people use Paul Ekman's tools to learn the subtleties of facial expression (mentioned in the introduction); at first the facial movements are analyzed consciously, but they are gradually incorporated into the intuition.

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Most mammals are born with the ability to interpret the physical world around them via their senses, at least at the most basic level, with little or no help from experience. Animals quickly learn to distinguish between food and non-food, human babies do not have to fall off a ledge to know not to crawl off of one (though they do have to have developed depth perception, as demonstrated in the famous "visual cliff" experiments*). By the natural selection model, these perceptual abilities must have developed (phylogenetically) because they conferred some survival or reproductive advantage.

* The visual cliff "consists of a board laid across a large sheet of heavy glass which is supported a foot or more above the floor. On one side of the board a sheet of patterned material is placed flush against the undersurface of the glass, giving the glass the appearance as well as the substance of solidity. On the other side a sheet of the same material is laid upon the floor; this side of the board thus becomes the visual cliff .... [infants who have already begun crawling or scooting about have] the good sense not to crawl out onto an apparently unsupported surface, even when Mother beckons from the other side. Rats, pups, kittens, and chicks also will not try to walk across to the other side." [VC 67] Variations on the visual cliff apparatus have been used in hundreds of different experiments but the Gibson and Walk study is probably the most well-known.

The basic mechanism is affect; an animal's actions or perceptions either make it feel good or bad. That description may imply conscious awareness of the affective state, but consciousness is not necessary. Positive affect serves as an encouragement or reward. Behaviors which cause pleasure encourage the animal to continue or repeat that behavior. Similarly, negative affect serves as a discouragement. Both pleasure and pain are relative, that is, if there are multiple options that would give pleasure, the one that gives the most pleasure will likely be selected. And the converse goes for pain.

Consider the motivational power of pleasure and how we modern humans have learned to trick our bodies so that we get the pleasure without the benefit for which the pleasure evolved: we drink diet soda to get the sensation of sweetness without the calories; we partake in all manner of non-procreative sex acts to get the pleasure without the babies.

Affect then, is the basic mechanism for aesthetic* judgements; as discussed, any percept via any of the senses causes some positive or negative affect. Sounds, smells and sights cause our brains to form an immediate (if perfunctory) opinion which falls somewhere on the positive-negative affect spectrum. For example, given a choice of different foods, an animal will usually eat the one it likes best first, but that does not necessarily mean it will not subsequently eat the other options. Continuing with the food example, we can see how preferences for certain foods might develop. If an individual had a taste for a food that was poisonous or even just lacking vital nutrients

* My use of the word 'aesthetic' here and throughout this thesis is perhaps sightly broader than common usage. While the usual definition includes only a preference for experiences leading to pleasure, I also include a preference for experiences which minimize pain or other unpleasant sensation.

or calories, that individual would be less likely to reproduce and pass the preference along. Evolution selects for such preferences and as a result they become common to all members of a species, who, by definition, have similar environmental and metabolic requirements [HA 33]. So, if such evolved preferences are the basis of our aesthetic sense, it stands to reason that at some fundamental and probably unconscious level, all humans share a core set of perceptual judgements. For example, while too much sweetness can be cloying, we can agree that in general, we all have a positive affective reaction to sweet foods, that is, we like sweets.

Similarly, a crucial aspect of our aesthetic preference is that it is non-specific. By this I mean the preference is not for a specific type of object, rather it is for the sensation provided by an object. The correlation between particular sensations and positive affect is what has evolved, rather than a preference for, say, specific foods or environments. For example, one might say he likes apples (object) because they are sweet (pleasurable sensation), but not that he likes sweetness because of apples. Furthermore, the relative nature of preference allows us to discern between the objects of the same type; if sweetness were the only criteria, we would choose the sweeter of two apples.

Of course, sampling all those apples could be pretty time-consuming. Luckily, evolution solved that problem for us, too. Somewhere along the way, our evolutionary ancestors figured out that there was a correlation between the way an apple looked and

the way it tasted* (or rather, developed a preference for apples that looked a certain way, and it happened to correspond with nutritional value, digestibility or at least not being poisonous and that preference was selected for). Again, these preferences are not object-specific. We like our apples plump and unblemished, but we do not like plumpness and lack of blemishes because of apples. Instead of creating a mental database of all possible foods indicating the criteria by which a particular item might be judged, we have evolved a set of subconscious principles which are likely to apply to many different kinds of foods.

The idea that the visual characteristics of an object correlate with non-visual characteristics is known as *indicator theory*; plumpness and lack of blemishes *indicate* that a fruit is fresh, healthy, etc. [HA 54]. Again, it is not necessary that a person know why she likes plump, unblemished fruit, all that is required is a pleasurable sensation when she sees the fruit.

When we go to the grocery store and choose produce, our decisions are often based on this kind of subconscious sense that plumpness and intensity of color are signs of good food. For example, when I find myself at a produce market in Chinatown looking at unfamiliar varieties of fruits and vegetables, I may not know what the fruit tastes like or know the variety-specific tricks for choosing the ripest or tastiest fruit, but I still think I know which individual fruits are healthy and undamaged. Unfortunately, growers and marketers exploit this innate visual preference to sell us produce that looks

* I should note that aesthetic preferences in this sense appear to be species-specific, for example, maggots will eat rotting flesh, but not living flesh; many pest insects are drawn to distressed plants. By this logic, you might say that rotting flesh is 'beautiful' to maggots. Dogs appear to prefer protein-rich foods, whereas humans seem have an additional preference for carbohydrate-rich foods not normally prominent in a dog's diet. Also, since canine olfaction is so much more sensitive than in humans (at least 100 times more sensitive! [ARP 37]), the appearance of food is probably less important.

great, but no longer correlates to being good food. Instead, tomatoes are bred (and/or genetically modified) to withstand impact, apples are bred (and often waxed) for long shelf-life, and just about everything is bred for size (bigger is better, right?) and sprayed with chemicals to prevent blemishes caused by insects and blight.

Human preferences when it comes to the visual characteristics of food appear to be fairly universal [HA 54]. The characteristics seem obvious when pointed out, but since my purpose is to elucidate how and what the visual characteristics of objects communicate to us, I will describe a few.

Plumpness, fullness or turgidity are preferable to wilt or flaccidity. Smoothness of surface is another way to describe similar attributes, with wrinkled or shriveled surfaces being less desirable. A look at the photos in any cookbook confirms our love of wet, shiny, glossy things in preference to dry, non-shiny objects. Cellophane owes some of its commercial success to our preference for glossy things—products packaged in cellophane packaging make even such non-glossy items as handkerchiefs or dried oats glisten and sparkle [TP 126]. Contrast intense or 'true' color to dull, faded or weathered; unblemished to scarred or cracked; clean to soiled. There are, of course, many non-visual characteristics that serve the same function; consider firmness, heaviness (density) and crispness, just to name a few. And on the flip side, consider the repulsion you feel when you see a mangy dog, an open wound, or maggot-infested meat.

Of course, the pleasure of seeing a good-looking apple is characteristically different from the pleasure of eating a tasty one. Someone might find Gala apples more

visually appealing than Macoun apples, but prefer the taste of the latter. Aesthetic preferences derived from different senses can affect and even contradict each other, to say nothing of the myriad other cognitive and cultural factors which influence our judgements. I am not suggesting that specific aesthetic judgements are simple or hard-wired, only that our evolved sense described in this simplistic example is one ingredient in the mix, and usually the first one. Such preferences are not absolute, that is, they can be overruled by a learned preference or conscious choice. Additionally, the preferences I have described are based on what might have been available in the natural world to pre-agricultural societies—fruits and vegetables, game animals, fish, etc., but because our aesthetic preferences are non-specific, the underlying principles can be applied to man-made artifacts as well as naturally occurring objects and environments. If we select apples for their intense colors, their smooth surfaces and lack of blemishes, it follows that we also prefer a shiny brand new car over one that has a splotchy paint job and lots of dings in the fenders.

Up to this point, I have only discussed human preferences as they relate to food, but our aesthetic preferences apply to much more than just food. Many of the same visual characteristics that indicate health and vigor in plants and game animals have similar implications for potential mates or rivals. Animals find the visual indicators of youth, health and vigor sexually attractive in potential mates and threatening in potential rivals. Obviously, there is much more to human interaction, whether amorous or antagonistic, but this kind of instant, often unconscious visual appraisal is our first

(and often most important) source of information about another person.

You are probably able to check my claims so far about universal preferences against your own experience, but that there seem to be nearly universal preferences for environments may be less obvious. An animal's environment obviously plays a large role in its survival, so by the same mechanism as the development of food preferences (that is, pleasure and pain: positive and negative affect), it follows that animals—including humans—would evolve preferences for environments which offer access to water, food, safe hiding/nesting places, topographic advantages for hunting, and other characteristics which help it avoid natural dangers such as predators, parasites, poisonous foods and unfriendly members of its own species [BH3 91]. A number of studies have shown that humans do indeed prefer such an environment:

> There is a general preference for landscapes with water; a variety of open and wooded space (indicating places to hide and places for game to hide); trees that fork near the ground (provide escape possibilities) with fruiting potential a metre or two from the ground; vistas that recede in the distance, including a path or river that bends out of view but invites exploration; the direct presence or implication of game animals; and variegated cloud patterns. … Not surprisingly, these are the very elements we see repeated endlessly in both calendar art and in the design of public parks worldwide [OXA 697].

The savannas of east Africa match this description well, and because some of the oldest hominid fossils have been found there, this is the environment where humans are believed to have evolved. Our evolutionary origins on the savanna are often cited as the source of our innate environmental preferences. However, for my purposes it is worth noting that the studies found that there was no discernible preference for particular species of flora or fauna; instead, our preferences are for spatial relationships, that is, like our food preferences, they are not object-specific [BH4 159].

All of the discussion thus far has been based on Charles Darwin's theory of evolution by natural selection, but Darwin also proposed another mechanism to explain a number of traits and behaviors he observed and which he could not explain by natural selection alone. Sexual selection is based on "a struggle between the individuals of one sex, generally the males, for the possession of the other sex" [OS 103]. Sexual selection is proposed to account for the sometimes dramatic differences in appearance or behavior between the sexes of a single species. Darwin's classic example of traits evolved via sexual selection is the male peacock. His large, elaborate tail feathers and display rituals make him more vulnerable to predators (because they significantly restrict his mobility), but more attractive to peahens. If one of her mate-choosing criteria were the beauty of the peacock's display, then she is, in some limited sense, making an aesthetic judgement.

Darwin does not draw a direct connection between the origins of human aesthetic preferences and sexual selection, he sees only that the female has some mental criteria for choosing her mate, the details of which remain unclear to the third-party observer. The reason for his opposition to such a connection seems to have been essentially racist, or at best, provincial. He argues the idea that if a "sense of beauty" (which he defines as "the pleasure given by certain colours, forms, and sounds" [DOM 60]) were innate (sexually or naturally selected), there would be little variation in aesthetic preferences within a species, but as he saw it, there was too much variation:

> I may first remark that the sense of beauty obviously depends on the nature of the mind, irrespective of any real quality in the admired object; and that the idea of what is beautiful, is not innate or unalterable. We see this, for instance, in the men of different races admiring

> an entirely different standard of beauty in their women. [OS 206].

Darwin considered the evolution of aesthetic preferences to be limited to the choosing of mates [DOM 60]. Yet he did not entirely dismiss the idea of a universal and even trans-species sense of beauty, as he noted some continuity between the aesthetic preferences of different species:

> Whether we can or not give any reason for the pleasure thus derived from vision and hearing, yet man and many of the lower animals are alike pleased by the same colours, graceful shading and forms, and the same sounds [DOM 61].

Darwin also makes an indirect connection between sexual selection and the decoration of man-made artifacts:

> The eye prefers symmetry or figures with some regular recurrence. Patterns of this kind are employed by even the lowest savages as ornaments; and they have been developed through sexual selection for the adornment of some male animals [DOM 61].

Many later evolutionary thinkers have developed the idea that the origins of human aesthetic preference (beyond preferences for foods and environments) lie in sexual selection and this remains the dominant theory regarding the origins of mankind's aesthetic inclinations [HA 66]. Some critics have argued that sexual selection alone is inadequate to explain the complexity of human aesthetic pursuits, saying it could explain the pleasure from the appreciation of art (e.g., peahens appreciating the peacocks' displays), but not the pleasure derived from the making of objects for aesthetic appreciation; presumably the size and coloration of the peacock's tail feathers is determined by genes, that is, the peacocks had no choice in the appearance of their plumage, and thus would not be subject to selective pressure to evolve an equivalent aesthetic sensibility.

Darwin's theories were related to individuals, but a more recent addition to the theory is the idea that our aesthetic abilities also served a social purpose, that is, they contributed to the survival or reproductive success of the group, not just the individual. In her 1992 book *Homo Aestheticus*, Ellen Disanayake offers such an explanation for human aesthetic proclivities. She argues that pleasure derived from making art came about because it benefitted group, rather than individual survival. Used in rituals and rites, art assuaged anxiety over uncertainties about survival. Though she does not discuss the genetic mechanism in much detail, she argues that the members of social groups that created art must have had some selective or reproductive advantage over those that did not. Arnheim cites a simpler explanation: speaking is often accompanied by gesturing. When that gesturing is descriptive, indicating for example, the appearance or location of a predator, Arnheim suggests that adding a piece of charcoal and a flat stone or a stick and a patch of sand to the descriptive gesturing quickly becomes drawing, a valuable means of communication [AVP 172]. The better the drawing, the clearer the communication and therefore the survival or reproductive value. Furthermore the ability to draw might be indicative of an individual's intelligence and therefore the ability might be reinforced via sexual selection.

* * *

The idea of developing a system to help designers to understand the expressive qualities of form is based on the assumption that there are significant commonalities we all share in the way we read meaning from form. My argument here is that human

aesthetic preferences are evolved via natural and sexual selection and are therefore common to all humans. At the level of gut reactions, we all react to form in a similar manner, that is, at a most basic, simplistic level, seeing a form causes similar affect in all of us. Affect explains how aesthetic preferences may have evolved. This affective reaction is the basis of our 'gut reactions,' that is, our intuition or our subconscious reactions. As such, the intuition can be trained, its reactions refined by experience. Because preferences are based on species-specific metabolic and environmental requirements, all humans share this most basic level of aesthetic preference. More specifically, what evolved is a preference for the visual indicators of beneficial qualities, such as health and vigor in food and mates and safety and necessary resources in environments. Finally, while the preferences may have evolved for the evolutionary advantages they confer, these preferences are manifest subconsciously; we do not prefer sweet things because we know they contain abundant calories, instead we prefer sweets because they cause a pleasurable sensation.

Serviceable Habits

The discussion of the evolution of human aesthetic proclivities in the previous chapter provides a structure and context in which to understand the way humans perceive form. However, it yielded only limited clues as to how specific visual forms convey meaning or expression. When we talk about expression in common parlance, we often mean expression of emotion using our faces and bodies. As psychologist Paul Ekman's studies of isolated tribal societies proved, all around the world, humans put their faces and bodies into particular configurations when they are feeling particular emotions [EE 390]. We all express our emotions in more or less the same ways. That we all make the same face when surprised or tense our muscles when angry implies an evolved trait, that is, one that helped our ancestors survive and reproduce.

In the previous chapter, I mentioned ANS responses without discussing what the experience of having an ANS response might feel like or what purpose it might serve. ANS responses are closely tied to what we consciously experience as emotions. Evolutionary psychologists have posited that each of our basic emotions evolved as a separate system to serve a specific purpose. In this sense, an emotional response includes more than just a conscious, subjective 'feeling'. An emotion begins with some

kind of sensory stimulus (or a memory of a stimulus), triggers specific physiological changes and leads to a specific pattern of behavior [EB 16]. Emotions cause immediate physiological changes, whereas thoughts leave the body relatively unaffected. And although thought and emotion are deeply interconnected (for example, conscious information is incorporated into subsequent intuitive responses), some psychologists have used this difference to distinguish between emotions and thoughts [EB 16].

Definitions of what constitutes an emotion vary depending on the purposes of the researchers. Brain scientists have identified specific neural pathways for four emotions shared by most predator animals and another four for social (or pack) animals, including humans. The former are anger, prey chase drive, fear, and curiosity/interest/anticipation; the latter are sexual attraction/lust, separation distress, social attachment, and play [AIT 94]. Paul Ekman has identified a list that consists of seven basic universal emotions as expressed on the face: surprise, enjoyment, sadness, anger, fear, disgust and contempt [ER 226]. Autism researcher Simon Baron-Cohen analyzed thousands of words related to emotion and came up with a list of 412 unique emotions in 24 categories [MWO 41; MR]. In his 1872 book *The Expression of the Emotions in Man and Animals*, Darwin does not attempt a comprehensive list, but describes scores of different general sorts of emotions, and the associated attitudes of the body. For my purpose of citing a few examples, I will discuss: anger, fear, enjoyment, sadness, disgust and seeking (which includes interest, anticipation, eagerness, curiosity, delighted surprise, etc.[*]). This short list presumes that the numerous different emotions we

* This usage of the term 'seeking' is taken from Temple Grandin's *Animals in Translation*, who draws from the work of neuroscientist Jaak Panksepp.

experience consist of combinations of these basic emotions, variations of intensity, and in some cases, cognitive input.

In the previous chapter, I discussed how positive and negative affect (e.g., pleasure and pain) are fundamental motivators to action and how they might be seen as the simplest forms of aesthetic judgements. If affect can be thought of as a general purpose motivator, the emotions can be seen as motivators to specific actions.

Several of the basic emotions prepare the body for dramatic physical action: anger prepares the body for a fight: fear gets us ready to run away (or freeze in place), disgust prevents us from getting sick or injured. If these emotions (which are usually experienced as negative) have the effect of exciting the body—getting it ready for action—the positive ones tend to help bring the body back down to a more relaxed state. Enjoyment is catch-all for the range of emotions that serve as general purpose rewards for beneficial behaviors. *Seeking* rewards novelty [AIT 95]. Sadness serves a social function—a stress that keeps us with, or motivates us to get back to our social group [AIT 109]. From this perspective, it follows that the specific body positions and physiological changes associated with each emotional state would be derived from the functional purposes described above. For example, the wide, low stance, rigid body position and threatening fangs of an angry dog certainly signal its state of mind, but this pose was most likely derived evolutionary because it increased the dog's chances of winning a fight. Darwin called this idea "serviceable associated habits" [EE 34].

Indicator theory, discussed in the previous chapter, posites a correlation between

the appearance of an object and its value for survival or reproduction. Similarly, the idea of serviceable habits posits a direct functional correspondence between the appearance of an animal and the activity it is engaged in. As such, a look at the general visual characteristics of various emotions is warranted here.

There are a number of actions or body positions associated with *fear*, for example, freezing, cowering, curling up into a protective pose, or running away. Fear causes us to want to get away from or shield ourselves from the source of the danger. Accordingly, the physical form a body takes when it is afraid is characterized by a drawing away. It is a defensive pose, ready to run, tense, primed for flight but without letting the threat out of sight. Attention is fixed. This defensive pose is also characterized by compactness, presumably limiting the exposure of extremities.

Anger prepares the animal to fight. Muscles are tensed, giving a stiffened, straightened appearance, adrenaline is flowing, the stance is widened and body lowered for stability, teeth and claws are bared. Very high energy, highly alert.

Disgust is closely tied to smell and taste, but it seems that it can be activated even by vision—which is useful so you do not have to taste or smell the nastiness to know that it is nasty. Consider the person who vomits at the sight of an injury. Disgust seems to be limited to things that are not threats, and perhaps requires a cognitive understanding of how something 'should' be. But because the objects we see that disgust us are not threats, the need to get away is less urgent than the fear/flight response. Accordingly, the body language of disgust is less energetic in its attempts to

get away from the source of disgust. A frightened animal with no place to run would never take its eyes off the threat, but a disgusted animal might turn its head away before its body. Disgust is also associated with vomiting and a natural response is to shorten and straighten the path from stomach to lips by pulling ones head back and down into the neck. [AFE 107] Moldy food is disgusting perhaps because we imagine the unpleasant taste we might have experienced if we had eaten the spoiled food. Wounds may be disgusting because we know that pain is associated. A worm in an apple can kill our appetite.

Enjoyment serves to relax us, to counteract the physiological frenzy induced by fear, anger or disgust. Enjoyment seems less directed—it is more a state of being than a reaction to a specific stimulus. It is characterized by relaxed body, but not an inert one. Enjoyment is characterized by sweeping movements, think of a dog's tail wagging or the bounding movements of a child at play. Ecstatic happiness might involve jumping up and down, sweeping gestures with large ranges. The actions are smooth and gradual, not sharp or sudden.

Seeking is a positive emotion, as I mentioned, useful for rewarding the kind of curiosity that is required for animals to learn and find food and shelter. Think of peek-a-boo with an infant, or a child opening a present. Alertness seems to be the key to this physical form. Picture a dog anticipating receiving a treat from its master; he is intent, but relaxed. In the case of delighted surprise, the cause is not a threat (similar to disgust), so the level of muscle tension is lower.

Sadness is characterized by low, inert body position. Relaxation to the point of slackness, low energy, little resistance to forces pushing against it. Arnheim discusses the analog between sadness and the appearance of the aptly named Weeping Willow tree saying it…

> …is not 'sad' because it looks like a sad person. Rather, because the shape, direction and flexibility of the branches convey passive hanging, a comparison with the structurally similar state of mind and body that we call sadness imposes itself secondarily [AVP 452].

Of course, like all the others in this short list of basic emotions, sadness is a general category and some of its forms are not so passive. Consider the flailing, convulsive, contorted, gnarled anguish of a mother throwing herself on the casket of her son after his sudden or violent death.

In this context, it may also be useful to note that these states are defined in relation to a 'normal' or resting state. Consider a dog, sitting or lying down, observing the world around her, or the way you feel when you sit in a comfortable chair to read a magazine. This resting state is generally considered mildly pleasurable, or at least not negative. The physical attributes of this state are relaxation without heightened awareness—not arousal, but not sleep or depression either.

With the possible exception of sadness, it is easy to see how all of the emotions and the associated body positions described above would be useful to the animal experiencing them, but the idea of expression assumes that there is another animal that can interpret the signals that arise from an emotional state. Expression requires an observer. The functional benefits (from which the form derives) can explain the survival value for the animal experiencing the emotions, but it does not explain the ability to

accurately read emotions in others. If there were no advantage to being able to read conspecifics' minds, it would be difficult to explain the ability.

However, it is only a small step to understanding how the ability to accurately read expression would be beneficial to animals living in groups and depending on each other for survival. For example, if a person can tell—just by looking, from a distance—when his boss (superior member of his social group) is angry, he can steer clear and avoid a confrontation. Similarly, pack members can avoid toxic substances illustrated by disgust of a fellow animal. Reading fear gives you a head start in getting away from a predator.

Since one of my goals is to formulate an understanding that accommodates all expressive character traits and their associated forms, to help explain these, I also looked to the necessary communication between animals which live in groups and depend on each other for survival. I am still working under the assumption of Darwin's principle of serviceable habits. Social animals also communicate via smell and sound, but I will concentrate on the visual signals. Presumably, however, other modes follow similar logic and also have species-specific universals [VI 176].

The situations where clear communication between members of a group of social animals would be useful can be broken down into the following general functional categories for analytical purposes, admitting significant overlap (to be discussed herein).

- *Safety/security:* this refers to protection from predators, unfriendly conspecifics, shelter (or at least some means of protection from environmental threats like heat/cold, sun, etc. as well as protection of offspring (see also reproduction, below).
- *Food acquisition:* for predators this means coordinating the actual hunt, but also the division of labor, as in, not all of the animals go on the hunt, some stay to protect the young/infirm/etc.

- *Social rank:* division of labor is largely determined by social rank, also who gets to mate with whom.
- *Family:* parent-child and family unit relations.
- *Reproduction:* behaviors relating to the choosing of mates, actual mating behaviors, and child-bearing behaviors.

Several of these categories such as safety and food acquisition have straightforward survival value: reading fear notifies other members of the social group of a threat, etc. But social hierarchies play a large role in inter-group communications and explain many of the behaviors of social animals which are difficult to explain based on survival or reproductive benefit.

Social rank is determined primarily by way of displays of *dominance* and *submission*. Looking to etymologies, we find that to dominate means to 'lord over' and to submit is to 'put below'. Accordingly, dominance is the pose of a victor (note that this is different than the pose of a fighter), while submission is that of the vanquished (again, the fight is over and the loser has conceded defeat). It is important to distinguish dominance and submission from such emotions as anger and fear, the emotions associated with fight and flight responses.

A dominant animal in a pack, an alpha walks tall and proud (superior position of a parent may be its origin). An alpha walks confidently among its peers without fear of attack, that is, there is no attitude displayed which is characteristic of defensiveness. However, if an alpha's position is challenged, the posturing and/or fighting that might result would likely involve a combination of dominance displays and angry, fighting behavior. Dominance is also expressed in ways not associated with fighting. For

example, in canines, mounting behavior by and upon either sex outside of reproductive coupling is generally thought to be a display of dominance rather than reproductive intent [DL 223].

Similarly, submission is characteristically different than fear. Lowering the head and tail, etc. may look very similar to the behaviors associated with fear, but a fearful animal is tense whereas a submissive animal can be relaxed. In addition, there are other forms of submission, like a dog rolling over on its back exposing its belly. This behavior is thought to be derived from the offspring's relationship with its mother and in this case may explain why submission can feel comforting. In the case of dogs, between whelping and weaning the pups never leave the den. The bitch cleans up after her pups with her tongue and has to roll them over to do so, and this is thought to be the origin of a dog's showing submission by rolling over and showing its belly. Dog "kisses" likely originate in a pup licking its mother's mouth to indicate its desire for her to feed it by regurgitation. Dog kisses are also used as a sign of submissiveness later in life as well as with regard to humans [DL 142]. Submission is not subjugation, again, it can be a pleasure. Parents may dominate, but they also provide food and safety.

Dominance and submission also play a role in other behaviors related to child-rearing. For example, instruction/correction. When a pup gets out of line, the mother growls, snaps (dominant behavior) or physically removes the pup. That feels bad (negative affect) so the pup shapes up [DL 161].

Animal courtship has been extensively studied, and of course, the drive to reproduce is a major motivator for healthy animals. Many of the behaviors relating to reproduction appear to be derived from the dominance and submission of the mother-offspring relationship. Submissive displays are also used as signs of affection and variations of dominant behavior are used by the males of many species to demonstrate their fitness for selection as a mate.

Of course, there are many activities that have characteristic forms but which fail to elicit an emotional response in conspecifics who witness them. Running, defecating and eating all have characteristic poses or motions which clearly communicate what the animal is doing, but these generally fail to elicit a visceral, emotional response in the viewer. It seems that there must have been no evolutionary (selective) pressure to abstract these forms so that the low road could activate bodily systems more quickly. As a result, our responses to these postures are more cerebral than visceral. An animal may notice what his fellow is doing, but he remains indifferent.

In discussing the general forms of bodies under the influence of the various emotions, I have described some of the spatial relationships that underlie these expressive forms, but a complete and detailed listing of the forms of all the numerous emotions and expressive forms seems impractical. Not only are the words we assign to emotions somewhat vague, their application and relative degree of intensity are highly subjective. So, my next step is to seek a description of form more generally which can describe all the variability of expression without the pitfalls of assigning specific and

highly emotionally-charged words. Furthermore, I do not wish to imply that the only messages form can communicate are emotional.

Purpose and Form, Abstracted

As is often discussed in the Pratt ID program, a form that exhibits a clear hierarchy of elements and/or spatial relations is preferable to one that does not. We are taught that an interesting composition includes a dominant element, followed by successively lesser elements; an object has a major (primary) axis and secondary and tertiary axes, and so on. The explanation given is that hierarchy makes compositions or objects more interesting, beautiful or satisfying, but that does not explain why this might be the case, nor how this visual task might be accomplished.

In chapter one, I alluded to the abstraction of ideas from sensory input that goes on below the level of consciousness. In the example of the charging bear, the idea extracted was that danger was imminent and the body, via the ANS, was activated accordingly. But that idea was just one in a long string of steps necessary to make sense of visual information. First the observer had to distinguish the bear from the setting, and that it was approaching. These tasks require numerous perceptual abilities and abstract concepts including edge detection, conception of time and depth perception. Of course, all of this processing is experienced simply as vision, not as a complex interaction of sensory input and abstract concepts already established in the mind. Cognitive

scientists and psychologists studying visual perception have long sought to understand the way our nervous systems convert retinal projections of the outside world into useful percepts. It is from their work that we can understand why a hierarchical organization of visual elements might be preferable to a less-ordered composition.

In perceiving expression, we carry out a process of abstraction, that is, we extract meaning from a particular configuration of visual elements. When we see a person with a big smile and a lively carriage, we conclude that the person is happy. But those are the last steps in the process of abstraction, before them came directing our attention to the person and observing the positions of the elements of the face and body with reference to an internal idea of what a person looks like in a archetypical state of being human. Yet, look at this example more closely; there is another level of abstraction in play. No two people look completely identical and certainly no two people express joy (or any emotion) in exactly the same manner, yet even people raised in grossly different cultures understand each other's emotional expression [EE 384]. The ability to interpret an unfamiliar face presupposes an extraction of common visual features which are then applied to a novel situation.

Yet, we take in only as much information as the sophistication of our abstractions will allow. Once we have enough visual data to conclude, for example, that the man on the street is happy, we cease to see the configuration of features by which we came to that conclusion. Arnheim discusses this failure to discern the significance of visual differences, once the relevant concept is reached, noting that…

> …adult human beings can cite countless examples to show that in an unfamiliar realm of experience the common properties of its constituents will predominate to such an extent as to make the differences invisible. The members of a strange race of human beings look all alike until one learns to tell them apart. A farmer, a shepherd, a zoo keeper perceives each animal as a distinct individual. To the outsider, sheep are sheep, and monkeys are monkeys. Soldiers in their uniforms or nuns in their garb may seem to show no individuality. The waiter, the salesgirl, the barber may be differentiated by the customer only to the level of their profession, but within that profession there is no observed *differentia*. The extent of differentiation will depend on how interested the particular person or cultural group is in refinement of the initial abstraction [VT 165].

Like Arnheim's farmer or zookeeper discriminating between his animals, people who can read the subtleties of expression in the faces and bodies of others are often lauded for being unusually 'perceptive.' They have refined their initial abstractions to a very high degree and those who are especially talented in this regard, we describe as being endowed with the ability to read people's minds. But even those with such an ability can rarely explain how they know what they know or what visual cues led them to their conclusions. All of that visual information is processed below the threshold of consciousness and only the end result—in this example, the other person's state of mind—is passed along for conscious consideration. A person might say he can 'see' that someone else is happy, that is, he is quite rightly claiming that he can 'see' a state of mind, an abstract idea, namely happiness. Of course, what is projected on his retinas is a pair of two-dimensional images of a face and body in a particular configuration and context. In order to make sense of that retinal projection, to perceive the meaning from form, the observer's nervous system must interpret what the eyes see. This process is based on rules, many of which may be hard-wired [VI 14], but some of which must be learned through experience, training and the refinement of abstractions. The designer seeking to make use of the expressive qualities of form aspires to read form with a level

of sophistication comparable to that of the mind-reader's ability to interpret faces and body language.

The refinement of abstraction can also be witnessed in the process of drawing. An artist drawing a figure does not operate like a mechanical printer, filling the page with dots of color in an orderly fashion from top to bottom. Instead, he first draws perhaps the general outlines of the major elements; the torso, the head, the arms and legs. Once satisfied with those, he proceeds to add detail until the work is completed (often making adjustments to the larger structural elements forms as he goes). A similar progression can be observed in the study of the development of children's drawings. In a child's earliest drawings, a representation of a person might be nothing more than a oblong shape, perhaps with circles for eyes and a horizontal line for a mouth near the top. With more experience, a child might draw a person as a blob with lines coming out the sides for arms and below for feet, or as a series of adjoining circular shapes representing the different parts of the body. Both the artist and the child are proceeding from abstract concept to image.*

In this manner, the way we perceive form can be understood as a hierarchy of abstractions. The visual manifestation of concepts begins with the perception of 'thing-ness', that is, an object in three-dimensional space or figure on ground is perhaps the most fundamental visual representation of an abstract concept, whether it be a table, a person or even something less tangible. At the next level, we perceive color, line, shape,

* For an in-depth discussion of abstraction and visual perception see Arnheim's *Visual Thinking*, especially chapters 9 and 10. For more extensive discussion of the development of children's drawings, see *Art and Visual Perception*, chapter 9, as well as the work of Rhoda Kellogg, e.g., *Children's Drawings, Children's Minds*. 1979 Avon Books, New York.

edges; then such characteristics as proportion and scale, which help us know how the object might be used. All the while, these characteristics are being compared against existing mental categories of objects. For example, if the perceived object is small enough to fit in one's hand, is long and thin and has a number of parallel tines at one end, it might register in the category 'fork'.

This process of refining abstractions is central to the way we discern what an object is, and in the case of functional objects, the purpose an item might serve and how a user might interact with it. These attributes which are communicated by form are of special interest to the designer and both are closely related to the hierarchy of abstraction. So let us consider each individually, beginning with the overall purpose and later returning the question of how a person knows how to interact with a functional object. Certainly the messages a user gets from the form of an object are dependent on much more than just its appearance; a number of non-visual skills, such as experience and knowledge of design conventions (for example, red means stop, green means go) are used for a given type or genre of product.

When I refer to an object's purpose, I am referring to the task it performs or the problem it helps to solve. Here too, a logical hierarchy comes into play. For example, the primary purpose of a car is to move people from one place to another. Of course, a car serves many additional purposes: a car is a container for people and cargo; it is a shelter from sun and rain, heat and cold; it provides protection in the event of an accident; it is a status indicator; and not least of all it provides a place to store your Big

Gulp. But these purposes are all secondary to locomotion. In the case of a car, it would be absurd to assert that its primary purpose is anything other than locomotion, but primary purpose is not always so clear. Consider the classic argument about the relative merits of dedicated tools designed for a single task and multi-purpose tools, designed for portability. The primary purpose of a chef's knife is clearly cutting, but is the primary purpose of a Swiss Army knife cutting, opening bottles or filing fingernails? In this case, compact storage and portability might outweigh the uses of the individual implements as the primary purpose.

In the fork example, the object's overall size allows it to be manipulated with the hands and this suggests its possible use. In his 1988 book *The Psychology of Everyday Things*, Donald Norman describes many such examples illustrating the process by which a person guesses about how an object might be operated. Norman's discussion includes several concepts which help a user understand how an object might be manipulated, but one of these, "perceived affordances,"* is particularly relevant to the question of how objects communicate with users. Norman uses the term 'perceived affordances' after James J. Gibson's coinage 'affordance.' For Gibson, the concept was that various environments allow particular operations [JND]. For example, water *affords* swimming and drinking, but not walking. In the realm of three-dimensional products, Norman cites exterior car door handles where the only possible way to activate them is to put your fingers into an indentation and pull outward on the handle. Or how visible

* Norman used the term 'affordance' alone in his 1988 book and subsequent editions (also know as *The Design of Everyday Things*), but has since clarified the terminology due to what he described as widespread misapplication of his concept: "POET was about 'perceived affordance.' When I get around to revising POET, I will make a global change, replacing all instances of the word 'affordance' with the phrase 'perceived affordance.' The designer cares more about what actions the user perceives to be possible than what is true." [JND]

screw threads indicate a possible twisting motion. Norman analyzes the relationship between the form and the purpose of these objects, but only in the context of how the design can limit the possible ways a part might be operated. One of the tasks of the designer is to communicate to the user how an object is to be used or manipulated. The central plot-line of the story the designer is trying to tell via form is how a product is to be used. Donald Norman writes:

> The most important design tool is that of coherence and understandability which comes through an explicit, perceivable conceptual model. Affordances specify the range of possible activities, but affordances are of little use if they are not visible to the users. Hence, the art of the designer is to ensure that the desired, relevant actions are readily perceivable [JND].

This does not necessarily mean that mechanical parts have to be visible or emphasized, in fact, in discussing his idea of conceptual models Norman describes how a user will imagine a mechanism: he invents a conceptual model to explain the device's operation based on its outward appearance. When this mental model fails to correlate with the actual mechanism or mode of operation, a user is unable to operate the device as intended. Arnheim describes this relationship between an object's function and its appearance this way:

> What happens in the perception of the functional object is not that internal forces manifest themselves outside but, on the contrary, that perceived external forces are projected upon the inside [POA 204].

Norman's analysis describes how making functional parts such as hinges visible helps the user understand how to operate a door, but he is not concerned with the specific visual cues that indicate how a hinge operates or what visual qualities let a user know that something is a knob, a switch or a button. This level of analysis is not especially

relevant to his argument, but for my purposes, it is critical.

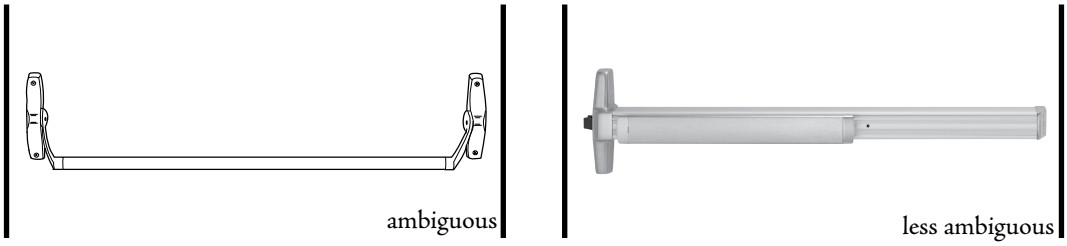
However, when I began trying to describe the visual characteristics at that level of detail, I quickly discovered that I lacked the vocabulary to describe the relevant visual cues. I had to expand the vocabulary of form that I had learned during my time at Pratt. For this purpose, I turned to the study of *visual dynamics*. Once again, Rudolph Arnheim proved to be an indispensable guide. Working from the base of knowledge about visual perception developed by the Gestalt psychologists, his study of visual arts and the traditional aesthetic education of artists and artisans, Arnheim lays out the principles of visual dynamics in his book *Art and Visual Perception*. The remainder of this thesis relies heavily on Arnheim's terminology and principles for close analysis of form. The basic principles of visual dynamics are familiar to anyone who has been through the 3D program at Pratt—all that stuff about axes and direction and movement. However, visual dynamics is discussed in greater detail in chapter six (including a brief summary of Arnheim's formulation).

Returning to the question of why a hierarchical order of visual elements might be preferable to other arrangements, we find that it is the job of the designer to explain the operation of a product via its appearance and that the significant operations, indicated by the visual dynamics of the object will be most clearly organized around the hierarchy of purpose. Accordingly, Arnheim offers the following explanation of the correlation between beauty and successful design:

> Even in the shaping of implements that are limited to strictly practical use, the 'functional' appearance of the object is a visual interpretation of its nature.… Given the nature of their products, industrial designers are bound to realize that it is their task to explain the nature

> of the object by its appearance, that is, to create a pattern of visual forces correspondent to the physical pattern that is characteristic for the functioning of the object.… Perceptual equivalents must be invented by the designer for all significant physical characteristics and relations; and beauty turns out to be an essential attribute of good industrial design because the order and clarity brought about by harmony of shape and good proportion are necessary to make the pattern readable. Beauty is a means of clarifying expression [POA 206].

The three-dimensional form of a product can reinforce or suggest its operation (e.g., the handle on top of a suitcase suggests lifting) or it can obfuscate, like Donald Norman's classic example of the symmetrical push-bar on a door that frustrates all who push on the wrong side, unable to discern which side of the door will swing open [POET 90].



In the latter case, the form of the push-bar fails to 'create a pattern of visual forces correspondent' with which way the door actually opens; the designer has failed in his responsibility to 'explain the nature of the object by its appearance'. Both the suitcase handle and the push-bar can be made with harmony of shape and good proportion by a designer, but in the absence of some relationship to purpose, the beauty he creates may be perceived as arbitrary or superficial.

It is certainly possible to create a beautiful, well-organized, hierarchical appearance for a product, but if the hierarchy of form does not match the hierarchy of purpose, the design is likely to be less comprehensible to users. By correlating the hierarchy of form with the hierarchy of purpose, the designer can help the user create a conceptual model that matches the actual operation of the device. That

is, the task of the designer is to help the user refine his abstraction about how a functional object operates.

Defining Expression

Before I get into the details of the relationship of form to expression in product design, I will try to clarify what I mean by expression. When I talk about expression, I am referring to a fairly narrow set of phenomena within the much larger realms of aesthetics and design, but there are many parallels with artistic modes beyond the boundaries of industrial design. By drawing upon investigations of expression in music, literature and typography, I hope to specify, as precisely as possible, what I have in mind when I use the somewhat nebulous word, expression.

The historical record of debate about aesthetics and perception goes back at least as far as Plato and Aristotle in the West and even further in the East [VT 8]. However, several analyses dating from the twentieth century have somewhat more direct bearing on the question at hand.

With regard to literature, T.S. Eliot coined the term 'objective correlative' to describe how a writer might evoke or reinforce the emotion a character was feeling by describing something concrete that evokes the emotion. Arnheim gives the following example: "The state of affairs in a human society may be similar to the tension in the skies just before the outbreak of a thunderstorm" [AVP 453]. Eliot described his concept

in a 1919 essay:

> The only way of expressing emotion in the form of art is by finding an 'objective correlative'; in other words, a set of objects, a situation, a chain of events which shall be the formula of that particular emotion; such that when the external facts, which must terminate in sensory experience, are given, the emotion is immediately evoked [HHP].

Because it depends on a reader's pre-existing knowledge of the expressive qualities of the referent in the analogy, Eliot's formulation is perhaps one degree removed from the direct perceptual analogy that occurs when the correlation is drawn between two different modes of perception. This latter method of expressing emotion in writing is the use of 'musicality'. Rhythm, rhyme, word choice, pacing, etc. are indispensable tools of the poet for conveying the tone or atmosphere of the piece; 'coloring' the words' semantic content. In this mode of expression, the analogy is not dependent on the reader's knowledge of an outside referent, but only on his immediate perception of the expressive qualities of the sounds of the words. For example, the manic prose of Dave Eggers' 2000 novel/memoir *A Heartbreaking Work of Staggering Genius* adds a tone of exuberance. The strong use of rhythm, repetition and measured pacing give Carl Sandburg's *Rootabaga Stories* a calm, sleepy, dreamlike atmosphere—a desirable quality in children's bedtime stories.

This latter, more direct mode of expression is the manner most relevant to the current inquiry, though I do not mean to imply that the other modes are any less important to the designer. Whereas the poet uses the sounds of words to set the mood of a piece, the industrial designer uses form to add the appropriate expressive qualities to a functional or decorative object. Here, onomatopoeia is another good example of

the directness of the translation that occurs between sensory modes; in this case, the correlation is between a sound in the world and a sound that the typical human vocal tract can produce. For example, the sound a rooster makes is transliterated as cock-a-doodle-doo in English and ki-kiri-ki in German; the sound of a stone dropping into water is 'sploosh' in English and 'plouf' in French. The point is that we are all constantly using and making this kind of analogy between sensory modes without even realizing it; cock-a-doodle-doo is simply the sound a rooster makes, we do not think of it as the work of a skilled poet.

Music is another medium in which the affective qualities of sounds can add 'color' to a message. Film, animation, opera and theater have long used music to enhance the emotional effect of visual and verbal content. The correlation between music and emotion has been studied extensively since the late nineteenth century. Alf Gabrielsson and Erik Lindström reviewed dozens of such empirical studies. Their summary shows a number of consistent findings, but also a number of persistent problems with such an endeavour. The same applies to the current, systematic investigation of expression and visual form.

First, musical terminology varies from study to study, making precise comparison difficult:

> Usually, tempo refers to the perceived pulse rate. However, sometimes the pulse rate can be felt at, say, half or double pace. Perceived speed may also be affected by note density (e.g., the number of notes per second) as well as density of melodic or harmonic changes [MAE 239].

With regard to three-dimensional design, terms such as proportion, concavity, line plane and volume are nearly universally understood, but beyond these fundamentals,

the relevant terminology is less widely agreed upon. As a result, the language used for analyzing the form of designed objects can be difficult to define precisely. What one person refers to as 'energy' in a composition might alternatively be referred to as 'dynamics', 'tension' or 'degree of activity' by another—and that is to say nothing of the manner in which the effect described is created. Paul Ekman had the same difficulty when he tried to map facial expressions to emotion words, finding that words for both the physical expression and the emotions conveyed are imprecise:

> Is the frown in the forehead or the mouth? A number of words which refer to expression are vague in this way. This is one of the reasons we had to develop a new 'language'—The Facial Action Coding System—to describe facial movements precisely [EE 366].

In addition to the problem presented by the vagueness of words as they relate to facial movements and emotional expressions, many of the same muscle movements in the face are used by more than emotion. For example, lowering the eyebrows can indicate anger, concentration or squinting to keep the sun out.

Similar problems are encountered when describing the expressive qualities of form. The imprecision derives from a number of sources. For example, a descriptor like 'masculine' is tied up in cultural constructs about what it means to be manly; some would say the primary determinant of masculinity in a human is physical strength or muscularity while others might refer to social dominance or aggression. Perhaps a less obvious case of such confusion comes from the subtle nuance or connotation associated with words which describe similar emotions. 'Disappointed' and 'crestfallen' have very similar meanings, but to sensitive readers, the latter may add a hint of defeated resignation affecting a person's entire countenance and carriage, whereas

disappointment might be momentary and less severe, as when a basketball player misses a free-throw. Of course, my purpose is not to create a comprehensive list of formal characteristics which correlate with such fine semantic distinctions, but like the studies of music and emotion, perhaps I can describe the general character of a larger category of expressive qualities. In addition to the general character, it is also possible to describe the relative degree of a particular characteristic; in this example we might say both crestfallen and disappointed fall in the category of sad emotions, but that crestfallen is more severe than disappointed.

Second, Gabrielsson and Lindström note that

> …listeners' perception of emotional expression—for instance, to perceive a piece of music as 'happy'—should be distinguished from listeners' own emotional reactions—for instance, to feel happy [224].

Such a distinction must also be made with regard to form. My investigation is limited to what meaning or emotion the form of an object conveys, rather than what a viewer feels as a result of seeing the object, because the resulting emotion is based on so much more than just the object's form. While a puppy or a Hello Kitty toy may be described as cute, the emotion it evokes in the viewer is most often affection, but that is not always the case. The emotion a particular viewer feels may be based on prior experience unrelated to an object's form. For example, due to a prior traumatic incident involving a puppy, a viewer might not feel affection upon seeing one, but he is unlikely to attribute his reaction to the puppy's form. That is, he might concede that a puppy is generally considered cute, but for him, the idea of a puppy might evoke fear rather than affection.

It is important to distinguish between expressions and reactions. There are

many descriptors that seem as if they describe form, but what they really describe is the observer's reaction. For example, when something is described as impressive, it can be impressively big, impressively small, impressively detailed, or even impressively ugly. There is no description of form; what is really being described is a person's reaction to it. Yet, sometimes expressive qualities and reactions can overlap in a single word. Cozy implies a some kind of wrapping around, but it also implies a enjoyable reaction; whereas claustrophobic implies wrapping around, but it is distinctly unpleasant. This is a pretty delicate distinction, but it is important because the visual language of expression I am describing is universal, but reactions are specific to the context and the individual.

Third, the reviewers point out that for the purposes of empirical study, it is useful to isolate the component characteristics of music, but in some cases it is impossible to do so. Melody cannot exist independent of tempo. The authors describe the phenomenon with regard to music and emotion:

> Perceived emotional expression in music is rarely or never exclusively determined by a single factor but is always a function of many factors … The influence of a certain factor may depend on how it is combined with other factors, that is, on the interaction between factors [242].

Similarly, components of visual form cannot always be separated, for example, color cannot exist without shape.

A final point relating to form, whether musical or visual: the expressive qualities are generic and abstract, that is, they cannot convey specific meaning, only mood or 'color.' With regard to facial expression, Paul Ekman puts it this way, "emotional

expressions never tell you their source—there are many reasons why, for example, someone might be sad" [ER 107]. A film score cannot indicate the specific cause of the protagonist's emotion (for example, the death of her mother), it can only convey her sadness in a general way and also the relative severity of the emotion. Arnheim puts it this way:

> The cognitive virtue of music derives precisely from the high level of abstractness at which it depicts patterns of forces. These patterns in themselves do not point to any particular 'application' but can be made to interpret such instances. ... In an opera or as accompaniment to a theater play or film, music serves to give shape to the generic inherent in the particular. In the words of Shopenhauer, 'music demonstrates here its power and higher aptitude by offering deepest, ultimate, and most secret revelations about the feelings expressed in the words or action which the opera represents, and discloses their proper and true essence. Music acquaints us with the intimate soul of the happenings and events of which the stage gives us no more than the husk and body' [VT 144].

With regard to the form of a product, this means that expressive qualities cannot explain, for example, to which trade an unfamiliar tool belongs, they can only convey the characteristic manner in which the object accomplishes its task. For example, a paper clip might hold a thick stack of papers together *tentatively*, whereas a binder clip accomplishes the same task *securely*. The task of holding papers together is generic, but the manner in which it is accomplished is the realm of expression.

* * *

Up to this point, I have emphasized the universality of the language of form, but for many readers, use of the word 'expression' and its conjugates may bring to mind a more individualistic intent. Within an individual designer's body of work a visual kinship, a continuity of form will inevitably emerge—even among unrelated projects designed many years apart, and for different clients. But the designer's task is to give

an object a voice of its own, not to use a mass-produced product to leave his mark on the world. Expression, as I use the word, is not the same as self-expression. Eva Zeisel writes that the common language of form

> …is not meant for monologues, nor for self-expression, but to speak to others. It is not intended to proclaim eternal values, to make designs innovative, or to champion the cause of artistic individualism. Nor does it proclaim any new, or follow any old, moral precepts or principles of good design [OD 13].

While Zeisel discusses what expression through visual form is not, Rudolph Arnheim offers more detail as to the distinction between expression and self-expression:

> The method of self-expression plays down, or even annihilates, the theme to be represented. It recommends a passive, 'projective' pouring-out of what is felt inside. On the contrary, the method discussed here requires active, disciplined concentration of all organizing powers upon the expression found in one's vision of the world [AVP 456].

So important is this point that poet and typographer Robert Bringhurst begins his classic book *The Elements of Typographic Style* by stating that "typography exists to honor content." He continues:

> Typography must often draw attention to itself before it will be read. Yet in order to be read, it must relinquish the attention it has drawn. Typography with anything to say therefore aspires to a kind of statuesque transparency [ETS 17].

Typography is certainly a genre of design which is highly attuned to the expressive qualities of form. Like the sounds of the words adding color to the poet's meaning, the shapes of the letters and their arrangement on the page inevitably confer an expressive quality. Bringhurst's formulation, with only slight modifications, might just as easily be applied to industrial design; industrial design exists to honor utility:

> A functional object must often draw attention to itself before it will be used. Yet in order to be used, it must relinquish the attention it has drawn. Industrial design with anything to say therefore aspires to a kind of statuesque transparency.

For this reason, when the dominant visual theme is one of self-expression, rather than the object's purpose, the form may seem arbitrary or self-important.

When I refer to expression, I am referring to a phenomenon which includes the following factors: First, like the evolved preferences for food, mates and environments, expression is defined by spatial relationships, not by context-specific details. Second, expressions must be distinguished from reactions, because reactions are context-specific, whereas expressions are universal. Finally, expression must be distinguished from self-expression. The former being a universal language, whereas self-expression is unique to the individual.

Decoding Expression

Emotional expression via movements of the face and body is a special case of expression more generally, but because of its familiarity, I find it helpful for explaining the larger phenomenon. In the case of emotional expression, the inner feeling and associated physiological changes which take place are manifested in the appearance of the individual experiencing the emotion. Expression, in the sense that I am using the term, requires an observer capable of accurately interpreting the visual cues. It is in this process—a process which normally takes place below the threshold of consciousness—that the mystery of expression lies. Just as there appear to be innate fear triggers and fear triggers that we are predisposed to learn, based on evidence from studies of facial expression and emotion there also appears to be an innate ability to interpret meaning based on visual cues.

In the process of emotional expression, there are three phases. First, an individual feels an emotion (subjective experience). Second, the emotion is displayed on face and/or body (the intangible, subjective experience is translated into concrete form via the principle of serviceable habits). Third, an observer sees and interprets meaning based on form (intangible, abstract idea). In the case of products, we presume that inanimate

objects are not capable of feeling things, so the first step is removed, leaving only form and interpretation. However, in just the same way that we perceive expression in a block of stone carved to look like a human, we also interpret meaning from any and every object we see. As I have discussed in the preceding chapters, the translation between form and expression is based on innate rules of visual perception, that is, we all interpret form in roughly the same way and expression is in everything we see, not just in people, animals or artistic representations of the same. As Arnheim puts it:

> Expression is an objective property of all organized patterns of shape and color. It is an inherent aspect of every perceptual quality whatever, of size, space, movement, illumination, etc. It is found in the percept of every object or activity, human or nonhuman, animate or inanimate, useless or useful, man-made or natural, in fine art or applied art. Expression can be weakened and disturbed by inarticulate, disorganized patterns, but it can never be absent. As an aspect of perception, expression is cerebral rather than retinal, that is, it arises in the brain rather than the eye, but it is lawfully dependent on the stimuli recorded by the eyes. Every change of shape, for example, makes for a corresponding change of expression [POA 202].

This lawful relationship between patterns of sensory stimuli (form) and expression implies a kind of subconscious mental code. Decrypting such a mental code would allow us to know, for example, precisely what elements or combinations of visual stimuli might activate a fear response. It would allow us to understand the nature of the abstraction used by the subconscious processes in the brain. However, as Joseph LeDoux told me, in neuroscience, the code of visual abstraction has not yet been broken.

In the absence of such an empirical explanation, I found that the principles of dynamics (visual or otherwise) can serve as the Rosetta stone for translating between form and expression. Of course, an object's dynamics are somewhat subjective and open to interpretation, but at least the principle provides a general structure in which to

understand the phenomenon of expression (and if these principles could be formulated in a sufficiently specific way, they could ultimately be subjected to empirical study). Like developing an 'eye' for design, skill at interpreting visual dynamics is developed through experience. Because the natural process of perceiving expression in existing objects happens subconsciously and nearly instantaneously, we cannot slow it down to consciously observe what is happening. For this reason, analyses of visual dynamics are necessarily descriptive and reductionist. Gestalt psychology more generally has suffered the same criticism, namely that it is merely descriptive, never generative. However, there is no formula for good design, it is necessarily an intuitive, iterative process: develop a form, evaluate it, make changes and evaluate again, *ad infinitum*. It is in these evaluative phases that analysis of visual dynamics can be useful to the designer. And over time, the results of conscious analysis get incorporated into intuition.

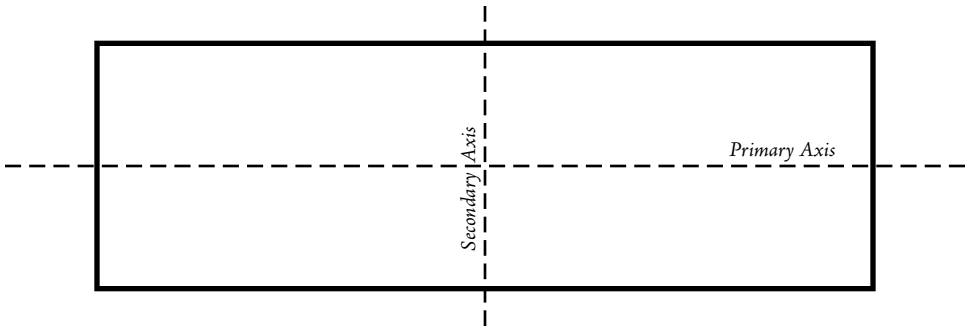
For readers unfamiliar with the principles of visual dynamics, the following is a brief and far from comprehensive summary of Rudolph Arnheim's formulation of the principles of dynamics as described in *Art and Visual Perception*.

The industrial design curriculum at Pratt is closely related to the courses developed at the Bauhaus prior to its dissolution in 1933. During his time as a lecturer there, Wassily Kandinsky wrote extensively on form in the arts, both fine and applied. In his 1926 book *Punkt und Linie zu Fläche* (*Point and Line to Plane*), he indicated his dissatisfaction with the predominant terminology 'movement' used by both the Gestalt psychologists and art theorists at the time to describe the way an image seemed to

direct the viewer's eye within an image or object. Noting that what is perceived is not movement, but the potential for movement he wrote, "tension is the force living within the element and represents only one component of creative movement. The second is the direction" [PLP 57]. Arnheim continues:

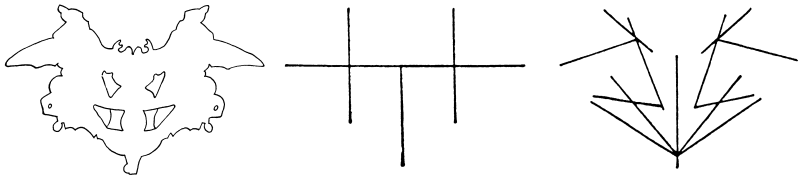
> Directed tension, then, is what we are talking about when we discuss visual dynamics. It is a property inherent in shapes, colors and locomotion, not something added to the percept by the imagination of an observer who relies on his memories, the conditions creating dynamics have to be sought in the visual object itself. … Directed tension is as genuine a property of visual objects as size, shape and color. The nervous system of the observer generates it at the same time that it produces the experience of size, shape and color from the stimulus input. There is nothing arbitrary or willful in these dynamic components of percepts, although they can be ambiguous. They are strictly determined by the nature of the visual pattern, even in the range of their ambiguities. [AVP 416–423].

Directed tensions determine what Arnheim refers to as the 'structural skeleton' of a visual element. The equivalent terminology used at Pratt refers to axes or vectors. The primary axis of a rectangle runs along its center in the direction of its longer dimension and its secondary axis lies perpendicular to the primary axis. Thus the structural skeleton of the rectangle is a pair of perpendicular lines.

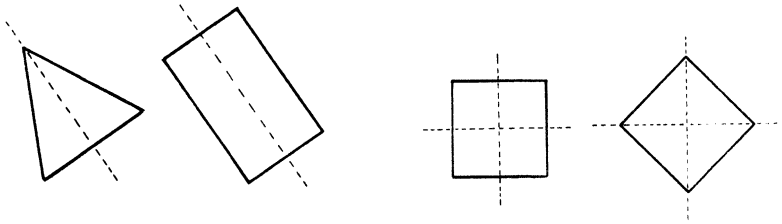


For example, repeating this process by placing a line along the primary axis of each major element of a human figure, we arrive at a simple stick figure which illustrates the structural skeleton of a human body. What constitutes a 'major' element depends, like

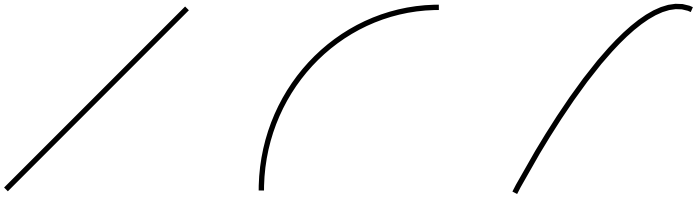
all abstraction, on the purposes at hand. In a stick figure of a whole body, a hand might be reduced to a single line or left out entirely, but in the structural skeleton of a hand, every finger (and perhaps between every knuckle) gets its own line. Taking the scale in the opposite direction, a crowd of people might be indicated by a series of vertical lines. The skeleton can be filled out by determining axes for smaller elements. Secondary axes (and therefore directed tensions) can also be found perpendicular to the primary axis and are also important to the structure. Below is an analysis of the structural skeleton of a Rorschach inkblot at two different scales of complexity [POA 96].



Moving into the third dimension, we find that 'perpendicular' can have more than one meaning, but excepting objects with radial symmetry, the secondary axis is usually easily determined. In cases where a primary axis is not clearly determined by an element's overall proportions, axes may also be determined by shape and position [AVP 99]. In the illustrations below, the shapes at left maintain their axes when rotated, however, in the figures at right which have square proportions, when the square is turned 45 degrees, the square becomes a diamond and the axes shift accordingly.



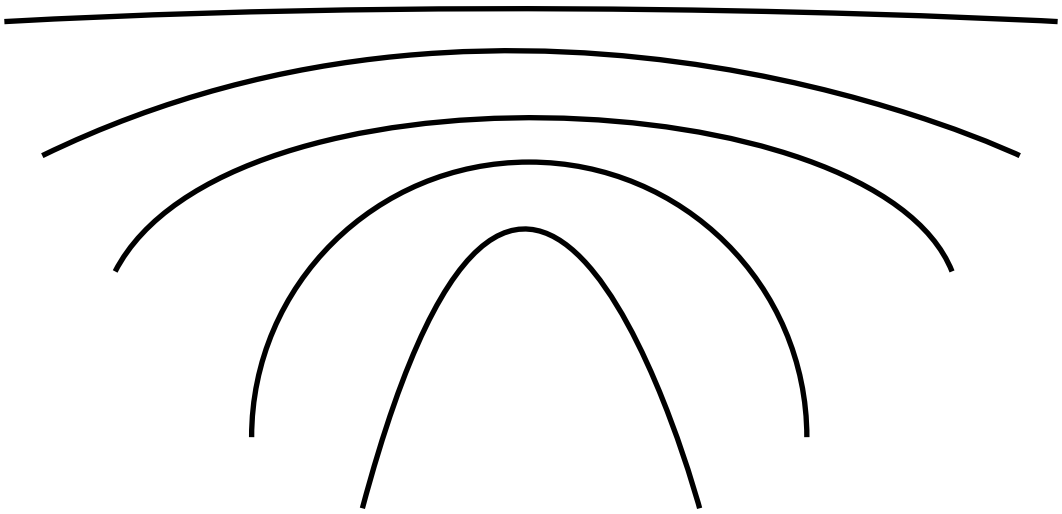
The most basic level of dynamics involves line. In the Pratt ID program this property is often discussed as the 'speed' of the line. This notion presumes that the direction of travel is along the line, as opposed to perpendicular to it. Arnheim cites several studies demonstrating the veracity of this principle and elucidating its subtleties. Accordingly, our eyes move along both a straight line and an arc (section of a circle) at a fixed speed, though not at the same speed. Straight lines are the fastest and arcs are the slowest. Many types of curves (e.g., a parabola) have a curvature that is constantly changing, and as a result, the speed of the curve is also changing, resulting in, for example, a sense of slowing down as the speed of near-straightness gradually gives way to a tighter and tighter bend.



Speed of line should not be confused with the overall dynamic effect of the line, element or shape of which it is a part. The dynamics of opposite halves of a symmetrical line tend to cancel each other out. As a result, the primary visual dynamic of a symmetrical curve tends to be perpendicular to its primary axis. As the accent of the curve is moved off center, the direction of the dominant dynamic properties also change.

Note that the lines below seem to 'push' upward. Logically, one could argue that the same phenomenon could be described as the line being 'pulled' upward, but

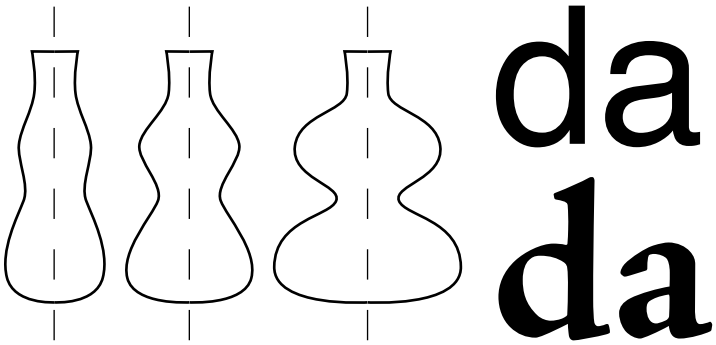
perceptually, the push is stronger.



The line is the figure element, it appears to us as the actor whereas the background is perceived as passive. Empty space does not exhibit much in the way of directed tensions (but it is not totally inert), and in spite of its vast area it does not have the power (or perhaps the will) to pull the line in a particular direction. The same is true in three dimensions, that is, the figure element will always be seen as acting against the ground surrounding it. A convex surface will always be seen as a bulge, not vacuum pulling on it. Similarly, a concavity will always be seen as a container of space, not as the result of space pressing in on it.

Of course, in three dimensions, curves most often delimit shape, rather than being elements unto themselves, floating in isolation. As such, they also exhibit another dynamic property, range. Range might be described as the amount the edge of a shape varies from its axis. In typography, this property is known as 'contrast' and refers to the variation in stroke width. For example, the common typeface Helvetica has a very

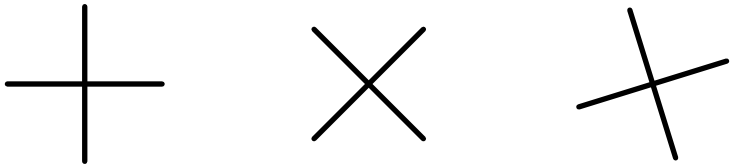
small degree of contrast, whereas the stroke width of Jenson, the typeface in which this document is set, varies from hairline-thin to fat-marker-thick.



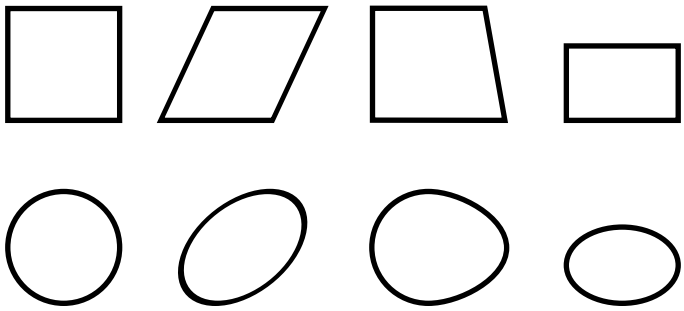
Arnheim describes four basic ways to set up directed tensions: obliqueness, deformation, dynamic composition and the stroboscopic effect. Again, these are separated here for purposes of analyses, but in practice, all these elements can work in concert to increase the overall dynamic effect, or in opposition, moderating the effect.

Oblique orientation creates tension in opposition to the stability of the vertical and horizontal. Arnheim offers the following example:

> The windmills in Dutch landscapes stand still if their arms are painted in vertical-horizontal position. The arms show a little more dynamics when they are a pair of symmetrically oriented diagonals. The effect is strongest in an asymmetrical, unbalanced position, although all three kinds of orientation are known to be phases of possible actual motion or rest [AVP 425].



Obliqueness can also play a role in the second method of obtaining dynamics, deformation. The Gestalt principle of *simplification* explains why we perceive a parallelogram (two edges horizontal, two edges oblique) as a skewed rectangle rather than a shape in its own right. The striving back to the simpler shape creates the tension.

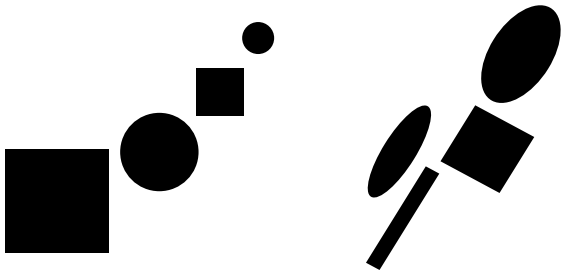


Deformation can take many forms, protruding, stretching, compressing, twisting, bending, but all operate on the same principle. In a composition, deformation may also occur in the space between elements, rather than in the elements themselves:

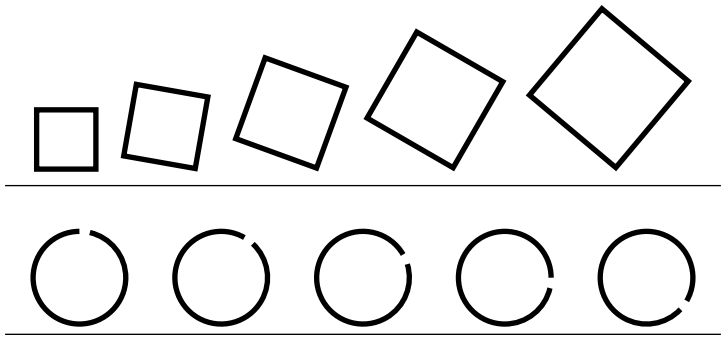
> Given a set of windows of a particular dimension and shape, the wall spaces between them will look too large and therefore oppressive, too small and therefore squeezed, or just right [AVP 429].

Finally, distortion may create tension by leaving shapes incomplete. The eye wants to complete the shape implied, and will try to move the shape out from behind whatever is obstructing or bisecting it, thus creating tension in the direction which would most easily move the obstructed shape out from behind the obstruction.

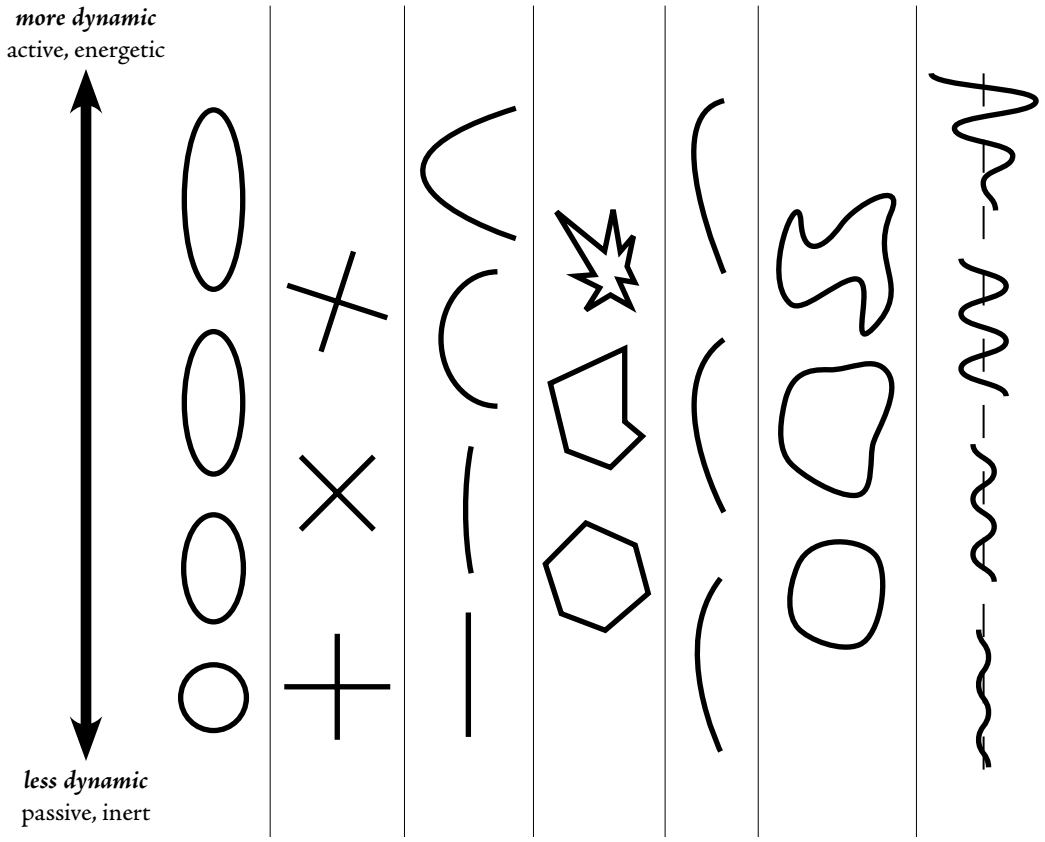
Similarly, when looking at the entire composition, an observer may perceive a number of related compositional elements as a single dynamic shape. Or, like the halves of the symmetrical curves discussed above, dynamics of the elements may cancel each other out, causing the overall dynamic character of the composition to be determined by other factors.



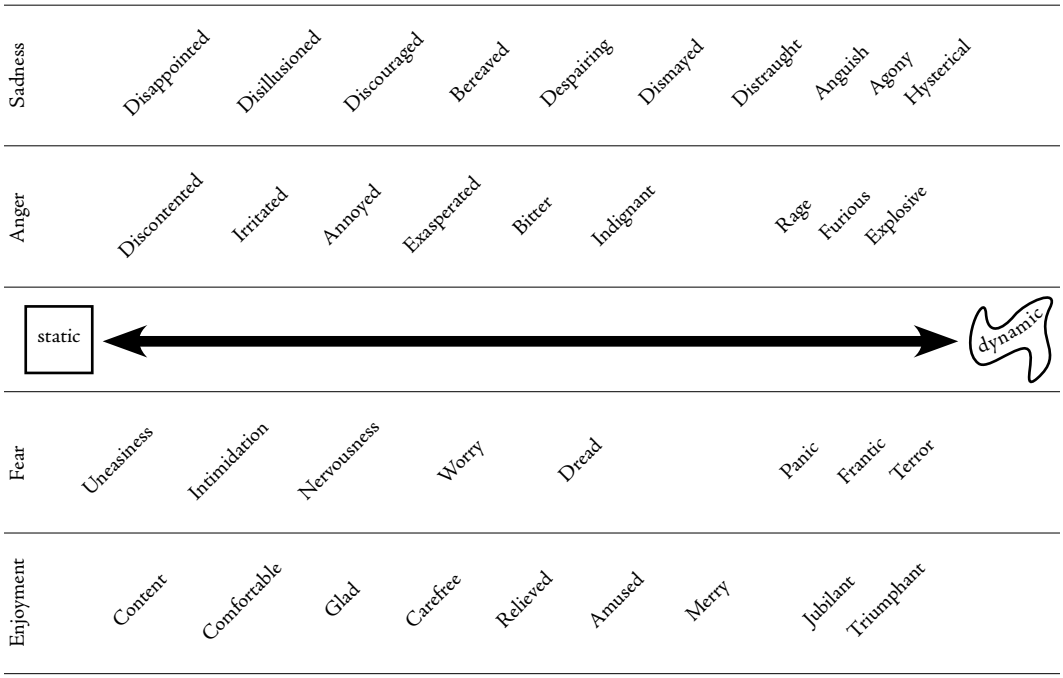
The final method involves repeating a shape with a progression of changes. The elements are seen as an action sequence, with each shape in tension between what it was and what it will become. Even if the individual elements are static, their sequential relationship with each other is the source of directed tension. Arnheim calls this the stroboscopic effect.



Another relevant characteristic is the overall level of dynamism exhibited by an object. There is a spectrum from totally static to highly dynamic. With regard to expressive qualities, forms that are more dynamic tend to seem livelier or more energetic, and less dynamic shapes tend to be more mellow or even passive.



In a similar way, many other attributes can be also be arranged according to how active, energetic or dynamic they are. For example, in the realm of emotion, strongly felt emotions can be thought of as being more dynamic.



An object's purposes can also be organized according to how active they are. For example, a teapot pours, lifts and contains tea. Of those, pouring is more dynamic than lifting which in turn is more dynamic than containing. The purposes differ in dynamism in relation to each other within a particular object, but there are also different levels of dynamism among all conceivable purposes. For example, the purpose of a knife is to cut, so, up to the point of breaking the blade, adding more energy (making it more dynamic) will continue to serve the purpose. On the other hand, adding more energy to the action of pouring will not serve the purpose, it will just make a mess. Thus, the purpose 'cutting' can accommodate a greater degree of dynamism than pouring.

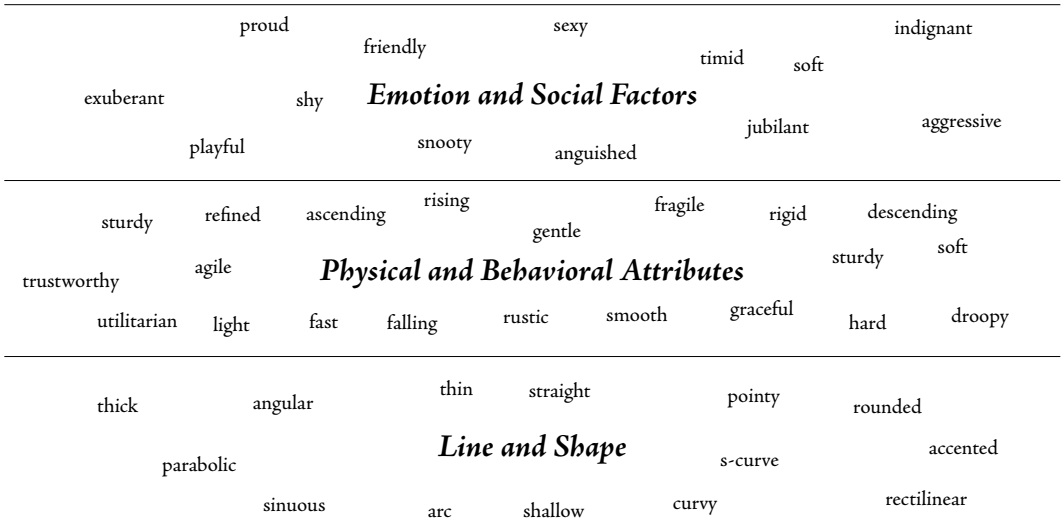
In this way, considering how dynamic the desired expressive quality and purpose (or any of the numerous other factors that can be evaluated according to how dynamic

they are) provides part of the solution for breaking the code of expression. But because any number of different visual traits (lines, shapes, compositions, etc.) can add up to a given level of dynamism, knowing the characteristic level of dynamism is not enough to usefully analyze, much less generate expressive form. The next part of the equation is the visual profile of an expressive trait.

As I discussed in previous chapters, our ability to perceive expression from form likely evolved because it conferred benefits for survival and/or reproduction. Returning to the archetypes of expression—facial expression and body language—the emotions each evolved as a separate mental system to address a particular need, each has a unique physiological profile that lends a unique outward bodily appearance. Another member of the species sees that outward bodily appearance and interprets meaning from it. From the perspective of the observer, each emotion has a unique visual signature that is recognizable independent of context and the quirks of a particular individual. What is perceived is more than just a varying degree of excitement (more or less dynamic). Instead, the observer sees a specific set of visual or spatial relationships that make up the unique dynamic fingerprint for the given emotional expression. The same is true of expression more generally.

While emotional expression may be the most complex set of relationships that constitute an expressive pattern, expression is not limited to the emotions. In its broadest sense, and for the purposes of this discussion, expression can be defined as the process of perceiving meaning from a pattern of visual cues. Expression operates

on a number of different levels of complexity. As I began to understand the nature of expression, I sorted all the different kinds of expressive qualities into three categories, based on the origin of each trait: line and shape, physical and behavioral attributes and emotion. Each level consists of combinations of elements of the lower levels.

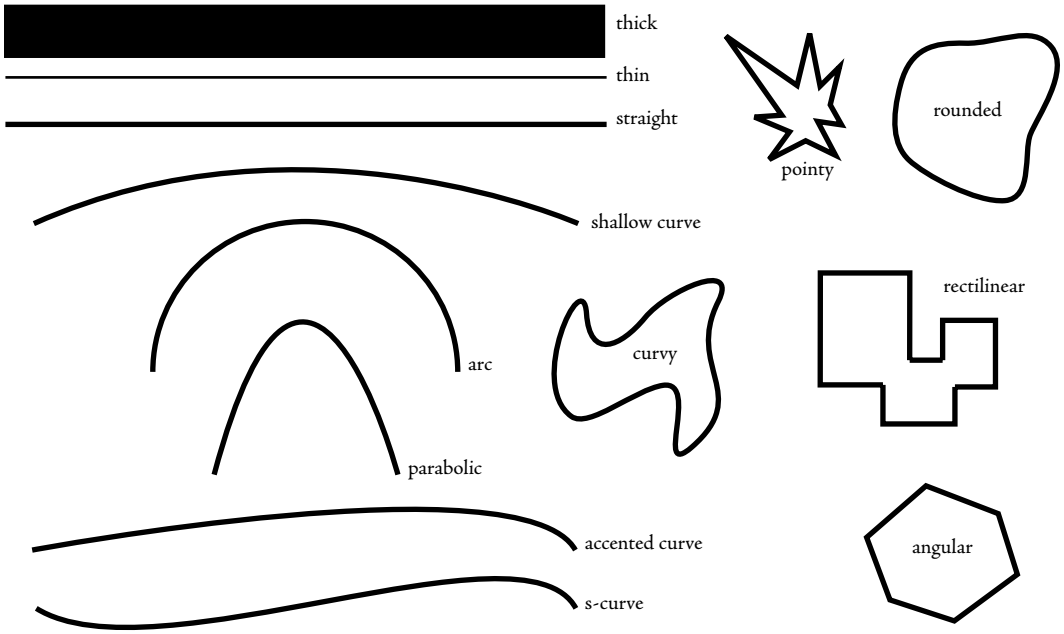


Line and Shape – On the first level are the most directly perceived character traits. The distance between abstract conception of, for example, a straight line and a particular visual representation (a line drawn with a ruler) is very small. The visual qualities of a ruler-drawn pencil mark expresses straightness, that is, the meaning conveyed by this particular form is the idea of straightness. Similarly, parabolas, arcs and all the other routes between points are abstractions which are manifested to the senses in line. This is the first level of meaning conveyed by form.

In three dimensions, lines take the form of axes, edges or contours describing surfaces. Contours which describe surfaces inherit their primary character traits from line. For example, a straight line translates into a planar surface; a circle revolved in

space creates a sphere.

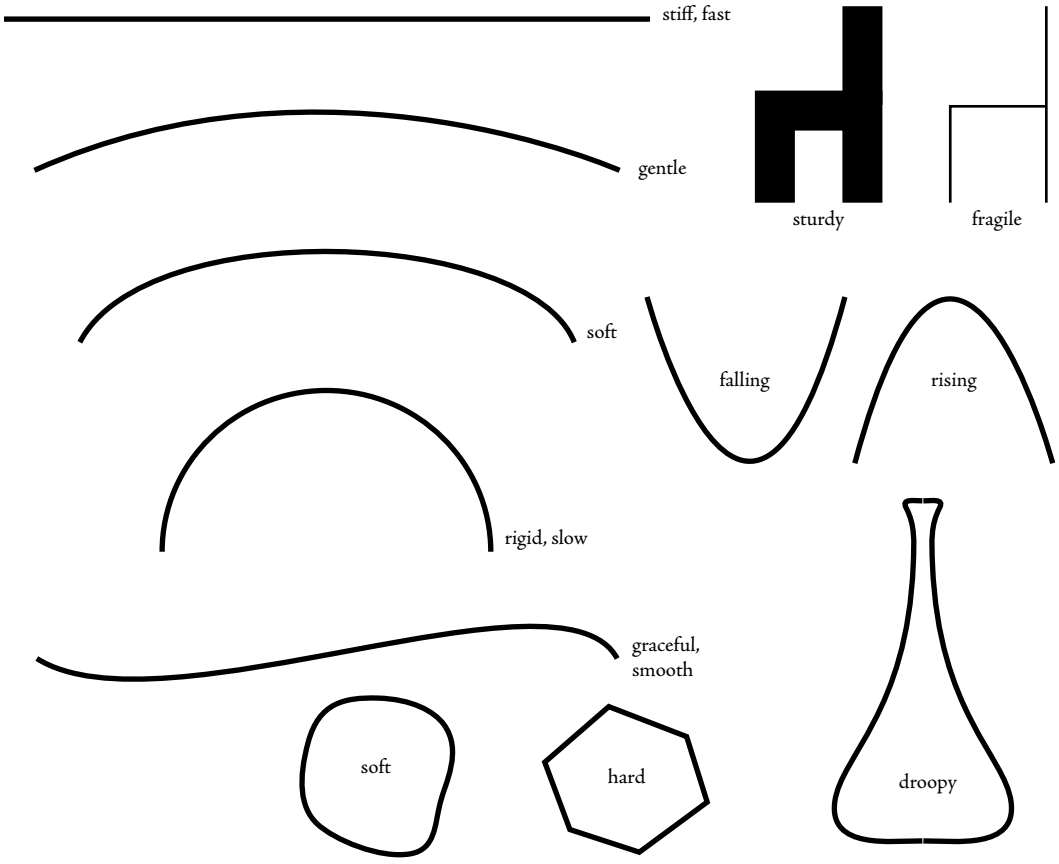
Shape is space or surface defined by edges and contours. For purposes of analyzing expressive qualities, shape can be divided into subcategories which will be familiar to any student of the visual arts: characteristic shape (e.g., angular, rounded), proportion (thin, compact), orientation (slanted, upright), visual weight or center of gravity (top-heavy, grounded), order (symmetrical, parallel), scale or relative size (titanic, miniscule), etc. When we talk about something being skinny or sinuous, we are referring directly to the shapes and lines.



Line and Shape

Physical and Behavioral Attributes – The qualities in this group generally tell the observer what to expect from an object. For example, the material or structural properties of an object, the way it might move or behave, or how active or energetic it is. Based on its appearance alone, an observer might expect an object with the sharp

edges to be made of a hard material and a droopy one to be made of a stretchy material even though touch might prove otherwise (e.g., it is possible to carve a pillow out of marble which may look soft, but to the touch, it will remain cold and unyielding). This group also includes 'perceived affordances' discussed in chapter four. These descriptors are often combinations of two or more of the line and shape factors. For example, sturdiness might involve weight, proportion and orientation; flexibility might be characterized by catenary curves and visual weight bearing a strong relationship to the vertical orientation; hardness involves straight lines or sharp edges; and so on.



Physical and Behavioral Attributes

Emotion and Social Factors – The third category consists of the most complex character traits, being comprised of combinations of the visual characteristics from the first two levels. In this group we find character traits associated with emotion (anger, enjoyment) and forms related to communication between social animals (affection, pride).

The traits at the level of line and shape may qualify as instances of expression based on the definition I gave earlier, but they hardly qualify as descriptors of personality in an object. At the level of material and behavioral attributes, we see the beginnings of personality, but taken at face value, these descriptors remain pretty bloodless. However, when these qualities are understood figuratively, signs of life begin to emerge. For example: the Kashiwado Chair (pictured on page 78) operates mostly at this second level. It is heavy, solid, stable, hard and it is easy to see why it is named after a famous sumo wrestler, that is, we can see that the chair and the wrestler share some visual traits. But personality-wise those same traits (by analogy) might add up to tough, trustworthy, reliable or unwavering.

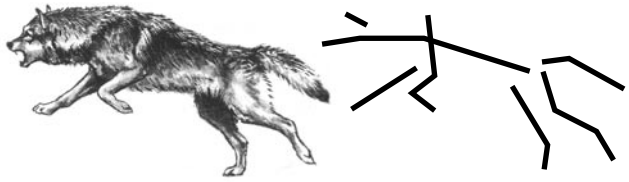
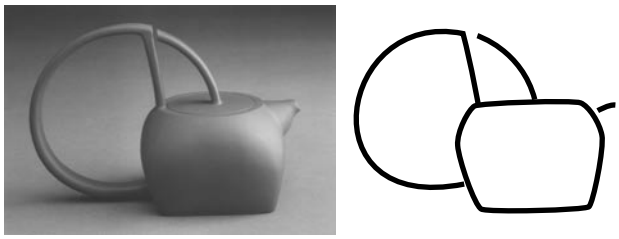
This type of analogy-making is one of several ways in which the form of an object can express personality, however, like T.S. Eliot's 'objective correlative,' the route is somewhat indirect. Traits such as solid and heavy are the immediate perceptions, and only by adding up these qualities does the personality emerge.

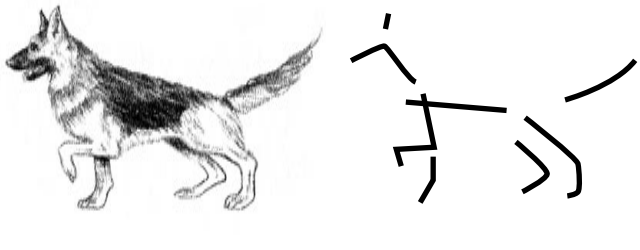
Kashiwado Chair
Designed by Isamu Kenmochi, 1961

A related means of expressing personality is the use of anthropomorphism or zoomorphism. Here again, there is an analogy with an outside referent, namely a human or animal which is expressive of the intended quality. As such, the expression is not perceived directly.

Expressive traits at the level of emotion and social factors are perceived more directly. In chapter three, I discussed how the distinct emotions may have evolved to allow quick action, and it is for this reason that I believe that emotional expressions, even in static, manufactured objects are perceived directly, without the use of the type of analogy required when discerning personality from the second group of expressive traits. This implies that the mental code includes visual abstractions for each of the basic emotional categories. As discussed, there is no consensus on what constitutes a basic category of emotion, but the list I chose to investigate in greater depth includes anger, fear, enjoyment, disgust, contempt, seeking and sadness.

Using a number of different methods (a few of which are described further in the following chapter), I tried to isolate the visual cues associated with each of these basic emotional categories. These are obviously very general descriptions necessitated by the broadness of the emotional categories.

emotion	***traits***	
anger	tense, straight, rigid, stable, sharp points	
fear	tense, rigid, low, compact, curved	
enjoyment	ambiguous or curvy axis, lightness, relaxation, smooth, gradual or sweeping curves of large range, rising	
sadness	low, horizontal, curves of small range, slackness, falling	

emotion	***traits***	
seeking	upright, rigid, intent, alert	

You may notice the absence of disgust and contempt in this list. Disgust is missing because I was unable to isolate any pattern of visual cues that expressed disgust. I searched for existing objects and attempted to create objects and images of that expressed disgust, but was unsuccessful. There were plenty of items that caused me to feel disgusted, or made reference to a human or animal expressing disgust, but none that expressed disgust in a more direct way. I may yet find an example of an object or image that expresses disgust in a non-anthropomorphic or zoomorphic way and isolate the visual pattern, but I think it is more likely that disgust is a reaction, not an expressive quality. Contempt, on the other hand, was not included in the list because it belongs to a different category of emotional expressions, namely those based on social factors, and more specifically on forms related to dominance and submission.

As described in chapter three, dominance and submission are distinct from anger and fear and accordingly, there are a number of characteristic forms whose origins can be found in the realm of social relations. Affection, shyness, pride and aloofness can be traced back to displays of dominance and submission. Accordingly, expressive forms associated with dominance tend to be upright, assertive, energetic, rising. Submission is low and horizontal, but neither is tense or rigid. Contempt can be thought of as

dominance plus a touch of anger.

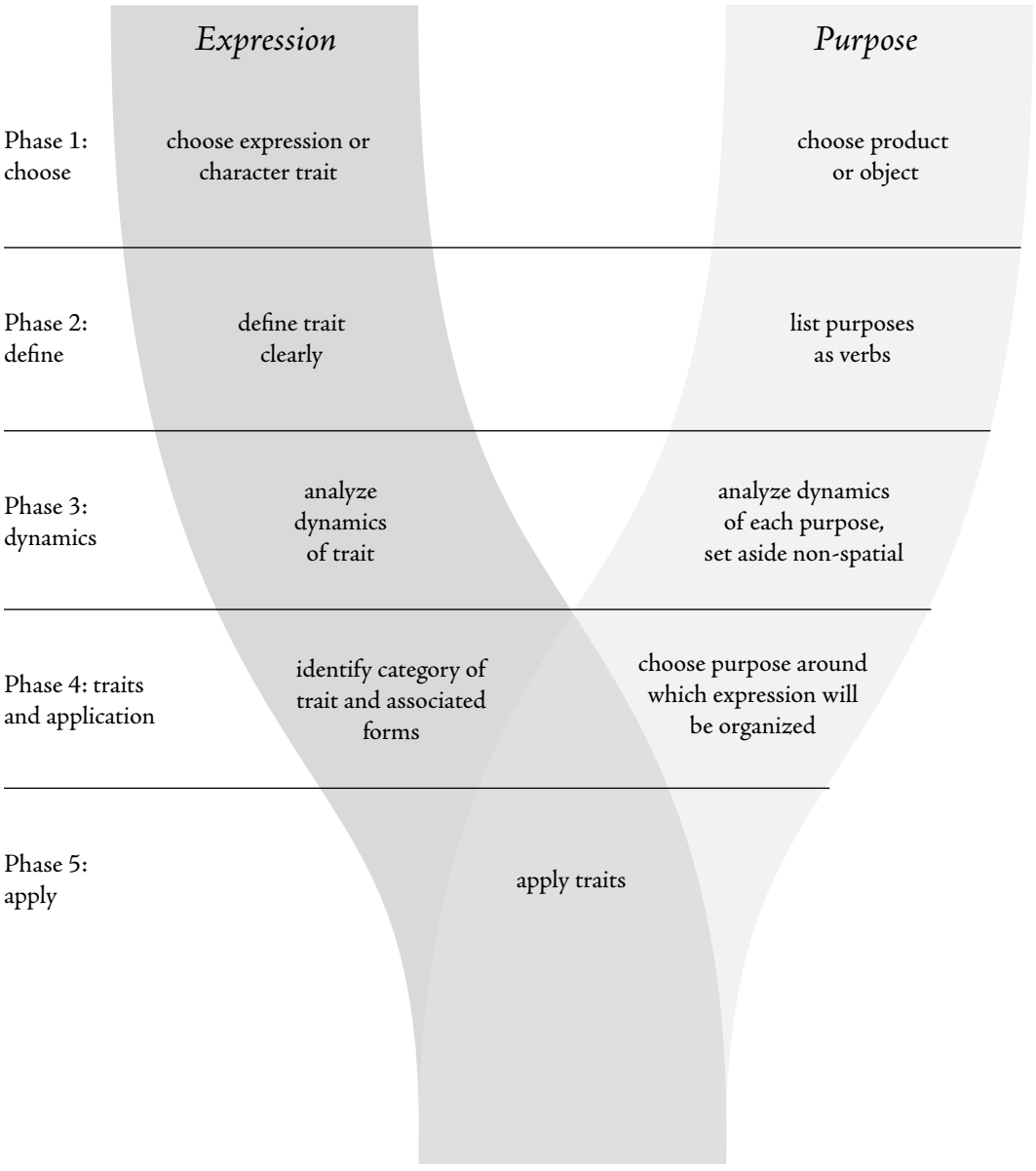
Based on the basic visual and spatial building blocks I have described here, any expressive form can be broken down into its constituent parts. This can be useful from a purely analytical point of view, but knowing the elements which constitute a particular expressive quality can serve as a starting point for form-generation.

Creating Expressive Products

Understanding the ways an object gets its character and the origins of our ability to perceive expression from them was immensely helpful for developing my own ability to analyze form for expressive qualities, but as an aspiring designer, my ultimate goal was to improve my ability to create expressive forms, that is, to design products. One problem I discovered fairly early on was that once I had extracted a list of attributes relevant to a particular expressive trait, it was not necessarily obvious how to apply those traits to a different product or context.

After many false starts and abortive attempts, I gathered all the factors I found to be helpful when trying to design an object that will express an intended expressive quality or character trait. The result is a process for use in designing expressive form. The process is represented in the diagram on page 83. The process is more of a rhetorical device for organizing the many facets of expression a designer might want to consider than a tool to aid in the design of an actual object. It does not represent the sequence of investigations I performed in my quest to understand the expressive qualities of form. I did not set out to create a process for designing expressive products, and the mere mention of such an idea has garnered extremely hostile responses

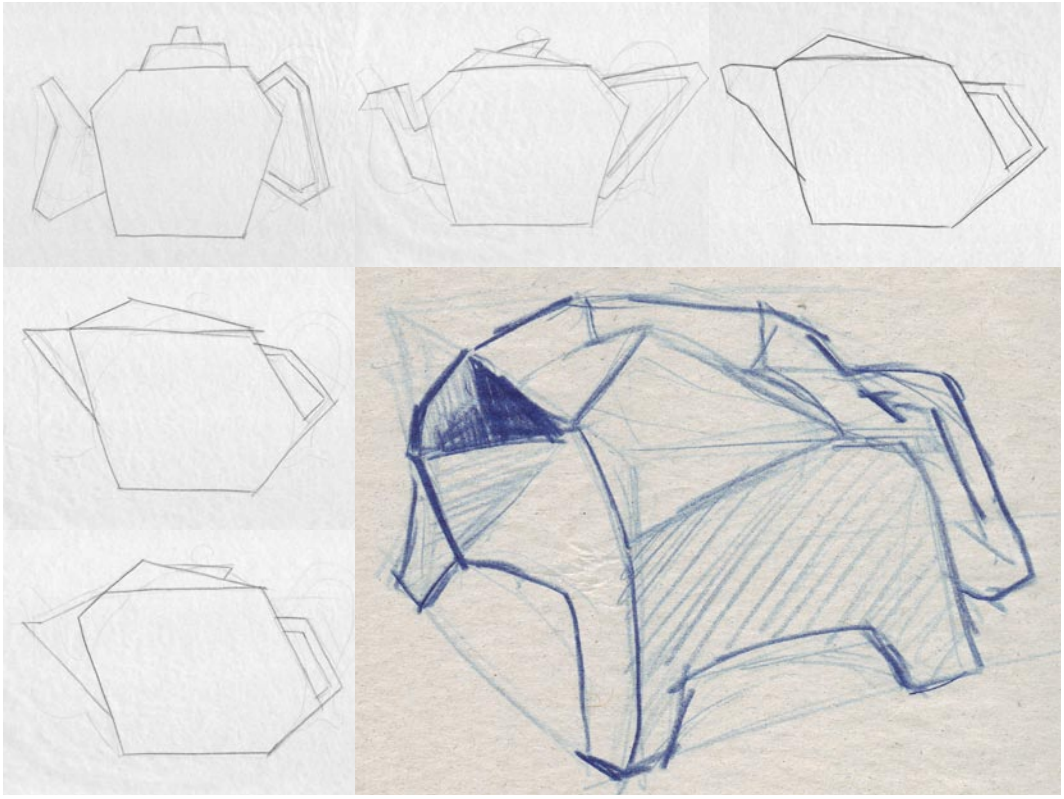
from many of my fellow students as well as several designers and even a few faculty members. However, with further development, I do think the process could be a useful tool for students of design who desire a structure in which to understand expression and form.



In an effort to be as clear as possible, I will describe this process using a single example of a product designed to express a certain quality. Both the expressive quality and the

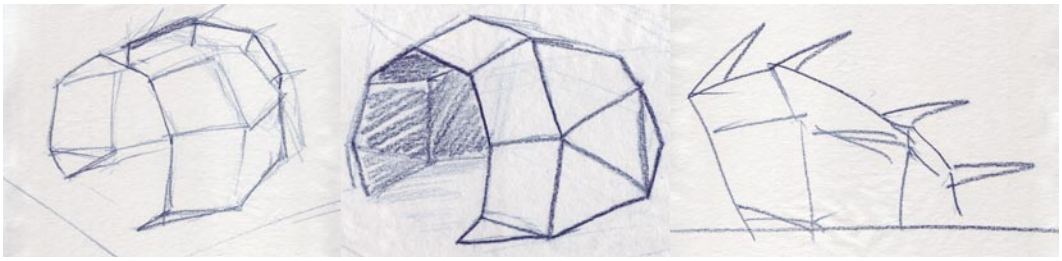
object are chosen somewhat arbitrarily.

Phase One – The first step is to choose a product and an expressive quality. For my example, I have chosen to design an aggressive teapot. The sketches below are some examples of my early attempts to apply the traits I had found.



Phase Two – Expressive qualities can be somewhat subjective, so I found it helpful to try to be as clear and specific as possible about what I meant by a particular trait. For example, a designer might want the car she is designing to look sporty, but that could mean fast, powerful, agile, or sleek, just to name a few. And more likely she is going for some combination. I also found that there needs to be a reason for the expressive trait chosen, because if there is not, it may be difficult to evaluate the resulting design and the expression will be unclear. I learned this lesson while attempting to

design a series of portable shelters, each with expressive traits appropriate to their purposes. I got the idea in my head to design a threatening-looking tent for military use, in the mold of tanks and other armaments. But I realized that my reason for choosing this expressive form were based on the idea of intimidating the enemy. There are several obvious problems with this idea. First, intimidation is a reaction, not an expressive quality, that is, just because a form expresses aggression, an observer will not necessarily be intimidated. Second, even if it were possible for a tent to be intimidating, the expression would probably be lost on the enemy, who would be unlikely to ever see the tent, as tents are usually erected far behind the front lines.



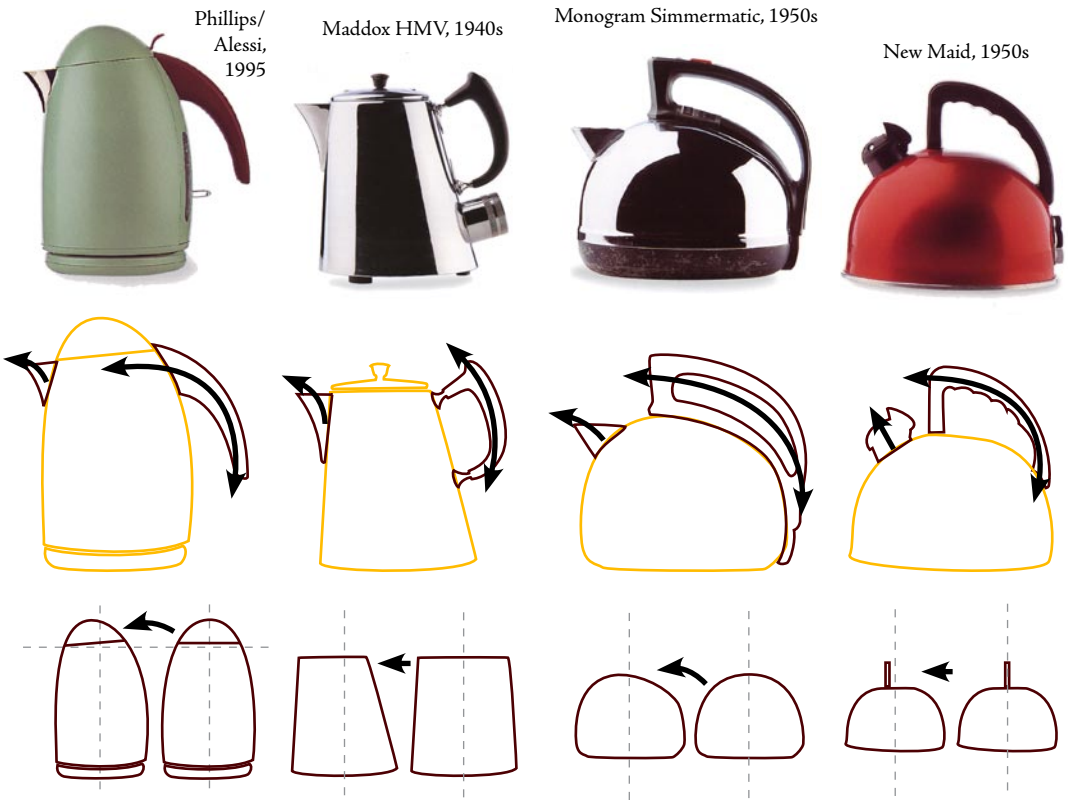
For my aggressive teapot example, the definition of aggressive I am using is: ready or likely to attack, threatening, dangerous, menacing. I also found it helpful to consider what I did not mean; I did not intend to create a sinister, guileful or ominous teapot.

The next step is to list the purposes of the product using verbs. For the teapot, the list includes: brew, insulate, lift, pour, contain, cover.

Phase Three – As I pointed out earlier, aggression is at the dynamic end of the spectrum of angry emotions. I also analyzed the dynamics of each purpose, setting aside the ones that do not imply some sort of spatial relationship or which operate on a vastly different scale. For example, infusing tea suggests a sort of infiltrating action, but

it happens at a much smaller scale than the gross actions of lifting and pouring.

In trying to figure out how these different levels of dynamics of purpose might be manifest in teapots, I analyzed a number of existing kettles. Here are some tea kettles in which most of the parts reinforce the pouring theme and the over all effect determines the strength of the dynamics. These are examples of the kind of visual analysis I found very helpful in understanding the expressive qualities of form.



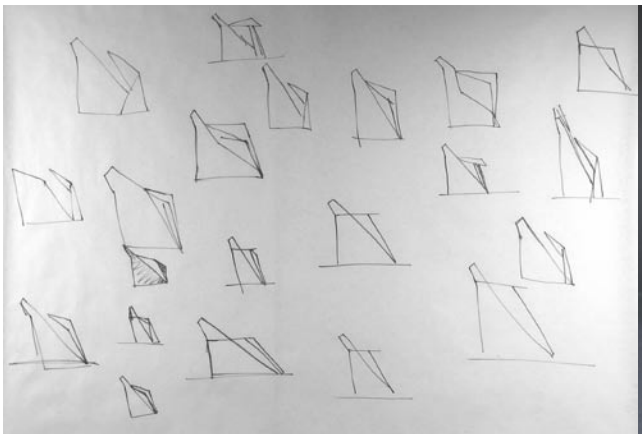
Phase Four – Returning to the aggressive teapot, based on what I had found in looking at the dynamics of emotions earlier, I knew I wanted my teapot to have visual characteristics derived from anger. Aggression = Anger + Direction.

Having identified the relevant traits, I needed to figure out how to apply them. That is where purpose comes in. On this point, Arnheim writes that,

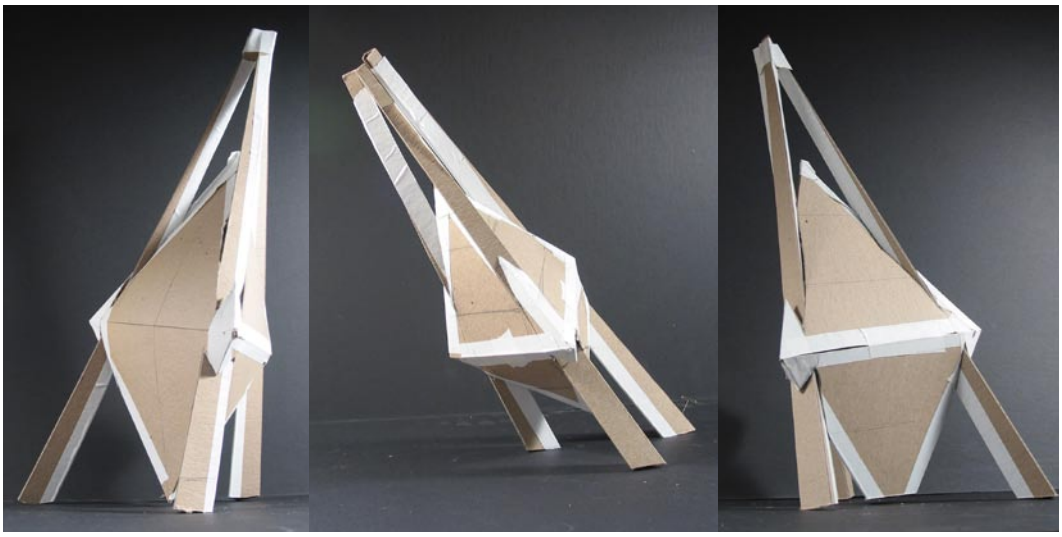
> In a functional-looking object we may see the dynamics of pouring, soaring, containing, receiving, etc. We also see such "character traits" as flexibility, sturdiness, gracefulness, strength, etc., which just as in representational work of fine art, are intimately and totally related to the theme: the gracefulness of the spout consists in the graceful pouring it displays visually; the sturdiness of the Doric column consists in supporting the roof sturdily. Expressive properties are adverbial, not adjectival. They apply to the behavior of things, not the things themselves [POA 208].

So purpose is the behavior, the action, verb and the expressive quality is the manner in which the action is accomplished. Because I wanted my aggressive teapot to be as dynamic as possible, I chose to organize it around the most dynamic of the purposes, namely pouring. So ultimately, what I am going for is a teapot that pours aggressively.

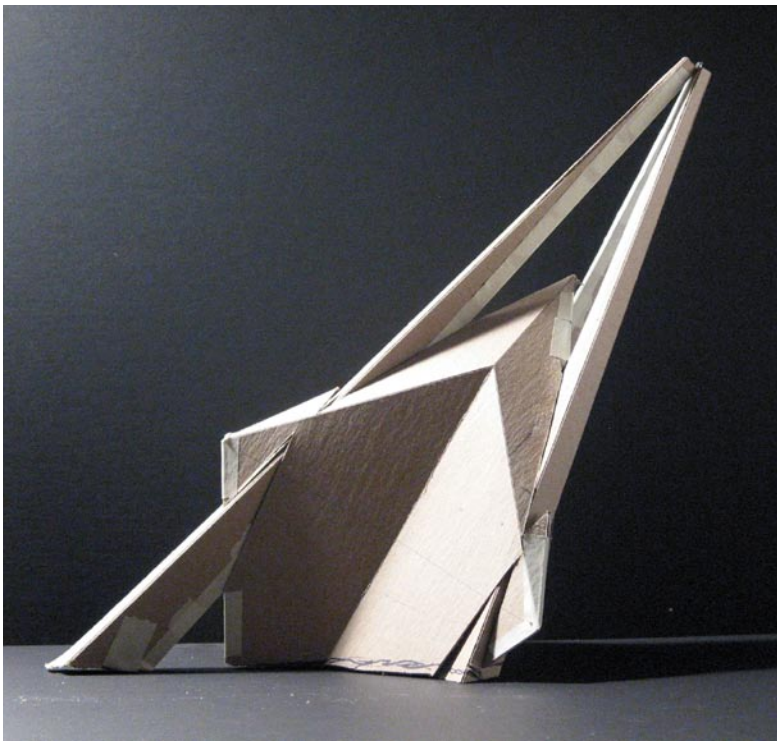
Phase Five – Finally, I tried putting it all together. The series on the left did not have the strong straight axis I was looking for. The sketch model on the right fixed that problem, but was too grounded, which counteracted the dynamic effect I was going for.



With these I got a little closer.



And I finally got it all in there on this one.



In addition to the theoretical methods described in previous chapters and the process described using the example of an aggressive teapot, I also explored the

question of how form communicates through several modes of form-generation and form-analysis. These methods yielded some important insights, but their primary value was in requiring me to closely observe form and its relation to expressive qualities of form. What follows is a description of several of the more hands-on methods I used during the course of this thesis process and some of the insights I gained. These explorations tended to take one of two basic forms: selecting an expressive trait, choosing existing forms (products, body language, natural objects) that I felt embodied that particular characteristic well, then trying to extract principles or constituent visual elements that caused the form to convey the particular trait. The second method was to begin with a trait in mind and try to create a form or product that embodies it using a more intuitive process.

In her Advanced Three-Dimensional Design course, Professor Lucia DeRespinis asks students to make small human figurines in clay. After completing this exercise, I was struck by how expressive these crude little models could be.

We are, of course, especially attuned to the meanings of our fellow humans' body language, but hoping to circumvent this familiarity, I tried a similar exercise using clay to create a series of crude dog-like figures. I found that these, too, were highly expressive.

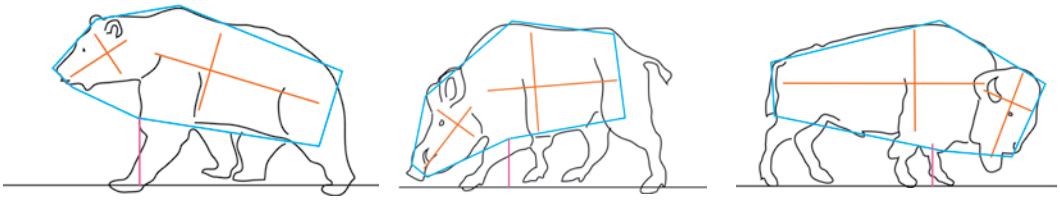
There is evidence that dogs and humans co-evolved, so perhaps we are closely attuned to dogs' body language as well, but it was not for this reason that I set aside the clay figures. Like the problems encountered by the reviewers of studies of emotional expression in music, I found that it was relatively simple to create a catalog of descriptions of the different body positions associated with each expressive trait, but there was often more than one trait being expressed so it became difficult to say which constituent form should be attributed to which trait. For example, dogs very often exhibit playfulness and excitement or fear and aggression simultaneously.

Fear & Aggression

Furthermore, many of the descriptive terms I was using could be applied to more than one trait. A lowered center of gravity is apparent in submissive dogs as well as angry ones. Surely, no one would mistake one for the other in real life, but such overlaps stymied attempts to extract general principles of the traits in question.

I analyzed a number of predatory animals which many people consider

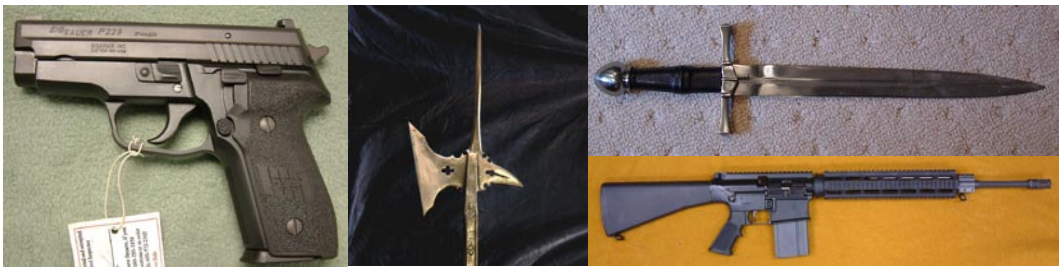
threatening and ran in to some similar problems. Predators tend to have a number of traits in common, such as eyes on the front, rather than the sides of the head, some sort of pointed weapon (talons, fangs, claws) but I wanted to see if there was something in the body shape of these animals that also conveyed the danger they might pose. I considered axes and overall shapes of a number of animals in profile view.



I also made small, crude models of a couple of these threatening animals in clay, but was unable to extract much in the way of general principles.

The one commonality I did note from these studies was a center of visual mass moved forward along the major axis in the direction of the head. Stated another way, many of these animals seemed to have big shoulders. This form tends to give an appearance of thrusting powerfully forward. I tried developing this idea in some abstract forms in clay (above, right), but found that in the absence of a recognizable object, the moved center of mass became ambiguous when the direction the mass moved could be front, back or even sideways.

Another approach was to gather images of things that I felt expressed a given trait particularly well, hoping to extract principles or lists of formal elements that added up to the overall character. For example, I looked to weapons for their aggressive forms.

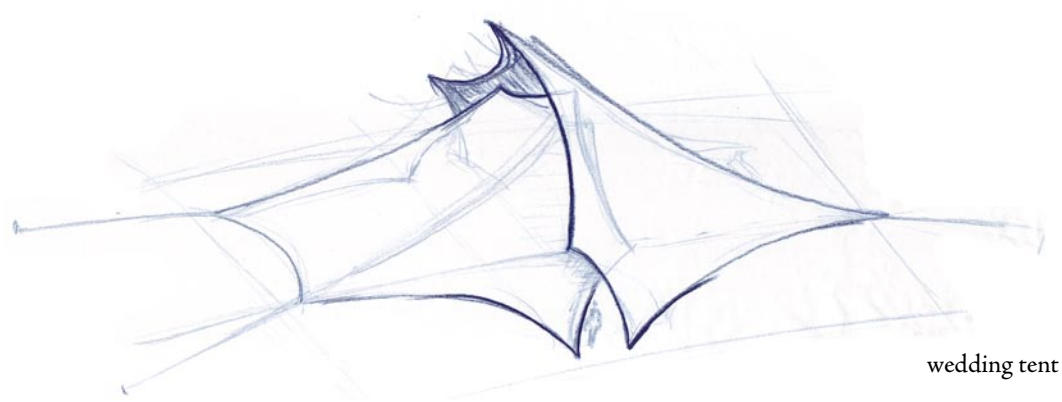


I found that bladed weapons, in particular, look aggressive, and among these, broadheads (razor-edged bow-hunting arrowheads) are a very pure expression of the trait I had in mind.

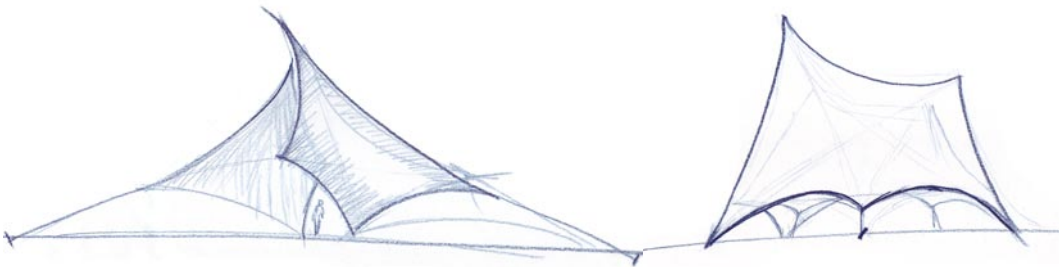
They are designed to penetrate game animals and do as much internal slicing and dicing as possible—many even have additional blades that unfold once the tip of the arrow has entered the animal. Additionally, like barbed fishing hooks, they are designed to be difficult to dislodge. From these forms, I gleaned the following constituent elements of aggression: sharp points; hard, straight edges; a strong, straight axis; unambiguous direction; strong symmetry around the axis of travel; a variety of sizes among elements.

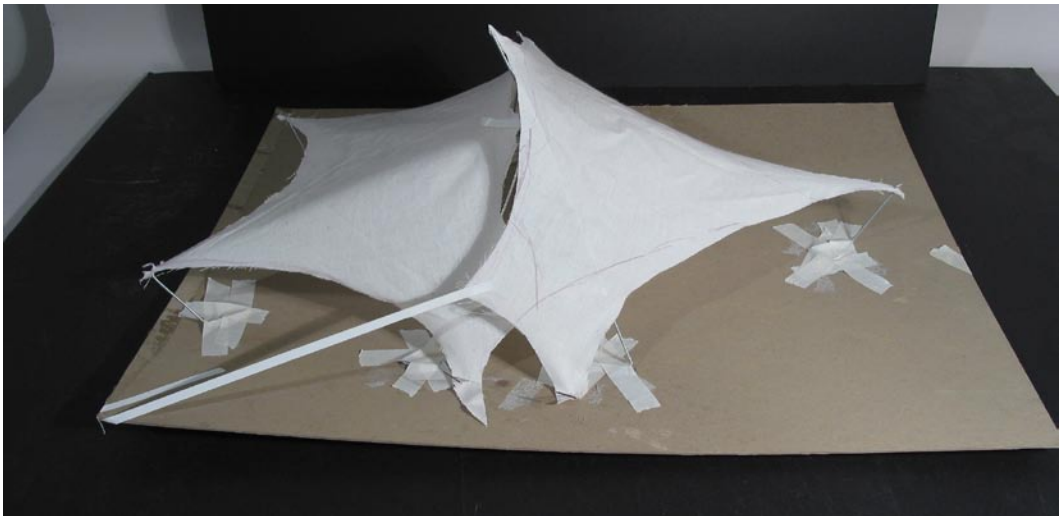
This technique led to some interesting insights, and as I mentioned, the process of paying such close attention to form in the context of expression was valuable in and of itself, and the reader may recognize some of the elements identified earlier as relating to anger.

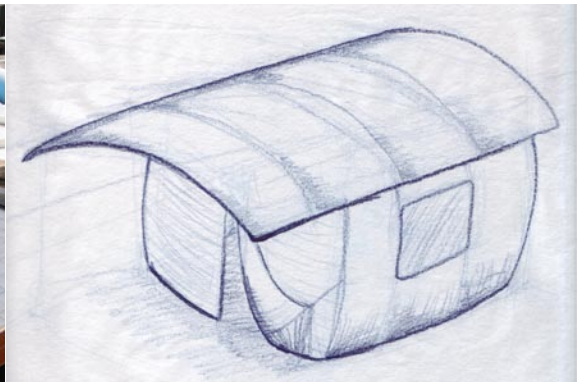
In addition to the military tent already discussed, the other expressive portable shelters attempted included a wedding tent (large-scale event tent) and a disaster relief tent for a single family. For the wedding tent, I wanted to express the joyfulness, formality and celebratory nature of the occasion. For the disaster relief shelter, I was hoping to create a comforting, inviting space. This exploration consisted of sketches and small, three-dimensional sketch models, I found that I was able to meet my goals for the design of the wedding tent, but the results were less satisfactory for the disaster relief shelter. In trying to understand why that might have been the case, I came to the conclusion that in addition trying to design a reaction instead of expression, I did not have a very clear idea of what I was trying to express. For the disaster relief shelter, I had defined the parameters somewhat more precisely than I had for the military tent (easy to transport, easy to assemble, field-repairable, etc.) but I had no idea if making the tents visually inviting was the appropriate expressive quality to imbue them with. Perhaps a fortress-like appearance would be more comforting to the displaced than a friendly appearance. Like the teapots, I had chosen tents because the form of a portable shelter seemed fairly flexible while still accomplishing its primary purpose of sheltering. But I discovered that because of the relationship between purpose and expression, if



wedding tent







disaster relief tent

the former is unclear, the latter will be as well.

These are just a few of the ways I came at the problem of trying to understand expression in product design. These examples resulted in visual evidence, but some of my most valuable investigations took the form of simply observing products with an eye for expression. For example, I spent many hours looking at the shape of wheel wells on various cars and trucks and considering how they related to the overall expressive traits of each vehicle. Another observation was focused on what visual qualities made the "muscle cars" of the late 1960s and early 1970s look 'muscular.' Thus, like all of the 3D training at Pratt, much of my time was spent just learning to see.

Conclusions

My interest in industrial design was born of frustration with existing products. To this day, every time I use a urinal and have to avoid the inevitable splashing back, I wonder why such poor designs are so prevalent. Over the years, I have come to understand many of the economic, manufacturing, and cultural factors which often take precedence over usability in the product development process. As an undergraduate dabbling in industrial design, I focused on designing for the end-user. I always thought of what I was doing as trying to make things work better. As for form-generation, my decisions were guided by ergonomics and user-interface concerns. When those criteria did not fully determine a form, I think I unconsciously fell back on the visual language of the products around me, which seemed to have some of the pure geometric shapes and unadorned surfaces of Modernism, though softened somewhat. On the other hand, I was just as irritated by designs which obviously compromised usability for the sake of appearance. Eventually I realized that my view of industrial design was pretty lopsided. So I decided to come to Pratt, known for its aesthetic focus, to try to round out my thinking.

The training in the fundamentals of three-dimensional form, color and so on was

a revelation to me, but I was never quite able to put it all together into a unified theory. Rudolph Arnheim recognized that the method of teaching design which focuses on developing the eye and hand through experience can be highly effective at training the intuition, but can leave the more rational, analytical side of students' minds out in the cold:

> Equally, in a lesson on design, it will be made clear that to the artist just as to any unspoiled human being, a circle is not a line of constant curvature whose points are all equidistant from a center, but first of all a compact, hard, stable thing. Once the student has understood that roundness is not identical with circularity, he may try for a design whose structural logic will be controlled by the primary concept of something to be expressed. An artificial concentration on mere shapes and colors as such will leave the student at a loss as to which pattern to select among the innumerable and equally acceptable ones. An expressive theme will serve him as a natural guide to forms that fit his purpose. [AVP 456]

As he suggests, my investigation of expression during the course of this thesis has provided the unifying theory that draws together all the disparate elements of design I learned in my first few years at Pratt.

Secondly, In addition to contributing to my own personal aesthetic development and its usefulness in helping guide form-generation, several designers I spoke to pointed out that this thesis might have a very practical application in communicating with clients. Clients usually want to understand what designers do. They often want explanations for design decisions regarding form and the unified understanding of and ability to speak clearly about the expressive qualities of form will be very helpful in explaining design decisions to clients.

Finally, expression provides the bridge between aesthetics and my earlier interest in user-centered design. User-centered design can be defined as design which gracefully accommodates human physical and psychological capacities and frailties. To this formulation, I would add a second mental capacity, by distinguishing perception from

cognition. If, as I have argued, the visual and spatial language of expression is an oft-neglected, but inherent aspect of perception, common to all humans, then designers who are truly concerned with improving the user experience should think of aesthetic considerations as more than a frivolity, a marketing gimmick or a status indicator of wealth and refinement. Instead, designers may consider the expressive qualities communicated via form a means of addressing a human capacity, just as we do when we place a control lever within easy reach or use the icons of a graphical user interface to represent otherwise intangible computer functions or segments of data. Attention to expression can help make the mass-produced objects of everyday life more humane.

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IVLA International Visual Literacy Association. http://ivla.org/org_what_vis_lit.htm#definition.

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